

Essentials of Pediatric Dentistry

Kanchan Harikishan Asnani



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DEDICATED TO

My Father

Mr Harikishan K Asnani

for his continuous encouragement, understanding and support

My Mother

Mrs Meena H Asnani

*for loving, caring and giving me her valuable presence to
continue my concentration in studies*

My Brother

Mr Amit H Asnani

for providing a unique atmosphere of friendship

Preface

The idea of writing this book took shape while I was studying as a final year student in college. As pediatric dentistry is an expanding field, the students need to read a book which is concise, to the point and yet provide all the essential information about the subject.

The dental students face the dilemma of selecting the book even more. This book has been written keeping in view the requirements of the students.

In part-1 of the book, I have dealt with the basics and fundamental of pediatric dentistry, this part introduces reader to the subject.

In part-2 of the book, I have dealt with various procedures and techniques to be undertaken in the primary dentition years—three to six years.

In part-3 of the book, I have dealt with the changes which should be offered in various dental procedures in various aspects in the transitional years—six to twelve years.

In part-4 of the book, I had provided the information which deals with adolescence.

Kanchan Harikishan Asnani

Acknowledgments

I always dreamt of presenting a textbook of pediatric dentistry to the students all over the country.

First and foremost I would thank "The Supreme Power God" for giving me energy, inspiration, courage to complete this arduous task and make my dream come true in two ways: first giving me first position in university examination of final year and second fulfilling my dream of presentation of textbook.

I acknowledge the unconditional assistance given to me in my day-to-day work, by my friend Ms Anubha Bansal (BE in electronics and telecommunications).

I am extremely grateful to Jaypee Brothers Medical Publishers (P) Ltd, New Delhi for selecting and finalizing my script.

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Part 1

Fundamentals of Pediatric Dentistry

- 1. The Practical Importance of Pediatric Dentistry*
- 2. Pain Reaction Control: Sedation*
- 3. Antimicrobials in Pediatric Dentistry*
- 4. Dental Public Health Issues in Pediatric Dentistry*



Chapter 1

The Practical Importance of Pediatric Dentistry

DEFINITIONS

American Academy of Pediatric Dentistry (1985)

“Pediatric dentistry also known as pedodontics and as Dentistry for adolescents and children, is the area of dentistry concerned with preventive and therapeutic oral health care for children from birth through adolescence. It also includes special care for special patients beyond the age of adolescence who demonstrate mental, physical or emotional problem”.

American Academy of Pediatric Dentistry (1999)

“Pediatric dentistry is age-defined speciality that provides both primary and comprehensive, preventive and therapeutic oral health care for infants and children through adolescence including those with special health care needs”.

Pediatric Dentistry Incorporates Various Branches of Dentistry within Itself. It is shown as in Figure 1.1.

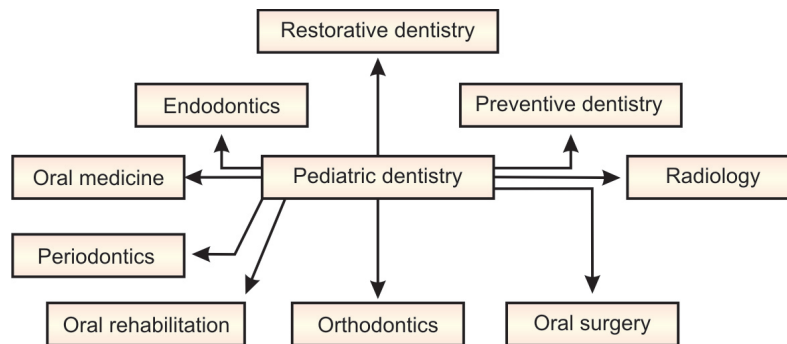


Fig. 1.1: Various branches of dentistry

What is Practical Importance of Pedodontics?

Various evidences reports the importance of study in field of paediatric dentistry.

- Evidence of child abuse and neglect
- Evidence of oral burns
- Bitemarks evidence.

These all evidences could be considered in general under a single title of “*forensic pedodontics*”.

Let us discuss all these evidences one by one.

(A) CHILD NEGLECT**DEFINITION**

Child neglect is generally characterized by omissions in care resulting in significant harm or risk of significant harm. Neglect is frequently defined in terms of a failure to provide for the child’s basic needs, such as adequate food, clothing, shelter, supervision or medical care.

Types of Neglect

- Emotional neglect
- Educational neglect
- Physical neglect.

EMOTIONAL NEGLECT

Emotional neglect is defined in following words:

- i. *Inadequate nurturing or affection*: Marked inattention to the child's need for affection, emotional support or attention.
- ii. *Chronic or extreme spouse abuse*: Exposure of the child to chronic or extreme spouse abuse or other domestic violence.
- iii. *Permitted drug or alcohol abuse*: Encouragement or permission of drug or alcohol use by the child.

- iv. *Permitted other maladaptive behavior*: Encouragement or permission of other maladaptive behavior (e.g. chronic delinquency, severe assault) under circumstances where the parent and caregiver has reason to be aware of the existence and seriousness of the problem but does not intervene.
- v. *Refusal of psychological care*: Refusal to allow needed and available treatment for a child’s emotional or behavioral impairment or problem in accordance with a competent professional recommendation.
- vi. *Delay in psychological care*: Failure to seek or provide needed treatment for a child’s emotional or behavioral impairment or problem that any reasonable layperson would have recognized as needing professional psychological attention (ego suicide attempt).

EDUCATIONAL NEGLECT

Educational neglect is defined in following words:

- i. *Permitted chronic truancy*: Habitual absenteeism from school averaging at least 5 days a month if the parent or guardian is informed of the problem and does not attempt to intervene.
- ii. *Failure to enroll or other truancy*: Failure to register or enroll a child of mandatory School age, causing the child to miss at least 1 month of school, or a pattern of keeping a school-aged child home without valid reasons.
- iii. *Inattention to special education need*: Refusal to allow or failure to obtain recommended remedial education services or neglect in obtaining or following through with treatment for a child's diagnosed learning disorder or other special education need without reasonable cause.

PHYSICAL NEGLECT

Physical neglect is defined in following words:

- i. *Refusal of health care*: Failure to provide or allow needed care in accordance with recommendations of a competent health care professional for a physical injury, illness, medical condition or impairment.
- ii. *Delay in health care*: Failure to seek timely and appropriate medical care for a serious health problem that any reasonable layperson would have recognized as needing professional medical attention.
- iii. *Abandonment*: Desertion of a child without arranging for reasonable care and supervision.
- iv. *Expulsion*: Other blatant refusals of custody, such as permanent or indefinite expulsion of a child from the home without adequate arrangement for care by others or refusal to accept custody of a returned runaway.
- v. *Inadequate supervision*: Leaving a child unsupervised or inadequately supervised for extended periods of time, or allowing the child to remain away from home overnight without knowing or attempting to determine the child's whereabouts.
- vi. *Other physical neglect*: May include inadequate nutrition, clothing, or hygiene, conspicuous inattention to avoidable hazards in the home and other forms of reckless disregard for the child's safety and welfare.

For example,

- Driving with the child while intoxicated
- Leaving a young child unattended in a car.

CHILD ABUSE (Fig. 1.2)

Types, Signs, Symptoms, Causes and Help

The first step in helping abused or neglected children is learning to recognize the signs of child abuse and neglect.

(To report abuse, call the National Child Abuse Hotline : 1-800-4-A-CHILD).

Child abuse is both shocking and commonplace. Child abusers inflict physical, sexual, and emotional trauma on defenseless children every day. The scars can be deep and long-lasting. Unfortunately, the more subtle forms of child abuse such as neglect and emotional abuse can be even more traumatizing than violent physical abuse.

What is Child Abuse?

Child abuse consists of any act, or failure to act, that endangers a child's physical or emotional health and development. Someone is abusive if he or she fails to nurture the child, physically injures the child, or relates sexually to the child.



Fig. 1.2: Abused child

What are the Types of Child Abuse?

The four major types of child abuse are:

- Physical abuse
- Sexual abuse
- Emotional abuse
- Neglect.

What is Physical Child Abuse?

Physical child abuse is an injury resulting from physical aggression. Even if the injury was not intended, the act is considered physical abuse.

The injury from physical child abuse may be the result of:

- Beating, slapping, or hitting
- Pushing, shaking, kicking, or throwing
- Pinching, biting, choking, or hair-pulling
- Burning with cigarettes, scalding water, or other hot objects
- Severe physical punishment.

Is Physical Punishment the Same as Physical Abuse?

Physical abuse is an injury resulting from physical aggression. Physical punishment is the use of physical force with the intent of inflicting bodily pain, but not injury, for the purpose of correction or control. As you can see, physical punishment can easily get out of control and become physical abuse.

Some other specific types of physical child abuse are:

- *Shaken Baby Syndrome*: Shaking a baby or toddler can cause serious head injuries.
- *Munchausen by Proxy Syndrome*: Inducing medical illness in a child or wrongly convincing others that a child is sick is both dangerous and abusive.

- *Drug use during pregnancy*: Drug and alcohol use during pregnancy or lactation can be harmful to your child, leading to problems such as Fetal Alcohol Syndrome.

Hundreds of thousands of children are physically abused each year by someone close to them, and thousands of children die from the injuries. For those who survive, the emotional scars are deeper than the physical scars.

What is Sexual Child Abuse?

Sexual abuse of a child is any sexual act between an adult and a child, including penetration, intercourse, incest, oral sex, and sodomy. Other examples include—

- *Fondling*: Touching child's genitals, making a child fondle an adult's genitals.
- *Violations of bodily privacy*: Forcing a child to undress, spying on a child in the bathroom or bedroom.
- *Exposing children to adult sexuality*: Performing sexual acts in front of a child, exposing genitals, showing pornography to a child.
- *Commercial exploitation*: Sexual exploitation through child prostitution or child pornography.

Regardless of the child's behaviour or reactions, it is the responsibility of the adult not to engage in sexual acts with children. Sexual abuse is never the child's fault.

Sexual child abusers can be:

- Fathers, mothers, siblings, or other relatives
- Childcare professionals or babysitters
- Clergy, teachers, or athletic coaches.
- Foster parents or host families of foreign exchange students
- Neighbors or friends
- Strangers.

What is Emotional Child Abuse?

Emotional child abuse is any attitude, behavior, or failure to act that interferes with a child's mental health or social development. It can range from a simple verbal insult to an extreme form of punishment. Emotional abuse is almost always present when another form of abuse is found. Surprisingly, emotional abuse can have more long-lasting negative psychiatric effects than either physical abuse or sexual abuse.

Other names for emotional abuse are:

- Verbal abuse
- Mental abuse
- Psychological maltreatment or psychological abuse.

Examples of Emotional Child Abuse

Intimidation	Yelling, screaming, threatening, frightening, or bullying.
Belittling or shaming	Humiliating the child, name-calling, making negative comparisons to others. Telling the child he or she is "no good", "worthless", "bad", or "a mistake".
Lack of affection and warmth	Showing little to no physical affection (such as hugs) or words of affection (praise, saying "I love you").
Habitual blaming	Telling the child that everything is his or her fault.
Ignoring or rejecting	Withdrawing attention, giving "the cold shoulder", disregarding.
Extreme punishment	Confinement to a closet or darkroom, tying to a chair for long

periods of time, or terrorizing a child.

Exposure to violence	Witnessing violent behavior, including the physical abuse of others.
Child exploitation	Taking advantage of a child, including child labor.
Child abduction	The trauma of being kidnapped, including kidnapping by a parent, amounts to abuse.

Emotional child abuse can come from adults or from other children:

- Parents or caregivers
- Teachers or athletic coaches
- Siblings
- Bullies at school or elsewhere
- Middle and high school girls in social cliques.

What is Neglect?

Neglect is a very common type of child abuse. According to Child Welfare Information Gateway, more children suffer from neglect than from physical and sexual abuse combined. Yet victims are not often identified, primarily because neglect is a type of child abuse that is an act of omission—of not doing something.

Some overlap exists between the definitions of emotional abuse and emotional neglect. However, neglect is a pattern of failing to provide for a child's basic needs. A single act of neglect might not be considered child abuse, but repeated neglect is definitely child abuse. There are three basic types of neglect; physical neglect, educational neglect, and emotional neglect.

Types of Neglect

- *Physical neglect:* Failure to provide foods, clothing appropriate for the weather, supervision, a home that is hygienic and safe, and/or medical care, as needed.
- *Educational neglect:* Failure to enroll a school-age child in school or to provide necessary special education. This includes allowing excessive absences from school.
- *Emotional neglect:* Failure to provide emotional support, love, and affection. This includes neglect of the child's emotional needs and failure to provide psychological care, as needed.

What are the Warning Signs and Symptoms of Child Abuse?**Signs of Physical Child Abuse**

- Burns, bite marks, cuts, bruises, or welts in the shape of an object
- Resistance to going home
- Fear of adults.

Signs of Emotional Child Abuse

- Apathy, depression
- Hostility
- Difficult concentrating.

Signs of Sexual Child Abuse

- Inappropriate interest in or knowledge of sexual acts
- Seductiveness
- Avoidance of things related to sexuality, or rejection of own genitals or body
- Either overcompliance or excessive aggression
- Fear of a particular person or family members.

Warning Signs of Online Sexual Child Abuse

- Your child spends large amounts of time online, especially at night
- You find pornography on your child's computer
- Your child receives phone calls from men you don't know, or is making calls, sometimes long distance, to numbers you don't recognize.
- Your child receives mail, gifts or packages from someone you don't know
- Your child turns the computer monitor off or quickly changes the screen on the monitor when you come into the room
- Your child becomes withdrawn from the family
- Your child is using an online account belonging to someone else.

Signs of Child Neglect

- Clothing unsuited to the weather
- Being dirty or unbathed
- Extreme hunger
- Apparent lack of supervision.

What are the Causes of Child Abuse?

Why would someone abuse a defenseless child? What kind of person abuses a child? Not all child abuse is deliberate or intended. Several factors in a person's life may combine to cause them to abuse a child:

- Stress, including the stress of caring for children, or the stress of caring for a child with a disability, special needs, or difficult behaviors
- Lack of nurturing qualities necessary for caring for a child
- Difficulty controlling anger

- Personal history of being abused
- Isolation from the family or community
- Physical or mental health problems, such as depression and anxiety
- Alcohol or drug abuse
- Personal problems such as marital conflict, unemployment, or financial difficulties.

No one has been able to predict which of these factors will cause someone to abuse a child. A significant factor is that abuse tends to be inter-generational—those who were abused as children are more likely to repeat the act when they become parents or caretakers.

In addition, many forms of child abuse arise from ignorance, isolation, or benign neglect. Sometimes a cultural tradition leads to abuse. For example, such beliefs as :

- Children are property
- Parents (especially males) have the right to control their children in any way they wish
- Children need to be toughened up to face the hardships of life
- Girls need to be genitally mutilated to assure virginity and later marriage.

What are the Results of Child Abuse?

Child abuse can have dire consequences, during both childhood and adulthood. The effects of being abused as a child vary according to the severity of the abuse and the surrounding environment of the child. If the family or school environment is nurturing and supportive, the child will probably have a healthier outcome.

NEGATIVE CONSEQUENCES OF CHILD ABUSE

Emotional Effects

- Low self-esteem
- Depression and anxiety
- Eating disorders
- Relationship difficulties
- Alienation and withdrawal
- Personality disorders.

Physical Effects

- Injury
- Death
- Lifelong health problems
- Cognitive difficulties.

Behavioral Effects

- Problems in school and work
- Delinquency
- Teen pregnancy
- Suicide attempts
- Criminal or antisocial behavior
- Substance abuse
- Aggressive behavior
- Spousal and child abuse

Note: For more details on the results of child abuse, see the Long-term consequences of child abuse and neglect, from the Child Welfare Information Gateway of the US Department of Health and Human Services.

You may be afraid to report child abuse because of possible repercussions to the child or yourself. You probably will be relieved to know that :

- *The child abuse will be confirmed before the child is removed from the home.* The authorities will investigate, and if your suspicions of abuse are correct, the child will then be removed from the home and placed in safe care.
- *Reporting is anonymous.* In most states, you do not have to give your name when you report child abuse. The child abuser cannot find out who made the report of child abuse.

Remember that suspected child abuse is sufficient reason to make a report to authorities. You do not need proof. Your call may save the life of a child.

How can Child Abuse be Prevented or Stopped?

Tips for preventing or stopping child abuse

What you want to accomplish?	Where you can get help?
To keep from physically hurting your child when you are angry...	Twelve alternatives to Lashing out at your child and Disciplining Children without spanking or other physical abuse.
To console a crying baby....	Some suggestions for coping with a crying baby
To intervene when you witness child abuse in a public place...	What can I do to stop child abuse in a public place?
To report suspected child abuse...	How do I report suspected child abuse?
To protect your child from abuse..	Following simple rules to prevent child abuse
To keep your children safe on the internet...	About...Kid's Safety and Protection from child abuse on the internet
To prepare your children to defend themselves...	Self-defense (for teens) and self-defense resources (a worldwide list of IMPACT style self-defense workshops

To identify paroled sex offenders who live in your neighborhood...

Children

To deal with bullies, at school or elsewhere...

To deal with possible child kidnapping...

To deal with abusive coaches...

National Sex Offender Public Registry and Federal Bureau of Investigation's Investigative Programs : Crimes Against (individual state databases)
Dealing with bullies (for kids) and Bullying and your child
When your child is missing : A family survival guide
Parenting: Dealing with abusive coaches.

Child abuse tends to be cyclical, repeated generation after generation. A child who has experienced the trauma of child abuse may repeat the pattern by growing into an adult who delivers abuse to the next generation. The only way to stop such a cycle is to work with parents, prospective parents, and other caregivers who seek help or who are referred for help.

Mental health professionals and others can prevent child abuse by:

- Establishing educational programs to teach caregivers good parenting and coping skills.
- Making people aware of alternatives to abusive behaviors so that they seek help for their own abusive tendencies.
- Educating the public about abuse so that people report abuse early enough for intervention.
- Establishing relationships of trust with children so that they feel comfortable disclosing abuse. Then someone can intervene early on.

(B) EVIDENCE OF ORAL BURNS

Finkelstein et al have reported that children less than 5 years of age are particularly prone to injury. The

etiology may be varied such as thermal (Flame and Scald), chemical, electrical and radiation. Boys of all age groups are more prone to burn injury as compared to girls. Health et al. have reported that 10 percent of all cases with Battered children involve burns.

As a result of secondary wound healing and scar contracture, burns involving the perioral and intraoral tissues can cause varying degree of microstomia in age between— 6 months to 3 years.

CAUSE

Electrical Burns

- Oral electrical burns most commonly occurs when the child places the female end of a line extension cord into the mouth
- The child sucks or chews on exposed or poorly insulated line wires.

Pathogenesis

One possible theory is that electric arc is produced between a source of the current such as the female end of an extension cord and oral tissues. The electrolyte rich saliva provides a short circuit between the cord terminal and oral tissues resulting in arc phenomenon. This type of burn involves production of intense heat, causing coagulation tissue necrosis (Fig. 1.3).

Nature of Injury

Clinical manifestation depends on several factors: (i) Degree and duration of contact, (ii) The source and magnitude of electric current, (iii) The state of grounding, (iv) Relative degree of resistance at the point of contact.



Fig. 1.3: Baby with oral electric burn

- The wound may be superficial including only the vermillion border of one or both lips or it may be very destructive, full thickness, third degree burn.
- The severe burns to the mouth generally involve not only a portion of the upper and lower lip, but the commissures as well.
- Damage associated with more serious burns may extend intraorally to the tongue, labial vestibule, floor of mouth or the buccal mucosa.
- There have been reports of damage to hard tissues such as mandible and the primary and permanent teeth.
- With 3rd degree burn, subcutaneous tissues may be damaged. The tissue destruction may be more extensive than is initially evident since nerves are frequently damaged the patient will probably have paresthesia or anesthesia.
- Arterial bleeding may occur during first 3 weeks of healing.
- Bleeding can also occur with sloughing of necrotic tissue that overlies regenerating granulation tissue.

- H. The clinical appearance of an electrical burns including lips and commissure reflects the fact that wound is caused by intense and localized heat as much as 300°C.
- I. The wound is characteristic of coagulation necrosis in which there is heat induced coagulation of proteins, liquefaction of fats and vaporization of tissue fluids.
- J. During the first few days after the accident, the centre of lesion is generally composed of grayish or yellowish tissue that may be depressed relatively and has slightly elevated narrow erythematous margin of tissue that surrounds.
- K. Within few hours after the injury there may be great increase in edema. The margins of the wound may be become ill-defined and the lips protrudent. In 7-10 days the edema begin to subside. The delineation between the central nonviable tissue and the surrounding viable tissue become more apparent. The necrotic tissue eschar appear and begin to separate from surrounding viable tissues.
The eschar slough off 1-3 weeks after the burn. Healing occurs by secondary intention as granulation tissue proliferates and matures.

Treatment

- i. Assess the general health of patient.
- ii. Local measures are undertaken such as control of minor hemorrhage, conservative debridement of non-viable tissue.
- iii. Immunization of patient by tetanus toxoid or DPT.
- iv. If bleeding persists place firm pressure with gauze for 10 mins.
- v. Acrylic prosthetic appliance should be given.

When in place the appliance has a static base from which the wings extends laterally to provide contact with both commissure.

- The shape and location of the wings are important not only in preventing contracture or cohesion of lips during healing but also in shaping the affected commissure.
- The proper size of wing will enhance acceptance and compliance by the child and parent.
- After delivery of appliance patient is usually seen at 2 days, 1 week, 3 weeks, 7 weeks during this period, if required modification of wings are made.
- Infants and toddlers who do not have primary molars that can be used for intraoral anchorage should given headgear type of extraoral anchorage appliance.
- Patient who did not have access to burns appliance therapy may require a commissurotomy to re-establish the original dimension and symmetry of mouth.

The American burn association injury severity grading system has classified burns in children as—

Minor: I and II degree burn less than 10 percent of body surface area in children.

Moderate: II degree of burn 10-20 percent body surface area.

III degree burn less than 10 percent of body surface area.

Major: II degree of burn more than 20 percent, III degree burn at least 10 percent of body surface area, inhalational burns or electrical burns, all burns in infants, and burn which the patient is at poor risk due to preconditions.

(C) BITEMARKS EVIDENCE**DEFINITION****Bite**

Is to tear or seize with the teeth.

Bitemark

A mark caused by teeth alone or is combination with other oral parts or consists of teeth marks produced by antagonists teeth can be as two opposing arch marks.

Classification of Bitemarks

- *Depending on biting agent*
 - a. Humans—Children, adult
 - b. Animals—Mammals, reptiles, fishes
 - c. Mechanical—Full denture
 - Sawblade tooth marks, electric cord, bicycle chain, belt marks, etc.
- *Depending on material bitten*
 - a. Skin-Humans, animals
 - b. Perishable items—Food items like cheese, apple, etc.
 - c. Nonperishable items—Undrinated objects like pipes, pen, pencils.
- *Depending on degree of biting*
 - a. *Definite bitemarks*: Tooth pressure marks are formed when a direct application of pressure by the biting edges has caused tissue damage, other marks are caused by tongue pressing tissues between necks of teeth.
 - b. *Amorous bitemarks*: These marks, made in amorous circumstances, tend to made slowly with the absence of movement between teeth and tissue. Lower teeth marks

are formed when teeth are pressed into tissue with a gradually increasing pressure on contrast, upper teeth form a series of arches where the tissue is sucked into the mouth and pressed against the back of tooth with tongue.

- c. *Aggressive bitemarks*: These marks may show evidence of scraping, tearing and avulsion of the tissue. This usually involves ears, nose or nipples. Such bites may be difficult to interpret.

BITE MECHANISMS**Tooth Pressure**

Marks are caused by direct application of incisal edges of anterior teeth or occlusal surfaces of posterior teeth.

- The mark will depend on
 - Force applied
 - Duration of force applied
 - Movement between teeth and tissue.
- The pale area represents the incisal edges and bruising represents the margin of incisal edge.
- Shape of the mark may be useful in identification of specific tooth.
- Tooth bitemark as “attack” or “defensive” bitemark is commonly seen in battered child syndrome.

Tongue Pressure

- Is caused when material is taken into mouth and pressed by tongue against teeth or palatal rugae.
- This leave a distinctive mark due to mechanism of suckling, a combination of sucking and tongue thrusting.
- Suck mark has a radiating linear abrasion pattern surrounding the central area and resembling a sunburst. These are mostly found in sexually associated assault.

Tooth Scrape

- May caused by teeth scrapping across the surface skin.
- These marks are usually inflicted by the anterior teeth.
- May appear as scratches or abrasion.
- If scratches, they might indicate a peculiarity of incisal edges and assist in identification.

Factors Affecting Bitemarks Injury

- a. *Inherent skin factor*: Loose skin at the site of injury (i.e. around the eye) will bruise easily and extensively where excess of subcutaneous fat is present as compared to skin supported by fibrous tissue with a good muscular tone.
- b. *Age*: Infants and old people tends to bruise easily and extensively. Infants because of delicate, loosely attached skin and presence of subcutaneous fat. Old people because of decreased elasticity of skin and lost subcutaneous fat.
- c. *Sex*: Females tend to bruise more easily than males and also bruise marks persists longer in females because of more subcutaneous fat and delicate skin.
- d. *Time*: The duration of bitemark depends on force applied and amount of tissue damage. Thinner area retain the marks longer.
- e. *Vascularity*: The intensity of discoloration depends on vascularity. Bruises will occur and last on a more vascular area like face than in the site which is less vascular like bite on hand or foot.

Chapter 2

Pain Reaction Control: Sedation

DEFINITION OF PAIN

- The English word pain is derived from an ancient Greek word meaning “penalty” and a Latin word that meant “punishment” as well as “penalty”.
- When the term pain is used in clinical dentistry or medicine, it is synonymous with strong discomfort.
- Pain signals real or apparent tissue damage that thereby energizes the organism to take action in relieving or alleviating its presence.
- Pain is a highly personalized state attending tissues damage that is either real (e.g. skin laceration) or apparent (e.g. excess bowel distention) as a result of an adequate stimulus.

SEDATION

Sedation represent a continuum whose effects vary from very mild anxiolysis to a deep sedation indistinguishable from general anesthesia. Sedation, depending on its depth, produces a relative reduction in anxiety facilitating.

- i. The opportunity to invite the patient to use learned coping skills
- ii. The raising of the pain reaction threshold.

Levels of Sedation

- a. Minimal sedation
- b. Moderate sedation
- c. Deep sedation
- d. General anesthesia.

(A) MINIMAL SEDATION

GOAL

- Decrease or eliminate anxiety
- Facilitate coping skills.

Patient Responsiveness

- Subjectively, the patient may sense and/or express less anxiety about the clinical procedure compared to presedation periods.
- Objectively, the patient may appear Calmer and less overly responsive to clinical stimuli, and purposefully interactive with the clinician compared to presedation periods.

Physiological Changes

- Patient remains stable and within age appropriate and health status norms for parameters involving

hemodynamic, ventilation, and oxygenation functions.

- No loss of protective reflexes.

Personnel Needed Monitoring Equipment

Clinical observation unless patient becomes moderately sedated, then appropriate monitoring needed.

(B) MODERATE SEDATION

GOAL

Decrease or eliminate anxiety facilitate coping skills. Younger patients show age appropriate behaviors including crying, older patients demonstrate interactive state.

Patient Responsiveness

Subjectively

The patient may sense and/or express less anxiety about the clinical procedure compared to presedation period.

Objectively

The patient may appear less tense cognizant of, but less overtly to clinical stimuli, responsive and purposefully interactive with the clinician compared to presedation period.

The patient if behaviorally and cognitively cooperative should be able independently to move his/her head and/or mandible, as directed by the clinician, and to assist in maintaining optimal airway patency.

Physiological Changes

Patient remain stable and within age-appropriate and health status norms for parameters involving

hemodynamic, ventilation, and oxygenation functions. No loss of protective reflexes.

Personnel Needed Monitoring Equipment

Blood pressure cuff/sphygmomanometer, pulse oximetry.

- Precordial/pretracheal stethoscope
- Capnograph/endtidal carbon dioxide monitor.

(C) DEEP SEDATION

GOAL

Eliminate anxiety; coping skills unaffected and overridden. Patient uneasily aroused but may respond to purposeful stimulation.

Patient Responsiveness

Subjectively

The patient may sense and/or express limited or no feelings of anxiety associated with the clinical procedure.

Objectively

The patient may appear very relaxed, not cognizant of an minimally or nonresponsive to clinical stimuli, and non-interactive with the clinician at any time. The patient would not be able independently to move his/her head and/or mandible to maintain optimal airway patency consistent with the clinical situation and under these circumstances, require continuous monitoring of the airway and continual assistance of the clinician (e.g. head tilt, chin lift procedure).

Physiological Changes

Patient remains stable and either minimally or moderately below the patients age and health status norms for haemodynamic, ventilation and oxygenation functions. Accompanied by partial or complete loss of protective reflexes.

Personnel Needed Monitoring Equipment

- Blood pressure cuff/sphygmomanometer
- Pulse oximetry
- Precordial/pretracheal stethoscope
- Capnograph/end-tidal carbon dioxide monitor
- Electrocardiogram.

(D) GENERAL ANESTHESIA**GOAL**

Eliminate sensory and skeletal motor activity
autonomic activity depressed.

Patient Responsiveness

Unconscious and unresponsive to surgical stimuli.

Physiological Changes

Partial or complete loss of protective reflexes including the airway, does not respond purposefully to verbal command or physical stimulus.

Personnel Needed Monitoring Equipment

- Temperature
- Blood pressure cuff/sphygmomanometer
- Pulse oximetry
- Precordial/pretracheal stethoscope.

NITROUS OXIDE**INTRODUCTION**

It is inhalational route of administration for minimal and moderate sedation.

Dose Control (Titration)

There are two ways to initially administer nitrous oxide to children.

(A) STANDARD TITRATION TECHNIQUE

- Nitrous oxide should be started at 10 percent concentration and administered in increments of concentration, ranging from 5 to 10 percent until the patient becomes comfortable and some clinical signs of optimal sedation are noted such as—
 - Slight relaxation of the limbs and jaw muscles.
 - Ptosis of the eyelids, a blank stare.
 - Slight change in the pitch of the patient's voice; and patient reports of being comfortable and relaxed.
- Each time the clinician increases the concentration, he or she would wait approximately 30 seconds while talking with the child and watch for classical signs of optimal sedation before deciding to increase concentration again most children seem comfortable and demonstrate optimal signs and sedation in the concentration range of 35 to 50 percent nitrous oxide.

(B) RAPID INDUCTION TECHNIQUE

- This technique is usually indicated for mild to moderately anxious, potentially cooperative child who may be on the edge of losing coping abilities and need to be controlled quickly by clinician.
- The technique involves administering 50 percent nitrous oxide immediately to the patient without any titration steps.

In either technique, nitrous oxide should be discontinued if the child becomes disruptive and no longer breathes through nitrous oxide hood or if the child becomes nauseated, vomits or both.

Advantages

Nitrous oxide lack any serious adverse effects, it is considered to be inert and nontoxic when it is administered with adequate oxygen.

Disadvantages

The use of nitrous oxide in pediatric dentistry also has several disadvantages.

- Weak agent
- Lack of patient acceptance
- Inconvenience, especially in small children
- Potential chronic toxicity: Dental office personnel who were exposed to trace levels of nitrous oxide suggest a possible complications like spontaneous abortions, congenital malformations, certain cancers, liver disease, kidney diseases and neurologic disease.

There results underscore the necessity for scavenging (removing) waste gases adequately from the dental operatory.

PHARMACOLOGIC AGENTS FOR SEDATION**Sedative Hypnotics**

- Sedative hypnotics are drugs whose principal effect is sedation or sleepiness.
- *Primary effect:* Sedative hypnotic used alone may lower the pain reaction threshold in some cases by removing inhibitions, and at inadequate dosages it may simply produce a patient who is more responsive to pain stimulation.
- *Site of primary effect:* Reticular activating system, an area of the brain involved in maintaining consciousness.
- *Effect:* Sedation/sleep

- *Categories:* Sedative hypnotic fall into two categories.
- *Barbiturates:* Pentobarbital, Secobarbital, Methohexital.
- *Non-barbiturates:* Chloral hydrate–25 to 45 mg/kg– paraldehyde

Antianxiety Drugs

- Antianxiety drugs are minor tranquilizers; antipsychotics drugs are called major tranquilizers.
- *Primary effect:* Decreases anxiety.
- *Site of primary effect:* Limbic system, which is the 'seat of emotions'.
- The antianxiety agents consists primarily of the benzodiazepines, such as diazepam (valium), midazolam (versed) and triazolam (halcion).
- Unfortunately, there is a lack of extensive clinical experience and research on these agents in children.

Narcotics**Primary Effects**

These drugs are used also in sedation for their primary action of analgesia.

Site of Primary Effect

Opioid receptors of the CNS.

Effects

These drugs modify the interpretation of the pain stimulus in the CNS and therefore raise the pain threshold; as the dose of narcotics are increased, other effects such as sedation will occur.

Narcotics used in sedation techniques include morphine, meperidine and fentanyl.

Chapter 3

Antimicrobials in Pediatric Dentistry

A large number of antimicrobial agents are available for use in pediatric dentistry.

Antimicrobial spectrum and preferred therapeutic agents.

<i>Microbial spectrum</i>	<i>Class of preferred antimicrobial</i>	<i>Examples</i>
i. Gram-positive aerobic bacteria	Natural penicillins	Penicillin G Penicillin VK
	Penicillinase resistant penicillins	Oxacillin, Nafcillin, Methicillin
	Aminopenicillins	Ampicillin, Amoxicillin
	Macrolides	Erythromycin Clarithromycin Azithromycin
	Glycopeptides	Vancomycin
ii. Gram-negative aerobic bacteria	Cephalosporins	Cefazolin Cephalothin Cephalexin, Cefaclor
	Lincosamides	Clindamycin
	Topicals	Bacitracin, Mupirocin
	Aminoglycosides	Gentamycin, Tobramycin, Amikacin
	Extended spectrum penicillins	Mezlocillin, Piperacillin
	Antipseudomonal penicillins	Carbenicillin Ticarcillin
	Monobactams	Aztreonam
	Carbapenems	Imipenem, Meropenem
	Cephalosporins	Ceftazidime
	Sulfonamides	Trimethoprim, Sulfamethoxazole

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<i>Microbial spectrum</i>	<i>Class of preferred antimicrobial</i>	<i>Examples</i>
iii. Broad spectrum antibacterial	3rd/4th generation cephalosporins β -lactam + β -lactamase inhibitor combinations	Cefotaxime, Ceftriaxone Ampicillin + Sulbactam Amoxicillin + Clavulanate + Ticarcillin Clavulanate
	Quinolones	Ciprofloxacin, Ofloxacin, Sparfloxacin, Norfloxacin
	Tetracyclines	Tetracycline
	Chloramphenicol	Doxycycline, Minocycline
iv. Anaerobic bacteria	Penicillin	Penicillin G
	Cephalosporins	Cefotetan, Cefoxitin
	Carbapenems	Imipenem + Cilastin, Ertapenem
	Lincosamides	Clindamycin
	Chloramphenicol	Chloramphenicol
	Metronidazole	Metronidazole
v. Fungal infections	Polyenes	Amphotericin B
	Azoles	Fluconazole, Itraconazole, Voriconazole
	Topical antifungal	Nystatin, Clotrimazole agents
vi. Viral infections	Antiherpes virus agents	Acyclovir, Ganciclovir, Foscarnet, Famcyclovir
	Topical antiherpes agents	Trifluridine, Idoxuridine

MODE OF ACTION

Antimicrobials may also be categorized according to their mode or site of action.

Antimicrobials: Mode of Action

- *Inhibition of cell wall synthesis*
 - Cephalosporins
 - Monobactams
 - Carbapenems
- Glycopeptides
- Azole antifungals.
- *Inhibition of protein synthesis*
 - *Bind 50s ribosome*
 - Macrolides
 - Chloramphenicol
 - Lincosamides
 - Oxazolidinones
 - Streptogramins

- *Bind 30s ribosome*
 - Aminoglycosides
 - Tetracyclines
- *Antimetabolites*
 - Sulfonamides
- *Alteration of cell membrane permeability*
 - Polymyxins
 - Clotrimazole (antifungal)
 - Polyene antifungals
- *Inhibition of nucleic acid synthesis*
 - Rifampin
 - Griseofulvin
 - Nucleoside antivirals
- *Topoisomerase inhibitors*
 - Malidixic acid
 - Quinolones
- *Inhibition of cytochrome sterol*
 - Azoles (antifungals).

ANTIBIOTIC RESISTANCE

- Bacterial resistance to antibiotics is one of the significant challenges in the management of infectious diseases.
- The development of resistant bacterial strains may be minimized by consistently using an appropriate antibiotic dosage for an adequate period of time.

Illustration

For gram-negative infections, especially pseudomonas infections, or infections with enterococci, treatment with combination of antibiotics β -lactam and aminoglycosides may help to prevent the emergence of resistant strains.

Note: When planning combination drug therapy it is important to select antibacterial agents that have synergistic or additive activity.

Chapter 4

Dental Public Health Issues in Pediatric Dentistry

WHAT IS DENTAL PUBLIC HEALTH?

- Dental public health is a field of study within the broader field of public health. Its philosophy and substance reflect public health and its focus on the community rather than on the individual patient.
- The ADA has recognized dental public health as one of nine-specialties of dentistry. The American Board of Dental Public Health (ABDPH) defined dental public health as—

“The science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts”.

It is that form of dental practice that serves the community as a patient rather than individual. It is concerned with dental health education of the public, with research and the application of the findings of research with the administration of programs of dental care for groups and with the prevention and control of dental disease through a community approach.

DENTAL PUBLIC HEALTH PRACTICE

Prevention is the bedrock of public health practice, and it is also the foundation for the practice of dental

public health. Dental public health practitioners share the belief that the public's dental health “can be improved by altering conditions-behavior, the environment, biological interactions, and the organizations of services—that might otherwise, at a future time, have an adverse impact on health”.

- The practice of dental public health requires a set of methods and skills to make that belief a reality.
- Dental public health practice can be considered as engaging in the processes and activities required to carry out the three public health functions.

Assessment

- i. Documenting the oral health status of children through epidemiologic surveys.
- ii. Assessing the supply and availability of dentists to meet the needs of children.
- iii. Assessing the status of water fluoridations in communities.
- iv. Assessing the need for dental care for children with special health care needs.
- v. Identifying barriers to dental access.
- vi. Screening children before entering school.

Policy Development

- i. Developing policies and advocating for legislative action to ensure access to oral health services for low income, under served, hard to reach, and vulnerable children.
- ii. Developing programs that focus on primary and secondary prevention.
- iii. Developing programs to provide dental care to children with special health needs or without access to adequate dental care.
- iv. Adopting state rules mandating oral health screening for children entering school for the first time.

Assurance

- i. Encouraging and coordinating efforts to provide oral health education and promotion in schools, clinics, community settings, and other settings.
- ii. Expanding or establishing new dental clinical sites.
- iii. Developing promotional activities by the state health agency to meet the oral health needs of a specific target group or community.
- iv. Targeting topical and systemic fluoride programs to areas with nonfluoridated water supplies and high risk populations.
- v. Including an oral health component in all school health initiatives.
- vi. Establishing school-based prevention programs and school linked dental clinics as components of comprehensive school health.
- vii. Establishing programs to train medical professionals and other health related workers to recognize oral health problems, including early childhood caries.

- viii. Integrating oral health services into appropriate health, education, and social service programs (e.g. maternal and child health, nutrition, school health).

To address and respond to these core functions, three categories of management-related activities have been identified—

- Program planning
- Implementation
- Evaluation.

MEDICAID

- Medicaid is a jointly funded federal state entitlement program that provide benefits for medical and health related services to America's poorest people.
- Medicaid covers three main groups of low-income Americans: Parents and children, the disabled, the elderly.

Early Periodic Screening, Diagnostic and Treatment (EPSDT) Services

The EPSDT service is Medicaid's Comprehensive and preventive child health program for individuals under age 21.

Dental Services

EPSDT dental services include diagnostic, preventive, and therapeutic or treatment services needed for relief of pain and infection, restoration of teeth, maintenance of dental health, starting at as early an age as deemed necessary and in accordance with current standards of dental practice.

Barriers to Care for Infants and Toddlers from Low Income Families

Dental care for infants and toddlers from low income families presents a dilemma for several reasons.

These children often:

- i. Lack financial access to care.
- ii. Have caregivers who fail to recognize the importance of early dental visits.
- iii. Have difficulty finding a dentist who accepts Medicaid.

- iv. Have difficulty finding a dentist who will treat children younger than 3 years.

Despite EPSDT program requirements that eligible children visit a dentist by age 3 (or younger in some states), the use of dental services by low income children ages 0-3 remains extremely low.

Continuing efforts are needed to convey the importance of early dental visits for this group of children.

Part 2

Primary Dentition: Three to Six Years

- 5. General Topics to be Considered*
- 6. Child Psychology*
- 7. Examination, Diagnosis and Treatment Planning*
- 8. Prevention of Dental Diseases*
- 9. Restorative Dentistry for the Primary Dentition*
- 10. Pulp Therapy for the Primary Dentition*
- 11. Periodontal Problems in Children and Adolescents*
- 12. Space Maintenance in the Primary Dentition*
- 13. Oral Habits*
- 14. Local Anesthesia and Oral Surgery in Children*



Chapter 5

General Topics to be Considered

Q. Describe differences between permanent and deciduous teeth and explain how morphology and histology of both dentition differs?

ANS. MORPHOLOGICAL DIFFERENCES

The Crown

<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none">• Lighter in color, bluish white (milky white) also called as milk teeth as its refractive index is same as milk, i.e. 1• Duration of deciduous dentition is from 6 months to 5½ yrs.• Number of teeth = 20; 2 incisors, 2 molars, 1 canine (five teeth in each quadrant)• Smaller in all dimension• The crowns are wider mesiodistally in relation to cervicoocclusally this gives cup shape to anterior teeth and squat shape to posterior teeth (molars)• Cuspids are slender and tend to be more conical• The cervical ridges are more pronounced especially on the buccal aspect of first primary molar• Buccal and lingual surface tend to converge towards occlusal surface especially in primary I molar so that they have narrow occlusal table in buccolingual plane• Occlusal plane is relatively flat• Molars are more bulbous and are sharply constricted (bell-shaped) cervically	<ul style="list-style-type: none">• Darker in color, grayish or yellowish white• Duration of permanent teeth is 6 years onwards• Number of teeth = 32; 2 incisors, 1 canine, 2 premolars, 3 molars (eight in each quadrant)• Larger in all dimensions• The crowns are large in cervicoocclusal dimension than in mesiodistal dimension this gives larger appearance to permanent anterior teeth.• Cuspids are less conical• Cervical ridges are flatter• There is less convergence of buccal and lingual surfaces of molars towards occlusal surface• The occlusal plane has more curved contour• They have less constriction of neck

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<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • The enamel is thinner and has a more consistent depth of about 1 mm thickness throughout the entire crown • The contact areas between molars are broader, flatter and situated gingivally • The enamel rods at the cervical slopes occlusally from DEJ • The supplemental grooves are less • Mamelons are absent because primary teeth develop from single lobe • First molar is smaller in dimension than the second molar 	<ul style="list-style-type: none"> • The enamel is thicker and has thickness of 2-3 mm • The contact point between permanent molars is situated occlusally • The enamel rods are oriented gingivally • The supplemental grooves are less • Mamelons present on incisal edges of newly erupted incisor teeth • First molar is larger in dimensions than the second molar

The Root

<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • The roots are larger and more slender in comparison to crown size • Furcation is more towards cervical area so the root root trunk is smaller • Roots are narrower mesiodistally • At the cervical region, the roots of primary molar flare outwards and continued to flare as they approach apices to accommodate permanent molars • Undergo physiologic resorption during shedding of primary teeth 	<ul style="list-style-type: none"> • Roots are shorter and bulbous in comparison to crown • Placement of furcation is apical thus root trunk is larger • Roots are broader mesiodistally • Marked flaring of roots is absent • Physiologic resorption is absent

The pulp: The pulp chamber anatomy in both primary and permanent teeth closely approximates the surface shape of crown.

<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • Pulp chamber is larger in relation to crown size • Pulpal outline follows DEJ more closely • Pulp horns are closer to the outer surface. Mesial pulp horn extends to a closer approximation of surface than does the distal pulp horns 	<ul style="list-style-type: none"> • Pulp chamber is smaller in relation to crown size • Pulpal outline follows DEJ less closely • The pulp horn are comparatively away from outer surface

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<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • High degree of cellularity and vascularity (at least in stages prior to advanced physiological resorption of roots) • High potential for repair • Comparatively less tooth structure • Greater thickness of dentin over the pulpal wall at the occlusal fossa of molars • Root canals are more ribbon like. The radicular pulp follows a thin, branching and tortuous path • Floor of pulp chamber is porous. Accessory canals in primary pulp chambers. Floor leads directly into inter-radicular furcation 	<ul style="list-style-type: none"> • Comparatively less degree of cellularity and vascularity in tissue • Comparatively less potential for repair • More tooth structure protecting for repair • Comparatively lesser thickness of dentin over the pulpal wall at occlusal fossa of molars • Root canals are well-defined with less branching • Floor of pulp chamber does not have any accessory canals

HISTOLOGICAL DIFFERENCES

<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • Roots have enlarged apical foramen. Thus, abundant blood supply demonstrate a more typical inflammatory response • Incidence of reparative dentin formation beneath the carious lesion is more extensive and irregular • Pulp nerve fibers passes to the odontoblastic area, where they terminate as free nerve ending • Density of innervation is less because of which primary teeth are less sensitive to operative procedures. Neural tissue is first to degenerate when root resorption begins • Localization of infection and inflammation is poorer in pulp 	<ul style="list-style-type: none"> • Foramen are restricted. Thus, reduced blood supply favors calcific response and healing by calcific scarring • Reparative dentin formation is less. • Pulp nerve fibers terminate mainly among the odontoblasts and even beyond the predentin • Density of innervation is more • Infection and inflammation in pulp is localized

Mineral Content

<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • Enamel and dentin are less mineralized • Neonatal lines present in both enamel and dentin • Enamel—bands of Retzius are less common; this may be partly responsible for bluish white color of enamel • Dentin—dentinal tubules are less regular • Dentin thickness is half that of permanent teeth. As a result dentin forming cells are functionally active by approximately 360 days • Interglobular dentin is absent • Dentin is less dense. This difference can be observed clinically by resistance offered to cutting of the bur. The dentin cuts more easily and also abrades more rapidly 	<ul style="list-style-type: none"> • Enamel and dentin are more mineralized • Neonatal lines seen only in I permanent molars (as mineralization takes place at birth) • Bands of Retzius are more common • Dentinal tubules are more regular • Dentin forming cells are functionally active by 700 days • Interglobular dentin is present just beneath the homogeneous and well-calcified mantle layer of dentin • The dentin is difficult to cut

Periodontal Structure

<i>Primary teeth</i>	<i>Permanent teeth</i>
<ul style="list-style-type: none"> • Cementum is very thin and is of primary type; secondary cementum is characteristically absent • Alveolar atrophy is rare • Gingivitis (Gingival inflammation) is absent in healthy child, similarly, the recession is infrequent 	<ul style="list-style-type: none"> • Secondary cementum is present • Alveolar atrophy occur • Gingivitis is common in adults

YOUNG PERMANENT TOOTH**INTRODUCTION**

It is a tooth just recently erupted into oral cavity and which does not have its root completed.

The eruption time is 6-12 years.

Calcification time is birth to 3 years.

Features of Young Permanent Teeth in Normal Circumstances

- i. Fundamental curvatures—proximal contacts are present initially which gets transformed into contact areas
- ii. A lot of interdental spaces; later they get closed by physiological mesial migration

- iii. Embrasure
- iv. Crown elevations and depressions as cusp or fossae, pits and fissure, ridges, development groove, mamelons—as teeth erupts and develops these cusps get rounded, pits become shallow and mamelons is not differentiated.
- v. Deepen gingival sulcus and pseudopocket.
- vi. Active and passive eruption.
- vii. Root apex is wide open and the apical foramen is funnel-shaped which is filled with periodontal tissues which get transformed into dentin and cementum. As teeth develops the apical foramen is going to narrow down.

BIOLOGICAL AND HISTOLOGICAL CONDITION

- *Enamel composition:*
Inorganic—86 percent
Organic—2 percent
Water—rest
 - Enamel in young permanent tooth is more permeable.
 - Surface texture like perikymata and enamel lamellae is seen.
 - Coating of developmental origin, enamel cuticle or nasmyth membrane or primary enamel cuticle or dental cuticle.
 - Reduced enamel epithelium
 - Coronal cementum
 - Coating of acquired origin—Plaque and salivary pellicle.
- *Dentin:*
Inorganic—70 percent
Water and organic content—30 percent
 - Thickness of dentin is very less with time the dentin increases due to constant deposition of dentin by pulpodentinal complex.

- Dentin is structurally made up of dentinal tubules in young permanent tooth we can see 75,000-80,000/mm²
- In old permanent teeth 35000-40000 tubules/mm²
- The incremental apposition of circumpulpal dentin is 4 µm/day. In old age is 0.5 µm/day.
- Dentin is more permeable due to widened dentinal tubules.
- Later they are calcified as aging process goes on; usually they are filled with dental lymph.
- As tooth become older mineralization occur and dentinal tubules are obliterated (sclerotic dentin).
- *Cementum:*
Inorganic 45-50 percent
Water and organic 50-55 percent
 - Cementum is of cellular type and is more permeable.
- *Periodontal ligament:* Highly cellular and vascular in YPT (young permanent tooth)
- *Pulp:* Wide pulp chamber with wide open apical foramen.
 - More cellular and vascular
 - As the pulp gets older the fibrous tissue increases.

Clinical Consideration

Preventive Measures

Fluoride application: Topical and systemic, enameloplasty, prophylactic odontomy, pit and fissure sealant

Treatment of young permanent tooth

- *For initial caries:* Normal conventional restoration.

- *For Deep caries:* Indirect pulp capping, direct pulp capping, pulpotomy, apexogenesis → Vital tooth, apexification → nonvital tooth and at last extraction.

Natal and Neonatal Teeth (Predeciduous Teeth)

Natal teeth: Teeth present at the time of birth.

Neonatal teeth: Teeth that erupt within 30 days of birth. Teeth which erupt after 30 days are called as early infancy teeth.

Features

- Extremely rare teeth when these are present they cause difficulty in feeding.

Prevalence

- Seen 1 in 2000 births, almost 95 percent of teeth (natal, neonatal are a part of deciduous teeth rest may be supernumerary teeth).
- The commonest site of occurrence is mandibular anterior region; posteriorly seen very rarely.

Clinical Features

- Look like a miniature cells containing enamel and dentin with or without roots.
- Teeth without roots are hypermobile.

Management

- As soon as parent comes; take a proper history of immunization
- If tooth is hypermobile; due to risk of aspiration it is extracted
- If it is firm go for IOPA to confirm it is supernumerary or deciduous

- If supernumerary—extraction
- If it is a deciduous tooth try to retain in oral cavity to prevent future arch deficiencies. Round off sharp margins to prevent injuries
- For extraction of natal or neonatal teeth wait till patient is 10 days old. This is to prevent hemorrhage due to hyperprothrombinemia. This waiting period of 14 days allow the intestinal flora of infant to produce vitamin that is essential for adequate prothrombin level
- For extraction of teeth apply topical anesthesia followed by finger with gauze piece in case of hypermobile teeth. In case of firm tooth, use narrow beak forceps
- Care should be taken to prevent aspiration of tooth
- The sharp incisor edge of tooth may cause laceration of lingual surface of tongue which is called Riga-Fede disease in such cases tooth has to be removed
- If breastfeeding is painful to mother, use of breast pumps and bottling of milk is recommended. However, infant can be conditioned not to bite during sucking process.
- In short period of time, if mother persists breastfeeding it is seen that infant senses of mother discomfort and learns to avoid causing injury.

TEETHING DISORDERS

Problems associated with eruption of teeth.

DEFINITION

It is physiological process of eruption of teeth into the oral cavity usually this occurs without any problem but in some infants, it is associated with some systemic disturbances and local symptoms. This symptoms are usually seen during 6th month to 2nd year of age of child.

Symptoms

- Excessive irritability
- Refusal to eat and sleep
- Excessive drooling of saliva
- Fever with chills, vomiting, dermatitis and gastro-intestinal disturbances
- Cough, convulsions
- Jaw grinding, finger sucking.

Various authors have related teething to systemic disturbances and they say this is a physiological process.

Where in the systemic disturbances are:

- i. Loss of maternal antibodies
- ii. Infections
- iii. Development of immunological response.

Treatment

- Treating the symptoms is a treatment of choice
- If there is no improvement, refer the child to a physician
- Lancing or incising the gingiva over tooth is contraindicated
- Commercially available teething rings can be prescribed
- Local pain symptoms are relieved by applying topical anesthetics or advising analgesics
- Inflammation of the gingiva may be seen which is reduced in few days
- Few authors have seen that teething causes day time restlessness which in turn increases the amount of finger sucking or rubbing of gums, which in turn increases the drooling of saliva, leading to loss of appetite and eventually loss of weight.

RAMPANT CARIES

Rampant caries are suddenly occurring (acute) growing type (widespread caries) with early pulpal involvement of teeth which are usually immune to decay (Masseleu 1945).

GENERAL FEATURES

- i. Many teeth are involved
- ii. Seen in children and adolescents
- iii. Carious lesion occurs on the surfaces generally considered to be at low risk of decay
- iv. Prevalence = 5-8 percent
- v. Females are more prone than males
- vi. Age: 4-8 yrs → Children
11-18 year → Adults.

Etiology

- i. Diet
- ii. Pathologic microorganisms
- iii. Teeth (Host for microorganisms to act)
- iv. Time
- v. Behavioral pattern
- vi. Other factors—carbohydrate metabolism by microorganism produces acids.
 - a. Lactobacillus and streptococcus
 - b. Teeth surfaces that are susceptible to acid degradation.
 - c. Parent overindulgence/parent ignorance.

General Factors

- Emotion, fear
- Dissatisfaction of achievement
- Traumatic school appearances
- Feeling of inferiority

- Tension and anxiety
- Xerostomia
- Sialorrhoea
- Radiation therapy
- Improper removal of neoplasm.

Clinical Features

Seen in primary and permanent dentition.

- In primary teeth features are related to order of tooth eruption.
- Initial lesions appears on labial surface of maxillary incisors near the gingival margin as a white area/pitting on enamel surface.
- In permanent teeth—Related to the eruption of teeth.
 - Here buccal and lingual surface of premolar and molar are involved.
 - Proximal and labial surface of maxillary incisors and proximal surface of mandibular incisors are involved.

Complications

- Affects maxillary anteriors which may lead to psychological problem due to loss of esthetics
- Minimal trauma can lead to fracture of teeth
- Difficulty in speech
- Development of abnormal habits
- Orthodontic problems
- Multiple abscess formation
- General health impaired
- Hospitalization may be required.

Aims of Treatment

- Management of existing caries
- Control of caries

- Institution of preventive procedures
- Restoration and rehabilitation.

Management is Undertaken Under

- Pediatrician
- Dietician
- Dental nurse
- Pedodontist.

Control of All Active Carious Lesion

- Gross excavation of caries and restoration with ZOE which will temporarily arrest the caries process and prevent pulp involvement
- Reduction in intake of carbohydrates
- Diet analysis and diet counselling
- Snacks should be suppressed
- Application of topical fluorides
- Repeat single fluoride application therapy every 3 months.
- If there is no loss of enamel, topical fluorides are given.
- If there is extensive cavitation with no pulp involvement in anterior teeth—GIC, polycarboxylate cement and in Posterior teeth—amalgam, stainless steel crown are given.
- Extensive cavitation with pulp involvement—pulpotomy, pulpectomy.

NURSING BOTTLE CARIES

It is a unique pattern of caries in very young children due to prolonged and improper feeding habits.

Etiology

- Teeth (Host for microorganisms to act)

- Time
- Pathologic or pathogenic microorganisms
- Diet.

Etiological Agents

Bovine milk, milk formulas and human breast milk have all been implicated in nursing caries because of their lactose content. Additional sweeteners in form of juice, honey dipped pacifiers can also cause this type of caries.

Nursing bottle can effectively block the salivary access to the tooth surface, thereby increasing the cariogenicity of oral flora.

The basic mechanism of demineralization (caries initiation, is key in the whole process of nursing caries as all four variables)—

- *Pathologic Microorganism—Streptococcus mutans* is the principal microorganism principal which colonises the teeth after it erupts into the oral cavity.
 - It is transmitted to infants mouth primarily through the mother.
 - It is considered more virulent because of—
 - a. It colonizes the teeth
 - b. It produces large amount of acids
 - c. It produces large amount of extracellular polysaccharides which favor plaque formation.
 - It is seen that child's infection is of 9 time greater who's maternal salivary count of *Streptococcus mutans* is greater than 100,000 colony forming unit per ml.
 - *S. mutans* are more evident in rapid and smooth surface caries and less common in pit and fissure caries.

- Substrate (Fermentable carbohydrate)—Carbohydrates are utilized by microorganism to produce dextrans.

- a. Adhere microorganisms to tooth surface
- b. Initiate producing organic acid to demineralize the tooth.

In infants and toddlers, the main source of fermentable carbohydrates are:

- Bovine milk, milk formulas
- Human breast milk
- Additional sweeteners like juices, honey dipped pacifiers or pacifiers dipped in sugar solution
- Sweet syrups like vitamin preparations
- Chocolates or other sweets.

- *Host*

- Teeth acts as host for microorganisms to act.
- Hypomineralized or hypoplasia of teeth increases the susceptibility of child to caries.
- Thin enamel in primary teeth is one of reason of early spread of lesion.
- Developmental grooves acts as plaque retentive areas.

- *Time*

More the time child sleeps with bottle in mouth, the higher is risk of caries. This is because salivary flow, swallowing reflex decreases thus provide more time for accumulation of carbohydrates in mouth which is acted upon by microorganism to produce acids leading to caries.

- *Other Predisposing Factor*

- Overindulgence of parents
- Crowded homes
- Malnutrition
- Low-birth weight infants (less than 2500 gm)

- Recently, it has been seen that salivary gland function is impaired by iron deficiency, excess of lead exposure, which makes the oral environment more caries susceptible.

Clinical Features

The intraoral decay pattern of nursing caries is characteristic and pathognomonic of the conditions. It affects the primary teeth in the following sequence of involvement—

- Maxillary central incisor and lateral incisors*: Facial, lingual, mesial and distal surfaces
- Maxillary first molars*: Facial, lingual, occlusal and proximal surfaces
- Maxillary canine and II molars*: Facial, lingual and proximal surfaces
- Mandibular molars at the later stage
- Mandibular incisors are usually spared because—
 - Protection by tongue
 - Cleanzing action of saliva due to the presence of the orifice of duct of sublingual glands very close to lower incisors.

Progression of Lesion

- Initially a demineralized dull, white area is seen along gum line on the labial aspect of maxillary incisors, which is undetected by parents.
- These white lesions become cavities which involve the neck of tooth in a ring-like lesion.
- Finally, the whole crown of incisors is destroyed leaving behind brown black root stumps.
- This unique pattern and unequal severity of the lesion is due to three factors—
 - Chronology of primary tooth eruption
 - Duration of deleterious habits of feeding
 - Muscular pattern of infant sucking.

Implication

- The child who have nursing caries has an increased risk of caries in permanent dentition
- The child with caries are susceptible to other health hazards
- The treatment of nursing caries may be a financial burden to some parents.

Differential Diagnosis

- Rampant caries
- Radiation caries
- Enamel hypoplasia.

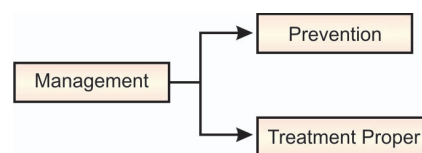
Management

Aims

- Management of existing emergency
- Arrest and control of caries process
- Institution of preventive procedures
- Restoration and rehabilitation.

Factors Affecting Management

- Extent of lesion
- Age of patient
- Behavioral problems of child due to young age of child.



i. Prevention:

- The main strategies for prevention is to aware and alert the parents, prospective new parents about the condition and its cause

- Information on nursing caries can be distributed to new parents through; obstetricians or gynecologists, pediatrics, paramedical staff, health workers, maternal and child health care centers
- Sealing of all caries free pits and fissures
- Topical fluoride application
- Water fluoridation in suboptimal fluoride water level areas
- Topical antimicrobial therapy
- Supervised home care should be taught
- Professional fluoride program.
- Broad committees at government level to address the issue of caries and risk factors in young children and how to recognize the early signs of the condition and promote early intervention.

ii. *Proper treatment:* Divided into 3 visits

First Visit

This phase of treatment constitutes treatment of the lesion, identification of cause for counseling of parents.

- All lesions should be excavated and restored
- If abscess is present it is treated through drainage
- X-rays are advised to assess the condition of succedaneous teeth
- Collection of saliva for determining salivary flow and viscosity
- Application of fluorides topically.

Parent Counseling

- The parents are questioned about the child's feeding habit, especially regarding the use of nocturnal bottles

- The parent should be asked to try weaning the child from using the bottle as pacifier while in bed
- In case, considerable emotional dependence on bottle, suggest the use of plain or fluoridated water
- The parent should be instructed to clean child's teeth after every feed
- Parents are advised to maintain a diet record of the child for one week which include time, amount of food given to child, the type of food, number of sugar exposure.

Second Visit

It should be scheduled one week after the first visit.

- Analysis of diet chart and explanation of disease process of child's teeth should be undertaken by simple equation
- Isolate the sugar factors from diet charts and control sugar exposure by intelligent use
- Reassess the restoration or redo if needed
- Caries activity test can be started and repeated at monthly interval to monitor the success of treatment.

Third and Subsequent Visits

- Restoring all grossly decayed tooth
- Endodontic treatment
- In case of unrestorable teeth, extraction followed by space maintainers are used
- Crowns can be given for grossly destructed teeth or endodontically treated teeth
- Review and recall after 3 months.

Chapter 6

Child Psychology

DEFINITION

Psychology is the scientific study of mental processes and behavior.

Psychologists observe and record how people and other animals are related to each other and to environment. It is a broad field that encompasses or explores a variety of questions such as thoughts, feelings and action. The word psychology comes from Greek word psyche—mind or soul and logy—study.

Theories of Psychology

Psychodynamic Theory

- a. Psychoanalytical theory
 - b. Psychosexual theory
 - c. Psychosocial theory—Erik Erikson (1963)
 - d. Theory of hierarchy of needs—Abraham Maslow.
- } Sigmund Freud (1908)

Behavior Learning Theories

- a. Classical conditioning theory by Ivan Pavlov
- b. Operant conditioning theory by BF Skinner
- c. Cognitive development theory by Jean Piaget (1952)
- d. Social learning theory by Albert Bandura (1963).

Psychoanalytical Theory

Id

- It is the most primitive part of personality from which other two systems develop later.
- It aims to avoid pain and obtain pleasure.
- Freud call it psychic reality because it represents the inner world of subjective experience and has no knowledge of objective reality.
- Id cannot tolerate increased energy that are experienced as comfortable states of tension.
- When tension is raised either by external stimulation or internally produced excitation the function to discharge the tension immediately and return to or gain to a comfortable, constant and low energy level, that is called *pleasure principle*.
- To obtain pleasure Id has its command on two process:
 - *Reflex action*: The inborn and automatic reaction like blinking and sneezing which relieves tension.
 - *In primary process* tension is relieved by forming an image of object that will remove tension for example primary process provide

the hungry man with mental image of food. This hallucinating experience in which the derived object is present in the form of memory image is called wish fulfilment.

Ego

- That aspect of psyche which is conscious and most in touch with reality.
- The ability to understand that their impulses cannot always be gratified immediately comes with development of ego, children learn that hunger must wait until someone provide food and satisfaction of relieving bladder or bowel must be delayed until bathroom is reached an ego obeys the reality principle.
- The child learns to differentiate between memory image and actual perception of food as it exists in the outer world.
- Ego obeys reality principles and operates by secondary process; the principle of reality principle is to prevent discharge of tension until object of satisfaction of need has been discovered.
- Principal role of ego is to mediate between instinctual requirement of the organism and conditions of the surrounding environment.

Superego

It is the internal representative of the traditional values and ideals of society as interpreted to the child by their parents and enforced by means of reward or punishments.

Superego obeys moral principles it is the moral arm of the personality.

- It represents ideal rather than real and strives for perfection rather than pleasure.
- Its concern as to decide between right and wrong so it can act in accordance with the moral standards authorized by the agents of the society.
- To obtain reward and avoid punishment, the child learn to guide its behavior along the lives laid down by the parents.
- Finally the Id, ego, superego work together as a team under the administrative leadership of ego.

In a way,

Id is the biological component of personality.

Ego is the psychological component of personality.

Superego is the social component of personality.

Psychosexual Theory

The child passes through the series of dynamically differentiated stages during the first 5 years of life following which a period of latency occurs in the next 5-6 years, a dynamic phase which becomes more or less stabilized with the advent of adolescence, the dynamic phase; erupts again and then gradually settle down as the adolescent moves into adulthood.

According to Freud as child grows and develops, different parts of the body serves as sources of pleasure.

Various Stages

Oral stage	- 1st year of life
Anal stage	- 1-3 years
Phallic stage	- 3-5 years
Latency stage	- 6 years to puberty
Genital stage	- Adolescence (12-18 years).

Oral Stage (1st Year of Life)

- It is the earliest stage of development.
- The infant's needs of perception and mode of expression are primarily centered around the mouth, lips, tongue and other regions located near the oral zone.
- The oral sensation include thirst, hunger, pleasurable tactile sensation evoked by the nipple or its substitute.
- The oral trait consisting of wish to eat, to sleep and to reach that relaxation which occurs at the end of sucking.
- If the infant is discouraged in his search for pleasure via sucking by too early or too abrupt weaning practices substantial portion of libidinal energy is forever reserved, in later childhood in adult life he will devote a lot of his time and energy to this pursuit of oral erotic activities like thumb sucking, eating, smoking, talking, etc.
- Successful early separation from the mother and the development of child sense of self (the ego) depends upon the child ability to maintain an image of his mother in mind thus when mother is out of sight she can still be present as a mental image.
- Characteristic clinical events mark the struggle of *separation anxiety*.
 - The noticeable anxiety the 9 months old child shows towards unfamiliar person.

Anal Stage (1-3 Years)

This stage is characterized by maturation of neuromuscular control over sphincters particularly the anal sphincter, thus permitting more voluntary control over retention or expulsion of faeces.

- This stage occur in response to efforts by parents to toilet train other children.

- During this stage the process of elimination become primary source of pleasure.
- Fixation at this stage caused by traumatic toilet training experience, may result in individuals who are excessively orderly or stubborn, or excessively generous or undisciplined.
- Fixation may result in characters like anal retentive or anal expulsive.
- The personality characteristic seen in anal retentive character involve high standard of cleanliness, punctuality, stringness, stubbornness.
- Characters in anal expulsive involve interest in elimination of all body wastes concern for the manipulation of plastic materials, artists, baker, painter or all who displace and arrange mold and semisolid materials.

Urethral Stage

Seen in between anal and phallic stage.

- Here urethral erotism which refers to pleasure in urination and pleasures in urinary retention analogues to anal retention.

Phallic Stage (3-6 Years)

At about 4 years the genital become primary source of pleasure. At this time child fantasies about sexual relations with opposite sex component.

Oedipus Complex

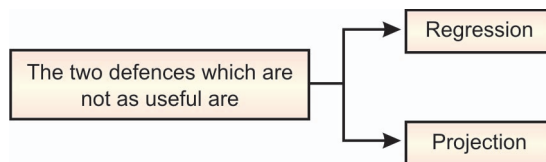
Here the boy attracted towards his mother and consider father as a rival. He imagines his dominant rival which will going to harm him of his fear in centered around the genital organ, this is called fear of castration or castration anxiety.

Electra Complex

Here the girl is attracted towards his father and her mother presence is threatening. It is the female counterpart of castration anxiety in boys. They too are collectively called as castration anxiety.

Latency Stage (6 Years to Puberty)

- Major shift occurs in the school age of child's life. He is required to leave the relative security of home to enter school, where he/she is judged on his/her own merit in comparison with his/her peer.
- This stage creates another major step in the process of separation individualization.
- They have sufficient self-esteem and initiative that make them able to make friends.



- They able to tolerate frustration and anxiety.
- This stage is called latency stage because it is reasonably calm period.

Regression involves acting younger and inadequate in period of stress.

Projection involves attributing to others the responsibility for ones own unacceptable behavior.

Genital Stage (Adolescence, 12-18 Years)

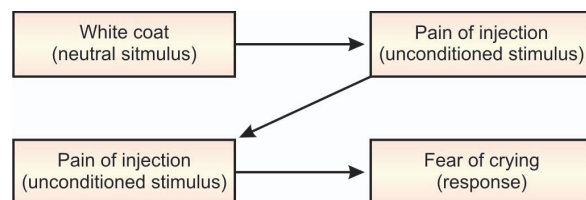
- As the child grows the pleasure is followed on the genitals.

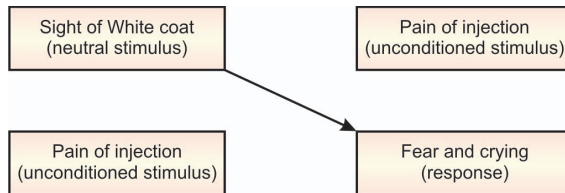
- The adolescent begin to love other for attractive motives. Sexual attraction, socialization, group activities, vocational planning, marring and raising a family begin to manifest themselves.
- By the end of adolescence the person become transformed from pleasure seeking into a reality oriented socialized adult.
- The function of genital stage is reproduction, the psychological aspect helps to achieve the end by providing a certain measure of stability and security.

Classical Conditioning Theory By Ivan Pavlov

- Russian psychologist Ivan Pavlov stated that, apparently unassociated stimuli could produce reflexive behavior.
- Classical conditioning occurs readily with young children and can have a considerable impact on a young child's behavior on the first visit to a dental office.
- When child experiences pain the reflex reaction is crying and withdrawal in pavlovian terms, the infliction of pain is an unconditioned stimulus, but the environment or setting in which the pain occurs can become associated with this unconditioned stimulus.

First Visit



Second Visit

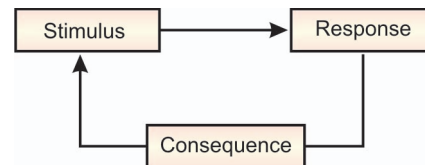
- For instances; if the unconditioned stimulus a painful treatment comes to be associated with conditioned stimulus of white coats, the child may cry and withdraw immediately at the first sight of white coated dentist or assistant.
- Associations of this type tend to become generalized painful and unpleasant experience associated with medical treatment can become generalized to the atmosphere of a physician office.
- Because of this it is important that the dental office should not look like physician office, the appearance should be different, so that it reduces the anxiety of the child.
- Treatment that produce pain should be avoided if at all possible on the first visit to a dental office.
- The association between a conditioned and an unconditioned stimulus is strengthened or reinforced everytime they occur together.
- Conversely; if the association is not reinforced, the association become less stronger and conditioned response will no longer occur. This phenomenon is called 'extinction' of the conditioned behavior.
- In general, if the consequence of a certain response is pleasant, that response is more likely to be used again in future, but if the consequence is unpleasant, the probability of that in future is reduced or diminished.

Skinner Described 4 Types of Operant Conditioning; Distinguished by Status of Consequence

Operant Conditioning Theory by BF Skinner

It can be viewed conceptually as a significant extension of classical conditioning.

The basic principle of operant conditioning is that the consequence of a behavior is itself a stimulus that can affect future behavior.



- **Positive reinforcement:** If a pleasant consequence follows a response, the response has been positively reinforced and the behavior that led to this pleasant consequence becomes more likely in the future.

For example, a child is given a toy as a reward for behaving well during first dental visit, she is more likely to behave well during future dental visits.

The opposite of generalization of a conditioned stimulus is discrimination, that is if a child is taken to other office setting where given a painful injection are not necessary a discrimination between the two types of offices which will develop and generalized response of fear and crying will no longer occur.

In other words, the consequence that follows a response will alter the probability of that response occurring again in similar situation.

- *Negative reinforcement*: Removal of undesirable stimulus involves the withdrawals of an unpleasant stimulus after a response like positive reinforcement. Negative reinforcement increases the likelihood of response in the future.

It mainly refers to the fact that reinforcement in a response that leads to the removal of an undesirable stimulus.

- *Omission*: Involves removal of a pleasant stimulus after a particular response, e.g. if a child who throws temper tantrums has his favourable toy taken away for a short period of time as a consequence of his behavior, then probability of similar misbehavior is decreased.
- *Punishment* occurs when in unpleasant stimulus is presented after a response, this also decreases the probability that the behavior that resulted in punishment will occur in the future. In general positive and negative reinforcement are the more suitable types of operant conditioning for use in the dental office.

The other two types, omission and punishment should be used sparingly with caution in the dental office since a positive stimulus is removed in omission, the child may react with anger and frustration. When punishment is used both fear and anger sometimes result.

Psychosocial Theory—Erik Erikson (1963)

Erik Erikson a friend and student of Freud, elaborated and modified Freud's theory of superimposition of psychosocial and psychosexual factors simultaneously contributing to the personality development of child.

Erikson's theory postulated that "society responds to the child's basic needs or developmental tasks in each specific period of life".

His approach emphasizes the dependent interaction of individual and society.

In his formation of the eight stages of development the first 5 of which detail childhood and adolescence, he has postulated a delicate balance between the successful or unsuccessful outcome of child's ability to master a need or task at a particular stage or to cope with a concomitant stress.

Erik's stages of emotional development: The sequence is more fixed than time when each stage is reached some adults never reach the final steps on the developmental staircase.

Development of Basic Trust (Birth to 18 Months)

In this initial stage of emotional development a basic trust or lack of trust in the environment is developed. Successful development of trust depends on caring and constant mother or mother substitute, who meets both the physiologic and emotional needs of infants. This bond must be maintained to allow the child to develop basic trust in the world. In fact, physical growth can be significantly retarded unless the child's emotional needs are met by appropriate mothering.

The syndrome of mother deprivation in which child receives inadequate maternal support is well-recognized though fortunately rare. Such infant fail to gain weight and are retarded in their physical as well as emotional growth. The maternal deprivation must be extreme to produce a deficit in physical growth.

Unstable mothering that produce no apparent physical efforts can result in a lack of sense of basic trust. This may occur in children from broken family or who have lived in series of foster homes. The tight bond between parent and child at this early stage of emotional development is reflected in strong sense of

separation anxiety in child when separated from the parents. If it is necessary to provide dental treatment at a early age, it is usually preferable to do so with parents present.

Development of Autonomy (18 Months to 3 Years)

Children around the age of 2 years often are said to be undergoing the “terrible twos” because of their uncooperative and frequently obnoxious behavior. At this stage of emotional development, the child is moving away from the mother and developing a sense of individuality identity or autonomy. Typically, the child struggles to exercise free choice in his life.

Failure to develop a proper sense of autonomy results in the development of doubts in child's mind about his ability to stand alone and this in turn produces doubts about others. Autonomy in control of bodily functions is an important part of this stage as the young child is toilet trained and taken out of diapers. At this stage wetting pants produce feeling of shame.

A key towards obtaining cooperation while treatment from a child at this stage is to have child think that what ever the dentist wants was his/her own choice, not something required by other person. Allowing the parents to be present during treatment may be needed for even the simplest procedures. Complex dental treatment of children at this age is quite challenging and may require extraordinary behavior management procedures such as sedation or GA.

Development of Initiative (3 to 6 Years)

In this stage, the child continues to develop greater autonomy, but now adds to it planning a vigorous

pursuit or various activities. The initiative is shown by physical activity and motion, extreme curiosity and questioning and aggressive talking. A major task for parents and teacher at this stage is to channel the activity into manageable task, arranging things so that the child is able to succeed and preventing him or her from undertaking task where success is not possible. At this stage a child is inherently teachable.

The opposite of initiative is guilt resulting from goal that are contemplated but not attained from acts initiated but not completed.

For most children the first visit to the dentist comes during this stage of initiative. Going to the dentist can be constructed as a new and challenging adventure in which the child can experience success. A child at this stage will be intensely curious about the dentist office and eager to learn about the things found there. An exploratory visit with the mother present with a little treatment accomplished usually is important in getting the dental experience of a good start. After the initial experience, a child at this stage can usually tolerate being separated from the mother for treatment and is likely to behave better in this arrangement, so that independence rather than dependence is reinforced.

Mastery of Skills (Age 7 to 11 Years)

At this stage, the child is working to acquire the academic and social skills that will allow him or her to compete in an environment where significant recognition is given to those who produce. At the same time, the child is learning the rules by which that world is organized; at this stage influence of parents as role model decreases and the influence of the peer group increase.

The negative side of emotional and personality development at this stage can be the acquisition of sense of inferiority. A child who begins to compete academically, socially and physically is certain to find that others do something better and that somehow does nearly anything better. Somebody else gets put in the advanced section, is selected as leader of group or is chosen first for team. Failure to measure up to the peer group on a broad scale predisposes towards personality characteristics of inadequacy, inferior and uselessness.

Orthodontic treatment often begins during this stage of development. Children at this stage still are not likely to be motivated by abstract concepts such as "If you wear this appliance your bite will be better". They can be motivated however by improved acceptance or status from the peer group.

Development of Personal Identity (Age 12 to 17 Years)

Adolescence a period of intense physical development, is also the stage in psychosocial development in which a unique personal identity is acquired. It is an extremely complex stage because of the many new opportunities that arrive, emerging sexuality complicates relationships with others. At that time physical ability changes, academic responsibilities increase and career possibilities begin to be defined.

Establishing one's own identity requires a partial withdrawal from the family and the peer group increases still further in importance because it offers a sense of continuity of existence in spite of drastic changes within the individual member of peer group becomes important role models and the values and tastes of parent and other authority figures are likely

to be rejected. At the same time, some separation from peer group is necessary to establish one's own uniqueness and value. An adolescence progresses, an inability to separate from the group indicates some failure in identity development. This in turn can lead to poor sense of direction for the future.

Most of the treatment is carried out during adolescent years and behavioral management of adolescents can be extremely challenging; since parental authority is being rejected, a poor psychological situation is created by treatment if it is being carried out primarily because the parents want it, not the child. At this stage treatment should be instituted only if the patient wants it, not just to please the parents.

Development of Intimacy (Young Adults)

Successful development of intimacy depends on a willingness to compromise and even to sacrifice to maintain a relationship, success leads to the establishments of affiliations and partnership both with a mate and with others of same sex in working towards the attainment of future goals. Failure leads to isolation from others and is likely to be accompanied by strong prejudices and a set of attitudes that serve to keep other away rather than bringing them into closer contact.

Guidance of the Next Generation (Adult)

A major responsibility of mature adult is the establishment and guidance of next generation. Becoming a successful and supportive parent is obviously a major part of this, but another aspect of the same responsibility is to provide the service to the group, community and nation.

Attainment of Integrity (Late Adults)

At this stage, the individual has adapted to the combination of gratification and disappointment that every adult experiences.

**Cognitive Development Theory
by Jean Piaget (1952)**

He proposes the assumption that the world is a stable environment and that the growing child learn this basic assumption through the acquisition of the knowledge of Mathematics and logic as a parts of reality. The child is then required to adapt to reality, those people showing the reality with him once again assuming that they share the same experience.

The process of adaptation is described by Piaget in his concept as—

Assimilation: It describes the ability of child to deal with new situations and problems with his age specific skills.

Accommodation

Is that process, which enable him to adapt and change his way of dealing with the world and to handle a problem which may at first may be too difficult to deal and master at his particular age and skills.

Piaget calls the major mechanisms that allow children to progress from one stage of cognitive functioning to next as assimilation, accommodation and equilibration.

For example, assimilation can be seen when a 5-year-old girl has learned that all the objects that fly in the sky are called birds. But when she sees a low flying helicopter and tries to assimilate it to her idea of bird the size and shape does not fit into her existing idea of a bird. Here assimilation is not possible then she realizes that she needs a new category for this new

object, parent might supply her a new word helicopter and explain the difference between two. This is accommodation, i.e. the individual tendency to change in response to environmental demands. As a result of this knowledge the child is temporarily in a state of equilibrium. The processes of establishing equilibrium is known as equilibration.

From the perspective of cognitive development theory development of a child can be divided into four major stages.

- i. *Sensor motor period (Birth to 2 years of age):* During this stage the child develops rudimentary concepts of objects including the idea that objects in the environment are permanent they do not disappear when the child is not looking at them.

Simple modes of thoughts are developing at this time, but communication between a child at this stage and an adult is extremely limited because of the child's simple concepts and lack of language capabilities.

- ii. *Preoperational period (2 to 7 years of age):* During the preoperational period; the capacity develops to form a mental symbol representing things that even not present and child learns to use words to symbolize these absent objects.

In this stage capabilities for logical reasoning are limited, e.g. if the child is first shown two equal sizes of glasses with water in them. The child agrees that both contain the same amount of water. Then the content of one glass are poured into a latter narrower glass while the child watches. Now when asked which glass have more amount of water child will usually say that the tall one have more water. Child's impressions are dominated by the greater height of water in tall glass. In this stage child will have two types of characters.

- a. *Primitive*: The child believes that people on TV screen can see him just as he see them.
- b. *Animistic*: Child will accept any reasonable explanation. During the dental treatment the dentists should be responsible to give reasonable explanation to satisfy a child's anxiety. He or she is much more likely to understand brushing makes your teeth feel clean and smooth and toothpaste makes your mouth taste good because these statement rely on things the child can taste or feel immediately.
- iii. *Period of concrete operation (from 7 year of age to puberty)*: Improved ability to reason emerges, she or he can use a limited number of logical process especially those involving object that can be handled and manipulated.
- iv. *Formal operation*: Occurs during the adolescence; this advance in cognitive development is not simply acquired by age but appears directly related to experiences in school. The major changes in this age group is ability to utilize the abstract thinking, logical operations and hypothetical reasoning.

In this stage when the patient becomes more esthetic conscious and in most cases patient is ready for any dental procedures to be carried out.

Social Learning Theory by Albert Bandura (1963)

Stimulus Response Theory

The principles of the social learning theory of child development are based on the basic that behavior is learned. This theory is based on the stimulus response (S-R) and psychoanalytical principles.

Social learning theories of child development hold that all behavior is learned by reinforcement.

From early infancy the child strives to have his basic needs met in order to reduce tension and to create a satisfied pleasurable feeling. The infant quickly learns in a reflexive manner that certain behaviors on his part elicit responses from his parents. The attention seeking behavior is essential for normal mother child interaction. If the responses are pleasing; rewarding to the child for his initial behavior will be repeated over and over and will eventually become part of his behavior and personality. Thus the approval or disapproval of the mother acts as a powerful reinforce for certain behavior in the child and the mother shape and modify the child's behavior to socially acceptable behavior.

The importance of stimulus response reactions in the social learning theory plays great significant effect of parent's role in child development.

Chapter 7

Examination, Diagnosis and Treatment Planning

- The examination, which may take only seconds, the dentist also has the opportunity to demonstrate oral hygiene, point out oral structures of importance, as record findings.
- Most infants will cry briefly during the examination, parents may need to be assured that infants who cry are normal, healthy babies and the response is expected.
- At the completion of the examination, the child is returned to the parent who can cuddle and console as needed.
- The dentist would expect to see a healthy oral cavity in most infants; but there are several oral conditions like natal and neonatal teeth, Riga-Fede disease. In addition other pathologic conditions of infancy, including dental lamina.
- Cysts (Bohn's nodules, Epstein's pearls).
- Congenital epulis.
- Eruption cyst.
- Neuroectodermal tumor of infancy.
- The dentist should look for development status, quality of dentition in terms of caries, hypoplasia and presence of plaque on teeth.

Oral Examination of Infant

The oral examination of the infant is a quick process but differs from the typical child examination in several ways :

- Use of a dental chair is unnecessary and the least preferred approach.
- The parent participates as a learner and immobilizer.
- Teaching about the oral cavity occurs during the examination process.
- The child may cry which is desirable and useful.

The preferred approach to infant examination is the "*Knee-to-Knee Approach*".

In this parent and dental surgeon sit facing each other, their knees should touch, creating a flat surface on which child can rest.

- The infant initially is held facing the parent and then reclined onto the lap of the dentist.
- The parent has the infant's legs straddling the torso and uses elbows to hold the feet in place, the parent holds the child's hands and the dentist looking down, stabilizes the child's head.

- The examination can occur wherever a suitable light source can be found.

Anticipatory Guidance

Parents often express interest in occlusal development and may indulge the dentist to discuss future orthodontic needs. Growth is difficult to predict; but the dentist ought to take the opportunity to discuss eruption, spacing and occlusion with parents as a part of anticipatory guidance.

THE EXAMINATION

The examination encompasses six major sections:

I. Behavioral Assessment

Chair side examination provide two opportunities to observe the behavior and initially assess potential cooperation.

II. General Appraisal

The general appraisal addresses the child psychological and behavioral status. The classic areas of this appraisal include gait, stature and presence of gross signs and symptoms of disease.

Illustration: The normal 3 to 6-year-old child is ambulatory well-coordinated in basic tasks, engaging and physically healthy in appearance.

III. Head and Neck Examination

Structures like hair, scalp, ears, eyes, nose, lips, temporomandibular joint, skin, chin are observed as elements included in head examination with using diagnostic techniques like—

- Visualization

- Palpation
 - Assessment of hearing, vision, function
 - Auscultation.
- Lymph nodes and thyroid is examined as elements of neck region.
- Palate, pharynx, tongue, floor of mouth, buccal mucosa, teeth are examined as elements of oral cavity.

IV. Facial Examination

a. Overall Facial Pattern

First, the facial profile is evaluated in anteroposterior plane.

To begin the examination the child should be seated in an upright position, looking at a distant point, three points on the face are identified.

- Bridge of nose
- Base of the upper lip
- Chin.

Line segments connecting these points form an angle that describes the profile as convex, straight, or concave.

Skeletal Relationship

Case I: A well-balanced profile in the anteroposterior dimension has an underlying skeletal relationship which is slightly convex that is labeled class I.

Furthermore, the canine relationships usually will be class I, and there will be overjet of 2-5 mm.

Class II: Some childrens have extremely convex profiles, these patients usually have class II permanent first molar relationships and distal step second primary molar relationships, have increased overjet.

Class III: Children with concave profiles are found with class III permanent first molar relationships and mesial step second primary molar relationships, class III canine relationships and negative overjet.

b. Facial Examination

Including observation of positions of maxilla and mandible giving again three possible skeletal patterns Class I, Class II and Class III skeletal relationship.

c. Vertical Facial Relationships

The third portion of facial examination is an evaluation of vertical relationships; proportionately the face is divided into thirds—

The upper third extends from hair line to the bridge of nose.

The middle third extends from bridge of nose to the base of upper lip.

The lower third extends from the base of upper lip to the bottom of the chin.

d. Lip Position

The anteroposterior lip position gives an estimation of anteroposterior incisor position.

- Lip posture is assessed by drawing an imaginary line from the tip of nose to the most anterior point on the soft tissue chin.
- Incisor position is grossly reflected in lip contour and posture.

e. Facial Symmetry

- Transverse facial dimension are examined to rule out true facial asymmetry.
- Asymmetry usually manifests in the lower facial third whereas upper facial asymmetry is extremely rare. All faces show a minor degree of asymmetry, but marked asymmetry is not normal.
- Evaluation of facial symmetry—The patient is reclined in the dental chair and the dentist seated

in the 12 O'clock position. Hair is pulled away from the face, and a piece of dental floss can be stretched down the middle of the upper face to aid in judging lower face symmetry.

V. Intraoral Examination

An important portion of the intraoral examination is directed to the teeth. Each of the 20 primary teeth should be explored and scrutinised visually.

Intraoral Examination Includes (Fig. 7.1)

- Occlusal evaluation
- Alignment of dental arches
- *Anteroposterior Dimension:* Primary molar and canine relationships are determined and compared with Skeletal classification. In the primary dentition, molars are called flush terminal plane, mesial step or distal step. Primary canines are classified as class I, class II, class III, or end-to-end. These dental classification generally reflect the skeletal classification.



Fig. 7.1: Intraoral examination of child

- *Transverse relationship*: Of the arches is examined for midline discrepancies and posterior crossbites
 - a. A large midline discrepancy is unusual in the early primary dentition, and clinicians should be suspicious of a mandibular shift.
 - b. If a posterior crossbite is encountered the clinician should try to determine the cause.
- *Vertical relationship*: The vertical overlap of the primary incisors, is measured and recorded in millimeters or as a percentage of the total height of the mandibular incisor crown.
Anterior openbite, lack of overbite are due to two basic reasons:
 - i. Existence of a sucking habit
 - ii. Ankylosis; the fusion of tooth to bone is common in the primary dentition.
- Radiographic views include:
 - a. Maxillary periapical view (no. 0 film)
 - b. Mandibular periapical view (no. 0 film)
 - c. Maxillary occlusal view (no. 2 film)
 - d. Mandibular occlusal view (no. 2 film)
- Radiographic evaluation:
Transition into the mixed dentition requires modification of the basic pediatric survey.

Special radiographic considerations:

- i. Potential eruption problems may be diagnosed from the radiographs by the study of the unerupted teeth.
- ii. Small palate size, especially early in the school age period, prevents or complicates maxillary periapical radiography via a long cone film stabilising apparatus.
- iii. Identification of missing teeth, supernumerary teeth, and the developmental status of permanent anteriors and premolars require greater periapical coverage on films.
- iv. Greater anteroposterior length in the posterior occlusion requires more bite-wing coverage.

VI. Diagnosis

- The dentist requires radiographs to make a thorough diagnosis in the 3 to 6-year-old child.
- Radiographic projections are indicated in the following circumstances:
 - a. History of pain
 - b. Swelling
 - c. Trauma
 - d. Mobility of teeth
 - e. Unexplained bleeding
 - f. Disrupted eruption pattern
 - g. Deep carious lesions.
- For the primary dentition, no radiograph are indicated when all proximal surfaces can be visualized and examined clinically, but when proximal surface could not visualised and examined clinically, bite-wing radiographs are indicated.

TREATMENT PLANNING

Elements of treatment planning to be addressed are:

- i. *Management of primary caries*: Within the age period of 3 to 6 years, a decision for carious primary teeth has to be undertaken carefully whether to extract or restore the tooth while keeping in mind the remaining lifespan as well as the length of time that the child will be without replacement.
- ii. *Management of pathosis*: Oral pathosis such as supernumerary teeth, odontomas, or missing teeth are given definitive management in age period of 3 to 6 years.

- iii. *Prevention of dental disease:* The choice of sealants is also made during this period, as are decisions about how to manage incipient interproximal lesion of permanent teeth.
- iv. *Health issues:* The child with cancer, orofacial clefting, cerebral palsy or other conditions may need special consideration.

The dentist's role is to provide information about the need for care, the benefits anticipated, the alternatives to care (including no treatment) and the burden of maintenance of care.

These special patients may tax the dentists skills in planning care, and they may require careful and frequent observation rather than treatment.

Chapter 8

Prevention of Dental Diseases

ORAL HYGIENE

Dental plaque is a sticky film that adheres to the teeth. It is composed of bacteria, food debris, and salivary components. Left undisturbed, it can cause tooth decay.

Parents should clean the infant's gums with a damp cloth after feedings. As the first tooth erupts, a brush that is easy for the parent to hold and small enough to fit in the infant's mouth is recommended. To ensure that brushing is safe and effective, the infant should be seated in the parent's lap, with both parent and infant facing the same direction. The parent should try to clean all tooth surfaces, "lifting the lip" to brush at the gum line and then behind the teeth.

Young children will want to hold the toothbrush and participate in toothbrushing. An appropriate-size toothbrush with a wide handle given to the child to use. However, because effective plaque removal requires good motor control, young children cannot clean their teeth without parental help. After they acquire fine motor skills (e.g. the ability to tie their shoelaces), typically by age 7 they can clean their teeth effectively but should be supervised by a parent or another caregiver.

NUTRITION

The Role of Food in Oral Health

The role of food in oral health is twofold. First, foods consumed contribute to the health of the mouth as well as to overall health. Foods that provide calcium and vitamin D are vital for strong bones and teeth, and foods that provide vitamin C are necessary for healthy gums. Eating a balanced diet provides the foundation for healthy dietary choices and eating practices.

Second, eating habits have a direct effect on the caries process. When food is consumed, bacteria, especially *Streptococcus mutans* initiate to breakdown carbohydrates in the mouth, creating the acid that causes tooth decay.

The ability of a food to contribute to the development of cavities depends on how they adheres to the tooth surface and how frequently it is consumed. If carbohydrate consumed frequently, adhere to the teeth, and are not quickly cleared from the mouth and acid can be produced.

It is both unrealistic and undesirable to try to eliminate carbohydrates. The frequent carbohydrate consumption can be reduced, however, by encouraging

children to have healthy, less cariogenic foods. As the young child is introduced to a variety of new healthful meal and snack patterns can be instilled.

Fats and proteins may have a protective effect on enamel, making it less susceptible to acid attack by coating the teeth and increasing the buffering ability of saliva. Carbohydrates in combination with fats and proteins may therefore inhibit caries and rinsing with water following snacking may also curtail the caries process.

Snacks of healthy, less cariogenic foods such as a slice of cheese, a glass of milk, nonsticks should be encouraged over sticky foods such as fruit roll-ups and candy. Complex carbohydrates found in fruits, vegetables, grain products especially whole and dairy products (milk, cheese, cottage cheese, and unsweetened yogurt) should encouraged over foods high in sugar, such as candy, cookies, cake, sweetened beverages (e.g. fruit drinks, soda), and fruit juice.

FLUORIDE

The primary factor in reducing the prevalence of cavities among children in the United States has been the widespread availability of fluoride and fluoridated products.

Frequent exposure to small amounts of fluoride each day is the best way to reduce the risk for developing tooth decay. It is important to understand the benefits of fluoride and to know how infants and children can safely ingest it in appropriate quantities. Mechanisms by which fluoride prevents or reduces decay include:

- Increased resistance of the tooth structure to demineralization.
- Enhanced remineralization of early carious lesions.

- Reduced cariogenic activity of plaque, through disruption of bacterial metabolic function.

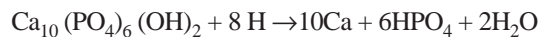
Infants and children receive fluoride in two ways: Systemically and topically. Only fluoride ingested during the tooth-forming years (ages 6 months to 19 years) has the systemic effect on enhancing resistance to later acid demineralization.

Either in the form of fluoride water or fluoride supplements (e.g. drops, swallowed liquids, and tablets) is very important; systemic fluoride reaches the developing teeth through the child's digestive and circulatory systems.

MECHANISM OF ACTION OF FLUORIDES IN CARIES REDUCTION

- Increased enamel resistance/reduction in enamel solubility:* It has been well-established that dental caries involves dissolution of enamel by acids from bacterial plaque and that dissolution is inhibited by the presence of fluoride. Because fluoride forms fluorapatite, fluorhydroxylapatite which is less soluble mineral.

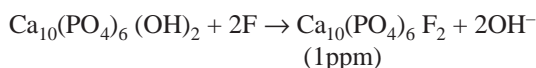
The dissolution of enamel during caries attack is a complete process when enamel is exposed to pH of about 5.5 or lower; enamel will dissolve.



This reaction occurs beneath the dental plaque. The concentration of calcium and phosphate ions in plaque fluid increases while leaving the dissolved enamel in their ionic form; the process is called demineralization. The presence of fluoride reduces the solubility of enamel by promoting the precipitation of hydroxyapatite and phosphate mineral.



Fig. 8.1: Intake of fluoridated water by child



When hydroxyapatite is exposed to low concentration of fluoride, i.e. 1 ppm a layer of fluorapatite forms on hydroxyapatite crystals this layer governs the rate of dissolution.

- b. *Pre-eruptive incorporation:* Fluoride get incorporated in fluid-filled sac, which surrounds the developing tooth, it then enter into developing enamel.
- c. *Increased rate of posteruptive maturation:* The greatest importance of fluoride to the maturation process lies in its ability to increase the rate of mineralization of hypomineralized areas. Newly erupted teeth often have hypomineralized areas that are prone to dental caries fluoride increase the mineralization or posteruptive maturation of these hypomineralized areas. Organic material is also deposited into enamel to further increase the resistance to dental caries. Both mineral ions and

organic material are deposited from saliva. A less soluble tooth that is more resistant to acid attack and less prone to caries is formed.

- d. *Remineralization of incipient lesions:* Minerals of tooth are continuously in exchange with minerals of saliva and thus the balance is maintained. This equilibrium can get disturbed with organic acids produced by fermentable carbohydrates by microorganisms; this leads to drop in pH of plaque on the enamel surface and in subsurface.

Minerals, particularly calcium and phosphate leave the dissolved enamel in their ionic form and enter the plaque fluid this process is called demineralization—This gets reversed with factors like fluoride and is termed as remineralization.

Due to loss of minerals the surface of enamel diffract light, creating an opacity that appears clinically as white spot are the incipient caries.

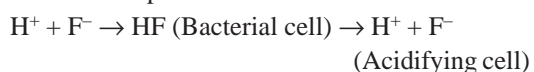
In presence of fluoride the spot (white spot) becomes smooth, shiny and in absence fluoride it becomes rough and chalky. The surface of white spot should not be probed too hard, though it appears intact because it is mineral deficient and weak layers may break and form cavitation. Therefore, this intact incipient lesion should be treated with topical fluoride and allow to remineralize.

On topical fluoride application the surface and subsurface enamel hold and absorb minerals, fluoride also present in plaque fluid which enhance the growth of partially dissolved crystals. The regrowth by fluoride incorporation chemically forms new crystals that are larger and more acid resistant.

- e. *Inhibiting demineralization*

- f. *Interference with plaque microorganism:* Plaque is reservoir of fluoride and approximately 2 percent of the fluoride in plaque is present as a free ion. Fluoride interact with bacterial cell rapidly and in pH dependent fashion; pertaining to the uptake of fluoride into bacterial cells is the differences between pH between the external medium and the intracellular cytoplasm “Fluoride pH effect”. The external pH becomes acidic (due to metabolism of fermentable carbohydrate and so the pH gradient will increase and a portion of fluoride ion in the plaque fluid then combines with hydrogen ion and rapidly diffuses in bacterial cell as HF (Hydroxy fluoride).

HF uptake into bacterial cell continues uptill the concentration of HF is equal in internal and external compartments



Once HF is inside the bacterial cell HF dissociated again. Acidifying the cells and releasing fluoride ions interferes with essential enzyme (enolase) activity thereby inhibiting bacterial metabolism and inhibiting plaque formation and demineralization.

- g. *Modification of tooth morphology:* Development of shallow and self-cleansable pit and fissure which are resistant to decay.

Chemistry of fluoride: Exists chemically in form of Fluorspar (CaF_2)

Fluorapatite ($\text{Ca}_{10}(\text{PO}_4)_6\text{F}_2$)

Cryolite (Na_3AlF_6)

I. SYSTEMIC FLUORIDE ADMINISTRATION

DIETARY FLUORIDE SUPPLEMENTATION

Fluoridated Milk

Jolan and Banoczy undertook longitudinal study to see the effect of milk consumption in 3-9-year-old children with homogeneous living condition.

Children were given 200 ml of milk with 0.4 mg of fluoride for preschoolers (3-5 years) and 0.75 mg for schoolers (6-9 years) for 300 days in years.

Caries reduction was seen in II and III year compared to I year.

Disadvantage: It provides limited exposure to children as consumption of milk tend to decline with increase in age.

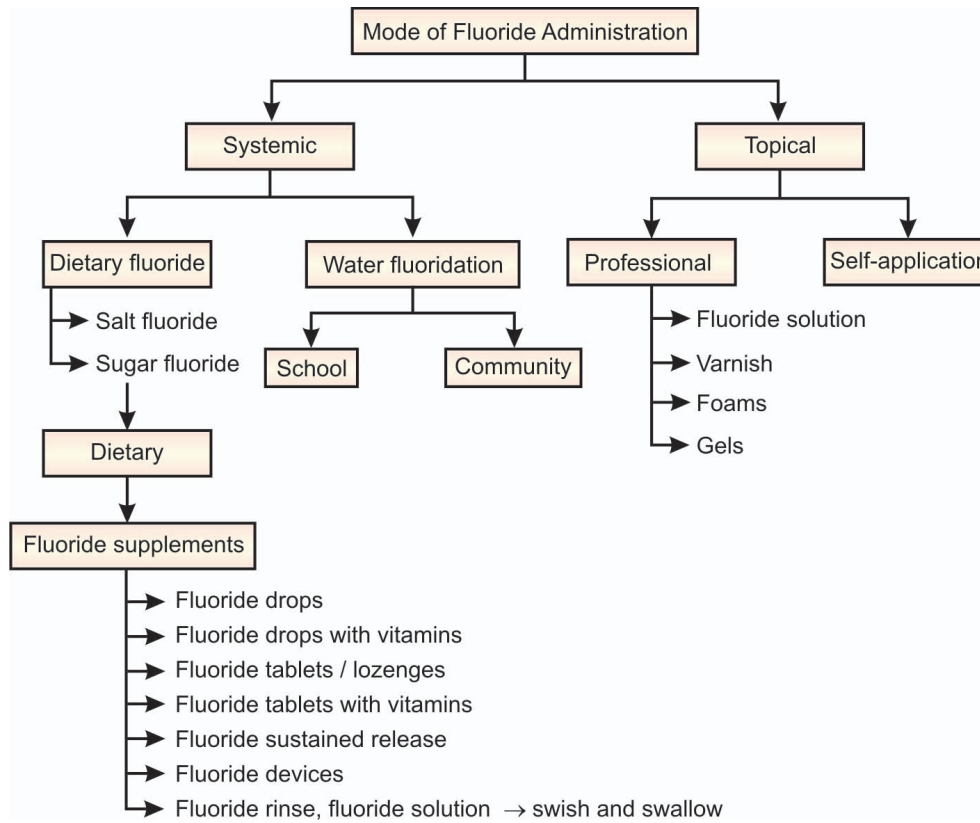
Absorption is slow as compared to water fluoridation.

Fluoridated salt: Commonly used potassium fluoride (250 mg/kg) and sodium fluoride—225 mg/kg. All over world only 5 countries—Belgium, France, Germany, Spain and Switzerland. A sixth Hungary is presently, contemplating a recommendation.

Fluoride in sugar: Fluoride in sugar and sugar products have potential to reduce cariogenic effect of sugar or fermentable carbohydrates among population group. 42 percent reduction in caries was observed in 3 year clinical trial.

Disadvantages: Increased consumption may lead to nutritional imbalance—

One type of fluoridated sugary product may not reach to all those needing fluoride supplements.



Water Fluoridation

Definition

Water fluoridation is defined as controlled adjustment of concentration of fluoride in a communal water supply so as to achieve maximum caries reduction and clinically insignificant level of fluorosis.

Water fluoridation may also be defined as the upward adjustment of concentration of fluoride ion in a public water supply in such a way that concentration of fluoride ion in the water may be consistently maintained at 1 ppm by weight to prevent dental caries with minimum possibility of causing dental fluorosis.

Water fluoridation was first done in Grand Rapids (Michigan).

Community Water Fluoridation

- *Optimal fluoride concentration and climatic condition*—The optimum concentration of fluoride in drinking water was assumed to be 1 ppm for incorporation of fluoride into dental enamel during the formative stages for children living in temperate climate (Refer Fig. 8.1). Children living in 1 ppm fluoridated area are assumed to receive an optimal intake of fluoride from water and food of 1 mg/day.

As water intake of individuals vary widely due to the influence of climate. In order to determine the amount of fluoride to be added to water; Galgan and Vermillion developed an empiric formula for estimating the amount of daily fluid intake-based on body weight and climatic conditions.

ppm fluoride $\rightarrow 0.34/E$

Where $E = 0.038 + 0.0062 \times \text{Temperature of Area in } ^\circ\text{F}$; E is the estimated daily water intake.

Temperature in $^\circ\text{C}$	Recommended pH
< 18.3	1.1-1.3
18.9–26.6	0.8-1.0
> 26.7	0.5-0.7

Depending upon the community mean maximum daily temperature.

Cold climate – 1.2 ppm.

Temperate or summer season–0.7 ppm.

- The recommended daily dose of fluoride for children above 3 years of age is 1 mg. This can be obtained by drinking one litre of water with 1 ppm concentration of fluoride ion.
- *Sample collection for fluoride estimation*: 500 ml of water to be tested is collected from a clean source in a clean dry polythene container; 2 cc of 6 N HCl is added to inhibit microbial growth and

store at 4°C for analysis preferably within 2-3 month, fluoride concentration is estimated by—

- Fluoride electrode coupled with standard pH meter.
- Scot-Sanchi's method.

Fluoride Compounds Used in Water Fluoridation

- Fluorspar
- Sodium fluoride
- Sodium silicofluoride
- Ammonium Silicofluoride
- Silicofluoride.

Types of equipment for water fluoridation—3 types

- Saturator system*—*Principle*: 4 percent saturated solution of sodium fluoride is produced and injected at a desired concentrated water distribution source with an aid of pump.
- Dry feeder systems*—*Principle*: Sodium fluoride or silicofluoride in the form of powder is introduced into a dissolving basin with aid of an automatic mechanism to ensure maintenance of correct supply of fluoride according to amount of water to be delivered.
- Solution feeder system*—*Principle*: Volumetric pump permitting the addition of a given quantity of hydrofluosilicic acid in proportion to the amount of water treated.

However, these systems incorporate electrical or mechanical devices that require maintenance by a capable operator. But the venturi fluoridator and saturated suspension cone are two systems which do not suffer from these.

This system was developed in Brazil by water and sewage authority it consists of cone charged with sodium silicofluoride through which constant flow of

water percolates. The solution is collected at the top by a horizontal perforated plastic pipe which forms the outlet.

School Water Fluoridation

- School water fluoridation is the adjustment of fluoride concentration of school water supply for caries prevention.
- Since children spend only 6 to 8 hours in the school; the concentration of fluoride is 4 to 6 times more than designated for community water supply.
- For instance in Elk Lake, Pennsylvania the school water supply was fluoridated at 5 ppm and in 5 years there was reduction of 29 percent seen in caries. After 10 years of school water fluoridation the children who attended school continuously had 39 percent less decayed, missing, filled teeth than there counter parts.

Advantage of School Water Fluoridation

It is a effective public health measure to reduce dental caries in communities where fluoridation of water is not possible.

Disadvantages

- Have less pre-eruptive fluoride exposure
- Intermittent fluoride exposure.

Benefits of Water Fluoridation

- Some tooth surface receives greater protection against caries.
For example, smooth surface → proximal surface derives maximum protection than do pit and fissures.

- Water fluoridation have both pre and posteruptive effects.
- Acts both systemically and topically.
- It make changes in morphology in the form of shallow pit.
- If there is question regarding the fluoride concentration, it is naturally present to some degree in water, the local authority of health can test samples and provide accurate information.
- Beverages botteled supplied to the influoridated areas or other such products may pass on the beneficial effects to fluoride deficient/deprived population. This is termed “Diffusion” or Halo Effect.

II. TOPICAL FLUORIDE ADMINISTRATION

By definition the term "topically applied fluorides" is used to describe those delivery systems which provide fluoride for a local chemical reaction to exposed surfaces of erupted dentition, the delivery system include measures designed for professional application in dental office, such as fluoride containing prophylactic paste, varnishes, gels, foams, as well as system designed for unsupervised home use such as fluoride dentifrices and Rinses (Stookey in 1990).

SELF-APPLIED TOPICAL FLUORIDE

Fluoride dentifrices: They contain 1000-1500 ppm of F⁻ formulated from either sodium fluoride or sodium monofluorophosphate and none contain stannous fluoride.

Advantages: Inhibits demineralization and enhance remineralization.

Precautions to be Considered

Preschool age children should be supervised while brushing to avoid excessive ingestion of paste.

- Only a dab or pea-sized amount of dentifrice should be used by 6 years of age or below.
- At least 1 brushing with F⁻ toothpaste should be done before bedtime.
- *Fluoride impregnated dental floss*: For interproximal surfaces.
- *Fluoride rinses*: Usually nonprescribed F⁻ mouth rinses contain 0.05 percent NaF they should be swished vigorously once a day for one minute and expectorated.

Prescribed F⁻ rinses generally contain 0.2 percent NaF they are designed to use under supervision once a week for one minute.

Precautions to be considered → children 5 years of age or handicapped child may swallow the rinse rather than expectorating so rinses are not recommended for them.

SUSTAINED RELEASE FLUORIDE

Sustained release fluoride → They provide a regular release of F⁻ slowly intraorally for a longer period. They effectively reduces the caries by remineralization of incipient caries.

A number of dental material are → cements, acrylics and resins while intraoral devices → copolymer membrane beads and glass pellets.

Professionally Applied Fluorides**Procedure to be Followed**

To reduce the likelihood of ingestion of fluoride during a professionally applied topical fluoride, the following procedure is kept in mind—

- Seat the patient—upright position.
- Use the trays with absorptive liners (Fig. 8.2).
- Limit the amount of agent, e.g. during gel application the gel is placed in tray to no more than 2.5 ml (one half of a teaspoon).
- Use suction during and after treatment.
- Have the patient expectorate thoroughly after the trays are removed.

Solutions

Amount	2 percent NaF pH = 7 (9,040 ppm)	8 percent SnF ₂ (9,360 ppm)
Method of preparation	To prepare 2 percent NaF dissolve 20 gm of NaF in 1 litre of distilled water in a plastic bottle. NaF should always be stored in plastic bottles if stored in glass bottles F ⁻ will react with silica of glass to form SiF ₂ thus reducing the availability of free F ⁻ ions for anticaries action	'O' No. gelatin capsules are priorly filled with 0.8 gm of SnF ₂ (powdered) and stored in air tight plastic containers. To prepare 8 percent SnF ₂ , content of 1 capsule is dissolved in 10 ml of distilled water in plastic container and shaken SnF ₂ solution is to be prepared just before each application
Technique of application	<i>Knuston and Feldman Technique (1948)</i> <ul style="list-style-type: none"> • Clean and polish the teeth in only first of all four applications • Isolate the upper and opposing lower quadrant with the cotton rolls • Dry the teeth thoroughly. • Apply 2 percent NaF with cotton roll applicator and allow it to dry on teeth for 4 minutes • NaF is applied only once because once a layer of 	<i>Muhler technique (1957)</i> <ul style="list-style-type: none"> • Do a thorough prophylaxis • Isolate the quadrant with cotton rolls and dry the teeth • Apply the freshly prepared 8 percent SnF₂ continuously to teeth with cotton applicators • Reapply the solution to the teeth every 15-30 sec, so that teeth

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Amount	2 percent NaF pH = 7 (9,040 ppm)	8 percent SnF ₂ (9,360 ppm)
	CaF ₂ (dominant product of reaction is formed) it interferes with the further diffusion of F ⁻ and react with hydroxyapatite this is called choking off phenomenon • Instruct the patient to avoid eating and drinking for 30 minutes	are kept moist with solution for 4 min. • Instruct the patient not to eat, drink or rinse for 30 min. This helps in prolonging the availability of F ⁻ to react with tooth surfaces
Number of application per year	• Second, third and fourth application are done at weekly interval • Applications are recommended at 3, 7, 11, 13 year.	Once per year
Advantages	• Chemically stable. • Acceptable taste because of neutral pH • Nonirritating of gingiva • Does not discolor the teeth • Cheap and inexpensive	• The rapid penetration of tin and fluoride in enamel within 30 seconds • Highly insoluble tin fluorophosphate complex forms on enamel surface that is more resistant to decay than enamel
Disadvantages	• Patient has to make four visits to dentist with a relatively short period of time	• Unstable in aqueous solution and should be prepared fresh for each patient • It has low pH (2.1–2.3) which is an astringent and solution has metallic taste • It cause gingival irritation • Produces discoloration of teeth particularly of hypocalcified areas • Causes staining at margins of restorations

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APF Gel and Solution

Amount	1.23 percent APF pH = 3 (12,300 ppm)	23 percent APF pH = 4-5 (12,300 ppm)
Method of preparation	<ul style="list-style-type: none"> • To prepare APF solution dissolve 20 gm of NaF in 1 liter of 0.1 molarity phosphoric acid • To this add 50 percent hydrofluoric acid to adjust the pH at 3.0 and F⁻ concentration at 1.23 percent 	<ul style="list-style-type: none"> • To prepare gel, a gelling agent methyl cellulose or hydroxy ethyl cellulose is added to solution and pH is adjusted between 4-5
Technique of application	<ul style="list-style-type: none"> • Brudevold technique (1963) • Do a thorough prophylaxis and isolate a quadrant with cotton roll • APF solution is continuously and repeatedly applied with cotton applicator • Keep the teeth moist for 4 min 	<ul style="list-style-type: none"> • Do a thorough prophylaxis and dry the teeth • Fill the U/L tray with APF gel. • Insert U/L tray simultaneously into mouth and have the patient bite down tightly for 4 min • Thixotropic gel dis-

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Fig. 8.2: Topical fluoride and application trays

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<i>Amount</i>	<i>1.23 percent APF pH = 3 (12,300 ppm)</i>	<i>23 percent APF pH = 4-5 (12,300 ppm)</i>
	<ul style="list-style-type: none"> • Pass the floss through each interproximal embrasure to ensure wetting of these surface • Repeat the procedure for remaining quadrant • Instruct the patient not to eat, drink or rinse for 30 min 	<p>plays a high viscosity at low shear rates and low viscosity at high shear rate. The clinical importance of this is that the gel thins out under the biting forces and more easily penetrate between teeth. Conversely, when it is not under stress it remains in tray and does not tend to run down the patient's throat.</p> <ul style="list-style-type: none"> • Instruct the patient not to eat, drink or rinse for 30 min
<i>Number of applications</i>	• Semiannual	• Semiannual
<i>Advantages</i>	<ul style="list-style-type: none"> • Fluoride uptake following application of APF solution is greatly accelerated whereas following NaF in lower 50% more effective than APF • APF is cheap and can be prepared easily • It is stable with a long shelf life when stored in opaque plastic bottle 	<ul style="list-style-type: none"> • Acceptable by child due to flavoured taste • Easy to apply and gel F⁻ comes in constant contact with teeth so reapplication is not required • Can be self applied • Thixotropic property • Caries reduction increases than APF solution
<i>Disadvantages</i>	<ul style="list-style-type: none"> • Teeth must be kept wet with solution for 4 min • APF solution is acidic, sour and bitter in taste so necessitate the use of suction 	<ul style="list-style-type: none"> • Can cause irritation to inflamed gingiva and to open carious lesion so this should be applied only after restoration of all carious teeth
	<i>Varnish</i>	<i>Foam</i>
<i>Used are</i>	• Duraphat, fluoroprotector, flouritop, bifluoride 12	• APF foam
<i>Contd...</i>		

Contd...

<i>Amount</i>	<i>1.23 percent APF pH = 3 (12,300 ppm)</i>	<i>23 percent APF pH = 4-5 (12,300 ppm)</i>
<i>Amount</i>	Bifluoride 12 (2.71% NaF 2.92% CaF ₂)	0.92% F (9200 ppm)
<i>Method of preparation</i>	Commercially available	Commercially available
<i>Technique of application</i>	<ul style="list-style-type: none"> • Do the thorough prophylaxis and dry the teeth (do not use cotton for isolation as varnish is sticky and tend to stick to cotton) • Drop the varnish onto the brush or foam pellet • Paint the varnish thinly first on the lower arch (as saliva collects more rapidly on it and then an upper arch starting from the proximal surfaces. Layers which are too thick, separate too easily. Instruct the patient — • Not to rinse at all for that day • Not to eat solid for that day • Take liquid and semisolids till next morning • Not to brush that day 	
<i>No. of application</i>	• Semiannual	Semiannual
<i>Advantages</i>	<ul style="list-style-type: none"> • Forms a water tight protective film insulating against thermal and chemical influences. • With correct application and proper mouth hygiene; varnish remains in place for several days During this time fluoride acts on the treated surface 	<ul style="list-style-type: none"> • It is less dense than gel and is able to flow better, allowing a free movement of F⁻ ion on the tooth surface and interproximal areas • Total density by weight is less than gel application. This reduce the risk of ingestion and systemic toxicity of F⁻
<i>Disadvantage</i>	• Patient complaine is required	• Retention onto the tooth surface is less as no polymers are added

Other Fluoride Application (by the Professional)

- *Fluoride impregnated prophylaxis paste and cup:* The temperature of enamel surface is raised during prophylaxis because of friction between the prophylaxis cup and the tooth. High temperature enhances the uptake of fluoride from prophylactic paste or solutions.
- *Iontophoresis:* It is based on a theory that small electric current will help to drive fluoride ion further into the dental enamel producing the desired effect, reduced enamel solubility, increase fluorapatite formation, retarded dentin sensitivity and even sterilization of root canals.
- *Dental Materials Containing Fluoride*
 - a. Carboxylate cements.
 - b. Fluoride in amalgam has also been tried: 1.5 percent stannous fluoride to silver amalgam alloy.
- Fluoride containing varnish and sealants: A polyurethane based material containing 10 percent sodium monofluorophosphate commercially available as "Epoxytite 9070".
- Glass ionomer cement with fluoride leaching property.

Defluoridation

It is a scientific means to improve the quality of water with high fluoride concentration by adjusting the optimum level in drinking water.

Methods

- i. *Adsorption and ion exchange method:* Some substances adsorb fluoride ion by the surface and it can exchange OH^- group for fluoride ions;

Thus concentration of F^- in water decreases this process depends on special conditions like pH, temperature, flow rate, grain size of material some of the commonly used materials are:

- Activated alumina
 - Fluidised activated alumina
 - Activated bauxite
 - Zeolite
 - Tricalcium phosphate
 - Superphosphate, activated bone char, magnesium activated carbon, palan carbon, charcoal, clay, soil and brick.
- ii. *Precipitation method:* In high pH condition, co-precipitation of several elements in water with fluoride ions forms fluoride salts. Sometimes it cause flocculation; if the substance used is aluminum thus F^- concentration in water decreases. A well-known substance of this group is alum, which is used in water supply systems and water treatment.
These substances include Alum, alum and lime (CaO), calcium chloride (CaCl_2).
 - iii. *Method based on membrane separation:* All elements in water gets diminished after filtration. This method is claimed to be the best water purification process available. This method seems to be expensive for developing countries as 30 percent of raw water is lost in this process.

Indian Technology for Defluoridation

Nalgonda technique: Using lime and alum.

The first community plant for removal of fluoride from drinking water was constructed in district Nalgonda in Andhra Pradesh; in the town Kathri thus, the name of technology.

Mechanism of Defluoridation by Nalgonda Technique

Rapid mix: It is the operation by which the coagulant is rapidly and uniformly dispensed throughout in single or multiple phase system. This helps in formation of microflocs and results in proper utilization of chemical coagulant, preventing localization of concentration and premature formation of hydroxides which leads to less utilization of coagulants.

Flocculation: It is a second stage of formation of settleable particles (floc) and is achieved by gentle and prolonged mixing.

Sedimentation: It is the separation from the water by gravitational setting of suspended particulates that are heavier than water.

Filtration: It is process of separating suspended and colloidal impurities from water by passage through porous media.

Other techniques are Prasanti technology and Combined Nalgonda and Magnesite technology.

KEY POINTS

- Dental plaque is a sticky film that adheres to the teeth. It is composed of food debris, and salivary components. Left undisturbed, it can cause dental (tooth decay).
- Parents should clean the infant's gums with a damp cloth after feedings. As the first tooth erupts, a brush that is easy for the parent to hold and small to fit in the infant's mouth is recommended.
- Frequent exposure to small amounts of fluoride each day is the best way to avoid the risk for developing dental caries.
- Infants and children receive fluoride in two ways—systemically and topical fluoride ingested during the tooth-forming years (ages 6 months to 19 years) this has the systemic effect of enhancing resistance to later acid demineralization.
- All infants and children who drink fluoridated water get benefit from systemic intake of fluoride which incorporates into their developing teeth, as well as from other important topical effects.
- Unless a dentist or other qualified health professional advises otherwise, fluoride toothpaste should be introduced at around age 2.
- Foods that provide calcium and vitamin D are vital for strong bones and teeth, foods that provide vitamin C are necessary for healthy gums.
- The ability of a food to contribute to the development of cavities depends on its adherence to the tooth surface and how frequently it is consumed.

Chapter 9

Restorative Dentistry for the Primary Dentition

In 1924, GV Black outlined several steps for the preparation of carious permanent teeth to receive an amalgam restoration. These steps have been adopted, with slight modification, for the restoration of primary teeth.

Restorative techniques for the primary dentition for amalgam and stainless steel crowns have remained consistent for over an period of time relatively for years. However, with an increased use of adhesive restorative materials and bonding systems, there is shift to more conservative preparations.

Anatomic Differences between Primary and Permanent Teeth

- Primary teeth have thinner enamel and dentin thickness is less than permanent teeth.
- Primary teeth are more whiter than permanent teeth.
- The pulps of primary teeth are larger in relation to crown size than permanent pulps.
- The pulp horns of primary teeth are closer to the outer surface of the teeth than the pulp horns of permanent teeth.
- The mesiobuccal pulp horn is the most prominent.

- The enamel rods of the gingival third of the crown extend in occlusal direction from the dentin-enamel junction in primary teeth, but enamel rods extends in cervical direction in permanent teeth.
- In contrast to permanent teeth, primary teeth demonstrate greater constriction of the crown and have a greater cervical contour.
- In contrast to permanent teeth, primary teeth have comparatively narrow occlusal surface.
- Primary teeth have broad, flat proximal contact areas.

RUBBER DAM IN PEDIATRIC RESTORATIVE DENTISTRY

Benefits of Using Rubber Dam

- Moisture control is greater than other forms of isolation.
- Provides better access and visualization by retracting soft tissues and providing a contrasting dark background to teeth.
- The safety of child patient is improved by preventing aspiration or swallowing of foreign bodies and protecting the soft tissues.

- The rubber dam acts as a separating medium or a barrier to various in and out movements of the oral cavity as perceived by the child patient as being less invasive than without the use of rubber dam in place.
- With a rubber dam in place, a child becomes primarily a nasal breather. This enhances nitrous oxide administration, when it has been deemed necessary from a behavioural stand point.



Fig. 9.1: Rubber dam punch

Rubber Dam not to be Used

- In presence of fixed orthodontic appliance.
- In presence of upper respiratory infection, congested nasal passage, or other nasal obstructions.
- When teeth that has recently erupted which will not retain clamp.

STEPS INVOLVED IN USE OF RUBBER DAM

Preparing for Placement of the Rubber Dam

- Rubber dams are available in various colours, may even be scented or flavored the darker the dam, the better is the contrast between the teeth and dam.
- The holes should be properly punched with the help of RD punch (Fig. 9.1) so that rubber dam is centered horizontally on the face and the upper lip is covered by the upper borders of the dam, but the dam must not cover the nostril.
- For single class I or V restorations, only the teeth being restored must be isolated.
- If the interproximal lesions are being restored, at least one tooth anterior and one tooth posterior to the tooth being restored should be isolated.
- Proper placement of RD allows better access, more ease in placing a matrix and visualization of adjacent marginal ridges for appropriate carving of the restoration.
- Isolation of maxillary quadrants, when isolation of several teeth is required instead of punching numerous holes in RD, two holes are punched about ½ inch apart and RD is cut with scissors to connect two holes. This technique called '*Slit Technique*'.
- The keen aspect of proper rubber dam application is proper selection of clamp.
- To prevent dislodgement and easy retrieval of clamp if dislodged, place a 12–18 inch piece of dental floss on the bow of the appropriately selected clamp as a safety measure.
- Floss the contacts through which RD will be taken; if floss cannot be passed through the contact because of reasons.
 - a. Defective restoration.
 - b. Other factors like dental anomalies

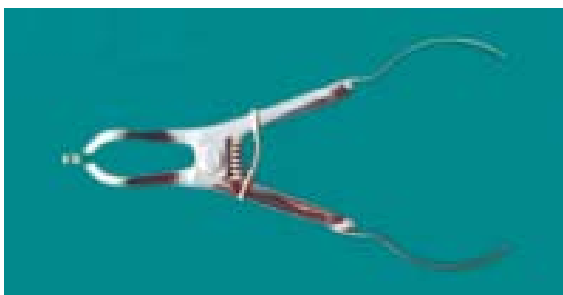


Fig. 9.2: Rubber dam forcep

Modification of contacts or RD will be necessary before placement.

- Next, with help of RD forcep (as shown in Fig. 9.2), place the selected clamp on the tooth, seating it from lingual to buccal direction.
- Be certain; that the jaws are seated below the heights of contour of crown and at same time clamp is not impinging on the gingival tissues.
- After clamp has seated appropriately, remove RD forceps and place finger on buccal and lingual jaws of the clamp and apply finger pressure gingivally so as to ensure the clamp is stable.

Rubber Dam Clamps Commonly Used in Pediatric Restorative Dentistry

- Partially erupted permanent molars—14A, 8A Ivory, 8A Hygienic corp, 8A Hufreidy.
- Fully erupted permanent molars—14, 8 A Ivory, 8A Hygienic Corp, 8A Hufriedy.
- Second primary molars—26, 27 Hufriedy, 3 Ivory, 3 Hufriedy.
- First primary molars / bicuspid / permanent canines— 2, 2A Ivory, 207, 208 Hufriedy.

- Primary incisors and canines—O Ivory, OOHygienic corp, 209 Hufriedy.
“A” clamps have jaws angled gingivally to seat below subgingival heights of contour.

Placement of Rubber Dam

- Rubber dam frame: The punched RD must be lightly stretched onto RD frame prior to placement of the clamp.
RD frame holds the corners of the dam (as shown in Fig. 9.3).
- Pull the floss which is attached to the clamp from the most posterior hole in dam that has been punched for the clamped tooth.
- With widely opened child’s mouth and with the operator’s index fingers, stretch the most posterior hole of the rubber dam over the bows and wings of the clamp, this makes slipping the dam material over the bow easy.
- To stabilize the rubber dam, first stabilize the rubber dam around the most anterior teeth which could be done by placing a wooden wedge interproximally by either—

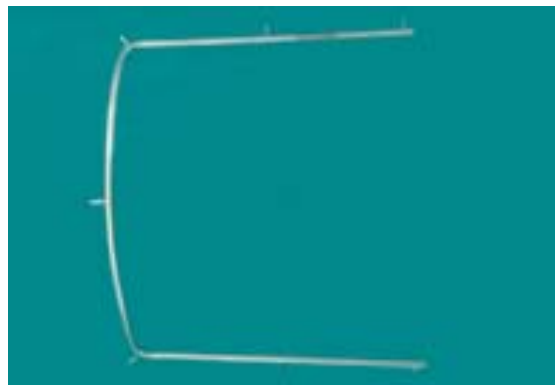


Fig. 9.3: Rubber dam frame

- a. Stretching a small piece of RD through the contact.
 - b. Or, by ligating with dental floss which is placed around the cervix of the tooth and have the dental assistant hold the floss gingivally on the lingual with instrument which must be blunt, the floss is carried tightly around the tooth from the buccal and surgical knot is tied preferably below the cervical bludge.
- After the anterior stabilization is completed teeth are isolated by holes that have been punched.
With the help of blunt instrument rubber dam is inverted into gingival sulcus around each isolated tooth.

Removing the Rubber Dam

- Remove ligatures (if any) used for stabilization of RD.
- Next, stretch the rubber dam so that interproximal septa of RD may be cut with help of pair of scissors.
- Clamp, frame and dam are then removed.
- After removal of RD inspection of mouth is must to see that no small pieces of rubber dam have left interproximally.
- Tissues around the previously clamped tooth are taken care by gentle massage.
- Rinse and evacuate the oral cavity.

STEPS OF CAVITY PREPARATION AND RESTORATION OF CLASS I AMALGAM RESTORATION

- Step 1:* Administer appropriate anesthesia and proper placement of rubber dam.
- Step 2:* With the help of high-speed turbine handpiece and using no. 330 bur, penetrate into the tooth parallel to its long axis in

Step 3:

Step 4:

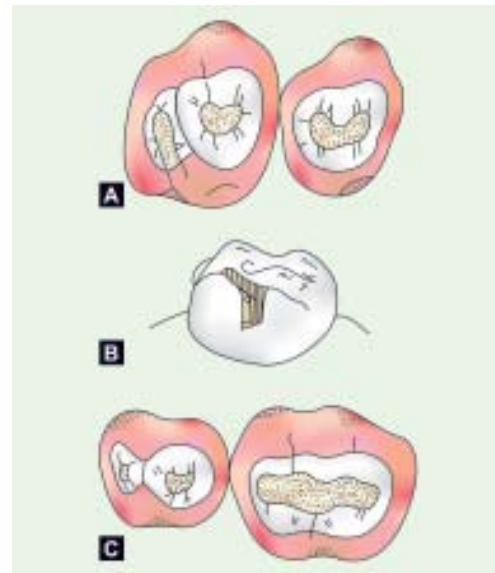
Step 5:

the central pit and extend into all susceptible pits and fissures to a depth of 0.5 mm in dentin (Figs 9.4 and 9.5).

All carious dentin is removed with help of a large round bur in the slow speed handpiece or with a help of sharp excavator (spoon excavator).

Smooth the enamel walls and finish the final outline form with no. 330 bur.

Inspect for any remaining caries, for sharp cavosurface margins, and removal of all unsupported enamel with help of hand instrument.



Figs 9.4A to C: Class I amalgam cavity preparations. (A) maxillary right second and first primary molars (occlusal view). (B) Maxillary second primary molar lingual view of distolingual groove preparation. (C) Mandibular right first and second primary molars (occlusal view)

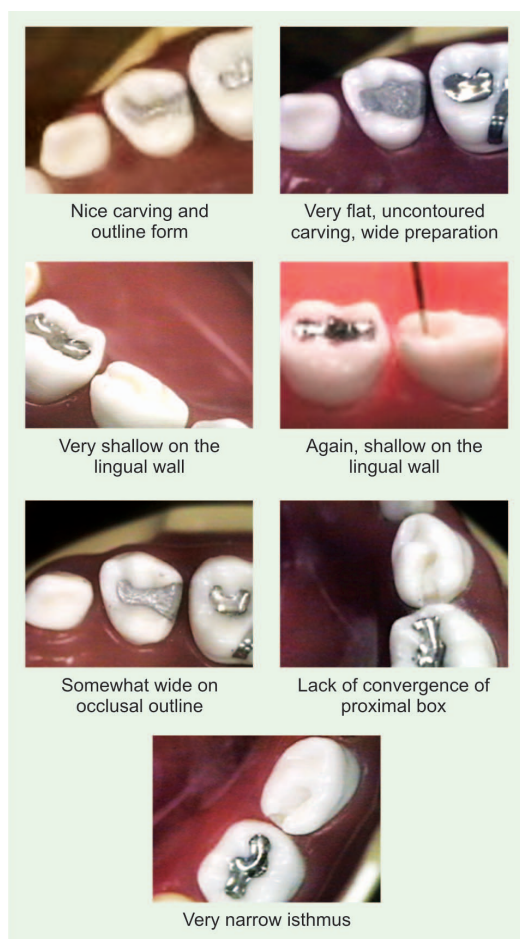


Fig. 9.5: Steps of cavity preparation

- Step 6:** Triturate the amalgam, and place one carrier load of amalgam into the preparation.
- Step 7:** Using a small condenser, immediately begin *condensation* of the amalgam into

the preparation, condensing small overlapping increments with a firm pressure until the cavity is slightly overfilled.

Step 8: Next to condensation, *carving* is done with a carver (small cleoid discoid carver works very well) for carving primary restorations.

- Always keep part of the carving edges of the instrument on the tooth structure so that over carving of the cavosurface margins does not occur.
- Remove all amalgam flash from cavosurface margins and keep the carved anatomy in primary teeth (i.e. grooves) shallow.

Step 9: Next to carving is *burnishing* the carved amalgam (when amalgam has begun its initial set and could resist deformation) with a small, round burnisher, which is lightly rubbed across the carved amalgam surface to produce a satin-like appearance of restoration (Fig. 9.6).

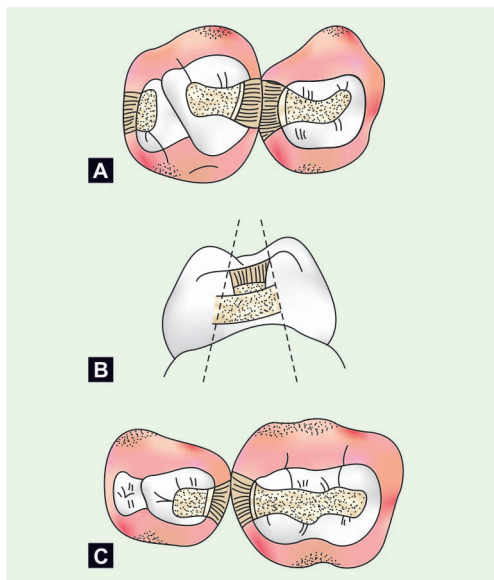
Step 10: Remove the rubber dam and *check the occlusion*.



Fig. 9.6: Initial smoothness and contour of class I amalgam

STEPS OF PREPARATION AND RESTORATION FOR CLASS II AMALGAM RESTORATION (FIG. 9.7)

- Step 1:* Administer appropriate anesthesia and proper application of rubber dam.
- Step 2:* *Preparation of occlusal outline:* Using a no. 330 bur in the high speed turbine handpiece with a light and brushing motion an ideal depth is gained.
- Step 3:* *Preparation of proximal box:*
- Preparation to start with begins at the



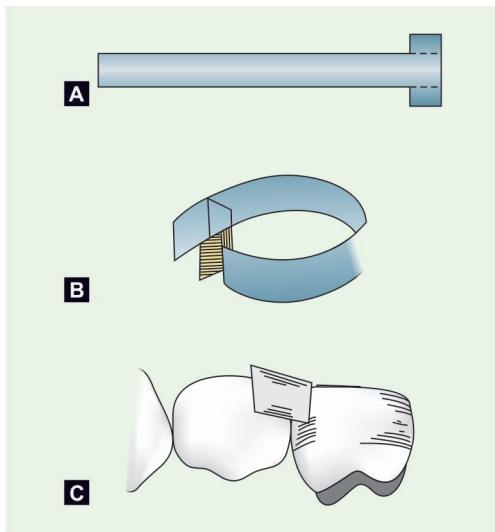
Figs 9.7A to C: Class II amalgam cavity preparations. (A) Maxillary right second and first primary molars (occlusal view). (B) Mandibular second primary molar (proximal view). (C) Mandibular right first and second primary molars (occlusal view)

marginal ridge by brushing the bur buccolingually and in gingival direction at the dentin-enamel junction.

- Placement of wooden wedge in the interproximal area being restored helps in retracting gingival papilla during instrumentation and also help in ensuring a tight proximal contact of the final restoration.
- Preparation in gingival direction is continued until contact is just broken between the adjacent tooth and the gingival wall and the wedge is seen.
- Round the sharp axiopulpal line angle slightly.
- Remove any unsupported enamel of the buccal, lingual or gingival walls with a small enamel hatchet.
- Remove the previously placed wedge placed at the beginning of treatment and place a matrix band, while holding the matrix band in place; forcefully reinsert the wedge between the matrix band and the adjacent tooth beneath the gingival seat of preparation.

Many types of matrix bands are available for use in restorative pediatric dentistry—

- T band:* No special equipment is needed (Fig. 9.8).
- Sectional matrix* [Strip - T, Denovo, Baldwin Park, calif]: is very easy to use, is not circumferential, must be held in place by the wedge.
- Auto matrix:* It is very easy to use, requires special tightening and removal tools.
- Spot-welded matrix:* A spot welder is required at chair side.



Figs 9.8A to C: (A) The T band matrix. (B) The T band is formed into a circle, and the extension wings are folded down to secure the band. (C) The T band is adapted to fit the tooth tightly and is trimmed with scissors, and the free end is bent back

e. *Tofflemire matrix*: It is used infrequently because it does not fit primary tooth contour well.

Step 4: Triturate the amalgam and then with the amalgam carrier add the amalgam to the preparation in a single increments, beginning in the proximal box.

Step 5: *Condense the amalgam* into the corners of the proximal box and against the matrix band to ensure the re-establishment of a tight proximal contact and with help of small condenser continue filling and condensing until the entire cavity is overfilled.

Step 6: With a small cleoid discoid carver *carving* of occlusal part is performed as in class I restoration. Marginal ridge is carved with a tip of an explorer or with a help of Hollen back carver.

Step 7: Removal of wedge and matrix band is done carefully. Check and see that the height of the newly restored marginal ridge is approximately equal to adjacent marginal ridge.

Step 8: Gently floss the interproximal contact.

- To check the tightness of the contact.
- To check for gingival overhang.
- To check for any remaining loose amalgam particles from the interproximal region.

Step 9: *Burnish* the restoration.

Step 10: Remove RD carefully and *Check for occlusion*.

ADJACENT OR BACK-TO-BACK CLASS II AMALGAM RESTORATIONS (FIGS 9.9 AND 9.10)

- Adjacent interproximal lesions are not uncommon in the primary dentition.
- Preparation for adjacent proximal restoration is identical to the previously described, a matrix is placed on each tooth and is wedged properly.
- T-bands, sectional, or spot-welded matrices are preferable because multiple matrix holders are difficult to place side-by-side.
- Condensation pressure toward the matrix will help in developing a tight interproximal contact.
- Carve the marginal ridges to an equal height and then carefully remove the wedge and matrix bands one at a time.

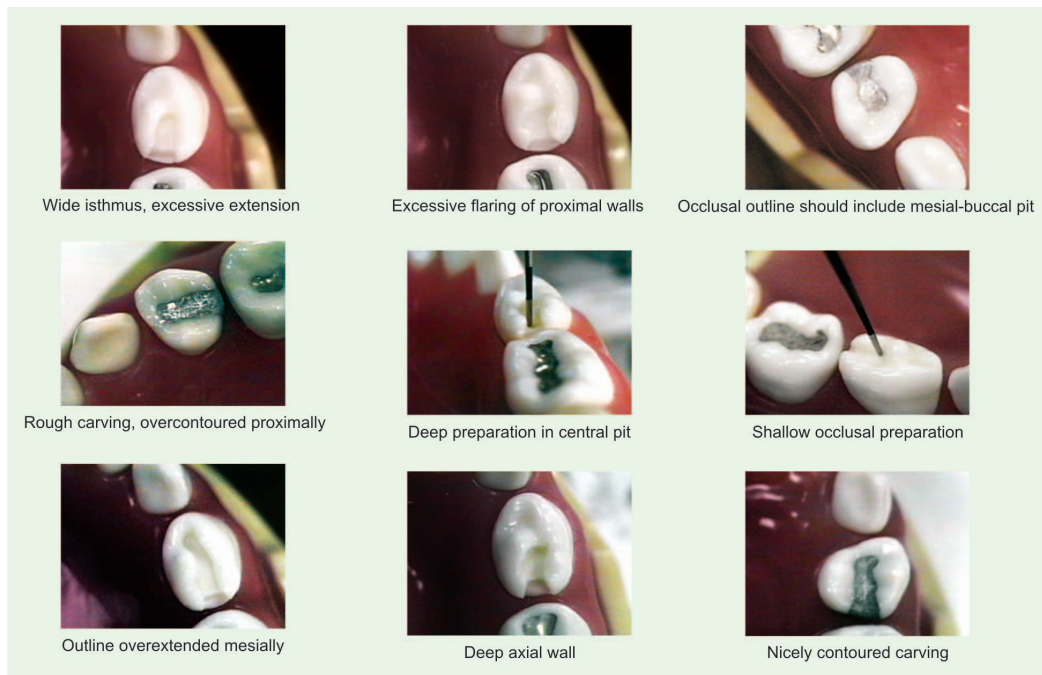


Fig. 9.9: Adjacent amalgam restoration

SEALANTS FOR PRIMARY TEETH

Pit and fissure sealing is defined as the application and mechanical bonding of a resin material to an acid-etched enamel surface, thereby sealing existing pits and fissures from the oral environment.

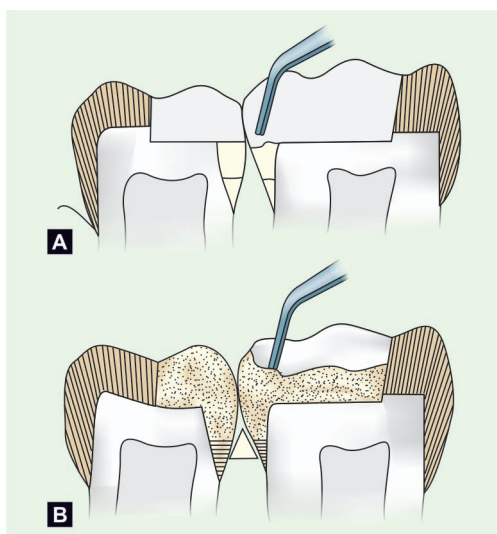
INDICATIONS

- Deep, retentive pits and fissure that may cause wedging of the explorer.
- Stained pits and fissures with minimal decalcified or opacified appearances.

- Pit and fissure caries or restorations in other primary teeth.
- No radiographic or clinical evidence of the interproximal decay.
- A patient who is receiving other preventive treatment, such as systemic and/or topical fluoride to inhibit interproximal caries formation.

TECHNIQUE OF SEALANT APPLICATION

Step 1: Isolate the tooth from salivary contamination.



Figs 9.10A and B: “Back-to-Back” amalgam preparations. (A) After wedging, begin condensing the adjacent proximal boxes alternately. (B) Continue condensing the amalgams alternately until both preparations are slightly overfilled

- Step 2:* Clean the tooth surface—by either pumice, prophylaxis paste on a low speed bristle brush or fissuretomy (to widen the fissures in enamel prior to sealant placement).
- Step 3:* Acid-etch for 15 to 20 sec.
- Step 4:* Rinse and dry the surface and apply bonding agent.
- Step 5:* Apply the sealant to the etched surface.
- Step 6:* Polymerize the sealant.
- Step 7:* Evaluate the sealant with explorer.
- Step 8:* Evaluate and adjust the occlusion.

CONSERVATIVE ADHESIVE RESTORATIONS FOR PRIMARY TEETH

INTRODUCTION

Conservative Adhesive Restoration (CAR) is a term that has been updated; which was first described by Simonsen and Stallard in 1977 and refined in 1985 as Preventive Resin Restoration (PRR).

Indicated for—The teeth that are suitable for CAR’s are those that demonstrate small, discrete regions of decay, often limited to a single pit.

Many CAR’s do not require anesthesia because of minimal teeth preparation.

Types

Type I CAR (PRR): It is a merely sealant application with minimal preparation to remove the areas of questionable incipient decay.

[Preparation is Confined to Enamel]

This is now considered as sealant application, not a restorative technique.

Type II CAR (PRR): Technique involves a similar ultraconservative preparation with a small round bur in the area of the decay.

[Preparation is Extended to Dentin]

Following caries removal the entire occlusal surface is etched, rinsed and dried and bonding agent is placed.

Then a wear-resistant resin-based composite or compomer material is placed in the cavity preparation. The entire surface is then polymerised.

Type III CAR (PRR): It is similar to type II CAR, except that a sealant layer forms an integral part of restoration.

In type III the wear resistant resin, is used only to restore the cavity preparation and the remaining adjacent pits and fissures are sealed with pit and fissure sealants.

USE OF STAINLESS STEEL CROWNS

SSC were introduced in pediatric dentistry by Humphrey in 1950. They are generally considered superior to large multisurface amalgam restorations (Fig. 9.11).

Types

There are two commonly used types of SSC's:

1. *Pretrimmed Crowns* [unitek (3M)] (Stainless steel crowns and Denovo crowns): These crowns have straight, non contoured sides but are festooned to follow a line parallel to the gingival crest. They still require contouring and some trimming.
2. *Precontoured Crowns* [Ni-Chro Ion Crowns and Unitek Stainless—Steel Crown (3M)]: These crowns are festooned and are precontoured, some trimming and contouring may be necessary but is usually minimal.

A third type of SSC is available but is not widely used.

Preveener SSC's (Nu Smile crowns, orthodontic technologies, Houston, Tex). These have resin based composite bonded to the occlusal and buccal surfaces in a laboratory process to create a more aesthetic posterior crown.

Indications for Use of Stainless Steel Crown

- SSC's are used as restoration for extensive carious lesions in primary or young permanent teeth. First primary molars especially with mesial

interproximal lesions are included in this category because the morphologic appearance of the tooth that exhibits inadequate support for the mesial interproximal restorations.

- Restoration for primary teeth followed by procedures like pulpotomy or pulpectomy.
- Restoration of hypoplastic primary or permanent teeth.
- Restoration for anomalies like amelogenesis imperfecta or dentinogenesis imperfecta.
- Restorations in individuals (disabled or others) with extremely poor oral hygiene and in whom failure of other materials is likely.
- As an abutment for space maintainers or prosthetic appliances.
- Use of stainless steel crown must be given strong consideration in children who require general anesthesia for dental treatment.

STEPS FOR PREPARATION AND PLACEMENT OF STAINLESS STEEL CROWNS (FIGS 9.12 AND 9.13)

- Step 1:*
- a. Note the dental midline
 - b. Preoperative occlusion
 - c. Cusp-fossa relationship bilaterally.
- Step 2:*
- a. Administer appropriate local anesthesia (enough to obtain lingual/palatal and buccal/facial anesthesia) of soft tissue surrounding the tooth to be crowned.
 - b. Proper placement of rubber dam.
- Step 3:*
- Occlusal reduction:* Reduction of occlusal surface is carried out with no. 169L taper fissure bur in a high speed handpiece.
- Depth:* Make depth cuts by cutting the occlusal grooves to a depth of 1.0-1.5 mm



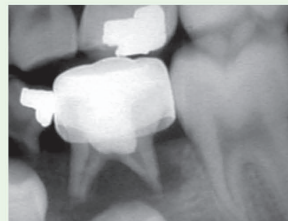
Composite strip crowns on the primary central incisors, stainless steel crowns on the primary lateral incisors



Polished amalgam restoration



Pit and fissure sealant on mostly erupted 1st permanent molar. Special care must be taken to maintain an absolutely dry field



Failing pulpotomy. Note significant bone destruction and external root resorption. In addition, the SSC is oversized



Anterior SSC with composite facing



Anterior stainless steel crowns... anesthetic, but durable

Figs 9.11: Use of stainless steel crowns

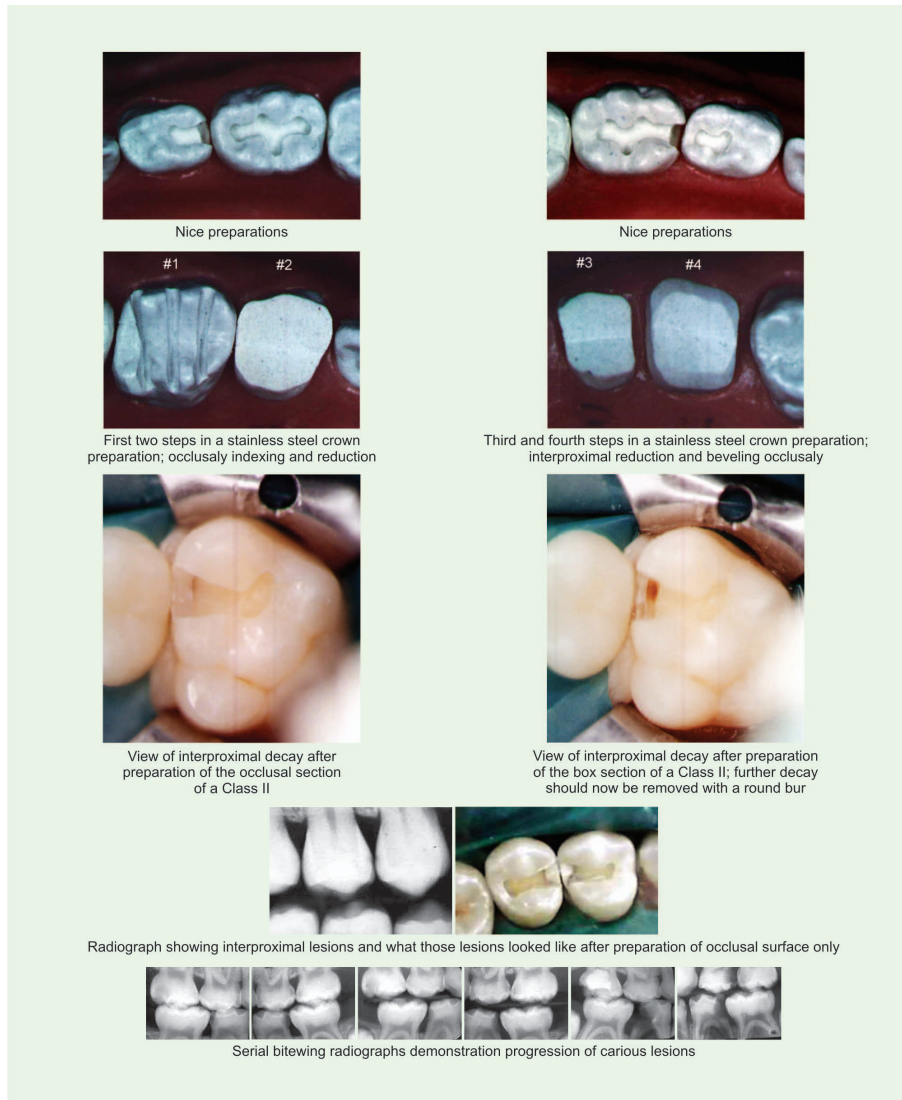
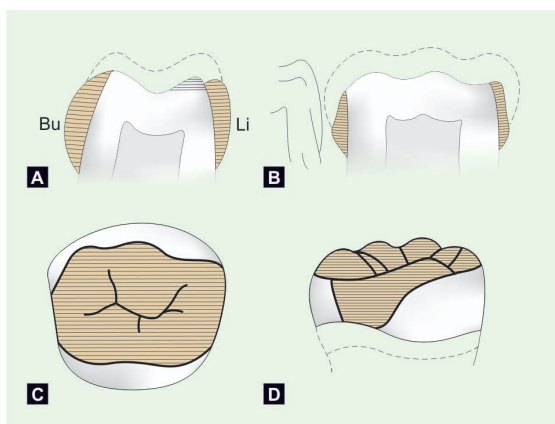


Fig. 9.12: Stainless steel crown



Figs 9.13A to D: Stainless steel crown preparation. Mandibular second primary molar. (A) Proximal view, Bu; Buccal Li; Lingual. (B) Buccal view. Note feather-edge gingival margins. (C) Occlusal view. Note rounded line angles. (D) Mesiolingual view. Note that lingual and buccal reduction is limited to the beveling of the occlusal third

and extend through buccal, lingual and proximal surfaces.

Maintaining cuspal inclines: Place the bur with sides and uniformly reduce the remaining occlusal surface by 1.5 mm.

Step 4: *Access to decay:* It is by use of no. 330 or 169L bur in high speed handpiece, then remove decay with a large, round bur in low-speed handpiece.

Step 5: *Proximal reduction:* It is accomplished by the taper fissure bur or thin tapered diamond.

- Contact with adjacent tooth must be broken gingivally and buccolingually.
- The gingival proximal margin should have feather edge finish line.

- Always maintain vertical walls with only slight occlusal convergence.
- The occlusobuccal and occlusolingual line angles are rounded by holding the bur at a 30°-45° angle to the occlusal surface and in a sweeping mesiodistal direction.
- Buccolingual reduction is often limited to beveling and is only confined to occlusal one-third of the crown.

Step 6:

Selecting crown:

- Selection of a crown begins as trial and error procedure.
- The goal is to place the smallest crown that could be seated on the tooth and establish preexisting proximal contacts.
- The selected crown is seated on the tooth (tried on tooth) by seating the crown lingually first and later applying pressure in buccal direction so that crown slides over the buccal surfaces into the gingival sulcus. Friction should be felt as the crown slips over the buccal bulge.

Step 7:

Establishing preliminary occlusal relationship:

Compare adjacent marginal ridge heights— If the crown does not seat to the same level of adjacent teeth, the occlusal reduction may be inadequate.

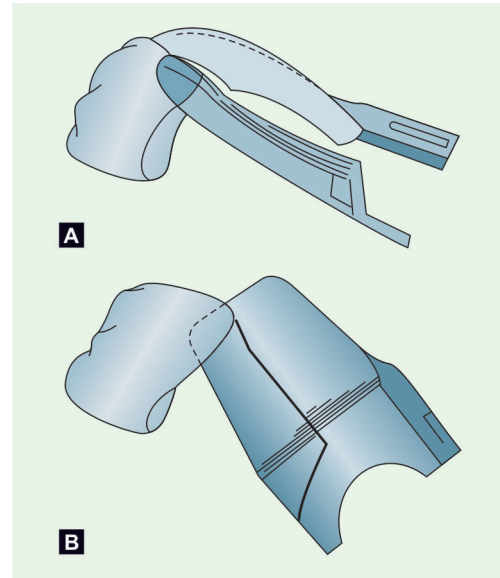
- The crown may be too long.
- A gingival proximal ledge may exist.
- Contact may not have been broken with the adjacent tooth.

Step 8: Trimming of crowns:

- a. Before trimming place the crown onto the preparation and lightly mark the level of gingival crest on the crown with a sharp instrument. The crowns are removed and trimmed 1 mm below the mark with crown and bridge scissors or with a low speed straight handpiece.
- b. The crown margins should be trimmed to lie parallel to the contour of the gingival tissue around the tooth and should include various curves without incorporating sharp angles.

Step 9: Contour and crimp the crowns:

- a. Contouring and crimping is done to form a tightly fitting crown. A tight marginal fit aids in.
 - Mechanical retention of crown.
 - Protection of the cement from exposure to oral fluids.
 - A proper maintenance of gingival health.
- b. Contouring includes bending the gingival one-third of the crowns margins in a inward direction so as to re-establish the normal anatomic features of natural crown.
- c. Contouring is accomplished circumferentially with—
No. 114 ball and socket plier or with (Fig. 9.14) No. 137 Gordon pliers.
- d. By crimping a final close adaptation is achieved, crimping is done in cervical margin 1 mm circumferentially. No. 137 pliers, special



Figs 9.14A and B: (A) Contouring is accomplished with a pair of no. 114 pliers. (B) Final crimping is accomplished with a pair of no. 800-417 pliers

crimping pliers such as no. 800-417 (unitek).

Step 10: Check for a proper fit of crown:

- a. After contouring and crimping, firm resistance is encountered when the crown is seated over the preparation.
- b. After seating the crown, gingival margins are examined with explorer to check for fit of crown.
- c. Examine for gingival tissue blanching, proximal contacts.
- d. Crown is removed with a help of carver or scaler while engaging the gingival margin and finger placed

over the crown, the crown is dislodged.

- e. The rubber dam is removed and crown is replaced to check for occlusion bilaterally in centric occlusion, movement of crown in occlusogingival direction with biting pressure.

Step 11: Final smoothing and polishing of crown—Smoothing is done with a heatless stone; rotation of stone should be toward and at a 45° angle to the edge of crown to create—

- Thin margins of crown
- Smooth and flowing curves.

Rubber wheel is used to remove scratches, a wire brush is used to polish the margins to a nice shine.

Step 12: Rinse and dry the crown inside and outside and preparing to cement it—The crown is filled approximately two-third with cement with all its inner surfaces covered (Glass ionomer, zinc phosphate, polycarboxylate or self-curing resin ionomer).

Step 13: Dry the prepared tooth and seat the crown completely

- The handle of a mirror or the flat end of a band pusher may be used to ensure complete seating of crown or patients is asked to bite on a tongue blade.
- Cement must be expressed from all margins.
- Patient must close in centric occlusion before cement sets.

Step 14: After the cement has partially set excess cement from gingival sulcus is removed with a tip of explorer. Interproximal areas are cleaned with use of dental floss.

- Step 15:*
- a. Ask the patient to rinse the oral cavity well
 - b. Examine the occlusion
 - c. Examine soft tissues
 - d. Discharge the patient.

TWO PRINCIPLES OF OBTAINING OPTIMAL ADAPTATION OF STAINLESS STEEL CROWNS TO PRIMARY MOLARS

The two key principles are:

- i. *Crown length:* The length of an SSC should allow the crown to fit just into the gingival sulcus, engaging the natural undercuts.

The most important point is that the crown length should extend just slight apical to tooth's height of contour.

- For primary teeth the buccal, lingual and proximal heights of contour happen to be just above the gingival crest.
- As an SSC is trimmed in length such that its gingival margins comes closer to the greatest diameters (height of contour) of the tooth crown, the spaces between the margins of crown and tooth surfaces are reduced.
- Thus, when the margins of the metal crowns nearly approximate the greatest diameter of the tooth, the spaces are small enough so that the metal can be easily adapted closely to the tooth.

ii. *Shape of the crown's gingival margins:*

- The shape or contour of the gingival margins differ from first to second primary molar, as well as from buccal to lingual to proximal.
- The margins of the trimmed crown should approximate the shape of the gingival crest around the tooth.
- The margins of the finished, trimmed steel crown consists of a series of curves or arcs as determined by the marginal gingiva of tooth being restored.
- The buccal gingival contour of second primary molar has been described as a “smile”.
- The buccal gingival contour of first primary molar has been described as a “Stretched out-S” (Fig. 9.15).
- The proximal gingival contour of primary molars has been described as a “frown” because the shortest occlusocervical heights are about midpoint buccolingually (Fig. 9.16).

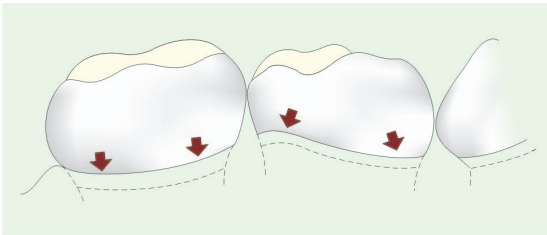


Fig. 9.15: The buccal gingival contour of the second primary molar has been described as a smile, and the buccal gingival contour of the first primary molar has been described as stretched out-S. The gingival contour of all the lingual surfaces (not pictured) is a smile

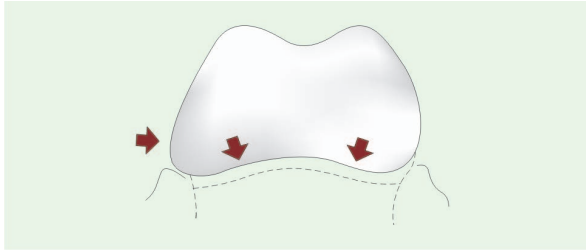


Fig. 9.16: The proximal gingival contour of primary molars has been described as a frown because the shortest occlusocervical heights are about midpoint buccolingually

SPECIAL CONSIDERATION FOR STAINLESS STEEL CROWNS

1. *Placement of adjacent crowns:* When Quadrant Dentistry is practiced, it is necessary to place SSC's on adjacent teeth; The tooth preparation and crown selection for placing multiple crowns are similar as described for single crown.

Following points are to be considered in particular:

- a. Prepare occlusal reduction of one tooth completely before beginning occlusal reduction of the other tooth; tendency is towards under reducing both.
 - b. Contact between adjacent proximal surfaces should be broken, producing an approximately 1.5 mm space at the gingival level.
 - c. Both crowns should be trimmed, contoured, and prepared for cementation simultaneously. It is better to begin placement and cementation of more distal tooth first.
2. *Preparing crowns in areas of space loss:* Frequently, when the tooth structure is lost as a

result of caries, a loss of contact and drifting of adjacent teeth into space occurs.

When this happens, the crown required to fit over buccolingual dimension will be too wide mesiodistally, the larger crown which will fit over tooth's greatest convexity is selected and an adjustment is made to reduce mesiodistal width.

This adjustment is accomplished by grasping the marginal ridges of the crown with Howe utility plier and squeezing it, thereby reducing the mesiodistal dimension.

Considerable recontouring of proximal, buccal, and lingual walls of the crown with no. 137 or no. 114 pliers will be necessary.

RESTORATION OF PRIMARY ANTERIORS (INCISORS AND CANINES)

INDICATIONS FOR RESTORATIONS OF PRIMARY ANTERIORS

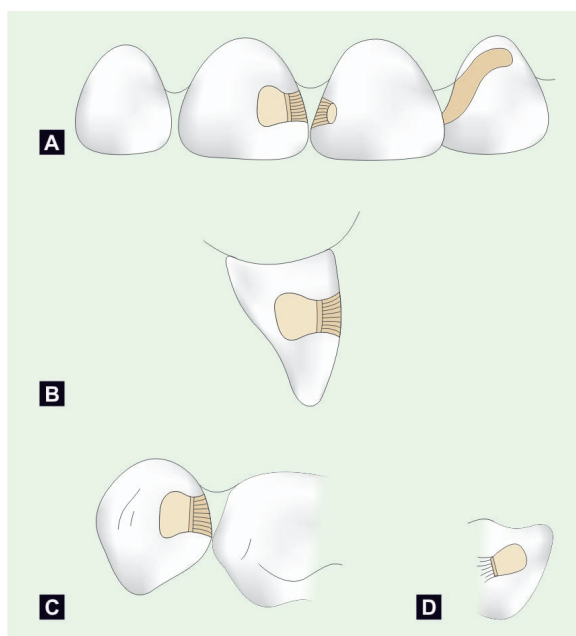
- Presence of caries
- Trauma
- Developmental defects of tooth's hard tissue.

STEPS IN PREPARATION AND PLACE-MENT OF A CLASS III ADHESIVE RESTORATION (FIG. 9.17)

- Step 1:* Administer appropriate anesthesia, and proper placement of rubber dam.
- Step 2:* Placement of a wooden wedge interproximally to protect gingival papilla from bur and minimize gingival hemorrhage.
- Step 3:* Remove caries with no. 330 bur or a no. 2 round bur in a high-speed handpiece,

utilizing a facial access. Axial wall is placed 0.5 mm into dentin gingival wall and lingual wall should just break contact with the incisal wall of the preparation to maintain adequate tooth structure.

Step 4: A dovetail or lock is placed on the lingual surface of maxillary canine and on labial



Figs 9.17A to D: Class III cavity preparations (A,B,C, labial view). Note that a short bevel is placed on the cavosurface margins of all the three preparations. (A) Slot preparation with a dovetail (the most frequently used class III preparation) the dovetail provides additional retention. (B) Slot preparation used for very small class III carious lesions. (C) Modified slot preparation, used when extensive gingival decalcification is evident to interproximal caries. (D) The interproximal box is placed perpendicular to a line tangent to the labial surface

- surface of mandibular canines (To enhance retention).
- Step 5:* A short bevel (0.5 mm) is placed on the cavo surface margins of preparation to be restored with resin-based composites. Bevel is placed with a flame-shaped composite finishing bur.
- Step 6:* Clean and dry the preparation with water and compressed air.
- Step 7:* Place a plastic or sectional metal matrix. Etch the preparation for 15 to 20 sec; with an acid gel. After etching, rinse and dry the preparation well.
- Step 8:* Place a dentin bonding agent in preparation (evenly over enamel and dentin) and polymerise the bonding agent.
- Step 9:* Place the composite in preparation with a use of plastic instrument or pressure syringe.
- Stabilize the matrix tightly around the preparation until curing is complete.
 - Visible-light cured composites are cured with an appropriate polymerizing time and visible light is held as close as possible to composite. Light is held from both lingual and facial surface for proper polymerization as per manufacturer instructions.
- Step 10:* *Finishing and polishing:* Can be performed immediately after polymerisation.
- Gross finishing is performed with fine-grit diamonds or with carbide finishing burs.
 - A lubricated, pointed white stone may be used for smoothing.

- Composite polishing gloss may be used for final polishing.
- Final interproximal polishing of the restoration is completed with sand paper strips.
- Mounted abrasive disks can be used to finish facial and lingual surfaces.

Step 11: When finishing is completed, remove rubber dam and floss interproximal areas to remove overhangs if any.

CLASS V RESTORATION FOR INCISORS AND CANINES

They are most often needed on the facial surface of canines.

- Step 1:* Penetrate the tooth in the area of caries with no. 330 bur until the dentin is reached (approx 1 mm from the outer enamel surface).
- Step 2:* Prepare an appropriate outline form while moving the bur laterally into sound dentin and enamel this establishes the walls of cavity. The lateral walls are slightly flared near the proximal surfaces to prevent the undermining of enamel.
- Step 3:* Pulpal wall should be convex, parallel to the external enamel surface.
- Step 4:* Mechanical retention—In preparation is achieved with use of no. 35 inverted cone bur or a no. ½ round bur this creates gingivoaxial and incisoaxial line angles.
- Step 5:* For resin-based composites—Short bevel is placed around entire cavosurface margin. Etching, bonding, material placement and finishing is similar to class III adhesive restorations; except that no matrix is used.

FULL COVERAGE OF INCISORS

Indications

- Incisors with large interproximal lesions.
- Incisors that have been fractured and have lost an appreciable amount of tooth structure.
- Incisors that have received pulp therapy.
- Incisors with small interproximal lesions that have also large areas of decalcification in cervical region.
- Incisors with multiple hypoplastic defects or developmental disturbances.
- Aesthetically displeasing discoloured incisors.

Methods of Providing Full Coronal Coverage to Primary Incisors

- Adhesive resin based composite crowns or *Strip crowns*
- Stainless steel crowns
- Open face steel crowns
- Prefabricated veneer steel crowns.

The most aesthetic and frequently placed crown is Adhesive resin-based composite crown or *strip crowns* (Fig. 9.18).

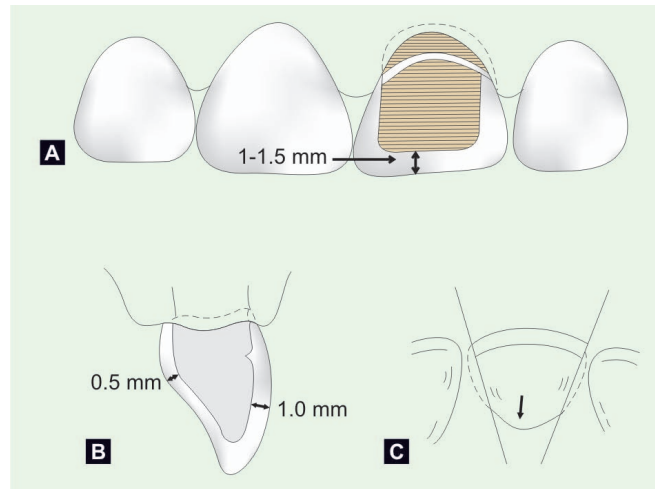
PREPARATION AND PLACEMENT OF ADHESIVE RESIN-BASED COMPOSITE CROWN (FIG. 9.19)

- Step 1:** Administer appropriate anaesthesia.
- Step 2:** Proper selection of shade of composite resin and proper placement of rubber dam.
- Step 3:** Select a proper primary incisor celluloid crown form with mesiodistal measurement approximately equal to the tooth to be restored.



Figs 9.18A and B: Strip crowns, maxillary primary incisors, before and after

- Step 4:** Remove the carious lesion of tooth with a large round bur in the low-speed handpiece. Do any pulp therapy if needed at this time.
- Step 5:** Reduce the incisal edge by 1.5 mm using a fine, tapered diamond or a no. 169 L bur.



Figs 9.19A to C: Adhesive resin-based composite crown (strip) preparation. (A) Labial view. (B) Proximal view. (C) Incisal view; the proximal slice should be parallel to the natural external contours of the tooth

Step 6: Reduction of interproximal surfaces by 0.5 mm to 1 mm; this reduction is performed to allow a crown form to slip over the tooth; interproximal walls should be parallel and the gingival margin should have a feather edge.

Step 7: Reduction of facial surface by 1.0 mm and the *lingual surface* by 0.5 mm.

- Round all line angles.
- Place a small undercut on the facial surface in the gingival one-third of teeth with no. 330 bur or no. 35 inverted cone; this under-cut serves as a mechanical lock when the resin polymerizes in this undercut.

Step 8:

Trimming and fitting of crown:

- Trim the selected crown form by cutting away the excess material gingivally with crown and bridge scissors. A properly trimmed crown form should fit 1mm below the gingival crest and should be of a comparable height to that of adjacent teeth. (Maxillary lateral is 0.5 to 1 mm shorter than those of central incisors).
- After adequate trimming and fit of crown next, a small hole is punched on a lingual surface as a vent for the escape of trapped air as the crown is placed with resin over the preparation.

- Step 9:* Etch the prepared tooth with acid-gel for 15 to 20 sec, rinse and dry the tooth; then apply bonding agent to entire tooth and polymerise.
- Step 10:* Seat the crown which is filled approximately two-third with a resin-based composite material.
- Excess material should flow from the vent prepared on lingual surface of crown and from gingival margin; this excess of material is removed with explorer tip.
- Step 11:* Polymerise the resin material by directing the curing light from both facial and lingual directions.
- Step 12:* Removal of celluloid form by composite finishing bur and then peel the form from the tooth.
- Step 13:* Remove the rubber dam and evaluate occlusion.
- Step 14:* Final finishing is required on facial surface; a flame carbide finishing bur is utilized for this purpose.
- Step 15:* Final contouring is required on lingual surface, a round or pear-shaped finishing bur is utilised for this purpose.
- Step 16:* Final polishing is carried with abrasive discs for areas of crown that require contouring.

PROSTHETIC REPLACEMENT OF PRIMARY ANTERIOR TEETH

Premature loss of maxillary primary incisors are mainly the result of—

- Extensive caries
- Trauma
- Congenital absence.

These all factors requires consideration for providing a prosthetic tooth replacement for the child.

TYPES OF PROSTHETIC APPLIANCE

- Fixed:* Do not require patient compliance
- Removable:* Require patient compliance.

A. Fixed Prosthetic Appliance

These type of appliances will always be preferred over removable appliance in preschool children because of compliance issue.

One fixed appliance design is *Nance-like device* constructed with two bands or preferably, steel crowns on primary molars that are connected with a palatal wire to which replacement teeth are attached.

Benefits of Appliance

- This appliance is cemented onto the molars and is not easily removed by the child.
- It requires minimal adjustments.
- The teeth can be made to sit directly on the ridge of edentulous space (preferred) or acrylic gingiva can be added.

Limitations of Appliance

- Difficulty in maintaining hygiene and home cleaning.
- Possible decalcification around the bands.
- Bending of the wires with fingers or with sticky foods, which may lead to occlusal interferences and require adjustments.
- Need for frequent recementation due to potential loosening of bands resulting from continual tugging of bands by the movement of wires during normal chewing.

B. Removable Prosthetic Appliance

- These appliances require the most compliance of any of the prosthetic replacements.
- They are not indicated in children younger than 3 years.
- The removable appliances is a Hawley-like device that replaces teeth and utilizes circumferential and ball clasps on the molars.

Benefits of Appliance

- The ability to remove the appliance for daily cleaning.
- Adjustments are made easily by the dentist without having to remove and recement bands.

Limitations of Appliance

- Patients compliance is required
- Clasps will need adjustment, frequency of which depends on child's handling of the appliance.

AIR ABRASION MICRODENTISTRY

Air abrasion microdentistry is a technique for cavity preparation as well as prophylaxis.

ABOUT THE TECHNIQUE

Air abrasive technology is the use of compressed air to propel aluminium oxide particles with such a force that make possible the cutting of tooth structure.

PROCEDURE

- Step 1:* Determine the extent of caries—
- With the help of radiograph.
 - With the help of caries detecting dye.
- Step 2:* *Isolation of tooth:* Isolate the tooth with rubber dam.

Step 3: *Cavity preparation:* Using abrasive unit with high volume evacuation placed in proximity of tooth; prepare cavity.

Step 4: *Etching:* Etchant is applied for 20 seconds and then thoroughly rinse the prepared cavity.

Step 5: Dentin bonding agent: is applied after thorough rinse.

Step 6: *Placement of composites:* After selecting correct shade of composite; place and photo-polymerise the material for 40 seconds.

Step 7: *Finishing and polishing:* After curing of material, give a proper finish to the restoration and final polishing is accomplished with a disc and polishing cup.

Step 8: Check occlusion.

What is Microdentistry?

Microdentistry is a new, alternative way to treat decay in teeth. The idea behind this technology is to remove as little of the natural tooth as possible while removing all of the decay. With the advent of our new bonding techniques, decay indicating dyes, magnification, fiber-optic lights and white filling materials, decay can be conservatively removed from a tooth and a filling placed that will restore a tooth to its original strength and beauty. Over 90 percent of the time, we do not need to make you numb to do microdentistry and air abrasion so we can eliminate the need for a shot. With the reduced need for anesthetic, we can complete more work in a shorter amount of time since we can work in multiple areas of your mouth in the same appointment. In addition to saving time, you will enjoy the reduction of noise normally caused by a traditional dental drill.

How is this Done?

We use air-abrasion, which is a relatively new process in which a fine, pressurized stream of aluminum oxide powder is used to remove the small decayed pits and fissures in teeth. Research studies have shown that in the absence of smoking and coffee drinking, if a patient presents with dark stained pits in their teeth, decay is present over 90 percent of the time underneath the stains. In our office we believe very strongly in prevention and early treatment of disease. It just makes good sense to treat small cavities early with conservative microdentistry than to wait for things to get worse.

The Technique

Small cavities are identified and scheduled for early treatment.

The teeth are isolated either with rubber dam or cotton rolls and the decay is removed with the air-

abrasion machine, under magnification and special light sources in a very conservative manner.

Red cavity stain photo special cavity stains are used to chemically stain decay in the teeth to help us see any small spots so nothing is missed. Once rinsed off, the tooth is now ready for the filling.

The prepared tooth is treated with an acid solution to roughen the surface and get it ready for the bonding process. Once “etched”, the tooth is ready for bonding agents and the conservative filling. We use special lights to harden the filling and then complete the process by polishing the filling.

The surface is sealed and protected leaving the tooth restored to its original strength and beauty.

Microdentistry is an excellent preventive treatment for those who share our belief that early, conservative care is ideal. You can have decay removed without the extensive preparations, loud noise, or bad smells.

Chapter 10

Pulp Therapy for the Primary Dentition

OBJECTIVES OF PULP THERAPY

The objectives of pulp therapy are conservation of the tooth in a healthy state of functioning as an integral component of the dentition. They are:

- Preservation of the arch space.
- Prevention of deleterious effects on the succedaneous tooth, and the periapical tissues and on the systemic condition of the child.
- Enhances aesthetics, mastication, prevent aberrant tongue habits, aid in speech and prevent psychologic effects associated with tooth loss.
- Helps in maintenance of a healthy oral environment, relief of pain, contributes to the development and maturation of the child, growth of the facial skeleton complex and development of dental complex to its fullest potential.

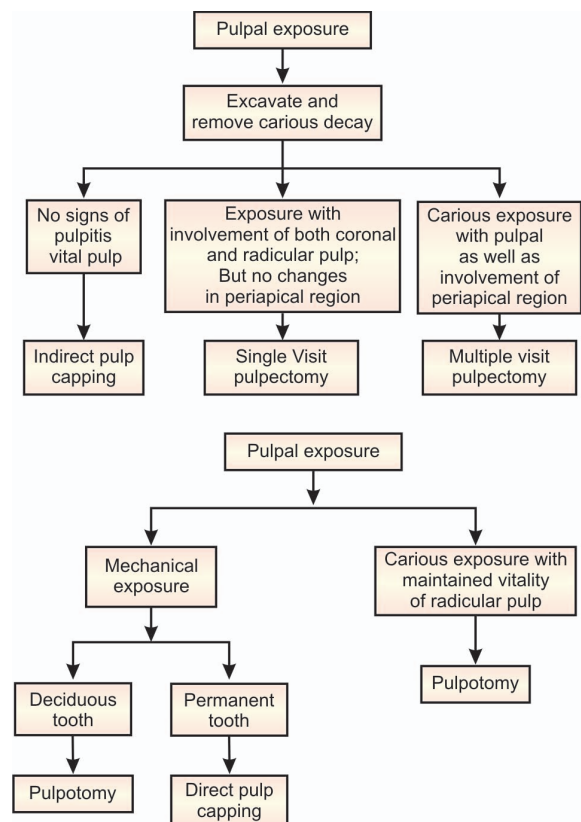
Pulp Therapies

Pulp exposure of the tooth exists when the continuity of dentin surrounding the pulp is broken due to the caries nearing and extending towards pulp.

Pulp therapies are:

- i. Indirect pulp capping
- ii. Direct pulp capping
- iii. Pulpotomy

Flow Chart 10.1



- iv. Pulpectomy
- v. Apexogenesis
- vi. Apexification.

I. INDIRECT PULP CAPPING

DEFINITION

It is a procedure where in small amount of carious dentin is retained in deep areas of cavity to avoid exposure of pulp, followed by placement of a suitable medicament and restorative material that seals off the carious dentin and encourages pulp recovery.

OBJECTIVES

- i. Arresting the carious process
- ii. Promoting dentin sclerosis
- iii. Stimulating formation of tertiary dentin
- iv. Remineralisation of carious dentin.

INDICATIONS

- Deep carious lesion, which are close to, but not involving the pulp in vital primary or young permanent teeth.
- Patient gives history of mild pain during eating.
- When pulp inflammation is seen as nominal and there is a definite layer of affected dentin after removal of infected dentin.
- When intraoral periapical radiograph is taken it must reveal:
 - No radiolucency at apex of roots or in the furcation area of tooth.
 - Lamina dura and periodontal ligament space around tooth is normal.

CONTRAINDICATIONS

- Discolouration, mobility with nonvitality of tooth are the features which are not considered to undergo indirect pulp capping.
- Patient giving history of sharp pain indicating an acute inflammatory condition; also patient complains of prolonged pain at night.
- When intraoral periapical radiograph is taken; if it reveals:
 - Pulp exposure
 - Radiolucency at apex of roots of teeth.
 - Interrupted lamina dura.

Procedure

Indirect pulp capping is undertaken in two appointments with a interappointment period of few weeks.

During First Appointment

- Step 1:* Appropriately give local anesthesia and isolate the tooth with the help of rubber dam.
- Step 2:* Prepare cavity with high speed handpiece; during cavity preparation remove the superficial debris; majority of the soft necrotic dentin with the use of large round bur.
- Step 3:* Excavate the soft decay until the resistance of sound dentin is felt.
- Step 4:* Rinse the prepared cavity with saline and dry it with cotton pellet.
- Step 5:* At the base of cavity place calcium hydroxide and the rest of the cavity is filled with zinc oxide eugenol cement.

During Second Appointment

- Step 1:* **History taking:** Patient is asked about pain (mild) which appears during eating; patient must report negative history.
Clinical examination: See to it that the temporary restoration placed during first appointment is intact.
Radiographic examination: To examine for appearance of sclerotic dentin, take a bitewing radiograph.
- Step 2:* Gently remove the temporary filling, remove the previous carious dentin that remained inside the cavity which could be easily removed in this appointment; due to the reason that; the remained carious dentin has been dried and lost its consistency.
- Step 3:* The cavity is seen with a whitish and soft area (predentin); this area must not be disturbed.
- Step 4:* Clean the cavity and place calcium hydroxide over which zinc oxide eugenol or GIC cement is filled and over it final restoration is placed.

II. DIRECT PULP CAPPING**DEFINITION**

It is defined as procedure in which the placement of a medicament or nonmedicated material on a pulp that has been exposed in course of excavating the last portions of deep dentinal caries or as a result of trauma.

OBJECTIVE

Objective of direct pulp capping is to create new dentin in the area of the exposure and allow subsequent healing of the pulp.

INDICATIONS

- Very small exposure (less than 1 mm²) surrounded by a healthy dentin in a asymptomatic vital primary teeth or a young permanent tooth.
- While a pulp is exposed the oozing bright red haemorrhage must be easily controlled by minimal pressure applied over the cotton pellet.

CONTRAINDICATIONS

- Patient gives history of spontaneous pain; also severe pain at night.
- Following features seen during clinical examination contraindicate direct pulp capping:
 - Swelling in relation to particular tooth
 - Tooth mobility
 - Excessive hemorrhage at the time of exposure
 - Serous exudate from the exposure.
- Radiographic contraindications are:
 - External/internal resorption
 - Appearance of pulp and periradicular degeneration.

PROCEDURE

- Step 1:* Isolate the tooth with appropriate placement of rubber dam.
- Step 2:* At the site of pulp exposure; any further manipulation is avoided; only irrigate the cavity with saline or distilled water.
- Step 3:* Bleeding from site of exposure is arrested with use of minimal pressure over cotton pellet at place.
- Step 4:* Place the pulp capping material gently over the site of exposure; avoid forcing the materials into the pulp chamber and over it place temporary restoration.

Step 5: Various materials used for pulp cap are:

- Calcium hydroxide $\text{Ca}(\text{OH})_2$
- Denatured protein—albumin
- Isobutyl cyanoacrylate
- Mineral trioxide aggregate
- 4-META adhesive
- Corticosteroids and antibiotics.
- Inert material—Tricalcium phosphate ceramic.
- Bone morphogenic protein
- Direct bonding
- Lasers.

Step 6: Recall patient after few weeks.

- a. History taking—Patient must give a negative history of pain.

- b. Clinical examination—Maintained pulp vitality, minimal inflammatory response.

- c. Radiographic examination—Appearance of dentinal bridge.

(a), (b), (c) determines the success of direct pulp capping, based on this final restoration is done.

Histological Changes after Pulp Capping (Fig. 10.1)

Histological changes after pulp capping are seen with varying duration of time period, it is explained as follows:

After 24 hours or 1 day: Necrotic zone adjacent to calcium hydroxide paste is separated from healthy pulp tissue by a deep staining basophilic layer.

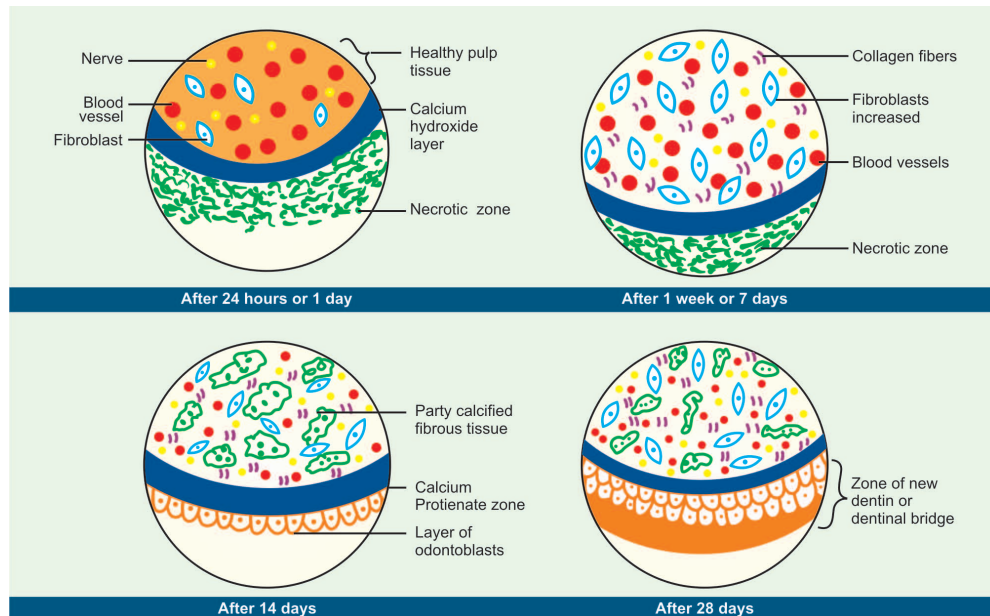


Fig. 10.1: Histological changes after pulp capping

After 1 week or 7 days: Increase in cellular and fibroblastic activity.

After 14 days: Partly calcified fibrous tissue lined by odontoblastic layer of cells is seen below the calcium protienate zone and there is disappearance of necrotic zone.

After 28 days: Zone of new dentin or dentinal bridge.

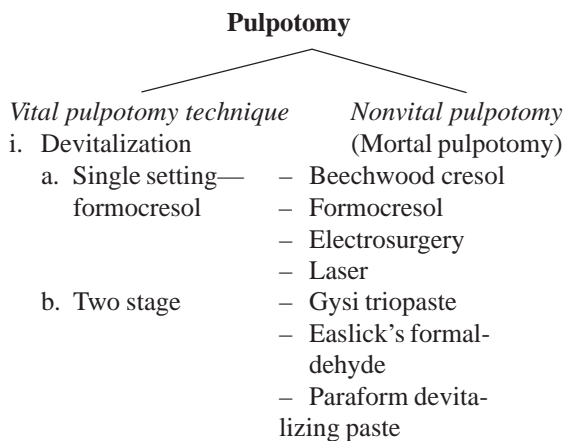
III. PULPOTOMY

DEFINITION

Pulpotomy can be defined as complete removal of the coronal portion of the dental pulp, followed by placement of a suitable dressing or medicament that will promote healing and preserve vitality of tooth.

Pulpotomy therapy can be classified according to the following treatment objective as:

- | | |
|----------------|--|
| Devitalization | - Mummification, cauterization |
| Preservation | - Minimal devitalization, noninductive |
| Regeneration | - Inductive, reparative |



- | | |
|-------------------|----------------------------|
| ii. Preservation | - Glutaraldehyde |
| | - Ferric sulphate |
| iii. Regeneration | - Bone morphogenic protein |

INDICATIONS

- i. Vital tooth with healthy peridontium.
- ii. Pain if present is either spontaneous or persistent.
- iii. Tooth which is restorable.
- iv. Tooth that possess at least 2/3rd of its root length.
- v. Hemorrhage from the amputation side is pale red and easy to control.
- vi. In mixed dentition stage primary tooth is preferable to a space maintainer.

CONTRAINDICATIONS

- i. Evidence of internal resorption.
- ii. Presence of interradicular bone loss.
- iii. Existence of abscess and fistula in relation to teeth.
- iv. Radiographic evidence of calcific globules in pulp chamber.
- v. Caries penetrating the floor of pulp chamber.
- vi. Tooth close to natural exfoliation.

DIAGNOSTIC CONSIDERATIONS

- The importance of performing the pulpotomy on teeth in which inflammation has been confined to coronal pulp and when radicular pulp is free of inflammation. Teeth selected according to this criteria will have successful prognosis.
- Radiographic interpretation can give some clues as to which extent of carious lesion is present,

status of lamina dura, presence of abnormal resorptive process or interradicular rarefaction which can give an indirect clue to the relative presence or absence of inflammation that exist.

DEVITALIZATION PULPOTOMY (SINGLE STAGE)

Formocresol pulpotomy technique (first advocated by Sweet 1930 as shown in Fig. 10.2).

- i. The formocresol is a solution of 19 percent formaldehyde, 35 percent cresol in vehicle of 15 percent glycerine and water.

To prepare 1:5 concentration of this formula first thoroughly mix 3 parts of glycerine with 1 part of distilled water then add 4 parts of this preparation to 1 part Buckley's formocresol and thoroughly mix again.

- ii. Mechanism of action of formaldehyde is to prevent tissue autolysis by bonding to proteins.

Procedure

- a. Tooth should be first anesthetized and isolated with rubber dam. A surgically clean technique should be used throughout the procedure. All remaining caries should be removed and the overhanging enamel should be planned back to provide a good access to the coronal pulp.
- b. The entire roof of pulp chamber should be removed with a bur. No overhanging dentin from the roof of pulp chamber should remain.
- c. A sharp discoid spoon excavator may be used to amputate the coronal pulp. The pulp stump should be cleanly excised with no tag of tissue extending to the floor of pulp chamber.
- d. The pulp chamber is then irrigated with light flow of water from the water syringe and evacuated.

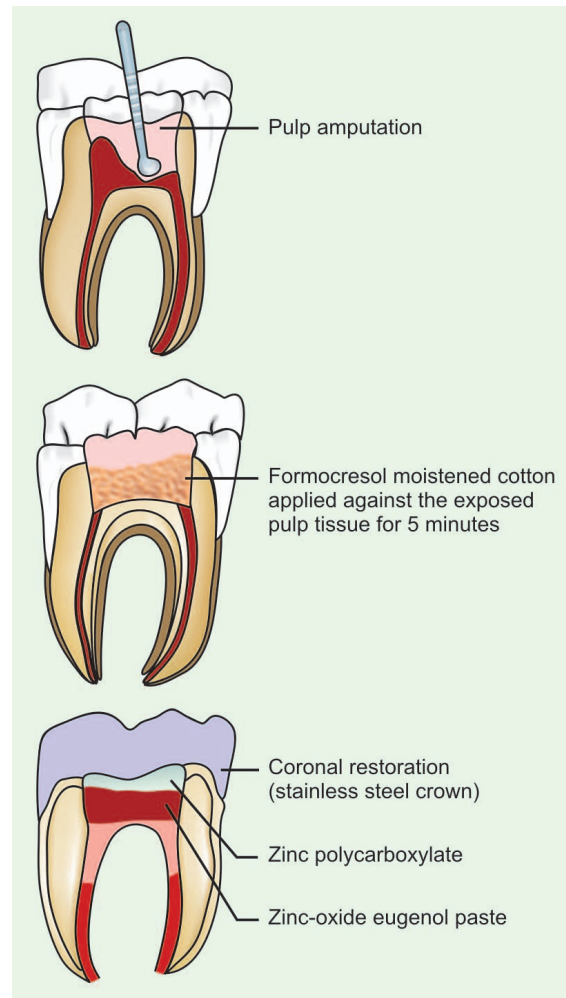


Fig. 10.2: Formocresol pulpotomy technique

Moist cotton pellets should be placed in pulp chamber and allowed to remain over pulp stump until a clot forms.

- e. If hemorrhage is controlled readily and the pulp stump appears normal, it may be assumed that pulp tissue in the canals is uninflamed hence; it is safe to proceed with pulpotomy.

The pulp chamber is dried with a sterile cotton pellet. Next a pellet of cotton moistened with a 1:5 concentration of Buckley's formocresol and blotted on a sterile gauze to remove the excess is placed in contact with pulp stump and allowed to remain for 5 min. The pellet is removed and the pulp chamber is dried with new cotton pellet.

- f. A thick paste consisting of zinc oxide eugenol is prepared and placed over the pulp stump.

A zinc polycarboxylate cement is placed over the paste and tooth is restored with stainless steel crown.

DEVITALIZATION PULPOTOMY (TWO STAGE)

This is a two stage procedure involving the use of paraformaldehyde to fix the coronal and radicular pulp tissue.

Formula of each agent used are—

Gysi triopaste — Tricresol
— Cresol
— Glycerine
— Paraformaldehyde
— Zinc oxide

Easlick's paraformaldehyde - P⁴C

Paste — Paraformaldehyde
— Procaine base
— Powdered asbestos
— Petroleum jelly
— Carimine to color

Paraform Devitalizing

Paste — Paraformaldehyde
— Lignocaine

- Propylene glycol
- Carbowax
- Carimine to color

Technique

First Appointment

Step I:

- Preparation of instruments and materials
- Isolation of affected tooth with rubber dam
- Preparation of cavity
- Excavation of deep caries.

Step II:

- When exposure site is encountered during excavation of deep caries, ensure that, exposed site is free of debris.
- Prepare a cotton pellet large enough to cover the exposure but small enough to clear the cavity margin; incorporate the paraformaldehyde paste into the pellet and place it over the exposure site then seal the tooth for 1 to 2 weeks. Formaldehyde gas liberated from paraformaldehyde penetrates through the coronal and radicular pulp, fixing the tissues.

Second Appointment

- On the second appointment, pulpotomy is carried out with the help of local anaesthesia. The roof of pulp chamber is removed and cleaned with saline and dried with cotton pellet.
- The pulp chamber is filled with antiseptic paste and tooth is restored.

Mortal Pulpotomy (NONVITAL PULPOTOMY)

Ideally, a nonvital tooth should be treated with pulpectomy and root canal filling. However,

pulpectomy of primary molar may sometimes be impracticable due to nonnegotiable root canals and also due to limited patient cooperation. Hence a two stage pulpotomy technique is advocated.

First Appointment

- The necrotic coronal pulp is removed, the pulp chamber is irrigated with saline and dried with cotton pellet, infected radicular pulp is treated with a strong antiseptic solution.
- Dip the pellet in beechwood cresol and remove the excess by damping it on a sterile cotton and place it in pulp chamber over the radicular pulp. Seal the cavity with a temporary cement for 1 to 2 weeks.

Second Appointment

- Isolate the tooth and remove the temporary filling and the pellet containing beechwood cresol.
- Note if the symptom persists or if there is no signs of resolution of the sinus, a decision is made either to repeat the treatment or extract the tooth.
- If there are no symptoms the pulp chamber can be filled with a antiseptic paste which is firmly pressed with cotton pellet to push antiseptic paste into the root canals; The tooth is then restored with stainless steel crown.

IV. PULPECTOMY

DEFINITION

Pulpectomy involves removal of roof and contents of pulp chamber in order to gain access to the root canals which are debrided, enlarged and disinfected; the canals are filled with resorbable material.

INDICATIONS

- i. Strategically important tooth (e.g. in case of deciduous second molar where the permanent first molar has not erupted).
- ii. Irreversible pulpitis
- iii. Minimal periapical pathology with sufficient bone support.
- iv. At least 2/3rd of root length is available.

PROCEDURE

There are two types of procedures:

a. Single Visit Pulpectomy

Indication

This procedure is an extension of pulpotomy. Where the inflammation extends beyond coronal pulp, indicated by haemorrhage from the amputated radicular stumps that is oozing continuously and is uncontrollable.

Procedure

- Step 1:* Appropriately give local anesthesia and isolate the tooth with rubber dam.
- Step 2:* Prepare an access cavity; expose the coronal pulp; all the accessible pulp tissue (coronal as well as radicular) is extirpated with the help of barbed broaches.
- Step 3:* After extirpation of pulp tissue is complete irrigate the pulp chamber and canals with saline and a diagnostic radiograph is taken for the working length of file.
- Step 4:* Shaping, irrigating of canals is undertaken, dry the canals with absorbent paper points.

Step 5: Obturate the canals and access cavity completely.

Step 6: Place the final restoration.

b. Multivisit Pulpectomy (Fig. 10.3)

Indications

- Tooth with necrotic pulp and periapical involvement.

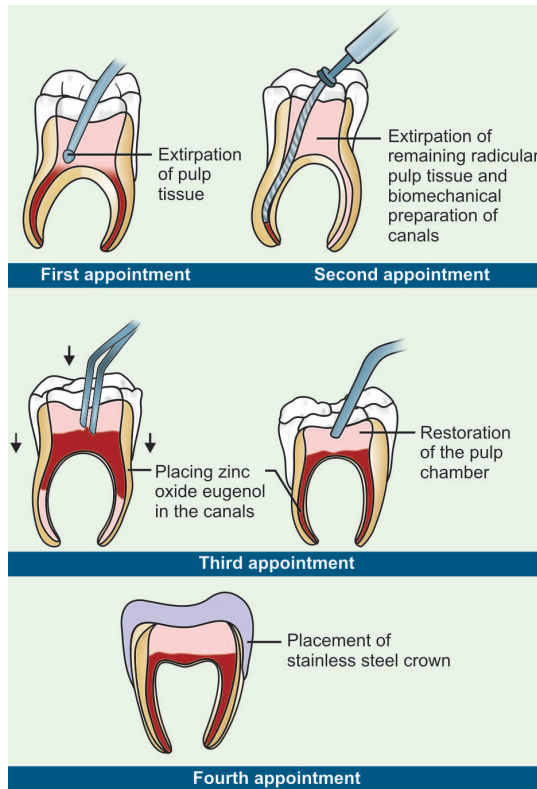


Fig. 10.3: Pulpectomy (multivisit)

- Presence of infection, abscess or chronic sinus.
- Nonvital primary tooth.

Procedure

a. During first appointment

Step 1: Appropriately give local anesthesia and isolate tooth with rubber dam.

Step 2: Prepare access cavity and expose the coronal pulp and extirpate all the pulp tissues (coronal and radicular) with barbed broaches.

Step 3: Place the cotton pellet over the pulp chamber soaked with formocresol and over it place temporary restoration.

After a duration of 1 week recall the patient.

b. During second appointment

Step 4 : Gently remove temporary restoration; irrigate the canals and start with biomechanical preparation of canals.

Note: Use appropriate working length of files to prevent perforation of canals.

Step 5 : Irrigate and dry the canals and place a sterile cotton pellet and over it place temporary restoration.

c. During third appointment

Step 6 : Gently remove the temporary restoration, irrigate and dry the canals with absorbent paper points.

Step 7 : Coat the walls of canals with luting consistency of cement with help of reamers and then fill the canals with thick consistency of cement with help of lentiluospirals.

Step 8 : Seal the pulp chamber with temporary restoration.

After duration of 1 week recall the patient.

d. *During fourth appointment*

Step 9 : If tooth is asymptomatic, place final restoration; give a stainless steel crown.

FILLING OF THE PRIMARY ROOT CANALS

Root Canal Filling Materials

Developmental, anatomic and physiologic differences between primary and permanent teeth call for differences in the criteria for root canal filling materials.

Ideal requirements are:

- i. Resorb at similar rate as the primary root
- ii. Should be harmless to the periapical tissues and to the permanent tooth germ, resorb readily if pressed beyond the apex
- iii. It should have a stable disinfecting power
- iv. It should be inserted easily into root canals and removed easily if necessary
- v. Should adhere to the walls of canals and should not shrink
- vi. It should not be soluble in water
- vii. Be radiopaque and not discolor the tooth.

Zinc Oxide-Eugenol Paste

Is probably the most commonly used filling material for primary teeth. Camp in 1984 introduced the endodontic pressure syringe to overcome the problem of under filling, a relatively common finding when thick mixes of ZOE are employed.

Underfilling however is clinically frequently acceptable. Overfilling on the other hand may cause a mild foreign body reaction.

Another disadvantage of ZOE paste is difference between its rate of resorption and that of the tooth root.

Iodoform Paste

Several authors reported the use of KRI paste.

- It resorbs rapidly and has no undesirable effects on succedaneous teeth when used as pulp canal medicaments in abscessed primary teeth.
- Further KRI paste that extrudes into periapical tissue is rapidly replaced by normal tissue.
- It has found to have long-lasting bacteriocidal effect/potential.
- Since iodoform paste does not set into hard mass it can be removed if retreatment is required.
- KRI was found to have success rate of 84 percent compared to zinc oxide eugenol which showed success of 65 percent.

KRI paste:

Iodoform	80.8 percent
Camphor	4.86 percent
Parachlorophenol	2.025 percent
Menthol	1.21 percent

Maisto paste:

Iodoform	42 gm
Camphor	3CC
Chlorophenol	
Thymol	2 gm
Zinc oxide	14 gm
Lanolin	0.50 gm

Walk Hoff paste:

Parachlorophenol
Camphor
Menthol

Calcium Hydroxide and Iodoform Mixture

Calcium hydroxide is generally not used in pulp therapy for primary teeth. However several clinical and histopathological investigations reveals the use of $\text{Ca}(\text{OH})_2$ and iodoform mixture.

Vitapex

- Calcium hydroxide
 - Iodoform
 - Oily additives.
- a. This material is easy to apply and resorbs at a slightly faster rate than that of root.
 - b. It has no toxic effects on permanent successor and is radiopaque for these reasons, the $\text{Ca}(\text{OH})_2$ —Iodoform mixture can be considered to be nearly ideal primary tooth filling material.
Gutta-percha is not a resorbable material, its use is contraindicated in primary teeth.

Obturation Techniques

Several techniques have been used for filling of materials into deciduous teeth canals—

- i. The primary teeth with the larger canals can be filled with thin mix; coating the walls of the canals with the help of reamer in an anticlockwise direction while taking out slowly followed by placement of thicker mix which is then pushed manually.
- ii. Pastes can also be filled by means of lentulospiral mounted on the micromotor handpiece. The direction of rotation needs to be checked for the material to properly flow into the canal.
- iii. The endodontic pressure syringe is also effective for placing the ZOE into the canals. The vitapex system also uses the syringe with material in it.

- iv. The syringe is introduced up to 1/5th distance from the apex of canal and the material is slowly injected as the syringe is withdrawn from the canal.
- v. Regardless of the method adopted to fill the canal, care should be taken to prevent extrusion of material into the periapical tissues.
- vi. The adequacy of obturation is checked by radiographs. In the event if a small amount of ZOE is inadvertently forced through the apical foramen it is left alone since the material is resorbable.
- vii. When the canals are satisfactory obturated a fast set temporary cement is placed in pulp chamber to seal over ZOE canal filling. The primary tooth is restored with a stainless steel crown.

V. APEXOGENESIS**DEFINITION**

It is a treatment of a vital pulp by capping or pulpotomy in order to permit continued growth of the root and closure of the open apex.

INDICATIONS

- Indicated for traumatized or pulpally involved vital permanent tooth when root apex is incompletely formed.
- Tenderness on percussion and sensitivity is negative.
- No pain, no hemorrhage and no radiographic abnormality.

CONTRAINDICATIONS

Apexogenesis is contraindicated in an evidence when radicular pulp has undergone degenerative changes and showing periapical radiolucency.

PROCEDURE

- Step 1:* Appropriately give local anesthesia and isolate the tooth with rubber dam.
- Step 2:* Prepare an access cavity and expose the coronal pulp; remove the coronal pulp with the help of excavators.
- Note:* Prevent damage to radicular pulp while removing coronal pulp.
- Step 3:* Rinse the access cavity and place a moist cotton pellet over the amputated radicular stumps to control haemorrhage.
- Step 4:* Mixture of calcium hydroxide is placed over the healthy radicular pulp stumps and followed by placement of temporary restoration over it.
- Step 5:* Recall patient after few weeks and take follow-up radiographs periodically to check for development of root.
- Step 6:* As indicated radiographically; that root development is complete; perform conventional root canal treatment.

VI. APEXIFICATION**DEFINITION**

It is a method of inducing development of the root apex of an immature pulpless tooth by formation of osteocementum/bone like tissue.

INDICATION

For nonvital permanent teeth with open apex.

Frank's Criteria for Apexification

- i. Apex is closed, through minimum recession of the canal.

- ii. Apex is closed with no change in root space.
- iii. Radiographically apparent calcific bridge at the apex.
- iv. There is no radiographic evidence of apical closure but upon clinical instrumentation there is definite stop at the apex, indicating calcific repair.

PROCEDURE**During First Appointment**

- Step 1:* *History taking*—Patient must give negative history of acute signs and symptoms.

Clinical examination—Evaluate following features in particular tooth and region around tooth.

- a. Swelling,
- b. Color,
- c. Mobility
- d. Tenderness.

Radiographic examination—Intraoral periapical radiograph should be evaluated.

- Step 2:* Appropriately give local anesthesia and isolate tooth with rubber dam.

- Step 3:* Prepare access cavity; derroof coronal pulp, remove necrotic pulp tissues and debris from the canals with barbed broaches.

- Step 4:* Circumferential filing of canals is done with help of file of appropriate working length; followed by irrigating the canals with saline to remove infected dentin and debris from the walls of canals; dry the canals with absorbant paper points.

Step 5: Fill the canals with calcium hydroxide cement; seal the access cavity with temporary restoration.

Recall patient after duration of 6 months.

During Second Appointment

Step 6: Take an intraoral periapical radiograph; two situations can exist.

- *Either apex is not closed*, then recall patient again after 6 months.
- *Or apex is closed*, then take out calcium hydroxide; irrigate root canals with normal saline, obturate canals with gutta-percha points and followed by final restoration.

Chapter 11

Periodontal Problems in Children and Adolescents

CHANGES IN TISSUES IN CHILDREN

Changes in Gingiva

- i. The gingiva appears to be flabbier due to the lesser density of the connective tissue in the lamina propria.
- ii. The gingiva appear more reddish due to thinner epithelium, a lesser degree of cornification and a greater vascularity.
- iii. The gingiva lack stipplings, due to shorter and flatter papillae from the lamina propria.
- iv. The gingival margins appears to be rounded, rolled due to hyperemia and edema that follows eruption.
- v. There is greater sulcus depth due to relative ease of gingival retraction.

Changes in Periodontal Ligament

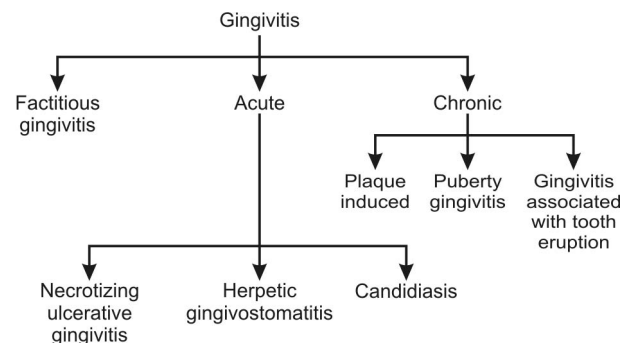
The periodontal ligament in children is wider and very less and reduced density of fibers per unit area are present. It has more blood vessels and lymph vessels in connective tissue than in adults.

Changes in Cementum and Alveolar Bone

- Cementum in children is less denser and thinner as compared to adults.
- Crest of alveolar bone is flatter, lamina dura is thinner, smaller amount of calcification, large marrow spaces.

CLASSIFICATION OF PERIODONTAL PROBLEMS IN CHILDREN

- A. *Gingivitis*
- B. *Gingival recession*
- C. *Juvenile periodontitis*



- Localized juvenile periodontitis
- Generalized juvenile periodontitis
- D. *Prepubertal periodontitis*
 - Localized
 - Generalized
- E. *Systemic diseases associated periodontitis*
 - Papillon-Lefèvre syndrome
 - Down syndrome
 - Ehlers-Danlos syndrome
 - Chédiak-Higashi syndrome
 - Leukocyte adhesion deficiency
 - Hypophosphatasia

GINGIVITIS

FACTITIOUS GINGIVITIS

It is also called gingivitis artefacta

Types

- a. *Major factitious gingivitis*: Major form is more severe and involves deeper periodontal tissue. It is caused mainly due to psychological aetiology behind the clinical appearances.
- b. *Minor factitious gingivitis*: Minor form is mainly habitual; it results from rubbing or picking the gingiva with fingernail.

ACUTE GINGIVITIS

It is characterized by sudden onset; may be following an episode of debilitating disease of acute respiratory tract infections.

Intraoral Signs

Two types of necrotizing ulcers are seen

- a. Lateral ulcerations
- b. Deep ulceration and necrosis.

- a. *Lateral ulceration* is characterized by involvement of buccal wall of papillae, margins and possibly the attached gingiva as it occurs in the distribution of lateral blood supply; these types of ulcerations are less common.
- b. *Deep ulceration and necrosis* of the tissues of the embrasure, giving rise to the typical truncated papillae; as occurs in the distribution of the intra-alveolar blood vessels; these type of ulcerations are comparatively more common.
 - Interdental craters are covered by gray pseudomembranous slough which is demarcated from the remainder of the gingival mucosa by a pronounced linear erythema (Fig. 11.1).
 - On slight provocation there is pronounced gingival bleeding.

Intraoral Symptoms

- There is constant radiating, growing pain that is intensified by eating spicy or hot food.
- The lesions are extremely sensitive to touch and patient is conscious of metallic foul taste and excessive amount of “pasty saliva”.



Fig. 11.1: Acute necrotizing ulcerative gingivitis (ANUG)

Extraoral Signs and Symptoms

- *In moderate cases*, local lymphadenopathy and there is slight elevated temperature.
- *In severe cases*, patient is febrile and reports of increased pulse rate, leucocytosis, loss of appetite is seen.

Severe Sequelae Follows

- Noma or gangrenous stomatitis (Fig. 11.2)
- Fusospirochetal meningitis
- Toxaemia and fatal brain abscess.

Predisposing Factors

- Nutritional deficiency
- Smoking
- Debilitating diseases
- Pre-existing gingivitis, e.g. incubation zones
- Injury occurred to gingiva due to malocclusion
- Psychosomatic factors.



Fig. 11.2: Noma or gangrenous stomatitis

Management

Management of acute necrotizing gingivitis is divided into steps in forms of visits of patient to the clinician's office.

First Visit

- Treatment is confined to acutely involved areas in first visit.
- Apply topical anesthesia to acutely involved areas.
- Gently swab the areas to dislodge and remove the pseudomembrane.
- With the use of ultrasonic scaler superficial calculus is removed.
- Before sending patient; patient is instructed to rinse the mouth every 2 hours with a glassful of a equal mixture of warm water and 3 percent hydrogen peroxide. Also, if there are systemic symptoms, penicillin or erythromycin or metronidazole is prescribed.
- Patient is recalled after 3-4 days.

Second Visit

- In second visit of patient, scaling is performed
- Recall patient again after 3-4 days.

Third Visit

- Scaling and root planing are repeated with instructions on plaque control.
- Ask the patient to discontinue the use of hydrogen peroxide, but continue use of chlorhexidine rinses for 2-3 weeks.

CANDIDIASIS

- This mycotic infection is caused by *Candida albicans*.

- Oral lesions are clinically of four types—
 - a. *Pseudomembranous type*—White curd-like plaques.
 - b. *Atrophic type*—usually seen on the dorsum of the tongue with papillary atrophy and erythema.
 - c. *Hyperplastic type*—Hyperkeratosis of the epithelium with white plaques (Fig. 11.3).
 - d. *Epidermal and perioral type*—Scaling patches at the corners of the lips.

Management (Antimycotic Agent)

Cotrimoxazole (oral troches) every 3 hours, i.e. for total of 6 per day for 7-10 days.

Acute Herpetic Gingivostomatitis

It is a viral infection of the oral mucosa caused by herpes simplex virus, it frequently occurs in infants and children of age less than 6 years.



Fig. 11.3: Moniliasis, oral thrush

Clinical Features

Include various intraoral and extraoral signs and symptoms.

Intraoral Signs

- a. Gingiva appears to be diffuse red, erythematous with varying degree of oedema and gingival bleeding.
- b. In the early stage, gray vesicles appear to be discrete, spherical involving labial and buccal mucosae, soft palate, pharynx and tongue, approximately after 24 hours the vesicles rupture leaving painful ulcers (Fig. 11.4).
- c. Ulcers created due to rupturing of vesicles appear to be red, elevated with halo-like margins and a depressed yellowish or grayish white central portion.

Intraoral Symptoms

- a. The ruptured vesicles are sensitive to touch, thermal changes and food

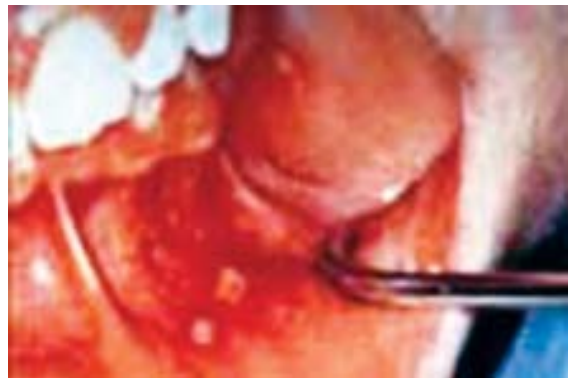


Fig. 11.4: Acute herpetic gingivostomatitis



Fig. 11.5: Herpes labialis



Fig. 11.6: Chronic gingivitis

- b. Generalized soreness of the oral cavity, which interfere with eating and drinking.

Extraoral Signs and Symptoms

- a. Involvement of the lips and face—Herpes labialis “cold sore” (Fig. 11.5).
- b. Cervical adenitis, fever is as high as 101°F to 105°F and generalized malaise are common.

Management

- a. *Palliative treatment:* Food debris and superficial debris is removed, relief of pain is obtained with 0.5 percent Dyclonine hydrochloride mouthwash which has a topical anesthetic effect.
 - Locally apply Talbot's iodine, Zinc chloride (80%) riboflavin, thiamine, chlortetracycline (aureomycin)
- b. *Supportive treatment:* Copious fluid intake, for relief of pain systemically administer aspirin.

CHRONIC GINGIVITIS

Chronic marginal gingivitis is the most prevalent type of gingival change in childhood. The gingiva exhibits all the changes; in color, size, consistency, and surface texture characteristic of chronic inflammation. A fiery surface discoloration is often superimposed on underlying chronic changes.

Gingival color change and swelling appear to be more common expression of gingivitis in children than are bleeding and increased pocket depth (Fig. 11.6).

Plaque induced

In children, as in adults, the cause of gingivitis is plaque, local conditions like materia alba and poor oral hygiene favor its accumulation.

In preschool children, however, the gingival response to bacterial plaque has been found to be markedly less than that in adults. Dental plaque appears to form more rapidly in children of age 8-12 years than in adults.

Gingivitis occurs more often and with greater severity around malposed teeth because of their increased tendency to accumulate plaque and materia alba. Severe changes include gingival enlargement, bluish-red discolouration, ulceration and the formation of deep pockets from which pus can be expressed.

- *Pubertal gingivitis*: A higher prevalence and severity of gingivitis and gingival enlargement is found in the circumpubertal period, this form of gingivitis has been termed pubertal gingivitis.

The most frequent manifestations is a significant increase in bleeding interdenal sites. This inflammatory lesion may include a gingival enlargement as a result of hormonal change that magnify the tissues response to dental plaque. It occurs in males and females and resolves partially after puberty.

- *Gingivitis associated with tooth eruption*: It is frequent and has given rise to the term *eruption gingivitis*. However, tooth eruption per se does not cause gingivitis. The inflammation results from plaque accumulation around erupting teeth.

The initiation of gingivitis appears to be related to plaque accumulation rather than to tissue remodeling associated with eruption.

LOCALIZED GINGIVAL RECESSION

- There are many causes of gingival recession but in children the position of teeth in the arch is the most important.
- Gingival recession occurs on teeth in labial version and on those that are tilted or rotated so that the roots project labially (Fig. 11.7).
- Anterior openbite increases the prevalence of gingival recession.



Fig. 11.7: Localized gingival recession

- The recession may be a transitional phase in tooth eruption and may correct itself when the teeth attain proper alignment, or it may be necessary to realign the teeth orthodontically.

JUVENILE PERIODONTITIS

DEFINITION

It is a disease of the periodontium occurring in an otherwise healthy adolescents, which is characterised by a rapid loss of alveolar bone around more than one tooth of the permanent dentition.

Types

It exists in two forms:

- Localized
- Generalized.

Localized Juvenile Periodontitis (LJP)

- It mainly appears in children of age group between 11-15 years.

- ii. Lesion is usually seen involving
 - First molar and / or incisors
 - First molar and/or incisors with additional teeth (not exceeding 14 teeth).
- iii. The most striking feature is lack of clinical inflammation, despite the presence of deep periodontal pockets.
- iv. Small amounts of plaque is seen which rarely mineralised to become calculus.
- v. Most common initial symptoms are mobility, migration of the incisors and first molars classically, a distolabial migration of the maxillary incisors with diastema formation occurs (Fig. 11.8).

Microbiology of LJP

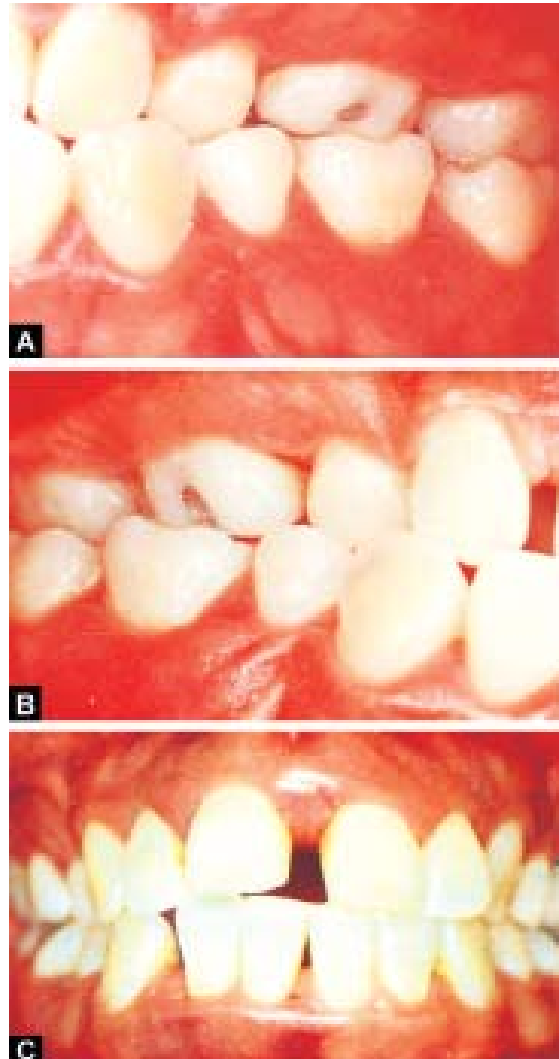
Two types of bacteria are considered to be pathogenic in LJP.

- *Actinobacillus actinomycetem comitans*.
- *Capnocytophaga*.

Reason of classic distribution of LJP

Involvement of first molars and incisors with least distribution in the cuspid. premolar area. The reasons could be:

- Production of opsonizing antibodies against *Actinobacillus actinomycetem comitans* (Aa).
- Bacteria antagonistic to Aa may develop thereby decreasing the number of colonization sites.
- Aa may lose its leukotoxin producing ability for unknown reason.
- Localization of the lesions could also be due to the defect in cementum formation.



Figs 11.8 A to C: Localized juvenile periodontitis

Pathogenesis of LJP

Interplay of several factors:

- The specific microbiology of subgingival plaque
- Defects in cementum (Hypoplastic/aplastic)
- Hereditary factors
- Impaired polymorphonuclear leucocytes functions and disorders of the immune system.

Radiographic Findings

- Vertical/angular bone loss around, the first molars and incisors in an otherwise healthy teenagers is a diagnostic sign of classic juvenile periodontitis.
“Arc-shaped” loss of alveolar bone extending from distal surface of the 2nd premolar to the mesial surface of the 2nd molar is seen.
- Bilateral symmetrical patterns of bone loss is seen “*Mirror-Image-Pattern*”

Generalized Juvenile Periodontitis (GJP)

Generalized juvenile periodontitis or generalized aggressive periodontitis is usually characterised by ‘generalized’ interproximal attachment loss affecting atleast three permanent teeth other than first molars and incisors.

Microbiology of GJP

- *Porphyromonas gingivalis*
- *Actinobacillus actinomycetem comitans*
- *Bacteroides forsythus*.

Clinical Features

- It affects persons between puberty to 35 years (but may be older).

- Quantitatively; the amount of plaque seems to be inconsistent with the amount of periodontal destruction.
- No specific pattern is observed, all or most of the teeth are affected.
- *Two types of gingival responses*: May be seen in Generalized juvenile periodontitis. One is severe, acutely inflamed tissue which is often proliferating, ulcerated and fiery red, spontaneous bleeding and suppuration is commonly seen.

In other cases, the gingival tissue may appear pink and free of inflammation but deep pockets can be demonstrated by probing (Fig. 11.9).

- Some of the patients may have systemic manifestations such as weight loss, mental depression and general malaise.

Radiographic Findings

No definite pattern of distribution occurs but, the radiographic picture can range from severe bone loss associated with the minimal number of teeth, to advanced bone loss affecting the majority of teeth in the dentition.



Fig. 11.9: Generalized juvenile periodontitis

Treatment of Juvenile Periodontitis

- In almost all cases systemic tetracycline hydrochloride 250 mg qid for at least a week should be given in conjunction with local mechanical therapy. If surgery is indicated systemic antibiotic are advised with patient instructed to begin taking the antibiotic approximately 1 hour before surgery.
- Doxycycline 100 mg/day may also be used.
- Chlorhexidine rinses should be prescribed.
- In refractory cases tetracycline resistant *Actinobacillus* species have been suspected. In such cases a combination of amoxicillin and metronidazole has been suggested.

PREPUBERTAL PERIODONTITIS**Localized Prepubertal Periodontitis**

- The age of onset is approximately 4 years.
- Plaque levels are usually low
- Alveolar bone loss is rapid
- Defect in neutrophil or monocyte functions has been reported.

Generalized Prepubertal Periodontitis

- Entire width of attached gingiva appears to be fiery red
- Gingival hyperplasia, cleft formation and recession
- Rapid destruction of the alveolar bone
- Systemic involvement like recurrent bacterial infections
- Defects in polymorphonuclear leukocytes and monocytes.

SYSTEMIC DISEASE ASSOCIATED WITH PERIODONTITIS**Papillon-Lefèvre Syndrome**

- It is characterized by hyperkeratotic skin lesions and severe destruction of the periodontium, these changes may appear before the age of 4 years.
- *Periodontal involvement*: Includes early inflammatory changes that lead to bone loss and exfoliation of teeth. Primary teeth are lost by 5 or 6 years of age. The permanent dentition erupts normally but within few years the permanent teeth are also lost.

Ehlers-Danlos Syndrome

- It is an inherited disorder affecting the connective tissue, the defect is in collagen molecular biology, but the nature of the defect is unknown.
- *Oral and periodontal manifestations*
 - Oral mucosa is often fragile and susceptible to bruising.
 - Postextraction hemorrhage can be a problem due to fragility of blood vessels and defects in the supporting connective tissues.
 - *Gingival tissues*: These are often fragile and bleed readily on tooth brushing. Some forms of Ehlers-Danlos syndrome (type VII) are reported to have advanced periodontal destruction.
 - *Teeth in Ehlers*: Danlos syndrome are fragile and fracture easily.
 - Due to the fragility of oral mucosa and gingiva, the periodontal therapy in Ehlers-Danlos syndrome should as atraumatic as possible.



Fig. 11.10: Down syndrome

Down Syndrome (Trisomy 21)

- It is a congenital disease caused by a chromosomal abnormality and characterized by mental deficiency and growth retardation.
- *Periodontal disease:* Include the formation of deep periodontal pockets associated with plaque accumulation and moderate gingivitis, usually generalized but more severe in the lower anterior region, acute necrotizing lesions are also common (Fig. 11.10).

Chédiak-Higashi Syndrome

This is a rare syndrome characterized by recurrent bacterial infection; it exhibits oral ulcer and rapidly destructive periodontitis.

Leukocyte Adhesion Deficiency

- These cases are rare and begin during, or immediately after eruption of the primary teeth.
- Extreme acute inflammation and proliferation of gingival tissues with rapid bone loss are found.
- Profound defects in peripheral blood neutrophils and monocytes are seen.

Hypophosphatasia

- This is a rare familial skeletal disease characterized by rickets, poor cranial formation, premature loss of primary dentition particularly incisors.
- Patients have low levels of serum alkaline phosphatases, teeth are lost with no clinical evidences of gingival inflammation and show reduced cementum formation.

Chapter 12

Space Maintenance in the Primary Dentition

INTRODUCTION

Consequence of proper or improper space management influence dental development in childhood to well into adolescence.

- Early loss of primary teeth may lead to compromise in the eruption of succedaneous teeth if there is a reduction in the arch length.
- In some case; if timely intervention is undertaken with space maintainers it may save space for the eruptions of the permanent dentition.
- The key to space maintenance in the primary dentition is in knowing the basic problem and cause of the problem to treat.
- Premature tooth loss is in terms of anterior (incisors and canine) and posterior (molar) is cited according to the basic etiology of the premature loss.

Etiology of anterior tooth loss is as follows:

- Trauma.
- Tooth decay.

A. Trauma

Injuries to the primary incisors are common because child in this age is learning to crawl, walk and run.

B. Tooth decay

Although the prevalence of dental decay appears to be declining; a small number of children still suffer from early childhood caries and rampant decay.

Etiology of posterior tooth loss is mainly due to dental caries; rarely are primary molars lost due to trauma.

Space maintenance during the primary dentition years is aimed primarily at the replacement of primary molars for the reason that:

Loss of interproximal contact as a result of decay, extraction, or ankylosis of an adjacent tooth result in space loss because of mesial and occlusal drift of the tooth distal to the newly created space. There is also an evidence that the tooth mesial to affected molar will drift distally into the space.

Therefore, loss of space or arch length is possible and can occur from both directions.

But early loss of primary incisor does not result in space loss as seen in many clinical situations.

There may be some rearrangement of space between remaining incisors but there is not net space loss.

Also *space maintenance begins with good restorative dentistry.*

The clinician should strive for ideal restoration of all interproximal contours, early restoration of interproximal caries ensure that no space loss occurs.

APPLIANCE THERAPY

Teeth lost during the deciduous dentition years cause later than normal eruption of the permanent tooth this necessitate the qualities of appliance to include—

Appliance should be properly monitored, adjusted and possibly replaced over a longer period of time.

FIXED SPACE MAINTAINERS

Space maintainers which are fixed or fitted onto the teeth are called fixed space maintainers (refer Table 12.1).

Advantages

- Bands are used which requires no tooth preparation.
- Jaw growth is not hampered.
- The succedaneous permanent teeth are free to erupt in the oral cavity.
- They do not interfere with the passive eruption of abutment teeth.
- They can be used in uncooperative patients.
- Masticatory function is restored if pontics are placed.

Disadvantages

- They may result in decalcification of tooth material under the bands.
- Supraeruption of opposing teeth can take place if pontics are not used.

Table 12.1: Classification of space maintainers

According to Hitchcock

- Removable or fixed or semifixed
- With bands or without bands
- Functional or nonfunctional
- Active or passive
- Certain combinations of above

According to Raymond C Throw

- Removable
- Complete arch
- Lingual arch
- Extraoral anchorage
- Individual tooth

According to Hinrichsen

Fixed space maintainers

Class I

- a. Nonfunctional types
 - Bar type
 - Loop type
- b. Functional types
 - Pontic type
 - Lingual arch type

Class II

- Cantilever type
- Distal shoe
- Band and loop

Removable space maintainers

- Acrylic partial dentures

- If pontics are used it can interfere with vertical eruption of the abutment tooth and may prevent eruption of replacing permanent teeth if the patient fails to report.

Examples

- Band and loop space maintainer
- Crown and loop appliance

- Lingual arch space maintainer
- Esthetic anterior space maintainer
- Band and bar type space maintainer
- Crown and bar space maintainer.

Four appliances generally are used for space maintenance in the primary dentition

- Band and loop
- Lingual arch
- Distal shoe
- Removable appliances.

BAND AND LOOP

- The appliance is used to maintain space of a lost single tooth.
- The appliance is inexpensive and is easily fabricated.
- With the use of this appliance a continuous care and supervision is required. However, it does not restore the occlusal function of the missing tooth.

INDICATIONS

- Unilateral loss of the primary first molar before or after eruption of the permanent first molar.
- Bilateral loss of a primary molar before eruption of permanent incisors.

FABRICATION OF BAND AND LOOP SPACE MAINTAINER

Step 1: (a) Select and fit a band on the abutment tooth. Band selection is on trial and error basis; bands are tried over the abutment tooth until one can be nearly seated on the tooth with finger pressure and to gain an appropriate final occlusal and

gingival dimension. Utilization of band pusher and band biter is accomplished.

- (b) A properly placed band is seated approximately 1 mm below the mesial and distal marginal ridges. If needed orthodontic separators can be used to gain or create space for the band material placement.

Step 2: Next, make a quarter arch impression of band and edentulous area with alignate impression material with use of perforated tray so that impression material can flow in perforations and can prevent distortion of impression when it is removed.

Step 3: Next, stabilize the band in impression in the correct position.

Step 4: The impression is poured in stone with band in place; the cast is separated.

Step 5: The wire is shaped into a loop and is well-contoured to fit the band and alveolar ridge (Figs 12.1A to P).

HOW TO BEND A BAND LOOP SPACER

Requirements

- The loop should parallel the edentulous ridge 1 mm off the gingival tissue and must rest against the adjacent tooth at the contact point. Faciolingual dimension of loop should be approximately 8 mm.
- The required dimensions must be included in fabrication to allow the permanent tooth to erupt freely but not impinge on the buccal mucosa or tongue.
- The fabricated loop should not restrict any physiological tooth movement such as increase in



Fig. 12.1A: Cut 2.5" of 0.36 wire



Fig. 12.1C: Try on cast for close fit



Fig. 12.1B: 3 prong pliers for contour



Fig. 12.1D: 3 prong for vertical contour

intercanine width which occurs during eruption of permanent lateral incisors.

Step 6: Adjustment: After fabrication of band and loop it should be fitted and adjusted accordingly.

Step 7: Cementation: Band should be cemented onto dry, clean tooth with zinc phosphate or glass ionomer cement.

Step 8: Patient recall visits: The patient is recalled every 6 months to check that appliance is



Fig. 12.1E: Vertical contour achieved



Fig. 12.1H: Space maintainer contact in the middle third of tooth mesial of the space



Fig. 12.1F: Check it for fit on the cast



Fig. 12.1I: Mark for "S" bend; contour is about 1 mm above tissue



Fig. 12.1G: Contour buccal and lingual arms with 3 prong



Fig. 12.1J: 45 degree bend with birdbeak pliers



Fig. 12.1K: 45 degree "up" bend



Fig. 12.1L: Wire at junction of occlusal and middle third of the band



Fig. 12.1M: Wire should now be contoured to the buccal and lingual contour of the tooth



Fig. 12.1N: Improved buccal contour



Fig. 12.1O: Proper contour; horizontal part of wire is at the junction of the middle and occlusal third of the band



Fig. 12.1P: Occlusal view—the appliance may now be soldered

working as per requirements as well as to check for fit of appliance and also that the cement has not washed out with also taking care of condition of abutment tooth.

Step 9: Indication of removal: Eruption of permanent tooth is easily recognized indication of removal of space maintainer.

Two modifications of band and loop appliance that are not recommended for use in space maintenance therapy.

Bonded Band and Loop

It is wire-shaped in a loop in a similar way of a loop portion of band and loop appliance that is bonded to the abutment tooth with composite resin.

Two reasons of not recommending this appliance are:

- It is difficult to keep the wire bonded to the tooth because of shearing force of occlusion.
 - When bond breaks there is a potential for loss of space.
 - Together with added danger of aspiration of wire.
- The adjustment of bonded band and loop is nearly impossible.

Crown and Loop Appliance

- The technique involved in crown and loop appliance requires preparation of abutment tooth for a stainless steel crown.
- Followed by soldering of a space maintaining wire directly to crown, failure of this soldered joint leave no approach to repair the appliance intraorally. For repair, the crown must be cut off, a

new crown is to be fitted and the wire to be resoldered.

DISTAL SHOE

Distal shoe appliance is otherwise known as intra-alveolar appliance.

INDICATIONS

The distal shoe appliance is used to maintain the space of a primary second molar that has been lost before the eruption of the permanent first molar.

- To prevent possible impaction of the second premolar.
- An unerupted permanent first molar drift mesially within the alveolar bone if the primary second molar is lost prematurely. The result of the mesial drift is loss of arch length and possible impaction of the second premolar.

FABRICATION OF APPLIANCE

- The appliance can be constructed from an impression.
 - a. Taken after removal of the primary second molar.
 - b. An impression taken before tooth is extracted.

In situation (a), the gingiva must be incised when the appliance is placed because of healing in the extraction site.

In situation (b), the construction cast must be modified to simulate loss of the primary second molar, but placement in the extraction site at the time of surgery is straight forward.



Fig. 12.2: Distal shoe space maintainer

- The primary first molar is banded and the loop extended to the former distal contact of the primary second molar (Fig. 12.2).

SPACE MAINTAINERS

- A piece of stainless steel is soldered to the distal end of the loop and placed in the extraction site.
The stainless steel extension acts as a guide plane for the permanent first molar to erupt into proper position.

Requirements

- A stainless steel extension is soldered to the distal end of the band and 36 mil loop.
- The extension is positioned 1 mm below the mesial marginal ridge of unerupted permanent first molar in the alveolar bone.
- After the permanent molar has erupted, the extension can be cut off or a new band-and-loop appliance can be constructed.

- To ensure that the stainless steel extension is in the proper position and in close proximity to the permanent first molar, a periapical radiograph is recommended before the appliance is cemented.

Problems Associated with Distal Shoe Appliance

- Due to its cantilever design and the fact it is anchored on the occlusally convergent crown of the primary first molar, the appliance can only replace a single tooth and is somewhat fragile.
- Due to lack of strength no occlusal function is restored.
- In additional examination histologically, It shows that complete epithelialization does not occurs after placement of the appliance; because the epithelium is not intact.
- Distal shoe appliance is contraindicated in medically compromised patients and in patients who requires subacute bacterial endocarditis antibiotic coverage.
- Appliance acts as a presence of a constant foreign body in the mouth.
- The placement of the appliance in the oral cavity may be a possible route of inflammation into the submucosa.
- Possible breakage leading to trauma and inflammation.

LINGUAL ARCH

The appliance is used to maintain posterior space in the primary dentition.

Indication

The lingual arch is often suggested when teeth are lost in both quadrants of the same arch.

Requirements

Because the permanent incisor tooth buds develop and erupt somewhat lingual to their primary precursors in the lower arch, a conventional mandibular lingual arch is not recommended in the primary dentition.

The wire resting adjacent to primary incisors might interfere with the eruption of permanent dentition (instead, two band-loop appliances are recommended when there is bilateral tooth loss in the mandibular arch).

Maxillary Lingual Arch

Use of maxillary lingual arch is feasible in the primary dentition because it can be constructed to rest away from the incisors.

Types

Two types of lingual arch designs are used to maintain maxillary space.

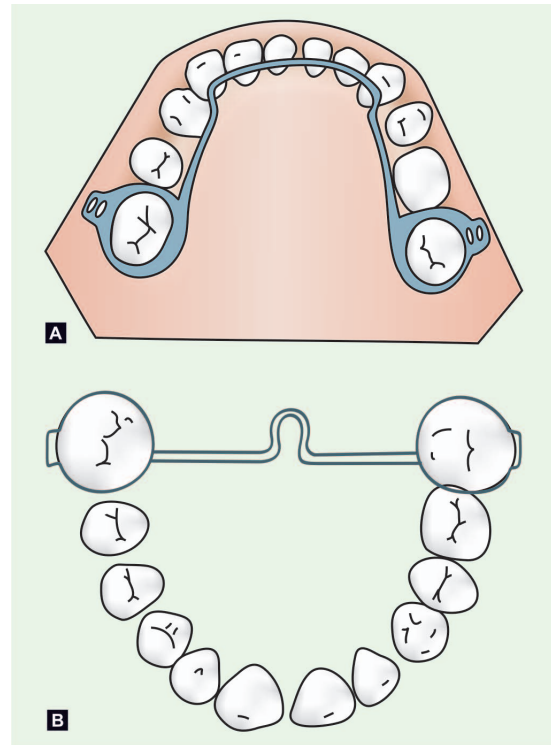
- Nance arch
- Transpalatal arch.

Basis of Appliance

- These appliances use a large wire (36 mil) to connect the banded primary teeth on both sides of the arch that are distal to the extraction site.
- The appliance is usually indicated to preserve the spaces created by multiple loss of primary molars.
- It helps in maintaining the arch perimeter by preventing both mesial drifting of the molars and also lingual collapse of the anterior teeth.

DIFFERENCES BETWEEN THE TYPES OF APPLIANCE

The difference between the two appliance was to do with where the wire is placed on the palate:



Figs 12.3A and B:
(A) Lingual arch space maintainer
(B) Transpalatal arch

- The Nance arch incorporates an acrylic button that rests directly on the palatal rugae (Fig. 12.3A).
- The transpalatal arch (TPA) is made from a wire that traverses the palate directly without touching it (Fig. 12.3B).

The best indication of TPA is when one side of the arch is intact, and several primary teeth on other side are missing.

Mandibular Lingual Arch

Indications

- Used in case of bilateral loss of primary teeth after the lower permanent incisors are erupted.
- Retention and stabilization of the position of mandibular anterior teeth after tooth movement to prevent relapse (Fig. 12.4).

Contraindications

- Anything that would require frequent adjustments in the pre-existing procedure, e.g. space regaining.
- Rampant dental caries, high plaque scores, poor patient cooperation.
- Extreme mandibular anterior crowding or lingually erupting succedaneous teeth.

Fabrication of Mandibular Lingual Arch

- Step 1 :* Band is placed on the first permanent molar on either side of same arch (Fig. 12.5).
- Step 2 :* After the impression is made pour the cast and make the working model.

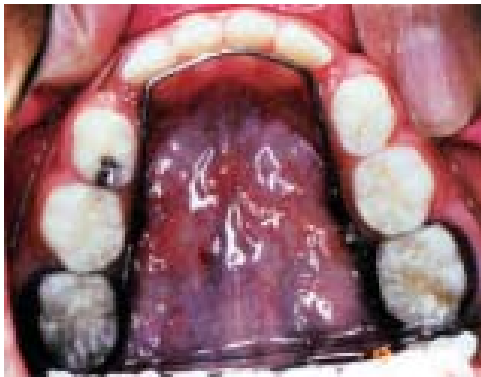


Fig. 12.4: Lower lingual holding arch



Fig. 12.5: Lingual holding arch being constructed on a model

- Step 3 :* On the cast draw the position of the intended lingual arch wire.
- Step 4 :* The lingual wire runs from the middle third of molar band along the gingival one-third of the primary molar and continue along the cingulum of incisors (Figs 12.6B to D). The wire should not interfere with occlusion, tongue or erupting teeth.
- Step 5 :* Solder the wire to band, trim and polish (Fig. 12.6A).
- Step 6 :* Try in and then cement the appliance in place.

ESTHETIC ANTERIOR SPACE MAINTAINER

- It was described by Steffen, Miller and Johnson in 1971.
- Its method of construction is simple and also provide esthetic component.
- The space maintainer consists of a plastic tooth fixed onto a lingual arch which, in turn, is attached to molar bands.



Fig. 12.6A: Wire is soldered to band at middle third of molar



Fig. 12.6C: Wire continues along the gingulum



Fig. 12.6B: Wire travels along the gingival one-third of primary molar



Fig. 12.6D: Wire running from middle third of molar band

BAND AND BAR SPACE MAINTAINER

This is a fixed space maintainer in which the abutment teeth on either side of the extraction space are bonded and connected to each other by a bar.

CROWN AND BAR SPACE MAINTAINER

After use of bands that are placed on the abutment teeth on either side of extraction site, stainless steel crowns can also be used on abutment.

REMOVABLE APPLIANCES

Introduction

- Removable appliances also can be used to maintain space in the primary dentition. The appliance is typically used when more than one tooth has been lost in a quadrant.
- They are space maintainers which can be removed and reinserted into the oral cavity by the patient.

Removable maintainers can be classified as:

- *Functional space maintainers:* They incorporate teeth to aid in mastication, speech and esthetics.
- *Nonfunctional space maintainers:* They have only acrylic extension over the edentulous area to prevent space closure.

Advantages

- They are easy to clean and permit proper oral hygiene.
- They maintain or restore the vertical dimension.
- They serve important functions like mastication, esthetics and phonetics.
- Room can be made for permanent teeth to erupt without changing the appliance.
- They help in preventing development of tongue thrust habit into the extraction space.
- Band construction is not necessary.

Disadvantages

- They may be lost or broken by the patient
- Uncooperative patients may not wear the appliance.
- Lateral jaw growth may be restricted, if clasps are incorporated.
- They may cause irritation to the underlying soft tissues.

Drawbacks of the Appliances

Two drawbacks of the appliances are:

- Retention
- Compliance.

Retention

Is a problem because primary canines do not have large undercuts for clasps engagement.

If multiple tooth loss is unilateral, retention problem can be overcome by placing sturdy retention clasps on the apposite side of arch. However, if multiple teeth are lost bilaterally, retention problem are almost inevitable.

Compliance

A problem of compliance is closely related to retention.

- A three to six-year-old children will not tolerate an ill-fitting appliance and will not use it. In fact, some children will not tolerate a retentive appliance, the dentist is then resigned to waiting until the permanent teeth (molars) erupt so that they can be used as abutments for a conventional lingual arch appliance.
- Some children are compliant in wearing an appliance but not in cleaning the appliance and the underlying tissue, this can result in tissue decay, tissue irritation and hyperplasia.

Indications

- Removable dentures are indicated when aesthetics is of importance.
- In case the abutment teeth cannot support a fixed appliance it is recommended to use a removable space maintainer.
- In case the radiograph reveals that the unerupted permanent tooth is not going to erupt in less than five months time a removable space maintainer can be given.
- In the case; if the permanent teeth have not fully erupted it may be difficult to adapt bands; thus it is advisable to use removable space maintainers.
- In cleft palate patients who require obturation of the palatal defect.
- Multiple loss of deciduous teeth which may require

functional replacement in the form of either partial or complete dentures.

Contraindications

- Lack of patient cooperation.
- In patients who are allergic to acrylic materials.
- Epileptic patients who have uncontrolled seizures.

Some Commonly Used Removable Space Maintainers

Acrylic Partial Dentures

- Acrylic partial dentures have been used successfully in patients who have undergone multiple extractions.
- This appliance can be readily adjusted to allow the eruption of teeth.
- The inclusion of artificial teeth in the denture restores masticatory function.
- Clasps can be fabricated on deciduous canines and molars for retention.

Full or Complete Dentures

- Sometimes all the primary teeth of a preschool child may require extraction due to rampant caries of teeth that cannot be restored.
- Although this procedure was more common in the pre-fluoridation era even today some children may require complete extraction of their deciduous teeth. These cases are managed by the use of a complete denture.
- These dentures not only restores masticatory function and aesthetics but also guide the permanent teeth into their correct position. The posterior border of denture should be placed over

the area approximating the mesial surface of unerupted first permanent molar.

- The denture will have to be adjusted and a portion of it cut away as the permanent incisors erupt, and the posterior border is contoured to guide the first permanent molars into position, when the permanent incisors and first permanent molars have erupted, a partial denture space maintainer can be used until the remaining permanent teeth erupt.

PLANNING FOR SPACE MAINTENANCE

There are various factors which should be considered when space maintainer is planned following the early loss of primary teeth.

Time Elapsed Since Loss of Teeth

- It is usually advisable to place a space maintainer as soon as the primary teeth are lost or removed.
- Studies indicate that the maximum loss of space occurs within 6 months of extraction of teeth. It would be better to fabricate the appliance prior to extraction of the primary tooth and insert the appliance soon after the extraction.

Dental Age of the Patient

- The dental age of the patient should always be considered rather than chronological age. This is because too much variation in eruption of teeth is observed.
- It is usually observed that the permanent teeth erupt once $\frac{3}{4}$ th of their root development is complete. This criteria can be used to predict the age of eruption of the permanent teeth.

Thickness of Bone Covering the Unerupted Teeth

The more is the bone covering the unerupted tooth, the more would be the time it would take to erupt, and therefore space maintainer is indicated.

Illustration

Normally premolars takes 4-5 months to erupt through a bone of 1 mm.

Sequence of Eruption of Teeth

Whenever a space maintainer is planned, adequate consideration should be given to the adjacent developing and erupting teeth. The neighbouring dentition can greatly influence the closure of the extraction space.

Illustration

When the deciduous second molar is lost early, we should study the development of permanent second molar and the second premolar. In case the second molar is ahead of the second premolar in its eruption, it is likely to exert a mesial force on the first molar which can move mesially this results in insufficient space for the second premolar.

Congenital Absence of Permanent Tooth

If permanent teeth are congenitally missing the dentist should decide:

- Is dentist is going to retain the space until a replacement can be given.
- Allow the other erupting teeth to drift and close the space.

Chapter 13

Oral Habits

- It is an act which is not socially acceptable.
- It is a fixed constant or certain practice established by frequent repetition of same act.
- It is a response to stimuli (extrinsic or intrinsic) which may persist even when the stimuli is withdrawn.

Classification

- | | |
|----------------|----------------|
| i. Compulsive | iii. Intraoral |
| Noncompulsive | Extraoral |
| ii. Meaningful | iv. Pressure |
| Empty | Nonpressure |
| | Miscellaneous |

Compulsive: Are those habits which have acquired a fixation of the extent that the child revert back to the habit whenever his security is threatened.

Noncompulsive: Can be easily withdrawn from the child's behavior as he matures.

Meaningful: Which have a psychological background.

Empty: No psychological background.

Intraoral: Tongue thrusting, thumb sucking, nail biting.

Extraoral: Abnormal pillowing.

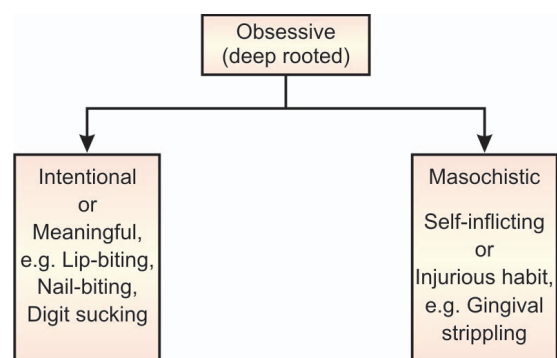
Pressure: Biting, sucking, thrusting, postural.

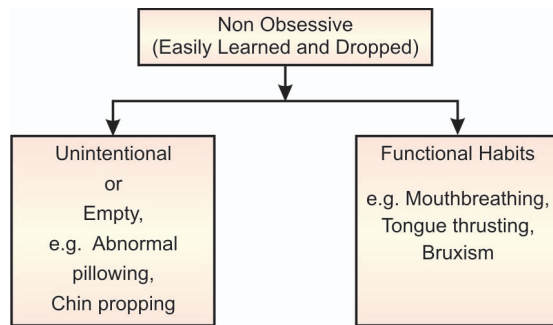
Nonpressure: Mouthbreathing.

Other Classification

Bruxism

- Night grinding or clenching habit.
- It is the total constriction of the masticatory muscles under rhythmic grinding of teeth during sleep.





Incidence—15 percent in 3-16-year-old child and 5.1 percent in 17-36-year-old.

Etiology

- i. Occlusal prematurities, e.g. highly placed restorations.
- ii. Emotional problems, e.g. psychological nervousness, tension.
- iii. In disorders like epilepsy, meningitis, GI disturbances, pinworm infestation.

Clinical Examination

- Worn out enamel is seen in initial stages.
- Later stages which may expose dentin and pulp in chronic cases which will lead to pain and swelling.
- There may be some TMJ abnormalities.

Management

- Find the Etiology. If it is due to psychological causes, psychological counselling and reassurance is given (Fig. 13.8).
- Any present occlusal prematurities or enhancing restoration are corrected and lip exercises are advised.

- To prevent further destruction of teeth due to habit Stainless steel crown may be given in posterior teeth.
- Mouth guards are also given.

LIP HABIT

DEFINITION

Habit that involves manipulation of lips and perioral structures are termed as lip habits.

CLASSIFICATION

- i. Wetting the lips with tongue
- ii. Pulling the lip into the mouth between teeth (Fig. 13.1).

ETIOLOGY

i. Malocclusion

Class II division I, deep bite malocclusion due to large overbite and overjet, this habit develops when the child wants to produce a normal lip seal during swallowing by placing the lower lip posterior to the maxillary incisors.



Fig. 13.1: Pulling the lip into the mouth

ii. Habits

In conjunction with other habits such as thumb sucking, digit sucking; which will further increase the overjet and overbite.

iii. Emotional stress

Children in stressful situation have increased salivary output, thus increasing the number of swallows and increased lip seals are required.

MANIFESTATION

- i. Protrusion of maxillary incisors and retrusion of mandibular incisor.
- ii. *Lip*: Lip sucking can be recognized by reddened irritated and chapped area below the vermillion border. The vermillion border is relocated farther outside the mouth due to constant wetting of lips.
- iii. Mentolabial sulcus becomes accentuated.
- iv. *Malocclusion*: Lip sucking and lip biting can maintain an existing malocclusion.

MANAGEMENT

- i. Correction of malocclusion—class II division I.
- ii. Treating the primary habits.
- iii. *Appliance therapy*: Oral shield helps to stop habit and also the incisal alignment. The addition of a small loop to the labial oral shield to improve the lip tonus by helping in lip exercises, i.e. 3-10 min a day.

Lip Bumper

It is used for both comprehensive and interceptive treatment regimens.

The lip bumper is placed in the vestibule of mandibular arch and serves to prohibit the lips from exerting excessive force on mandibular incisors and to repositioning the lip away from lingual surface of maxillary incisor; this prevent the distal movement of maxillary incisor resulting in decreased overjet and overbite.

CHEEK-BITING

DEFINITION

It is an abnormal habit of keeping or biting the cheek muscles in between the upper and lower posterior teeth.

CLINICAL FEATURES

- Open bite
- Tooth malpositioning in buccal segment
- Ulcers in the level of occlusion.

MANAGEMENT

- A removable crib
- A vestibular screen.

NAIL-BITING

DEFINITION

It is one of the most common habit in children and adults. It is a sign of internal tension (Fig. 13.2).

Age of Occurrence

This is absent before 3 years of age. The incidence rises sharply from 4-6 years and remain at fairly constant level between 7-10 years and rises again to a peak incidence during adolescence.

Etiology: Emotional problem



Fig. 13.2: Nail biting

Effects (Dental): Crowding, rotation and attrition of incisal edges of incisors (mandibular)

Effects on nails: Inflammation of nail beds and also of nails.

MANAGEMENT

- Mild cases no treatment is indicated.
- Avoid punitive method such as scolding, threats.
- Treat the basic emotional factor.
- Encourage outdoor activities which may easing tension.
- Application of nail polish, light cotton nutils as reminder.

SELF-INJURIOUS HABITS (MASOCHISTIC HABIT, SADO MASOCHISTIC HABITS, SELF-MULTILATING HABITS)

DEFINITION

Repetitive act that result in physical damage to the individual. These habits show increased incidence in mentally retarded population.

ETIOLOGY

a. Organic

Syndrome and syndrome-like abnormalities Lesch-Nyhan disease, de Lange's syndrome in which symptoms such as repetitive lip, finger, tongue, knee and shoulder biting is common.

b. Functional

This can be further divided into—

- *Type A:* These are injuries superimposed on pre-existing lesion, e.g. a child with finger nail biting is under treatment of skin lesion. The lesion will show no evidence of healing as it is perpetuated by this injurious habit which occurs mainly at night.
- *Type B:* They include injuries secondary to another established habit, e.g. Rotation of thumb during thumb sucking can harm the soft tissue.
- *Type C:* They include injuries of complex origin.
- *Frenum thrusting:* This habit is rarely seen. If the maxillary incisors are slightly spaced apart, the child may lock his labial frenum between these teeth and permit to be in this position for several hours on constant repetition this may turn into habit and which may displace the tooth.

TREATMENT

- Treatment first initiated towards *psychotherapy*. Some children experience a feeling of neglect and loneliness and through the use of self-injurious behaviour attempt to solicit the attention and love.
- *Palliative treatment*—Bandages for oral ulceration which will help healing of wounds as well as serve as habit reminder.
- *Mechanotherapy*—Oral shields.

MOUTHBREATHING

DEFINITION

Mouthbreathing is defined as habitual breathing through mouth instead of nose.

CLASSIFICATION BY FINN

- **Anatomic:** Anatomic mouthbreather is one whose short upper lip does not permit complete closure without undue effort.
- **Obstructive:** Children who have increased resistance to, or complete obstruction of the normal flow of air through nasal passages.
- **Habitual:** Who continually breathes through his mouth by force of habit, although abnormal obstruction has been removed.

Etiology

- Enlarged turbinates
- Deviated septum and other nasopharyngeal abnormalities.
- Allergic rhinitis, nasal polyps.
- Enlarged adenoids, tonsils.
- Abnormally short upper lip preventing proper lip seal.
- Obstruction in the bronchiol tree or larynx.
- Obstructive sleep apnea syndrome.
- Genetically predisposed individual—Ectomorphic children having a genetic type of tapering face and nasopharynx are prone for nasal obstruction.
- Thumb sucking or similar oral habits can be the instigating agent.

CLINICAL FEATURES

General Effects

- *Pulmonary development* with oral respiration the resistance is lacking and poor pulmonary compliance is seen. This gives the appearance of pigeon chest.
- *Lubrication of oesophagus:* In mouthbreathers the oropharynx is dry and mucous collected in expectorated. This denies the oesophagus of essential lubrication and can produce a low grade esophagitis.
- *Blood gas constituents:* Blood gas studies reveal the mouthbreathers have 20 percent more CO₂, 20 percent less O₂ in the blood.

Effect on Dentofacial Structures

- Facial form:* Adenoid facies—Characterised by long narrow face, short nose, short upper lip, V-shaped maxilla, expression less face, nose in tipped superiorly.
- Dentitional changes:*
 - Anterior open bite
 - Proclination of maxillary anteriors
 - Constricted maxilla (Fig. 13.3).
 - High vault palate
 - Patient is prone to oral infections
 - Patient is more prone to dental caries.
- Gingival:* Chronic keratinized marginal gingivitis in the maxillary anterior region.
- Lip:* The patient has a lip apart posture, on smiling, many of these patient reveal large amount of gingiva producing 'gummy smile'.



Fig. 13.3: Arch constricted due to the habit of mouthbreathing

Incompetent upper lip and a voluminous curled over lower lip.

- v. *Speech:* Speech performance is compromised. Nasal tone in voice is seen.
- vi. *External nares:* Long-standing nasal airway obstruction can lead to disuse atrophy of the lateral cartilage. The result is a slit-like external nares with a narrow nose; sometimes after the airway obstruction is removed and patent airway is established, the nose may collapse on inspiration, making reconstructive surgery necessary.
- vii. *Other effects:* Otitis media.

DIAGNOSIS

i. History

Parents are questioned whether the child had a frequent lip apart posture. Frequent occurrence of allergic rhinitis, tonsillitis and otitis media is queried.

ii. Examination

Ask the patient to take a deep breath; The nasal breather will inspire through nose with lips tightly closed.

A mouthbreather when asked to deep breath with his lips closed he will not change appreciably shape and size of external nares rather contracts nasal origins while inspiring.

A normal nose breather will dilate the nostril while deep breathing.

iii. Clinical Test

- *Butterfly test:* A whisp of water is placed in front of the patient mouth if patient is a mouth breather, the fluttering of water is observed.
- *Water holding test:* Ask the patient to hold some water in the mouth. If patient is a mouth breather, he can't hold it for a longer time.
- *Mirror test:* Take a double ended mouth mirror keep one in front of nose and one in front of mouth. If patient is a mouth breather fogging of the mouth mirror in the front of mouth is seen.
- *Paper test:* Ask the patient to hold a piece of paper in between the lips. If he is a mouth breather he can't hold it for long.

iv. Inductive plethysmography - (Rhinomanometry)

It is a reliable method to quantify the mouthbreathing that how much is the air flow through nose and mouth.

v. Cephalometrics

To establish the amount of nasopharyngeal space, size of adenoids, skeletal pattern of patient by taking various cephalometric angles.

MANAGEMENT

- As with other habit, correction of mouth breathing is expected as child matures this is attributed to increase in nasal passage as child grows.
- Refer the child to ENT surgeon for removal of nasal and pharyngeal obstruction.
- Preventing and intercepting the habit by physical exercise like lip exercise and appliance therapy, e.g. oral/vestibular screen after the underlying problem has been corrected.

TONGUE THRUSTING

DEFINITION

(Schneider 1982): Tongue thrust is a forward placement of tongue between the anterior teeth and against the lower lip during swallowing (Fig. 13.4).

CLASSIFICATION

- Type I* Nondeforming tongue thrusting
Type II Deforming anterior tongue thrust



Fig. 13.4: Tongue thrusting

- Type III* Deforming lateral tongue thrust
Type IV Deforming anterior and lateral tongue thrust.

OTHER CLASSIFICATION PHFA

- *Physiologic*: This comprises of normal tongue thrust swallow of infancy.
- *Habitual*: The tongue thrust is present as a habit ever after correction of malocclusion.
- *Functional*: When tongue thrust mechanism is an adaptive behaviour developed to achieve oral seal.
- *Anatomic*: Patient have enlarged tongue and can have anterior tongue posture.

ETIOLOGY

- Retained infantile swallow.
- *Upper respiratory tract infection*: Such as chronic tonsillitis, allergies promote an anterior posture of tongue due to pain.
- *Neurological disturbance*: Hyposensitive palate, moderate motor disability, disruption of sensory control and coordination of swallowing can lead to tongue thrust.
- *Functional adaptability to transient change in anatomy*: The tongue can protrude out when the incisors are missing following the loss of deciduous teeth and prior to full eruption of permanent teeth (incisors) there exist a natural opening for tongue tip to protrude during swallowing. It has been seen that protrusive activity will change with full eruption of permanent incisors.
- *Feeding practice*: Development of improper swallowing is either due to bottlefeeding or breastfeeding is a controversial matter.

- *Induced due to other habits:* Habits like thumb sucking leads to anterior open bite is seen during swallowing.
- *Hereditary:* The type of maxillary structure that favors the development of tongue thrust may be hereditary.
- *Tongue size:* Macroglossia can have an effect on dentition.

CLINICAL MANIFESTATION

Extraoral Findings

- Lip posture:* Lip separation is greater in the tongue thrust this is a consistent finding both at rest and in function.
- Mandibular movements:* There is no collaboration in between movements of tongue, lip and mandibular movements. The average path of mandibular movements is upward and backward and of tongue is forward.
- Speech:* Lispings, problems in articulation of (/s/, /n/, /t/, /d/, /th/, /z/, /n/) sounds.
- Facial form:* Increase in anterior face height.

Intraoral Findings

- Tongue movements are jerky, movement are irregular from one swallow to another within the individual.
- Tongue posture is lower (tongue tip) at rest.
- Malocclusion:
 - *Features pertaining to maxilla:* Proclination of maxillary anteriors resulting in an increased overjet.
 - *Features pertaining to mandible:* Retroclination or proclination of

mandibular teeth depending upon the type of tongue thrust.

- Generalized spacing between the teeth
- Maxillary constriction.

Intermaxillary Relationship

For a newborn infant, after establishment of respiratory reflex, it is important to obtain the milk with is to be transferred to GIT. All newborn infants have a characteristic swallowing pattern associated with feeding called as sucking reflex. The part of sucking reflex in infant is called as visceral/infantile swallow and in adults is called as somatic reflex/mature swallow.

VISCERAL REFLEX

- Characterized by mandibular thrust
- Lip musculature contraction
- Anterior tongue thrust in between the gum pads
- Marked furrow extending from the tip of tongue to the dorsum of tongue
- Tongue is positioned lower than palatal vault during swallow.

SOMATIC REFLEX

- No mandibular thrust
- No lip musculature contraction
- No anterior tongue thrust
- The tongue tip is placed on the lingual gingival margin of upper and lower anterior teeth during swallow
- During the procedure, the dorsum of tongue arches over the palate, so that there is no space between palate and tongue for solid bolus ingestion.

MANAGEMENT

Simple Tongue Thrust

If exaggerated anterior proclination, correct the proclined anterior teeth by using the orthodontic appliance, during the treatment the habit may get corrected and there is no need for treatment for habit itself.

Complex Tongue Thrust

- Training the patient for normal swallowing pattern by asking the patient to place his tongue tip in between the hard and soft palate and then swallow. Ask the patient to do this for 40 times a day.
- Place the ortho elastic on the tip of tongue and ask the patient to swallow by placing the tip on the palate. If swallowing is corrected, the elastic is retained.
- Go for the appliance therapy with cribs and can be removeable, or fixed appliance with rags or oral screen/vestibular screen (Fig. 13.6).
- Surgical treatment: the treatment of retained infantile swallow behaviour is difficult and often consisting of orthognathic surgeries to correct the skeletal malformation.



Fig. 13.5: Habit breaking appliances



Fig. 13.6: Hotz modification of oral screen

THUMB SUCKING

DEFINITION

Thumb sucking can be defined as placement of thumb or one or more finger into various depths into the mouth (Fig. 13.7).

CLASSIFICATION

i. Normal thumb sucking

Seen during II and III year of life such a habit disappears as the child matures. The habit at this age does not generate any malocclusion.

ii. Abnormal thumb sucking

When habit persist beyond the preschool period then it is considered abnormal, if this habit is not controlled or treated at this stage it cause deleterious effect to the dentofacial structures.

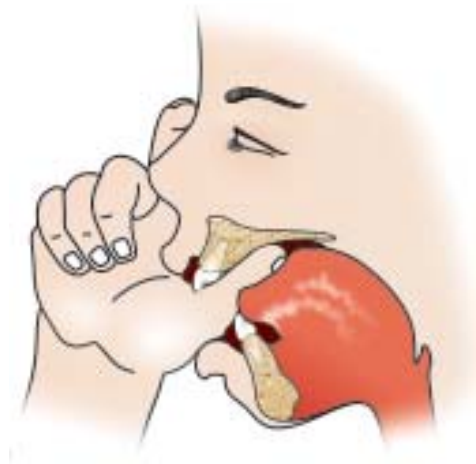


Fig. 13.7: Child with habit of thumb sucking

iii. Psychological

Involves deep rooted emotional factor and may be associated with insecurities, neglect, loneliness.

iv. Habitual

Have no psychological bearing, they are the potential cause for malocclusion.

Sucking habits are classified as—

- *Nutritive habits:*
e.g. breastfeeding, bottlefeeding
- *Nonnutritive sucking habits (NNS):*
e.g. thumb or finger sucking, pacifier sucking.

Subtelny has graded thumb sucking into four types:

Type A: This type is seen in almost in 50 percent of the children, where in the whole digit is placed inside the mouth with the pad of thumb pressing over the palate

while at the same time maxillary and mandibular anterior contact is present.

Type B: This type is seen in almost 13-24 percent of the children where the thumb is placed in oral cavity with out touching vault of palate, while at the same time maxillary and mandibular, anterior contact is maintained.

Type C: Seen in 18 percent of children where thumb is placed inside the oral cavity beyond the first joint and contacts the hard palate and only the maxillary incisors, but is no contact with mandibular incisors.

Type D: This type is seen in 6 percent of children where very little portion of thumb is placed into mouth.

Theories

Various theories have been proposed by psychologists to explain nonnutritive digit sucking.

- *Classical freudian theory:* The concept of this theory is that human posses of biologic sucking drive.
- *The learning theory (Davidson):* The infant associates sucking with such pleaseable feeding as hunger.
- *Oral drive theory (Sears and Wise):* Thumb sucking is the result of prolongation of nursing and not the frustration of weaning.
- *Johnson and Larson:* That believed that it is a combination of psychological and learning theory which explains that all children posses an inheritent biologic drive for sucking.

CAUSATIVE FACTORS

- *Parent's occupation:* This can be related to the socioeconomic status of family. Family living in a

high socioeconomic status are blessed with ample sources of nourishment. The mother is in the better position to feed the baby and within short-time the baby's hunger is satisfied.

Mothers belonging to low socioeconomic status is unable to provide the infant sufficient breast milk. Hence, in the process the infant suckles intensively for a long time to get the required nourishment thus they exhausted the whole of their sucking urge. This theory explains the increase in incidence of thumbs sucking in industrialised area when compared to the rural area.

- *Working mother:* The sucking habit is commonly observed to be present in children with the working parents such a children brought up in hands of caretaker may have feeling of insecurity. Therefore they use their thumb to obtain a secure feeling.
- *Number of siblings:* The development of habit can be indirectly related to the number of siblings. As the number increases the attention given by the parents to child gets divided. A child neglected by the parents may attempt of compensate his feeling of insecurity by means of this habit.
- *Order of birth of the child:* It has been noticed that the later the sibling rank of a child, the greater the chance of having a oral habit. It has been speculated that to some extent siblings imitate one another in suckling.
- *Social adjustments and stress:* It is associated with the psychological effects compounded by the emotional impact of peer group pressure and punitive and scolding parents.
- *Feeding practice:* Various controversies are present related to feeding practices like habit is seen in breast fed children, or abrupt weaning from bottle or breast is hypothesized.

- *Age of child:* The time of appearance of digit sucking has a significance.

In neonate: insecurities are related to primitive demands as hunger.

During the first few weeks of life: related to feeding problem.

During the eruption of primary molar, due to teething disorder.

Still later: children use the habit for the releases of emotional tensions with which they are unable to cope.

DIAGNOSIS

History

Questioning regarding—frequency, intensity, duration of habit.

Examination

Extraoral

- *The digits:* Digits that are involved in the habit will appear reddened, exceptionally reddened chapped and with a short fingernail, i.e. clean dishpan thumb, fibrous roughened callus may be present on the superior aspect of finger. The habit is also known to cause deformation of finger.
- *Lips:* Upper lip may be short and hypotonic. Note the posture of lips at rest whether they are held together or apart.
- *Facial form analysis:* Check mandibular retrusion, maxillary protrusion, high mandible plane angle and profile.

Intraoral

- *Tongue:* Examine for correct size and position of tongue at rest and tongue action during swallowing.



Fig. 13.8: Thumb sucking showing anterior open bite

- *Dentoalveolar structures:*
 - i. Maxillary anterior proclination and mandibular anterior retroclination is called *Crow Bar Effect*.
 - ii. Anterior open bite (Fig. 13.8).
 - iii. Constriction of maxillary arch "V-shaped arch".
 - iv. Posterior crossbite.

MANAGEMENT

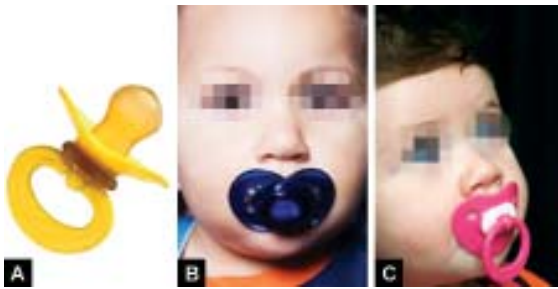
Psychological Therapy

- Screen the patient for the underlying psychological disturbances that sustain a thumb sucking habit. Once the psychological dependence is suspected, the child is referred to professional for counselling (Fig. 13.9).
- The use of positive behaviour modification techniques and even hypnosis has been effective in digit habit therapy. When the habit is discontinued, the child can be rewarded with a favorite new toy or special outing.



Fig. 13.9: Professional counselling of child

- *Dunlop's Beta Hypothesis:* He believed that if subject can be forced to concentrate on the performance of the act at time he practices it; he can learn to stop performing the act. The child should be asked to sit in front of mirror and ask to suck his thumb, observing himself as he indulges in the habit.
- *Choosing a pacifier:* If parents choose to have their infant or child suck a pacifier, health professionals advise them to take certain safety precautions. The following precautions are recommended.
 - Never attach a pacifier to a ribbon or string around the infant's or child's neck.
 - Make sure the pacifier is a sturdy, one-piece construction and that the material is nontoxic, flexible, and firm but not brittle.
 - Make sure the pacifier has easily grasped handles (Fig. 13.10).
 - Make sure the pacifier has inseparable nipples and mouth guards.



Figs 13.10A to C: (A) Pacifier, (B) Toddler boy with pacifier, (C) Baby with pacifier

- Make sure the pacifier has mouth guards of adequate diameter to prevent aspiration, and two ventilating holes.
- Keep the pacifier clean.
- Replace the pacifier when it becomes worn.
- Do not dip a pacifier in sweetened foods (e.g. sugar, honey, syrup) to encourage sucking.
- Never clean or moisten a pacifier with saliva before giving it to an infant or children.

Reminder Therapy

Extraoral Approach

Application of distasteful agents over thumb or finger, e.g. - Cayenne pepper, quinine, as a foetida, thermoplastic thumb post. About 6 week time is required for elimination of habit.

Intraoral Approach

Removable appliances may be used—palatal cribs, rakes, palatal arch, lingual (spurs, hawleys, retainer with or without spurs (Fig. 13.5).

Fixed appliances: Upper lingual tongue screen. If the child has made appreciable changes in habit by 3 months the appliances can be safely removed for testing period.

Mechanotherapy

- Fixed intraoral antithumb sucking appliances.
- Blue grass appliance
- Quad helix.

Chapter 14

Local Anesthesia and Oral Surgery in Children

LOCAL ANESTHESIA

Local anesthesia has been defined as a loss of sensation in a circumscribed area of the body caused by a depression of excitation in nerve endings or an inhibition of the conduction process in peripheral nerves.

Important Feature

Local anesthesia is that it produces the loss of sensation without inducing a loss of consciousness.

Desirable Properties for a Local Anesthetic

- It should not be irritating to the tissue to which it is applied.
- Its systemic toxicity should be low.
- It must be effective regardless of whether it is injected into the tissue or applied locally to mucous membranes.
- The time of onset of anesthesia should be as short as possible.
- The duration of action must be long enough to permit completion of the procedure yet not so long as to require an extended recovery.

- It should not cause any permanent alternation of nerve structure.

Sequence of Proposed Mechanism of Action of Local Anesthesia

Displacement of calcium ions from the sodium channels receptor site which permits binding of the local anaesthetic molecule to this receptor site; which thus produces blockage of the sodium channel, and a decrease in sodium conductance; which leads to depression of the rate of electrical depolarization and a failure to achieve the threshold potential level, along with a lack of development of propagated action potentials, which is called conduction blockage.

Mode of Action of Local Anesthetics

It is possible for local anesthetics to interfere with the excitation process in a nerve membrane in one or more of the following ways:

- Altering the basic resting potential of the nerve membrane.
- Altering the threshold potential (firing level)
- Decreasing the rate of depolarization.

- Prolonging the rate of repolarization.

Pain control is one of the most important aspect of behavioral management in children undergoing dental treatment, unpleasant childhood experiences have made many adults acutely phobic with regard to dental treatment.

Special concerns in pediatric dentistry relevant to local anesthetic include anaesthetic overdose, complications related to prolonged duration of soft-tissue anesthesia, and technique variations related to smaller skulls and differing anatomy of younger patients.

Local Anesthetic Overdose

- Overdose from a drug develops when its blood level in a target organ (e.g. brain) becomes excessive, undesirable (toxic) effects may be caused by intravascular injection or the administration of large volume of drug.
- Local anesthetic toxicity develops when the blood level of the drugs in the brain or heart becomes too high.
- Local anesthetic toxicity produces central nervous system (CNS) and cardiovascular system (CVS) depression with reactions ranging from mild tremor to tonic-clonic convulsions (CNS), from a slight decrease in blood pressure and cardiac output to cardiac arrest (CVS).
- Maximum recommended doses (MRD's) of all drugs administered by injection should be calculated by body weight and should not be exceeded, unless it is absolutely essential to do so.

Illustration

A 13 kg patient should receives no more than 91mg of lidocaine (based on high MRD of 7.0 mg/kg). The

range of doses administered by dentists treating children was 0.9 to 19.3 mg/kg. As the patient's weight increased, the number of milligrams per kilograms reached lower and safer levels; the maximum mg/kg range falling to 12.6 mg/kg in the 20 kg patient and 7.2 mg/kg in the 35 kg patient.

Complications of Local Anesthesia

- Accidental biting or chewing of the lip, tongue, or cheek is a complication of residual soft tissue anesthesia.
- Soft tissue anesthesia always lasts longer than pulpal anesthesia and may be present for 4 to 5 hours or more after local anesthetic administration.
- Problems related to soft-tissue anesthesia most involve the lower lip; much less frequently the tongue is injured and rarely the upper lip is involved.

Management

Management of soft tissue trauma involves reassuring the patient, allowing time for the anesthetic effects to diminish, and coating the involved area with lubricant (petroleum jelly) to prevent drying, cracking and pain.

TOPICAL ANESTHETICS

Topical anesthetics reduce the slight discomfort that may be associated with the insertion of the needle before the injection of local anesthetic.

Topical anesthetics are available in forms of gel, liquid, ointment, pressurized spray.

Demerits

- If they have a disagreeable taste to the child.
- The additional time required to apply them may

allow the child to become apprehensive concerning the approaching procedure.

Topical Anesthetic Agents

- Ethyl aminobenzoate butacaine sulfate
- Cocaine
- Dyclonine
- Lidocaine
- Tetracaine.

Applications

- The mucosa at the site of the intended needle insertion is dried with gauze, and a small amount of the topical anesthetic agent is applied to tissue with a cotton swab.
- During the application of the topical anesthetic, the dentist should prepare the child for injection. The explanation should not necessarily be a detailed description but simply an indication that the tooth is going to be put to sleep so that the treatment can proceed without discomfort.

JET INJECTION

- Jet injection produces surface anesthesia instantly and is used by some dentists instead of topical anesthetics.
- The method is quick and essentially painless, but the abruptness of the injection may produce momentary anxiety.
- This technique is useful for obtaining gingival anesthesia before a rubber dam clamp is placed for isolation procedures that otherwise do not require local anesthetic.
- *Principle of injection:* The jet injection instrument is based on the principle that small quantities of liquids forced through a very small openings under

high pressure can penetrate mucous membrane or skin without causing excessive tissue trauma.

ANESTHESIA FOR THE MAXILLARY TISSUES

Posterior Superior Alveolar Nerve Block

Innervates the posterior maxillary deciduous molars anesthetized as:

- Needle is inserted immediately behind the buttress of the zygoma at the height of the vestibule.
- Tip of the needle must be in close proximity to the periosteum.
- Foramen is approximately 8 mm from the insertion point in a 5 years old child and 11 mm in a 14 years old.

Middle Superior Alveolar Nerve Block

Innervates the premolars and the mesiobuccal root of the I permanent teeth.

The method of anesthetization is similar to posterior superior alveolar nerve.

Maxillary Anterior Region Block

Infiltration in the apical region of the anterior teeth provide satisfactory anesthesia in most cases (Fig. 14.2).

Infraorbital Nerve Block

The infraorbital foramen in a 3 year old is about 5 mm above the vestibular depth.

Palatal Infiltration

Anesthetic agent is injected into the depth of rugae as they contain less sensory endings. The amount deposited is about 0.2-0.3 ml (Fig. 14.4).

Nasopalatine Nerve Block

Nasopalatine nerve innervates the maxillary anterior teeth. It is indicated when vestibular infiltration is inadequate. About 0.2-0.3 ml of local anesthetic solution is administered at the entrance of the incisive foramen on the incisive papilla (Fig. 14.1).

Greater Palatine Nerve Block

Greater palatine nerve innervates the maxillary posterior teeth in the palatal aspect. It is anesthetized at the region midway between the midline of the hard palate and the palatal surface the posterior teeth.

Anesthesia for the Mandibular Tissue

Inferior alveolar nerve block—for anesthetizing the molars and premolars. The needle is penetrated into the pterygomandibular space and the solution is deposited close to the mandibular foramen. Factors to be considered are—

- In children the mandibular foramen is located near the posterior border of the ramus. In a 3-year-old



Fig. 14.1: Nasal palatine block



Fig. 14.2: Labial infiltration



Fig. 14.3: Buccal infiltration maxillary molar



Fig. 14.4: Palatal infiltration

the foramen is about 5 mm from the posterior border and 20 mm from the anterior border.

- The foramen invariably aligns with the deepest concavity on the anterior border of mandible.
- Mucosal depression on the medial aspect of the mandible formed by the medial pterygoid muscle also aligns with inferior alveolar foramen and should be the point of insertion of the needle.

Technique

- The anterior border of the ramus is palpated with finger or thumb resting in its greater curvature.
- It should be observed that as the internal pterygoid ligament passes inferiorly and laterally to attach at the base of the mandible, a triangle is formed by the anterior border of the ramus, the internal pterygoid muscle and the vault of the palate. The apex of the triangle is placed inferiorly. An imaginary longitudinal line dividing the tip of finger or thumb as it rests in the coronoid notch passes medially over a depressed area just above the apex. The penetration site of needle is the point of intersection (Fig. 14.5).
- The anesthetic syringe is introduced into the oral cavity parallel with the occlusal plane of the mandibular posterior teeth.
- The needle depth is 8-10 mm from the mucosal surface. The amount deposited is 0.9-1.0 ml.
- Lingual nerve is anterior and medial to inferior alveolar nerve, so the needle has to be withdrawn and solution deposited half the distance from inferior alveolar foramen—deposited 0.5 ml.
- Buccal nerve can be anesthetized by infiltration in the buccal sulcus distal to the permanent teeth—0.2 ml (Fig 14.6).
- *Mental nerve block*—Anterior teeth and premolar—0.5-1 ml; mandibular anterior region—Infiltrate in buccal and lingual vestibule 0.5-1.0 ml.



Fig. 14.5: Inferior alveolar nerve block



Fig. 14.6: Long buccal nerve block

ORAL SURGERY IN CHILDREN

INTRODUCTION

Oral surgical procedures for children are similar to and possibly easier than those performed for adults.

PREOPERATIVE EVALUATION

The dentist treating the child patient must be careful to consider the entire patient and not focus only on the oral cavity. Important considerations are:



Fig. 14.7: Upper extraction forcep



Fig. 14.8: Lower extraction forcep

- i. Obtaining a good medical history.
- ii. Obtaining appropriate medical and dental consultations.
- iii. Anticipating and preventing emergency situations.
- iv. Being fully capable of managing emergency situations when they occur.

Armamentarium for tooth extractions

Most pediatric dentists prefer the smaller pediatric extraction forceps; such as the no. 150s and no. 151s for the following reasons:

- Their reduced size more easily allows placement in the smaller oral cavity of the child patient.
- The smaller pediatric forceps are more easily concealed by the operator's hand (Fig. 14.7).
- The smaller working ends (beaks) more closely adapt to the anatomy of the primary teeth (Fig. 14.8).

EXTRACTIONS

MAXILLARY MOLAR EXTRACTION

- The height of contour of primary maxillary molar is closer to the cemento-enamel junction and their roots tend to be more divergent and smaller in diameter.

Because of this reason there is potential weakening of the roots during the eruption of the permanent tooth; root fracture in primary maxillary molar is common.

- The relationship of the primary molar roots to the succeeding premolar crown; if the roots encircle the crown, the premolar can be inadvertently extracted with the primary molar.
- No. 301 straight elevator is used to luxate the tooth after the epithelial attachment is separated. Extraction is completed using a maxillary universal forceps (No. 150s).



Fig. 14.9: Buccal palatal direction of forcep maxillary molar extraction



Fig. 14.10: Mandibular molar extraction

- Palatal movement is initiated first, followed by alternating buccal and palatal motions with slow continuous force applied to the forceps (Fig. 14.9).

MAXILLARY ANTERIOR TEETH EXTRACTION

- The maxillary primary and permanent central incisors, lateral incisors, and canines all have single roots which are usually conical.
Because of this reason they are less likely to get fractured and easily allow the rotational movements during extraction.
- No. 1 forcep is useful in extraction of maxillary anterior teeth.

MANDIBULAR MOLAR EXTRACTION

- Prime consideration is given to support the mandible with the nonextracting hand so that no injury to temporomandibular joint is inflicted.

- Luxate tooth with 301 straight elevator and No. 151s forcep is accomplished to extract the tooth with alternating lingual and buccal motions (Fig. 14.10).

MANDIBULAR ANTERIOR TEETH EXTRACTION

- The mandibular incisors, canines and premolars are all single rooted.
Because of this reason carefully place the forcep while extraction of teeth; otherwise it may lead to dislodgement of adjacent tooth.
- Rotational movements are performed in extraction process, then continuous force is applied in alternating labial and lingual directions this facilitates easy removal of these teeth.

SOFT TISSUE SURGICAL PROCEDURES

Soft tissue procedures are occasionally performed for the child patient; these are—

BIOPSIES

- A very small lesion is probably best managed with an excisional biopsy, whereas lesions 0.5 cm or larger should probably have an incisional biopsy if there is any doubt regarding the diagnosis of lesion.
- Before performing a biopsy on a lesion, the dentist must consider the possibility that lesion is vascular.

FRENECTOMIES

- **Maxillary labial frenectomies:** This surgical procedure is only performed when it has been observed that high maxillary labial frenum is causative factor for diastema between maxillary central incisors until permanent canines have erupted.

Therefore, maxillary labial frenectomy is not indicated prior to age of 11 or 12 years.

- **Lingual frenectomies:** should be performed in severe ankyloglossia (tongue - tie); but only after an evaluation and therapy by a qualified speech therapist.

ODONTOGENIC INFECTIONS

- Management of odontogenic infections is directed at providing adequate drainage of the infection which is usually accomplished by pulpectomy or extraction.
- Managing a more serious odontogenic infection is best accomplished by way of surgical incision and drainage.

Part 3

Transitional Years: Six to Twelve Years

- 15. Pit and Fissure Sealants and Conservative Adhesive Restoration*
- 16. Managing Traumatic Injuries in the Young Permanent Dentition*
- 17. Treatment Planning and Management of Orthodontic Problems*
- 18. Behavior Management*
- 19. Care of Special Child (Handicapped Child)*



Chapter 15

Pit and Fissure Sealants and Conservative Adhesive Restoration

INTRODUCTION

Pit and fissure caries represent approximately 90 percent of the total caries experience in childhood and adolescence. The development of pit and fissure caries occurs not only in 6-14 years old children but also in adolescents and young adults.

With the introduction of sealants, a clinical approach to prevention of caries in pit and fissure became available.

With innovative applications of the acid-etch technique, tooth surfaces with isolated involvement of pits and fissures may also benefit from the conservation of the tooth structure afforded by conservative adhesive resin restorations.

With the use of both fluoride releasing sealant and glass ionomer-based material which acts as a fluoride reservoirs for adjacent enamel and dentin, provide enhanced caries resistance for sound enamel and dentinal caries.

To make significant gains in caries reduction in the child, adolescent and adult population in the near future, it is necessary for the dental professional to educate and inform the general public, parents, physicians, underwriters of dental care plans and funding agencies about the cost-effectiveness and caries-preventive benefits of sealants and preventive restorations.

With the widespread use of the acid-etch technique, it may be possible to provide the majority of children, adolescents and adults with a caries-free-dentition.

MORPHOLOGY OF SURFACES WITH PITS AND FISSURES

The two main types of pits and fissures are:

- i. *Shallow; wide V-shaped fissures* that tend to be self-cleansing and somewhat caries resistant.
- ii. *Deep, narrow I-shaped fissure* that are quite constricted and may resemble a bottleneck in

that the fissure may have an extremely narrow slit-like opening with a larger base as it extends towards dentino-enamel junction. These caries-susceptible, I-shaped fissures may also have a number of different branches extending towards or into a underlying dentin.

- *Reason for Early Development of Caries in Pits and Fissures*
 - i. The fissure provide a protected niche for plaque accumulation.
 - ii. The rapidity with which dental caries occurs in pits and fissures is most likely related to the fact that the depth of the fissure is in close proximity to the dentinoenamel junction and the underlying dentin; which is highly susceptible to caries.
- The morphology of occlusal surfaces varies from one tooth to the next and from individual-to-individual. But in general; the “Typical” premolar has a prominent primary fissure with usually three or four pits.

In typical molar as many as 10 separate pits may be present in primary, secondary and supplemental fissures.

HISTOPATHOLOGY OF CARIES IN PITS AND FISSURES

- The inclines forming the walls of the fissures are affected first by caries process.
- The first histologic evidence of lesion formation occurs at the orifice of the fissure and is usually represented by the two independent bilateral lesions in the enamel composing the opposing cuspal inclines.
- As the lesion progresses, the depth of the fissure walls becomes involved and coalescence of the two independent lesions into a single, contiguous lesion occurs at the base of fissure.

- The enamel at base of the fissure is affected to a greater degree than that of cuspal inclines, and lesion spreads laterally along the enamel adjacent to the depth of the fissure and readily towards dentinoenamel junction.
- Once the caries process involves the dentin; it leads to eventual cavitation of the fissure owing to loss of mineral and structural support from the adjacent affected enamel and dentin, resulting in a clinically detectable lesion.

Historical Attempts in Prevention of Pits and Fissure Caries

- In 1924, “Thaddeus Hyatt”, advocated “prophylactic restoration”; This procedure consisted of preparing a conservative class I cavity that included all pits and fissures at risk for caries development and then placing amalgam restoration.

Rationale of Prophylactic Restoration:

- An otherwise caries-free surface was that the procedure prevented further insult to the pulp from caries.
- Decreased loss of tooth structure.
- Required less time for restoration when the tooth eventually succumbed to caries.
- *A conservative approach by Bodecker in 1929:* Initially; cleaning of pits and fissure is performed with the use of explorer and flowing a thin mix of oxyphosphate cement into the fissure in an attempt to “seal” the fissures.
- *Prophylactic Odontomy by Bodecker:* The mechanical eradication of fissures is done in order to transform deep, retentive fissures into a easily cleansable ones.

These techniques were employed until the use of sealants became prevalent.

DIAGNOSIS OF PIT AND FISSURE CARIES

Clinical Examination

Caries is present when the explorer catches or resists removal after insertion into pit or fissure with moderate to firm pressure and when this is accompanied by one or more of following signs of caries—

- a. Softness at the base of the area.
- b. Opacity or loss of normal translucency adjacent to pit or fissure as evidence of undermining or demineralization.
- c. Softened enamel adjacent to the pit or fissure that can be scraped away with the explorer.

Radiographic Examination

Evaluation of pit and fissure caries on occlusal surfaces has been found to be of minimal diagnostic value especially evaluating enamel caries and superficial dentinal caries.

Currently, there are a number of techniques to aid the dentist in diagnosis of pits and fissure caries—

- Radiography—Conventional, xeroradiographic, digital
- Fiberoptic transillumination/infrared laser
- Caries detecting dye
- Light-induced fluorescence
- Ultrasonic imaging
- Electrical resistance
- A promising ancillary diagnostic device.

Electronic caries detector (having sensitive and very specific detecting explorer).

ALTERNATIVES OF PIT AND FISSURE TREATMENT

Dental practitioner can consider following alternatives:

- Observation only
- Sealant placement
- Conservative adhesive restoration
- Conservative restorations
 - Glass-ionomer-resin conservative restoration
 - Glass-ionomer conservative restoration
 - Sealant amalgam conservative restoration
- Amalgam, glass ionomer, glass-ionomer-resin or posterior composite restorations.

INDICATIONS FOR PIT AND FISSURE SEALANT PLACEMENT

- Deep, retentive pits and fissures, which may cause wedging or catching of an explorer.
- Stained pits and fissures with minimal appearance of decalcification or opacification.
- Pit and fissure caries or restoration of pits and fissures in other primary or permanent teeth.
- No radiographic or clinical evidence of interproximal caries in need of restoration on teeth to be sealed.
- Use of other preventive treatment such as systemic or topical fluoride therapy; to inhibit interproximal caries formation.
- Possibility of adequate isolation from salivary contamination.

CONTRAINDICATIONS TO SEALANT PLACEMENT

- Well-coalesced, self-cleansing pits and fissures.
- Radiographic or clinical evidence of interproximal caries in need of restoration.

- Presence of many interproximal lesions or restorations and no preventive treatment to inhibit interproximal caries could be given.
- Tooth partially erupted and no possibility of adequate isolation from salivary contamination.

Also the presence of an operculum over the distal marginal ridge is associated with loss of sealant material.

- Life expectancy of primary teeth is limited.
- For dentinal caries consider preventive restoration, conventional restoration.

CLINICAL TECHNIQUE : SEALANT APPLICATION

Step 1: Isolation of tooth surface from salivary contamination— Ideally a rubber dam isolation is preferred; but also cotton roll isolation with adequate suctioning to remove saliva from the operating field is also acceptable.

Step 2: Cleaning the tooth surface:

- Prophylaxis of the tooth surface is carried out in several ways—
- Using a pumice slurry applied with a rubber cup or pointed bristle brush.
- Using a air-polishing device with an air-powder abrasive (sodium bicarbonate slurry) system; later neutralize this slurry with phosphoric acid for 5-10 sec.
- Using simply a tooth brush prophylaxis with toothpaste or pumice followed by copious water rinsing to prepare the pits and fissures.
- Trace the pits and fissures with a

sharp, fine-pointed explorer to remove any cleansing material lodged within the pits and fissures.

- Once the tooth surface has been thoroughly cleansed, rinse and air dry the surface.

*Step 3: Acid-etch tooth surface—*The efforts of acid-etching on enamel were studied by Buonocore in 1955.

Before explaining clinical application of Acid-Etch Technique the Scientific Basis for the Acid-Etch Technique must be understood

Acid-etching of surface enamel has been shown to produce a certain degree of porosity.

A sound enamel etched with phosphoric acid is affected at three levels microscopically they are:

- A narrow zone of enamel is removed by etching. By this way plaque, surface and subsurface organic pellicles are effectively dissolved.
- The other zone after narrow zone is etched zone is a fully reacted zone in which inert mineral crystals in the surface enamel are also removed, resulting in a more reactive surface, an increased surface areas, and a reduced surface tension that allows resin to wet the etched enamel more readily.

Etched Zone is Approx 10 mm in Depth

- The next zone is qualitative porous zone which is approx 20 mm in depth. The name of this zone itself explains that porosities which are created by the etching process is easily distinguished qualitatively from adjacent sound enamel.
- The final zone is quantitative porous zone; this zone extends into enamel for an additional 20 mm.

As its name suggests it has relatively small porosities created by etching process that may be identified by quantitative methods using polarised light microscopy.

The resin material penetrates in these created porosities by various zones.

After gaining knowledge about various zones of enamel it is essential to know about various etching patterns.

Three characteristic etching patterns occurs following exposure of sound enamel to phosphoric acid

Type I etching pattern: In this prism cores are lost but the prism peripheries remains.

Type II etching pattern: In this prism core are relatively intact but prism peripheries are lost.

Type III etching pattern: Enamel shows a generalised surface roughening and porosity with an areas with no exposure of prism cores or peripheries.

These three etching patterns are found adjacent to one another.

Clinical Applications of Acid-Etch Technique

- Etching agent is applied over tooth surface with a fine brush, a cotton pledget or a minisponge using a recommended exposure time—
For permanent teeth—Exposure time is 15 sec.
For primary teeth—Exposure time is 15-30 sec.
Fluorosed teeth require an additional exposure time.
- Gently rub the etchant applicator over the tooth surface; while rubbing periodically of fresh etchant is added; but while rubbing prevent spillage of etchant in interproximal areas (which may lead to irritation of gingiva in interproximal areas); in this

regards a gel material is preferred to have controlled etching gently rubbing the etchant with including 2 to 3 mm of the cuspal inclines and reaching into any buccal or lingual pits and grooves that are present.

Step 4: Rinse and dry-etched tooth surface

- Rinse the etched tooth surface with an air-water spray for 30 seconds. This will remove the etching agent and reaction products from etched enamel surface.
- Dry the tooth surface for at least 15 seconds with uncontaminated compressed air. The dried, etched enamel should have a frosted-white appearance. If the enamel does not have this appearance; repeat the etching step.
- If etched and dried tooth surface is contaminated at this stage reisolate the teeth, rinse the entire tooth surface, dry thoroughly and repeat the etching process.

Step 5: Apply sealant to etched tooth surface

- Sealant material is allowed to flow in all etched pits and fissures; with mandibular teeth; sealant is applied at the distal aspect and allow it to flow at the mesial aspect and with maxillary teeth sealant is applied at mesial aspect and is allowed to flow distally. To allow sealant material to flow helps in preventing the incorporation of air in material.
- A thin layer of sealant is carried using a fine brush, or applicator to the cuspal inclines to seal secondary and

supplemental fissures; and flow the sealant material into buccal or lingual pits and grooves.

- With photo activated sealants the setting reaction is initiated by exposing the sealant to visible light and usually requires 10 to 20 seconds for complete setting.

Step 6: Explore the sealed tooth surface

Explore the entire tooth surface for pits and fissures that may not have been sealed and for voids in the material.

If deficiencies are present, apply additional sealant material.

Step 7: Evaluate the occlusion of sealed tooth surface

- Evaluate the occlusion of sealed tooth surface to determine whether excessive sealant material is present and must be removed, allowing proper interdigitation.
- Evaluate the interproximal regions for inadvertent sealant placement by performing tactile examination with an explorer and passing dental floss between the contact regions.

Step 8: Periodically reevaluate and reapply sealant as necessary

- During routine recall examination, it is necessary to reevaluate the sealed tooth surface for loss of sealant material; and or caries development.
- If reapplying of sealant is necessary: the steps involved in reapplying sealant material to an existing sealant are identical to those used for initial placement.

FLUORIDE: RELEASING SEALANTS

- Fluoride-releasing sealant material composed of modified urethane-BIS-GMA resin.
- A reduction of approximately 60 percent of secondary caries formation occurs with use of the fluoride-releasing sealant compared with conventional sealant material.
- The fluoride released from the sealant material apparently becomes incorporated into the adjacent enamel and provides an increased level of caries resistance.
- It is possible to increase the fluoride load within a resin-based material, this may result in substantial increase in fluoride-release in the local environment and may reduce the effect of cariogenic challenge.
- Incorporation of organic fluorides in resin materials also enhances fluoride release while maintaining the physical properties of resin material.

Organic Fluorides that may be Incorporated into Polymer Matrix of Dental Material Includes

- Acrylic amine-hydrogen fluorides salt.
- Methacrylol fluoride-methyl methacrylate.
- *t*-butylaminoethyl methacrylate hydrogen fluoride.
- Tetraethylammonium tetrafluoroborate.

CONSERVATIVE ADHESIVE RESTORATIONS

- Recently, additional types of conservative adhesive restorations have been introduced to deal with more extensive caries in isolated pits and fissures that require restoration of the prepared cavities with dental materials of greater strength.
- A well-accepted clinical procedure used for restoring isolated pits and fissures and simultaneously preventing caries in the remaining unaffected pits and fissures was originally

designated the “preventive resin restoration” and uses acid-etch technique.

This restorative technique is been renamed “Conservative adhesive resin restoration”.

A conservative adhesive resin restoration require the same steps as those used for sealant placement except that caries are removed from isolated pits and fissures.

Step 1: Isolate tooth surface from salivary contamination: Isolate tooth surface as described in pit and fissure sealant placement technique.

Step 2: Remove caries from isolated pits and fissures

- Removal of caries from isolated pit and fissure is accomplished by inverted cone- shaped, round or pear-shaped bur in a high-speed handpiece.
- Caries should be removed making no attempts to incorporate retention into the preparation.
- The size of the bur and the resulting cavity preparation will be dictated by the amount of caries present.

Step 3: Cleanse tooth surface: Perform tooth prophylaxis followed by rinsing and drying.

Step 4: Place cavity base or lining material: If cavity is deep leading to exposure of dentin; calcium hydroxide or glass ionomer base should be placed prior to acid etching.

Step 5: Acid-etch tooth surface: Etch, rinse and dry tooth surface similar to described previously with pit and fissure sealant placement technique.

Step 6: Place resin and sealant material

- Place a thin layer of resin bonding

agent or dentinal bonding agent in the prepared cavity.

- Next; place composite resin over the bonding agent. If it is chemical cured; allow time for complete setting reaction to occur; and or expose light cured material to the visible light source to initiate the setting reaction.
- Next, apply sealant material over the restored area and the adjacent intact etched pit and fissures.

Carry the sealant material up the cuspal inclines for 2 to 3 mm and into buccal-lingual grooves and pits; provide adequate time for sealant setting reaction.

Step 7: Explore the sealed and restored tooth surface: Explore the sealed and restored surface as described previously and add sealant material in deficiencies if any.

Step 8: Evaluate the occlusion of sealed and restored tooth surface

- Evaluate the occlusion of the sealed and restored tooth surface to determine presence of any occlusal interferences if any.
- Evaluate the interproximal regions for inadvertent resin placement by using explorer and dental floss.

Step 9: Periodically reevaluate the conservative adhesive restoration, repair and reapply sealant as necessary: During routine recall visits and examination it is necessary to reevaluate the sealed and restored tooth surface for—

- Loss of sealing material if any.
- Development of any carious lesion in already restored area.

Repair of the restored regions and reapplication of sealant material may be necessary periodically.

Chapter 16

Managing Traumatic Injuries in the Young Permanent Dentition

INTRODUCTION

- Injuries are defined as the damage of the part of body due to trauma.
- Traumatic injuries to anterior teeth are considered emergency situations in the dental office because they cause disfigurement of child along with psychological trauma to child and parents.
- An injury to the teeth of a young child can have serious and long-term consequences, leading to their discoloration, malformation, or possible loss.

The emotional impact of such an injury can be far reaching, it is therefore important that the dentist treating children must be knowledgeable in the techniques for managing traumatic injuries.

- Fractures are more seen in permanent dentition whereas displacement injury is seen in primary dentition due to following reasons—
 - Less crown length
 - Thin labial cortical plate
 - Anterior teeth being more vertical
 - Elasticity of surrounding bone.

ETIOLOGY OF TRAUMA IN THE YOUNG PERMANENT DENTITION

- Falls during play account for most injuries to young permanent teeth.

- Children engaging in contact sports are at greatest risk for dental injury.
- In the teenage years, automobile accidents cause a significant number of dental injuries when occupants not wearing seat belts hit the steering wheel or dashboards.
- Children with protruding incisors, as in developing class II malocclusions, are two or three times more likely to suffer dental trauma than children with normal incisal overjets.
- Children with chronic seizure disorders experience an increased incidence of dental trauma.
- Another serious cause of dental injuries to young children is child abuse.

Often overlooked by the dental professionals; upto 50 percent of abused children suffer injuries to head and neck.

CLASSIFICATIONS OF INJURIES TO YOUNG PERMANENT TEETH

A. Classification by Rabinowitch (1956)

- i. Fractures of the enamel or slightly into dentin
- ii. Fractures into dentin
- iii. Fractures into pulp

- iv. Fractures of roots
- v. Comminuted fracture
- vi. Displaced teeth.

B. Classification by Ellis and Davey (1960)

- Class I: Simple fracture of the crown involving little or no dentin.
- Class II: Extensive fracture of the crown involving considerable dentin but not dental pulp.
- Class III: Extensive fracture of crown involving considerable dentin and exposing dental pulp.
- Class IV: The traumatized teeth become nonvital with or without loss of crown structure.
- Class V: Tooth lost as result of trauma.
- Class VI: Fracture of root with or without loss of crown structure.
- Class VII: Displacement of tooth without fracture of crown and root.
- Class VIII: Fracture of crown-en-mass and it's replacement.
- Class IX: Traumatic injuries to primary teeth.

C. Classification by Andreasen

- The classification is based on system adopted by the WHO in its application of the international classification of diseases of dentistry and stomatology.
- This classification can be applied to both primary and permanent dentition.

INJURIES TO HARD DENTAL TISSUES AND PULP

- a. *Crown Infraction N873.60*: An incomplete fracture (crack) of the enamel without loss of tooth structure.

- b. *Uncomplicated Crown Fracture N873.60*: A fracture involving enamel and dentin but not exposing the pulp.
- c. *Complicated Crown Fracture N873.62*: A fracture involving enamel, dentin and pulp.
- d. *Uncomplicated Crown-Root Fracture N873.64*: A fracture involving enamel, dentin and cementum but not involving pulp.
- e. *Complicated Crown-Root fracture N873.64*: A fracture involving enamel, dentin, cementum including pulp or exposing pulp.
- f. *Root fracture N873.63*: A fracture involving dentin, cementum and pulp.

INJURIES TO THE PERIODONTAL TISSUES

The most common type of injuries to primary and young permanent teeth are luxation (displacement injuries). These injuries damage supporting structures of teeth, which include periodontal ligament (PDL) and alveolar bone. The PDL is the physiologic "Hammock" that supports tooth in its socket. Several types of luxation injury occurs.

- i. *Concussion (N873.66)*: The tooth is not mobile and is not displaced. The PDL absorbs the injury and is inflamed, which leaves the tooth tender to biting pressure and percussion.
- ii. *Subluxation N873.66*: The tooth is loosened but is not displaced from its socket.
- iii. *Intrusive Luxation N873.67*: The tooth is driven into its socket. This compresses the PDL and commonly causes a crushing fracture of the alveolar socket.
- iv. *Extrusive Luxation (partial avulsion) N873.66*: This is a central dislocation of tooth from its socket. The PDL is usually torn in this injury.

- v. *Lateral Luxation N873.66*: The tooth is displaced in labial, lingual or lateral direction, the PDL is torn and contusion or fracture of supporting alveolar bone occurs.
- vi. *Avulsion (Ex-articulation N873.68)*: The tooth is completely displaced from the alveolus. The PDL is severed, and fractures of the alveolus may occurs.
- ii. *Contusion of Gingiva or Oral Mucosa N902.XO*—A bruise usually produced by a blunt object and not accompanied by break of continuity in the mucosa, causing submucosal hemorrhage.
- iii. *Abrasion of Gingiva or oral Mucosa N910.00*—A superficial wound produced by rubbing or scraping of mucosa leaving a raw bleeding surface.

INJURIES OF THE SUPPORTING BONE

- i. *Comminution of Alveolar Socket (Mandible N802.20 Maxilla 802.40)*: Crushing and compression of alveolar socket. This condition is found together with intrusive and lateral luxation.
- ii. *Fracture of Alveolar Socket Wall (Mandible N802.20, Maxilla 802.40)*: A fracture contained to facial or lingual socket wall.
- iii. *Fracture of Alveolar process (Mandible N802.20 Maxilla N802.40)*: Fracture of alveolar process which may or may not involve alveolar socket.
- iv. *Fracture of Mandible and Maxilla (Mandible N802.21, Maxilla 802.42)*: A fracture involving base of mandible, maxilla and often alveolar process (Jaw Fracture). The fracture may or may not involve alveolar socket.

INJURIES TO GINGIVA OR ORAL MUCOSA

- i. *Laceration of Gingiva or Oral Mucosa N873.69*—A shallow or deep wound in the mucosa resulting from a tear usually produced by a sharp object.

PATHOLOGIC SEQUELAE OF TRAUMATIZED TEETH

Complications following traumatic injuries to teeth appear shortly after the injury.

The following terms describe a spectrum of clinical signs and symptoms that accompany inflammation and degeneration of the pulp and/or periodontal ligament.

Reversible Pulpitis—The pulp's initial response to trauma is pulpitis

- Capillaries in the teeth become congested; a condition that can be clinically apparent upon transillumination of the crown with a bright light.
- If tooth has undergone a luxation injury there is PDL inflammation; so tooth with reversible pulpitis in this case is tender to percussion.
- Pulpitis may be totally reversible if the condition causing it is addressed; or else it may progress to irreversible pulpitis state to necrosis of the pulp.

Infection of Periodontal Ligament (PDL)

When tooth suffers from luxation injury—

It leads to detachment of the gingival fibers from the tooth



This allows invasion of microorganisms from the oral cavity along root to infect PDL



Infection of periodontal ligament



Loss of alveolar bone support can be seen in periapical area as well as adjacent to roots



Increased tooth mobility accompanied by exudation of pus from gingival crevice



Subsequently; require extraction of traumatized tooth

To prevent this condition parents should be informed about the risk of infection and provided with appropriate instructions to minimize such risk.

Irreversible Pulpitis

- Irreversible pulpitis could be acute, chronic; partial or complete also called total involvement of pulp.
- Following a traumatic injury there could be either of two possible situations—

Situation 1: The pulpitis could be painful due to the reason that following the injury exudate accompanying pulpal inflammation cannot be vented. This situation is called acute irreversible pulpitis.

Situation 2: This situation occurs generally in child patients; following the injury exudates accompanying pulpal inflammation are vented quickly and pulpitis progresses to a chronic; painless condition; this situation is called chronic irreversible pulpitis.

Pulp Necrosis

Two main mechanisms can explain how the pulp of injured tooth become necrotic.

Mechanism 1: Infection of pulp in cases of untreated crown fracture with pulp exposure.

Mechanism 2: Interrupted blood supply to the pulp through the apex in cases of luxation injury leading to ischemia.

Coronal Discoloration

As a result of trauma, the capillaries in the pulp ruptures leaving blood pigments deposited in the dentinal tubules.

- In mild cases; the blood is resorbed and a very little discoloration occurs, or that which is present becomes lighter in several weeks.
- In severe cases, the discoloration persists for the life of the tooth.

Various color changes following traumatic injury are:

- *Pink discoloration* is observed shortly after the injury may represent intrapulpal hemorrhage (Rupture of blood vessels in the pulp).
- *A reddish hue* is noticed long after injury is usually due to internal resorption in the pulp chamber.
- *Yellow discoloration* can be seen when dentin is thick and pulp chamber is narrower than usual; this condition is called pulp canal obliteration.

Treatment of above three color changes is just follow-up

- *Dark Discoloration (Black, Gray, Brown and Intermediate hues):* If the pulp loses its vitality and cannot eliminate iron containing molecules; the tooth may remain discoloured.

- **Diagnosis of Pulp Necrosis:** If dark-discolored tooth is present with additional signs such as swelling, fistula, or a periapical radiolucent defect; the diagnosis of pulp necrosis is easy.

Inflammatory Resorption

- Inflammatory resorption occurs subsequent to luxation injuries and is related to a necrotic pulp and an inflamed PDL.
 - Inflammatory resorption can occur either on the external root surface or internally in the pulp chamber or canal.

A. Internal resorption

In case of traumatic injury, the odontoblastic layer may lose its integrity exposing the dentin to odontoclastic activity, which is then seen on radiographs as radiolucent expansion of pulp space.

Eventually this process reaches the outer surface of the root causing the root perforation.

If the coronal dentin is resorbed completely the red color of resorbing tissue becomes visible through the enamel.

B. External resorption

External inflammatory root resorption is a rapid process characterized clinically by—

- Increased mobility of the tooth
- Sensitivity to percussion
- A dull sound produced by percussion
- A fistula or swelling in the gums above the tooth.

Radiographically

- The periodontal space is widened
- The root surface is irregular.

Treatment

Traumatized tooth with external inflammatory root resorption should be extracted.

Note: Removal of the necrotic, and probably infected pulp may stop the resorptive process. However, due to the unfavorable preexisting conditions the benefit of root canal filling aimed to save the tooth is questionable.

Replacement Resorption

- Replacement resorption; also known as Ankylosis.
- Due to irreversible injury to periodontal ligament; alveolar bone contacts directly and becomes fused with root surface; the root is resorbed and is replaced with bone.

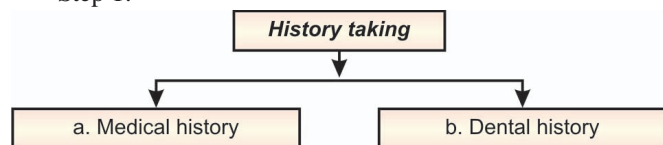
Pulp Canal Obliteration

- Following traumatic injuries a pulp canal obliteration is a common finding.
- Pulp canal obliteration is the result of intensified activity of the odontoblasts that results in accelerated dentin apposition which gradually reduces the pulp space to stage that pulp space cannot be seen on a radiograph.

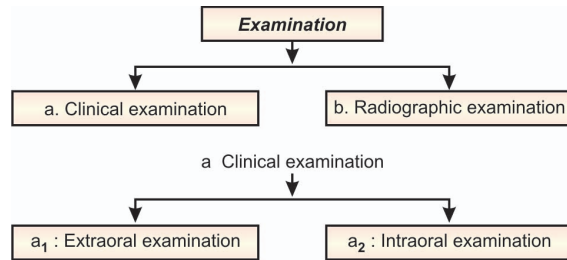
Management of Traumatic Injuries

Management of traumatic injuries include following step:

Step 1:



Step 2:



Step 3:

Emergency care

Step 4:

Definitive treatment

Step 1: History Taking

Obtaining an adequate medical and dental history is essential to proper diagnosis and treatment.

Medical History

Information particularly relevant to dental injury includes the following—

- Cardiac disease; which may necessitate prophylaxis against infectious endocarditis.
- Bleeding disorders
- Allergic to medications
- Seizures disorders
- Medications
- Status of tetanus prophylaxis.

Dental History

There are certain important questions to be asked by dentist to gather an informative dental history —

Ques. 1: When did the injury occurred, i.e. Time-elaped since the injury ?

Note: Time is an important factor in determining the type of treatment to be provided.

Ques. 2: Where the injury occurred ?

Note: This question sheds light on severity of injury; The information regarding this question help in determining the need for tetanus prophylaxis.

Ques. 3: How the accident occurred ?

Note : This question obviously provide the dentist with most information regarding severity of injury.

Illustration : Serious head injuries should be ruled out by the dentists asking if the child lost consciousness, has vomited, or is disoriented as a result of accident. A positive finding indicate potential central nervous system injury, and in such cases medical consultation should be immediately obtained.

Ques. 4: The dentist should ask the child if there is spontaneous pain from any teeth ?

Note: Positive finding here may indicate pulp inflammation that is due to a fractured crown or injuries to the supporting structures such as extravasation of blood into the periodontal ligament.

Ques. 5: Does the child experience a thermal change with sweet or sour foods ?

Note: If this situation is present dentin or pulp may be exposed.

Ques. 6: Are the teeth tender to touch or tender while chewing ?

Ques. 7: Does the child note a change in occlusion?

Note: Positive findings with these questions indicate a luxation injury or an alveolar fracture.

Step 2: Examination**Clinical Examination**

Once the medical and dental histories are complete, the dentist is ready to begin the clinical examination.

Extraoral Examination:

- The child's facial skeleton should be palpated to determine discontinuities of facial bones.
- Extraoral wounds and bruises should be recorded.
- The temporomandibular joints should be palpated, and any swelling, clicking or crepitus should be noted.
- All mandibular excursive movements should be checked and recorded.
- Any stiffness or pain in the child's neck necessitates immediate referral to a physician to rule out cervical spine injury if any.

Intraoral Examination:

- All soft tissues should be examined and areas injured and lacerated are recorded.
- Each tooth in the mouth should be examined for
 - Fracture
 - Pulp exposure
 - Dislocation.
- Displacement of teeth should be recorded; as well as horizontal and vertical tooth mobility is recorded.
 - iv. Reaction to palpation and percussion of teeth is recorded; percussion sensitivity is recorded carefully.

Note: Percussion sensitivity is a good indicator of periodontal ligament inflammation.

- Pulpal vitality testing is performed.

Radiographic Examination

Radiographs allow the clinician to detect—

- Root fractures
- Extent of root development
- Size of pulp chambers
- Periapical radiolucencies
- Resorptions
- Degree of tooth displacement
- Position of unerupted teeth
- Jaw fractures
- Presence of any tooth fragments or foreign material in soft tissues.
- Many pathological changes are not immediately apparent in radiographs following the traumatic injuries. After approximately 3 weeks periapical radiolucencies that are due to pulpal necrosis can be usually detected.
- Inflammatory root resorption may also be evident in 3 weeks of time period.
- Replacement resorption or ankylosis may be evident in 6 to 7 weeks time period.

Thus, there is adequate rationale to obtain postoperative radiograph at 1 month and 2 months following the injury.

Step 3: Emergency Care

Basics to be followed by the dental surgeon are:

- Tetanus antitoxin should be given
- Cleaning of wound and laceration
- Debride the area with normal saline
- Suturing of area.

Information and Instructions for Parents*Emergency Telephone Call*

Parents call dentist stating that their child injured a primary tooth and asking how urgent it is to bring the child to the dental office.

If call sounds for injury of a serious luxation; the child should be seen as soon as possible. The management of other conditions can be postponed until the next day without risking the prognosis.

Information and Instructions Provided at the Emergency Visit

- Parents should be informed about possible complications of the injury, prognosis of the injury and the likelihood of damage to the permanent successors.
- In cases of luxation injuries, parents should be given strict instructions for their child's oral hygiene.

Application of an antiseptic medicament such as, 0.2 percent chlorhexidine gluconate or 3 percent hydrogen peroxide, to the injured gingiva which improve the chance for healing.

Step 4: Definitive Treatment of Traumatic Injuries

Injuries to the Hard Dental Tissues

Enamel Fractures

- In cases with minor enamel fractures; fractures can be smoothed with fine disks.
- In cases of larger fractures; they are restored using an acid-etch/composite resin technique.

Enamel and Dentin Fractures

- The primary need in managing fractures that expose dentin is to prevent bacterial irritants from reaching the pulp.
- In past; the standard care for covering exposed dentin with calcium hydroxide or glass ionomer cement to seal out oral flora was performed.
- But recent technique recommends covering the deepest portion of dentin fractures with glass

ionomer cement, followed by a dentin bonding agent and the tooth then can be restored with an acid-etch/composite resin technique.

- If adequate time is not available to restore the tooth completely, an interim covering of resin material (a resin “patch”) can temporise the tooth until a final restoration can be placed.

Fractures Involving the Pulp

The objective of treatment in managing these injuries is to preserve a vital pulp in the entire tooth.

Maintaining a vital pulp in the tooth crown allows the clinician to monitor the tooth's vitality periodically. Treatment options depends on following situations

- Treatment of vital exposed pulp of tooth with immature roots:
 - Direct pulp cap
 - Apexogenesis with calcium hydroxide
 - Pulpotomy.
- Treatment of vital exposed pulp of tooth with matured roots (closed root apex)
 - Direct pulp cap
 - Pulpectomy
 - Root canal therapy.

In situations when pulp of traumatized tooth has turned nonvital; treatment options then are—

- Treatment of Nonvital, immature tooth—apexification.
- Treatment of Nonvital mature tooth—pulpectomy, root canal therapy.

DIRECT PULP CAP

The direct pulp cap is only indicated in small exposures that can be treated within a few hours of the injury.

Clinical Technique

- Step 1:* A rubber dam is applied, and the tooth is gently cleaned with water.
- Step 2:* After cavity preparation is done with high speed handpiece under the constant water spray and the caries removal with slow speed handpiece; the cavity should be rinsed with diluted sodium hypochlorite, this disinfects the cavity and removes the blood clot if present.
- Step 3:* If bleeding persists, application of pressure to the exposure site with a cotton pellet moistened with saline will stop it.
- Step 4:* Commercially available calcium hydroxide paste is applied directly to the pulp tissue and to the surrounding dentin.
- Step 5:* It is essential that a restoration must be placed that is capable of thoroughly sealing the exposure to prevent further contamination by oral bacteria.
It is acceptable to use an acid-etch/composite resin system for an initial restoration.
- Step 6:* The calcific bridge stimulated by calcium hydroxide should be evident radiographically in 2-3 months.

PULPOTOMY**Indications**

- This technique is favoured for immature permanent teeth with exposed pulps.
- It is also indicated in large exposures or for pulps exposed for more than a few hours.

Clinical Technique

- Step 1:* Isolate tooth with rubber dam to prevent contamination of the pulp with oral bacteria.
- Step 2:* The inflamed pulp is gently removed to a level approximately 2 mm below the exposure site with a sterile diamond bur at high speed; copious irrigation is mandatory to avoid pulp injury.
- Step 3:* The preparation should provide adequate space for calcium hydroxide pulp dressing and a glass ionomer seal; Attaining a bacteria tight coronal seal is essential for the success of this technique.
- Step 4:* The tooth can then be aesthetically restored with composite resin.

PULPECTOMY

Pulpectomy involves complete pulp tissue removal from crown and root.

Indications

- When no vital tissue remains.
- When root maturation is complete and the permanent restoration requires a post build-up.

In the absence of inflammatory root resorption, treatment is to obturate the canal with gutta-percha.

One of the greatest challenges facing the clinician is the treatment of a nonvital immature permanent tooth with an open apex. In this case; an apexification procedure is indicated.

APEXIFICATION

Apexification is a method of treatment for immature permanent teeth in which root growth and development ceased due to pulp necrosis.

Its purpose is to allow the formation of an apical barrier.

Clinical Technique

- Step 1:* Anesthetise the tooth together with proper application of rubber dam.
- Step 2:* Gain access to pulp chamber.
- Step 3:* Extirpate the coronal pulp.
- Step 4:* Determining of root canal length by placing reamer in root canal and taking radiograph. Extirpate radicular pulp by barbed broach; while taking care not to traumatise periapical tissue.
- Step 5:* Biomechanical preparation is carried out with reamer and file.
- Step 6:* Irrigation of root canals with normal saline.
- Step 7:* Dry root canal with paper points.
- Step 8:* Mix calcium hydroxide cement and place in root canal; it is made to reach root apex by plugger.
- Step 9:* Seal access cavity with temporary restoration.
- Step 10:* Follow-up visits—
 - Recall patient after 6 months and take an intraoral periapical radiograph if apex is not closed; then,
 - Recall patient again after 6 months and take an intraoral periapical radiograph if apex is still not closed; then,
 - Replace the previous filled calcium hydroxide filling in canals with a fresh calcium hydroxide.

- If root apex is closed; take out calcium hydroxide and irrigate root canals with normal saline and then obturate with gutta-percha and later followed by permanent restoration.

APEXOGENESIS

Apexogenesis is done in immature teeth when part of the pulp tissue remains vital and uninfamed as in some trauma situations in which pulp exposure occurred and treatment was delayed.

Procedure allows continuation of root formation apically to calcium hydroxide; the root formed usually is irregular but nevertheless provide additional support for the tooth.

Criteria for Success

Criteria of judging success of various techniques used to manage pulpal insult in fractured teeth include the following:

- i. Completion of root development in immature teeth.
- ii. Absence of any clinical findings such as pain, mobility, or fistula.
- iii. Absence of any radiographic signs and pathologic processes, such as periapical radiolucency of bone or root resorption.
- iv. *Posterior Crown Fractures:* This type of fracture usually occurs secondary to hard blows to the underside of the chin; and vertical crown fractures may result.

Treatment: Full coverage with stainless steel or cast metal crowns is a frequently used mode of treatment.

- v. *Root Fractures*: The prognosis for root fractures is best when the fracture occurs in the apical one-third of the root. The prognosis worsens progressively with fracture that tends to occur more cervically in the root.

Diagnosis

- It is seen that 75 percent of teeth with intraalveolar root fractures maintain their vitality.
- A series of radiographs are taken with different angulations to verify the extent of fracture.
- The tooth position should be verified radiographically and the pulp sensitivity should be tested.

Treatment

- *Former recommendations* called for firm immobilisation with a splint for several months.
- *Recent recommendations* indicate that root-fractured tooth may heal better if splinted for only 3 to 4 weeks with a functional splint that allows for some mobility of the teeth.

INJURIES TO THE SUPPORTING TISSUE

Luxation injuries damage the supporting structures of teeth, that is the periodontal ligament and alveolar bone.

Also, in mature teeth with closed apices; the pulp frequently becomes necrotic but pulp necrosis is very less noted in immature tooth with open apex; in these cases pulp canal obliteration is a common finding.

Primary Objective

Objective of treatment of these injuries is to maintain periodontal ligament vitality.

Concussion and Subluxation

Clinical features

- Teeth suffering concussion injury are sensitive to percussion without any additional sign.
- Subluxated tooth present increased mobility.
- If teeth is examined shortly after injury, signs of bleeding from the gingival crevice can be seen.
- Concussion and subluxation are mild injuries, they often go unnoticed; parents if questioned may recall the injury, when a late complication develops, such as tooth discoloration.

Radiographic features

- Subluxated teeth present widening of periodontal ligament space.
- In concussion injuries pulp necrosis and root resorption have been reported.

Treatment

- Concussion injuries in permanent teeth must be followed closely; involved teeth can be carefully taken out of occlusion if child complains of pain.
- Subluxated teeth must be followed closely with radiographs for at least 1 year and root canal therapy should be instituted at the first sign of pathologic change.

Splinting of subluxated teeth should be avoided.

Intrusive Luxation

Treatment: There are two treatment modalities for cases with intrusive luxation.

Modality 1—Surgical repositioning: Immediate surgical repositioning is indicated for intruded permanent teeth.

Modality 2—Orthodontic repositioning: Firmly intruded permanent teeth should not be surgically repositioned as this enhance both root resorption and alveolar bone loss.

The treatment of choice is to reposition the intruded teeth orthodontically, using light forces, Also using technique same as apexification.

- The pulp should be extirpated within 2 weeks following the injury.
- Calcium hydroxide should be placed in root canals using the same technique.
- Radiographic monitoring of the tooth should occur for at least 1 year, and the calcium hydroxide in the canal should be replaced if signs of root resorption persist.

Extrusion

An extruded tooth is clinically elongated in comparison with adjacent unaffected teeth (Fig. 16.1).

Clinical Features

- The tooth presents increased mobility and sensitivity to percussion.
- Bleeding from the gingival sulcus can be seen shortly after the injury.
- The more the tooth moves out of the alveolar socket the higher are the chances of disruption of blood supply and development of pulp necrosis.

Radiographic Features

- A periapical radiograph of an extruded tooth will show widening of periodontal ligament especially around the apex.

Treatment

- Extruded permanent teeth with closed apices will undergo pulpal necrosis therefore root canal therapy should be initiated after teeth are splinted (for 2-3 weeks).

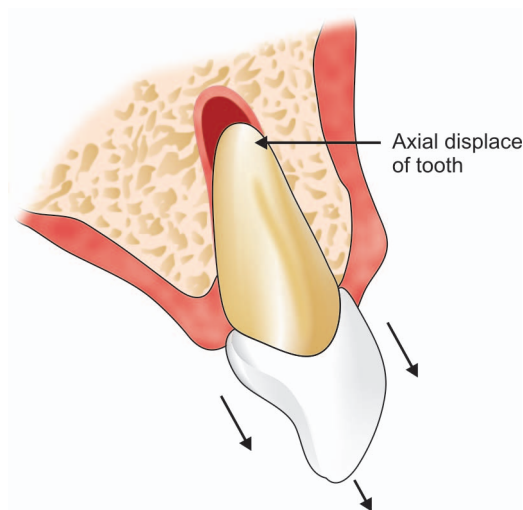


Fig. 16.1: Extrusion injury

- Extruded teeth with open apices have a chance to revascularize and maintain their vitality : so the decision to initiate root canal therapy should be delayed until initial clinical or radiographic signs indicate necrosis.

Lateral Luxation

- In lateral luxation injuries alveolar bone fractures occurs frequently, in most severe cases periodontal ligament and marginal bone loss occurs (Fig. 16.2).
- **Treatment:** Reposition the teeth and alveolar fragments; a splint should be then applied for 3 to 8 weeks, depending on the degree of bone involvement.
- Maintain a good oral hygiene with a use of 0.12 percent chlorhexidine mouth rinse with this alveolar bone regeneration can occur in children in approximately 8 weeks.

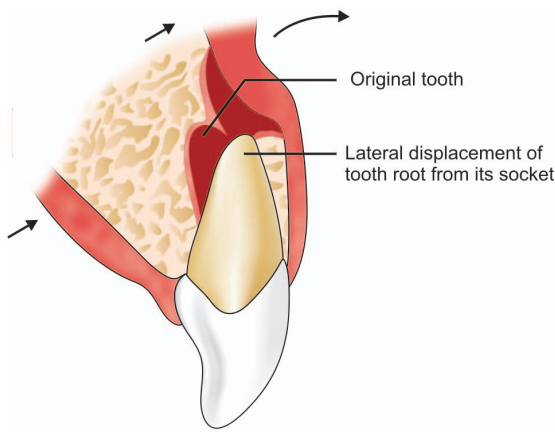


Fig. 16.2: Lateral luxation

Avulsion (Refer to Fig. 16.4)

- *Prognosis:* The prognosis of avulsed permanent teeth worsens more when longer the tooth is out of the socket.
- *Primary Objective* is to maintain the vitality of periodontal fibers.

TREATMENT

Reimplantation

- It is imperative the avulsed tooth be immediately reimplanted by the first capable person whether that person is a parent, teacher, or sibling.
- The best transport medium for avulsed teeth is Hanks balanced salt solution (HBSS) which significantly increases the likelihood of periodontal ligament cells survival for several hours.
- The other alternatives for storing avulsed permanent tooth is:
 - a. Milk; which is readily available, relatively



Fig. 16.3: Reimplantation of avulsed tooth prior to non-rigid splinting for 7-10 days

aseptic, and its osmolality is more favourable for maintaining vitality of periodontal ligament cells.

- b. Patient's mouth (Saliva).
- c. The last and least effective is water.

Guidelines for Treatment of Avulsed Tooth by Reimplantation (Refer Fig. 16.3)

- *Extraoral time* is one of the most critical factors affecting prognosis. The avulsed tooth should be replaced immediately into its socket, whenever possible, reduce this time to an absolute minimum.
- *Management of the socket:*
 - a. The less manipulation of the socket the better prognosis is for the reimplanted tooth.
 - b. Do not curette or vent the socket.
 - c. Use light irrigation and gentle aspiration to remove any blood clot present in the socket, to permit reimplantation.
 - d. After reimplantation, manually compress the facial and lingual bony plate.

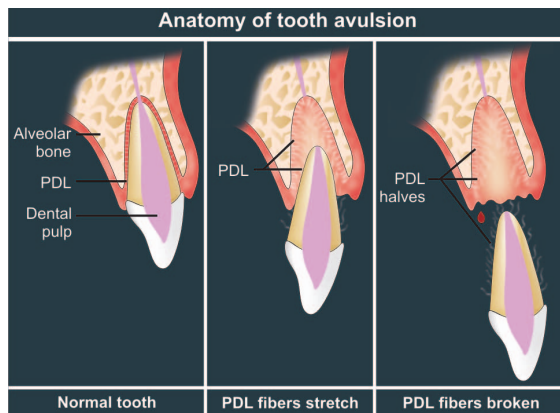


Fig. 16.4: Anatomy of tooth avulsion

- *Management of the root surface*
 - a. To preserve the vitality of root surface cells, do not handle, scrape, brush or remove any of the root surface.
 - b. If the root surface is dirty, rinse it with clean tap water and if persistent debris remains on the root, use cotton pliers gently to pick away any debris, or as a last resort, use a wet sponge to brush off debris gently.
 - c. Do not apply any medicaments, disinfectants, or chemicals to the root surface.
- *When to perform endodontic treatment*
 - a. The endodontic treatment should be initiated within 7 to 14 days of reimplantation and when the tooth is in its socket.

- b. If the tooth apex is open, monitor the reimplanted tooth every 2 weeks for revitalization of pulp.
- c. If pathologic signs are noted, then extirpate the pulp, and continue with an apexification procedure using calcium hydroxide until such time as endodontic treatment and root canal filling can be completed.
- d. In summary the procedure for reimplantation of a mature tooth is as follows—
 - i. Hold the tooth by the crown to prevent damage to periodontal ligament.
 - ii. Gently rinse the tooth with tap water. No attempt should be made to scrub or sterilise the tooth.
 - iii. Manually reimplant the tooth in the socket as soon as possible.
 - iv. Apply a light, functional splint for 1 week.
 - v. Complete calcium hydroxide pulpectomy after 1 week and then remove splint.

Characteristics of an Ideal Splint

- a. Splint should be passive and not cause trauma.
- b. Splint should be flexible and allow functional movements of the tooth.
- c. Splint should allow for vitality testing and endodontic access.
- d. Splint should be easy to apply and remove.

To allow for flexibility, a light orthodontic arch wire or a 30 to 60 pound test monofilament finishing line can be used.

Chapter 17

Treatment Planning and Management of Orthodontic Problems

INTRODUCTION

When considering treatment for problems during the mixed-dentition years, the precise problem and the goal of treatment must be clear in mind.

After the problem list has been generated and each problem has been ranked in order of severity, possible solutions to each problem should be listed; the solution list should be comprehensive that is all reasonable solutions should be considered for each specific problem without regard for the other problems.

In some cases the best solution for one problem is the best solution for all problems and the treatment plan is easily derived.

TREATMENT PLANNING PROCESS

The planning process follows these steps—

Step 1: Selection and Evaluation of Required Diagnostic Methods

The different developmental stages have different diagnostic requirements because there will be different objectives and hence, different treatment plans.

Illustration

The objectives for patients with deciduous dentition are far more limited than for older patients. Therefore, the clinical study and study on casts will be performed without gnathological and cephalometric analysis. The latter cannot be performed as there are no cephalometric patterns for patients under 7. Cephalometric norms are established as from age 8½-9. Nevertheless, gnathological and cephalometric studies are very important tools in other stages.

Data Gathering and Recording in a Database

It implies data gathering and recording in a database for ready access according to field of interest.

It is a key element in the planning process.

Classification of Problems According to Priority

All relevant information on problems encountered is duly recorded in the database. Once spotted, these problems should be ranked along a priority list.

This order of priorities will be established, on the one hand, by the clinician and on the other, by the

patient, whose priorities may sometimes differ from those of the clinician.

Out of sheer logic, patients expectations should come first.

Step 2: Evaluation of Clinical Possibilities and Selection of a Feasible Therapeutic Approach

From the onset; clinicians should be aware of chances of solving problems, regardless of where they stand in their priorities. This may also condition the therapeutic approach applied to solve these problems.

Illustration

A gummy smile on a class I adult patient with significant upper and lower crowdings should be avoided/ignored, in spite of this aesthetic problem, and thus not included in the planning of an orthodontic treatment as chances of success are almost nil.

Instead, if said problem were a top priority for the patient, an orthodontic surgical treatment should be used duly including the correction of the gummy smile in the planning.

It is essential to instruct the patient on the various therapeutic approaches and their subsequent treatment results; features, scope risk/benefit ratio, and then treatment planning will proceed accordingly.

Step 3: Preliminary Goals

These objectives are based on the clinician's observations on the basis of adequate diagnostic approaches relevant to the case under study. Such objectives are subjected to the clinician's common sense.

These objectives aim at a deeper analysis of the case and by way of an overview involve the following aspects.

Aesthetic

Facial

To achieve a harmonious relation of the lips in the facial profile and an unstrained lip closure.

Oral

Perfect dental alignment.

Cephalometric

- Orthopedic changes required.
- Harmonious teeth positioning based on cephalometric norms.

Gnathological

To achieve a maximum intercuspation, stabilized in centric relation and a functional occlusion in harmony with temporomandibular joints.

All these preliminary objectives should be taken into account at this stage of planning process and regarded as a mere "intention to treat" for the time being.

There is a straight forward correlation between therapeutic approach to be applied and the preliminary objective set. In some cases, a comprehensive planning with two or more treatment alternatives will be required. These alternatives will enable the visualization of treatment objectives (VTO).

Illustration

In a patient with a mild class III dentoskeletal pattern who at first refuses surgery, two VTO's should be constructed—

One aiming solely at a proper teeth correction, masking the problem.

Another VTO depicting the outcome of a combined orthodontic-surgical treatment.

Undoubtedly, a mere comparison of both results may lead the patient towards the correct choice and pave the way for the clinician to define the appropriate therapeutic approach.

Step 4: Dynamic and Structural Summary of the Case

Treatment goals, on the basis of the dynamic and structural summary of the case will enable clinicians to determine.

- Structures to be modified
- Biological limitations for said changes : In view of—
 - Patient's age
 - Facial type
 - Magnitude and direction of growth
 - Morphological and structural characteristics
 - Dental and/or periodontal health
 - Occlusion in relation to the TMJ
 - Aesthetics
 - Patients self-assessment of the condition.

Step 5: Visualization of Treatment Objectives (VTO)

The visualization of treatment objectives is a traced plane that combines anticipated growth of the patient and its influence on therapeutic procedures with the predicted end of treatment changes.

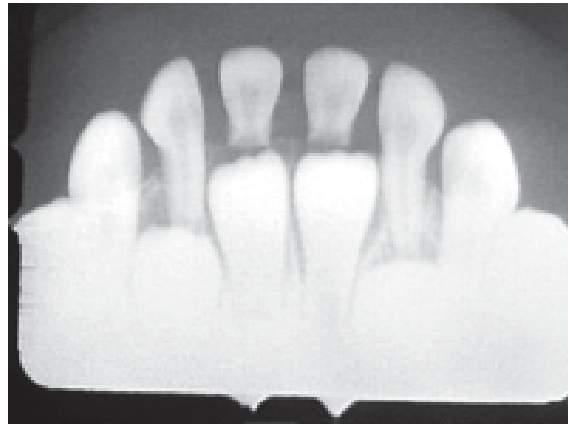


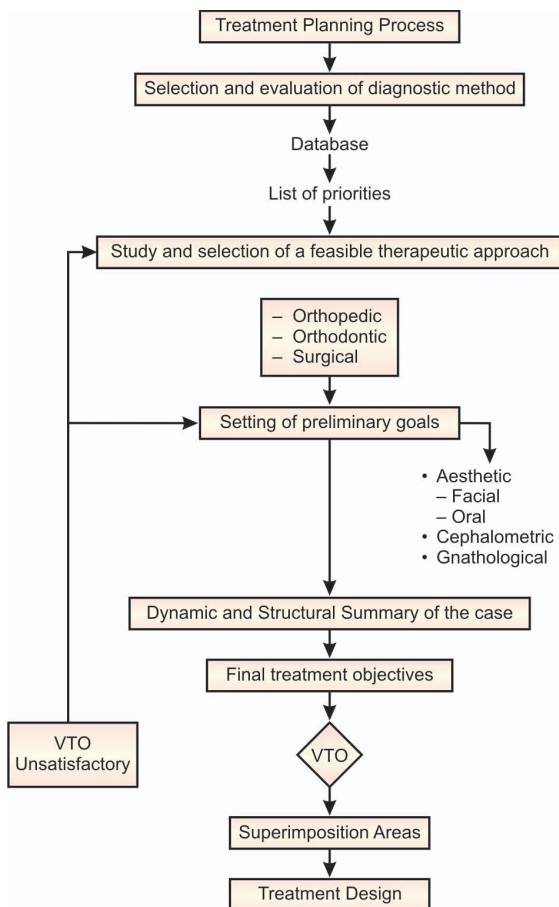
Fig. 17.1: Good primary spacing in radiograph



Fig. 17.2: E space, or Leeway space, demonstrated in radiograph

The Implementation of VTO Requires

- A careful clinical evaluation
- A radiographic examination (Figs 17.1 and 17.2)
 - Panoramic, occlusal and periapical X-rays
 - Lateral and sometimes frontal head films



- Study casts mounted on the semi-adjustable articulator.
- Records of condylar position.
- Lateral cephalometric analysis, in some cases, frontal analysis as well.
- Assessment of facial type.

Step 6: Tracing of Superimposition Areas

The superimposition areas establish a link between static and dynamic cephalometrics that is—

- Between the patients initial condition and growth related alterations (initial cephalometric analysis and growth prediction without treatment).
- Between the initial condition and prediction of growth induced as well as treatment related changes (initial cephalogram and VTO).
- Between the VTO and the intermediate cephalogram (evaluation of treatment outcome).
- Between the above mentioned and a post-treatment cephalogram (evaluation of long-term results).

Step 7: Treatment Design and Sequential Use of Appliances

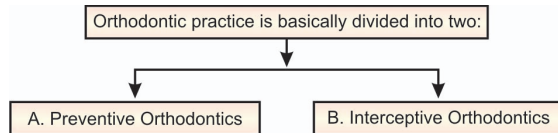
This is an aim of every planning process. They imply logical steps leading from the start to an organized treatment involving:

- Selection of appliances.
- Sequence in the use of the different appliances.
- Estimated time of use for each of them in terms of the partial objectives as treatment develops.
- Approximate duration of treatment.
- Use of other therapeutic resources (e.g. orthodontic surgical treatment).
- Type and duration of the postorthodontic retention to be used.

MANAGEMENT OF ORTHODONTIC PROBLEMS

Before starting with managing various orthodontic problems, let us discuss for important aspects required to understand management of orthodontic problems in a better way—

I.



A. Preventive Orthodontics

It is that part of orthodontic practice which is concerned with the patients and parents education, supervision of the growth and development of the dentition and the craniofacial structures, the diagnostic procedure undertaken to predict the appearance of malocclusion and the treatment procedures instituted to prevent the onset of malocclusion.

The following are some of the procedures undertaken in preventive orthodontics:

- i. Parent education
- ii. Caries control
- iii. Care of deciduous dentition.
- iv. Management of ankylosed teeth (Fig. 17.3)



Fig. 17.3: Ankylosis of 1st primary molar, very significant

- v. Maintenance of quadrantwise tooth shedding time table
- vi. Check-up for oral habits and habit breaking appliance if necessary
- vii. Occlusal equilibration if there are any occlusal prematurities
- viii. Prevention of damage to occlusion, e.g. milwaukee braces
- ix. Extraction of supernumerary teeth
- x. Space maintenance
- xi. Management of deeply locked first permanent molar
- xii. Management of abnormal frenal attachment.

Interceptive Orthodontics

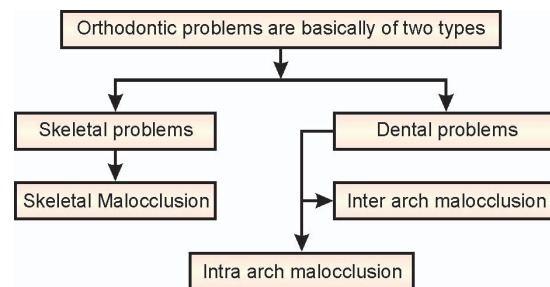
Definition

Interceptive orthodontics has been defined as that phase of the science and art of orthodontics employed to recognize and eliminate potential irregularities and malpositions of the developing dentofacial complex.

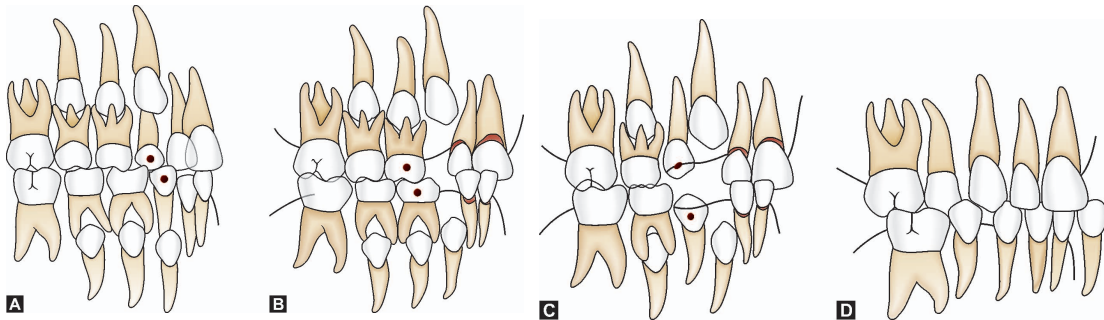
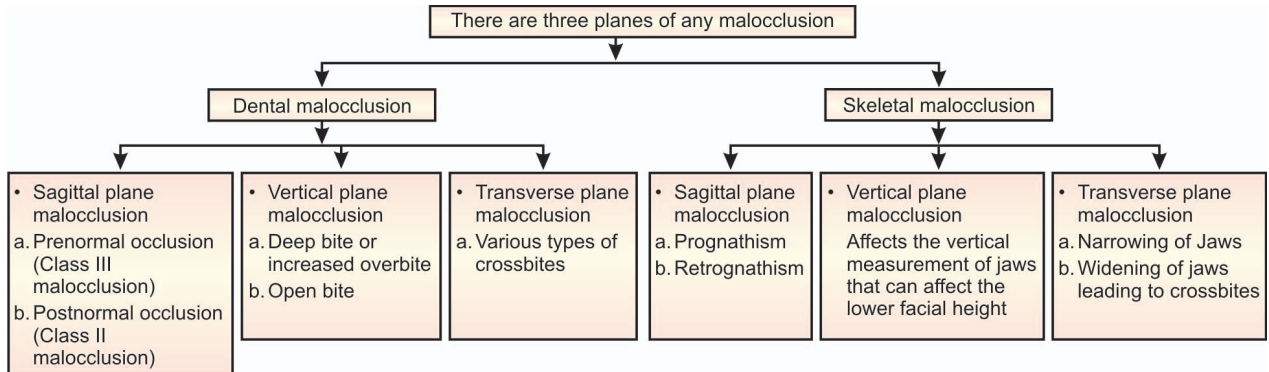
The procedures undertaken in interceptive orthodontics include:

- Serial extraction (Figs 17.4 and 17.5)
- Correction of developing crossbites
- Control of abnormal habits

II.

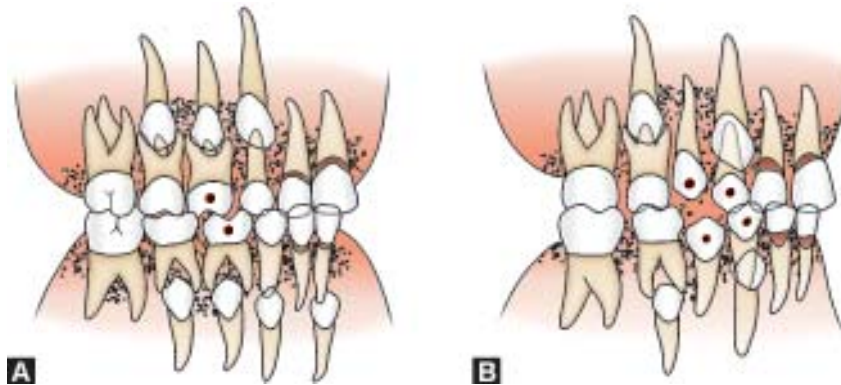


III.



Figs 17.4A and B: Dewel's method of serial extraction (A) Step one – extraction of deciduous canines to create space for the alignment of the incisors (B) Step two – extraction of deciduous first molars to accelerate the eruption of first premolars

Figs 17.4C and D: Dewel's method of serial extraction (C) Step three—Extraction of the erupting first premolars to permit the permanent canines to erupt (D) Serial extraction completed



Figs 17.5A and B: Tweed's method of serial extraction
(A) Step one—Extraction of deciduous first molar **(B)** Step two—Extraction of deciduous canine and first premolar

- Space regaining
- Muscle exercises
- Interception of skeletal malrelation
- Removal of soft tissue or bony barrier to enable eruption of teeth.

SAGITTAL PLANE MALOCCLUSION

CLASS I MALOCCLUSION

See Figures 17.6 and 17.7

CLASS II MALOCCLUSION

Introduction

According to Angle's classification, class II malocclusion indicates that the mandibular arch is in a distal relation that of the maxilla.

It occurs in two main forms

- Class II, division 1
- Class II, division 2

The only similarity that both these forms exhibit is the class II molar relation.



Fig. 17.6: Supraeruption into edentulous space in primary dentition



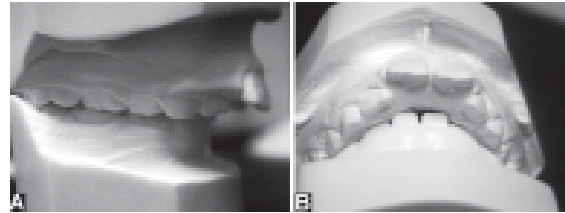
Fig. 17.7: Class I occlusion in the mixed dentition

Class II Division 1 Malocclusion

Features

- The patient exhibits a class II molar relation (Disto-buccal cusp of the upper first permanent molar occludes in the buccal groove of the lower first permanent molar (Fig. 17.8).

The molar relation can vary from an end on molar to one that is a full-fledged class II.



Figs 17.8A and B: Study models of class II division 1 in the mixed dentition

- The classical feature of class II division 1 malocclusion is the presence of proclined maxillary anteriors with resultant increased overjet (Fig. 17.8).
- Patient exhibits
 - Increased overbite and excessive curve of Spee.
 - Have a short hypotonic upper lip; also patient place lower lip against palatal surface of the upper incisors this is called lip trap.
 - Patient lack an anterior lip seal due to the short upper lip.
 - Narrow upper arch which predisposes to posterior crossbite.

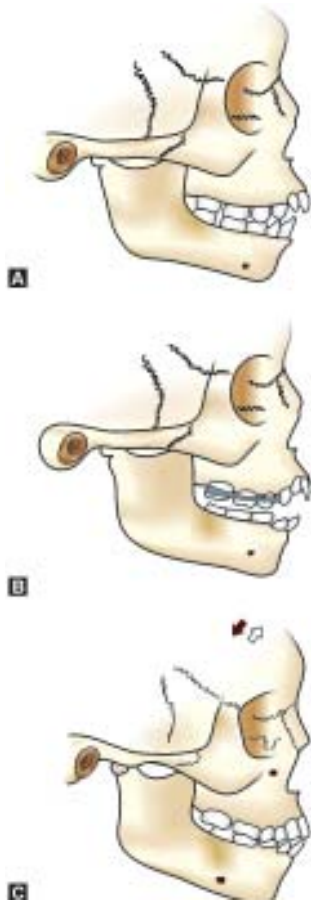
Skeletal Features

A class II malocclusion may be complicated by the presence of abnormal skeletal relationship of the maxilla and the mandible. The abnormal skeletal features most often found are:

- Maxillary protrusion
- Mandibular retrusion
- Maxillary protrusion and mandibular retrusion.

Treatment of Skeletal Class II Malocclusion

There are three basic approaches to the treatment of class II division 1 malocclusion they are (Fig. 17.9):



Figs 17.9A to C: Sequence of event leading to a spontaneous correction of a sagittal malocclusion. (A) Pre-treatment—the patient has excessive overjet and an end-to-end molar relationship. (B) The placement of the appliance immediately creates a downward rotation of the position of the mandible because of the posterior occlusal acrylic. During the treatment, an intrusive (and slightly protrusive) force is produced on the skeletal and dental structures of a maxilla. (C) During the post-expansion period, the upper dental arch has been widened. The lower jaw often is postured forward to achieve a more stable occlusal relationship

Growth Modification

Most often maxillary prognathism or mandibular deficiency occurs; these abnormal skeletal patterns can be intercepted by means of functional and orthopedic appliances to reduce the severity of the skeletal relationship.

Correction of Mandibular Deficiency

Class II malocclusion complicated by mandibular deficiency or retrognathism is treated during the mixed dentition period by use of myofunctional appliances such as activator or functional regulator.

In case the patient is at the end of the growth period fixed appliances like Herbst appliance or Jasper Jumper is indicated.

Correction of Maxillary Prognathism

Class II malocclusion exhibiting maxillary prognathism can be intercepted by the use of face bow with headgear to restrict further maxillary growth.

Both Maxillary Prognathism as well as Mandibular Deficiency

In such patients an appliance such as activator with head-gear is used to restrict maxillary growth and promote mandibular growth.

Camouflage

Patients too old for successful growth modification using myofunctional appliances—in patients who are beyond growth period, it is not possible to undertake growth modification procedures.

Thus, the underlying skeletal discrepancy can be camouflaged by orthodontic tooth movement; this is

often done by extraction of certain teeth and moving the rest of the teeth into space created.

Concept implies that major skeletal changes are not possible after the cessation of growth.

Illustrations

In case of a well-aligned lower arch with a class II molar relation with excellent intercuspation, it is possible to reduce the overjet and obtain stable results by extracting first premolars only in the upper arch.

Orthodontic camouflage may also be done in some patients by distal driving of the maxillary molars. This is done in mild class II malocclusion prior to eruption of second molars.

Surgical Correction—Orthognathic Surgeries

In patients exhibiting severe skeletal malrelationship, surgery may be the ideal treatment modality.

Based on the underlying skeletal pattern a maxillary set back or a mandibular advancement is undertaken after the completion of growth.

Correction of Deep Bite and Crossbite

Class II malocclusion may be associated with anterior deep bite; this can be treated by following ways—

- *Use of removable anterior bite planes* to encourage vertical development of the posterior dentoalveolar segment (Fig. 17.21).
- *Use of fixed appliances* to intrude the upper and lower anteriors.

Class II Division 2 Malocclusion (Fig. 17.10)

The class II, division 2 malocclusion is a condition characterised by a class II molar relationship with

retroclined upper centrals that are overlapped by the lateral incisors (Fig. 17.10A).

Features

- Molars in distocclusion (Fig. 17.10B)
- Retroclined central incisors and rarely of other anteriors as well.
- Deep overbite (Fig. 17.10C)
- Pleasing straight profile
- Broad square face
- Backward path of closure
- Deep mentolabial sulcus
- Absence of abnormal muscle activity.

Treatment of Class II Division 2 Malocclusion

The deep anterior overbite and retroclination that is characteristic of division 2 malocclusion is treated by—

- *Reduction in incisal overbite:* The deep overbite is reduced by use of anterior bite plane or fixed appliances incorporating anchor bends or reverse curve of Spee.
- *Alteration of incisal inclination:* The incisor inclination often necessitates the use of torquing springs to move the upper incisor roots lingually and the crowns buccally.
- *Role of functional appliances:* During the mixed dentition period, it is possible to procline the maxillary incisors thereby converting a class II, division 2 into a malocclusion that resembles class

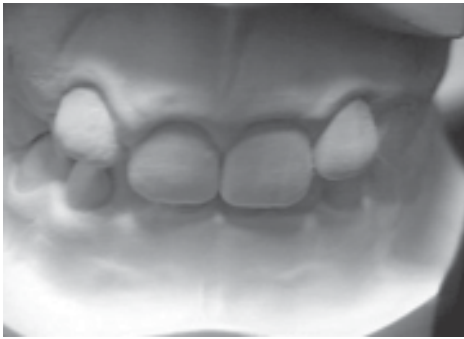


Fig. 17.10A: Retroclined upper centrals



Fig. 17.10B: Molars in distoocclusion

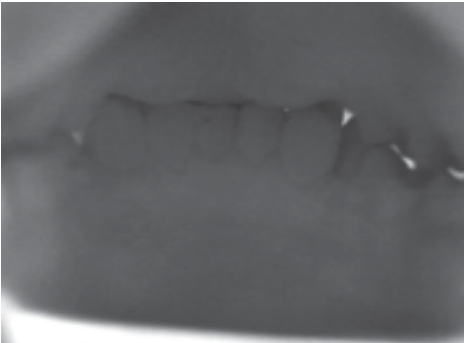


Fig. 17.10C: Deep overbite

Figs 17.10A to C: Models of class II division 2 patients

II division I and then followed by Frankel's appliance used in treatment of class II division 1 malocclusion.

CLASS III MALOCCLUSION

Introduction

According to Angle a class III molar relationship refers to a condition where the mesiobuccal cusp of the upper first molar occludes between the mandibular first and second molars (Figs 17.11 and 17.12).



Fig. 17.11: Class III (mesio step) occlusion in the primary dentition. Difficult to see



Fig. 17.12: Moderate lower anterior crowding in late mixed dentition

Features

- The patient has a class III molar relationship.
- The incisors may be in an edge-to-edge relationship or an anterior crossbite may occur; it is not uncommon to find a normal incisal relationship (Figs 17.13 and 17.14).



Fig. 17.13: Class III, anterior crossbite



Fig. 17.14: Anterior crossbite



Fig. 17.15: Deep dental bite in the mixed dentition

- Upper arch is frequently narrow and short and lower arch is broad leads to posterior crossbites which is a common feature of class III malocclusion.
- Upper arch (Maxillary) teeth are usually crowded and mandibular teeth are spaced.
- Vertical growers exhibiting an increased intermaxillary height may have an anterior open bite. In some patients a deep overbite may occur (Fig. 17.15).
- Pseudo class III malocclusion: A type of class III malocclusion characterised by the presence of occlusal prematurities resulting in a habitual forward positioning of the mandible.

Skeletal Features (Fig. 17.16)

- A short or retrognathic maxilla
- A long or prognathic mandible
- A combination of the above.



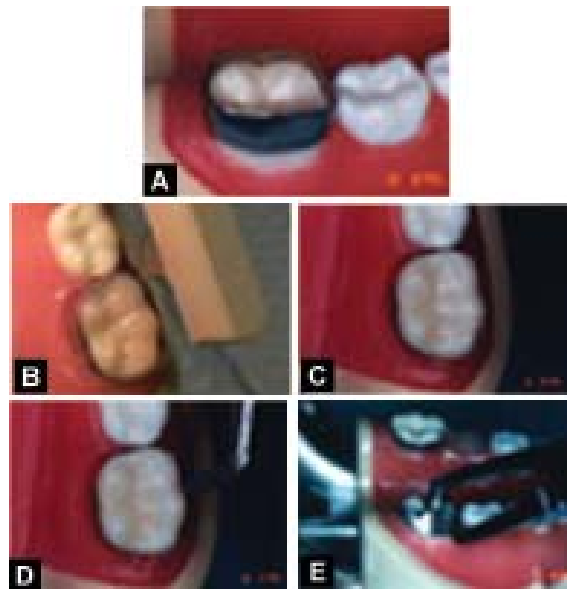
Fig. 17.16: Enamel decalcification due to poor oral hygiene during orthodontic treatment

Treatment of Class III Malocclusion (Fig. 17.17)***Interception During Growth***

Class III malocclusion with an underlying skeletal malrelationship require early treatment to intercept the developing skeletal malocclusion.

The following are some of growth modulation procedures:

- Frankel III, a myofunctional appliance can be used during growth to intercept class III malocclusion due to maxillary skeletal retrusion.
- Reverse activator
- Chin cup with high pull headgear is used to intercept class III malocclusion due to mandibular prognathism (Figs 17.18 and 17.25).
- Severe class III malocclusions that are a result of maxillary retrusion can be treated by reverse headgear (or face mask) to protract the maxilla (Fig. 17.19).



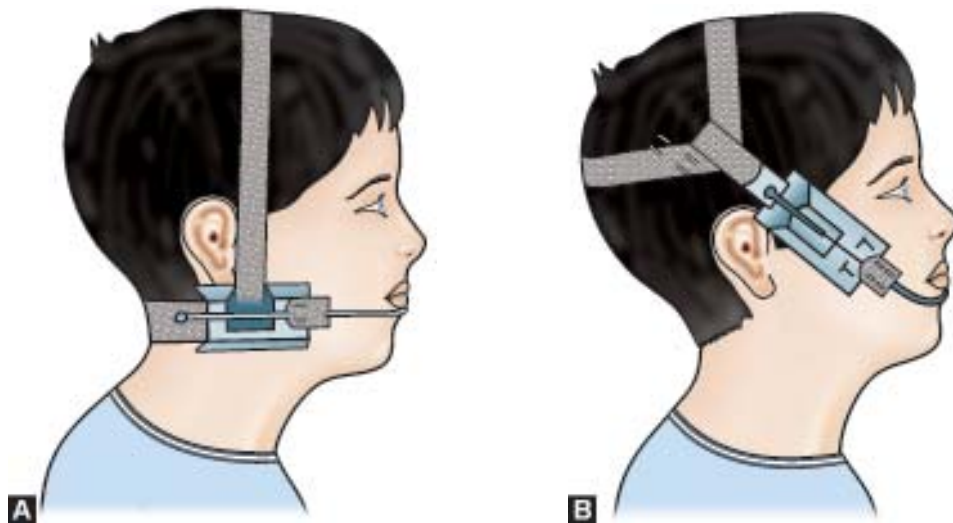
Figs 17.17A to E: Band seating sequence: (A) Select tight band size (B) Use band seater with finger pressure or have patient bite on the instrument... be careful! (C) Band seats beneath marginal ridge (D) Adapt band with adaptation instrument (E) Band removing plier

Anterior Crossbite

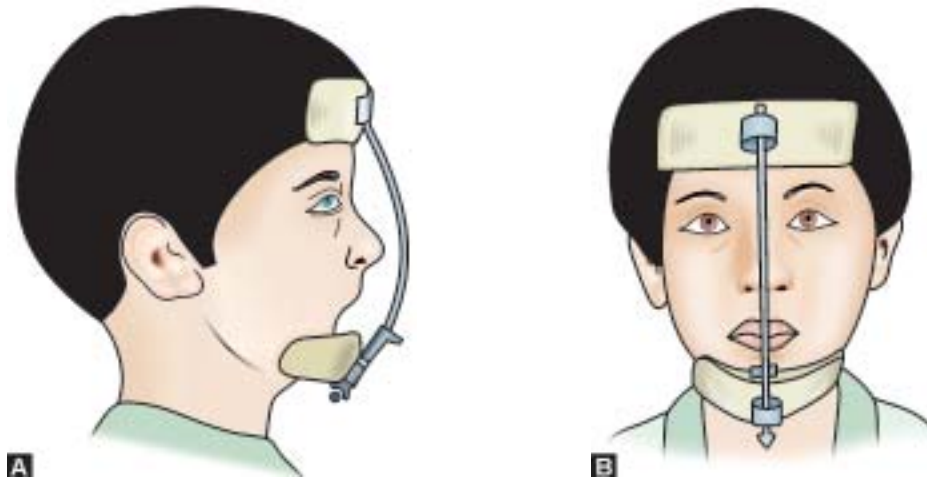
Mild anterior crossbites can be treated using lower anterior inclined planes or removable appliances incorporating screws designed for anterior expansion.

Posterior Crossbite

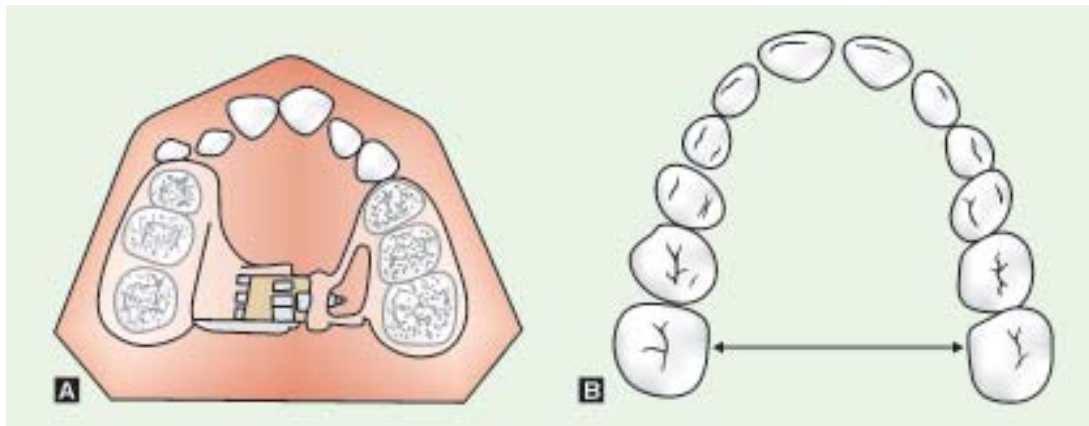
The posterior crossbite can be treated by rapid maxillary expansion (Fig. 17.20).



Figs 17.18A and B: Headgear (A) Straight-pull headgear with J hooks. (B) High-pull headgear with J hooks



Figs 17.19A and B: The orthopedic facial mask of petit (A) lateral view. (B) Frontal view; The appliance, best used in patients in early mixed dentition; is worn on a full-time basis for about 6 months, after which it can be worn on a night-time basis as a retention appliance



Figs 17.20A and B: (A) An acrylic splint RME appliance that is bonded to the maxillary primary molars and the permanent first molars. The occlusal coverage of acrylic produces a posterior bite block effect on the vertical dimension. (B) Maxillary transpalatal width, as measured at the intersection of the lingual groove with the gingival margin; the distance is used as an indicator of maxillary bony base development

Role of Extractions

Class III malocclusion characterized by lower arch length deficiency and anterior crossbite can be treated by extracting lower first premolars followed by fixed mechanotherapy including the use of class III intermaxillary elastics.

Treatment of Severe Class III After Growth

Completion: Orthognathic surgeries

Note: This treatment option is not used in child patient

- *Class III due to maxillary deficiency:* Treated by maxillary advancement procedures such as LeFort - I osteotomy.
- *Class III due to mandibular prognathism:* Treated by mandibular set back procedures.

Treatment of Pseudo Class III Malocclusion

Remove occlusal prematurities.

VERTICAL PLANE MALOCCLUSION

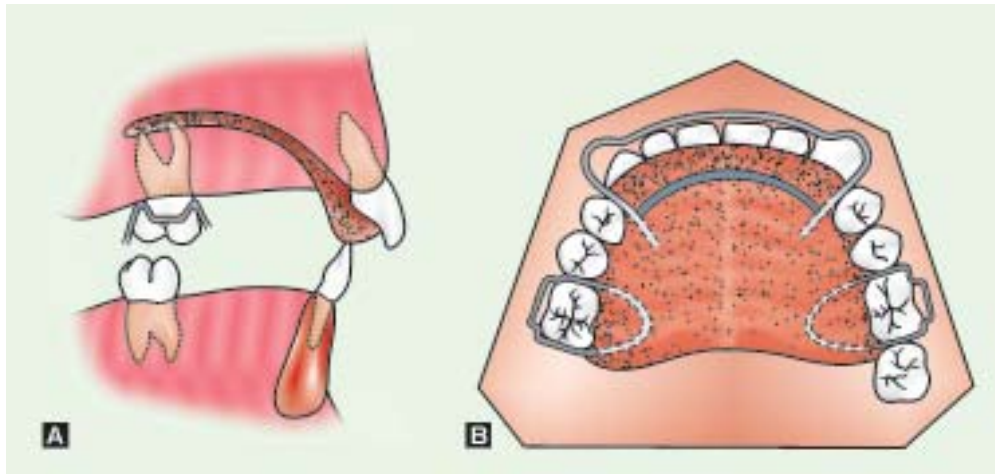
DEEP BITE

Definition

Grabner has defined deep bite as a condition of excessive overbite, where the vertical measurement between the maxillary and mandibular incisal margins is excessive when the mandible is brought into habitual or centric occlusion.

Type—Deep bite can be broadly classified into two types—

- a. Skeletal deep bite
- b. Dental deep bite.



Figs 17.21A and B: Anterior bite plane (A) A clearance of 1.5-2 mm should exist between the upper and lower posterior teeth. (B) Anterior bite plane

Features

Skeletal Deep Bite

- Patients exhibit a horizontal growth pattern.
- The anterior facial height is reduced.
- A reduced interocclusal clearance (free way space).
- A cephalometric examination reveals that most of the horizontal cephalometric planes such as mandibular plane, FH plane, SN plane, etc. are parallel to each other.

Dental Deep Bite

Dental deep bites occurs due to—

- *Over-eruption of anteriors*—Dental deep bite associated with over-eruption of lower incisors is usually seen in class II malocclusion.

Note: In class II malocclusion due to presence of an increased overjet allows the lower incisors to over-erupt until they meet the palatal mucosa.

- These patients have excessive curve of Spee.
- The interocclusal clearance is usually normal as the molars are fully erupted.
- *Infraocclusion of molars*
Causes of infraocclusion
 - Premature loss of posterior teeth.
 - The presence of a lateral tongue posture prevent the molars from erupting to their normal occlusal level.

Treatment of Deep Bite

Deep bites can be treated using removable, fixed or myofunctional appliances—

Removable Appliances

Anterior Bite Plane (Fig. 17.21B)

- It is a modified Hawley's appliance with a flat ledge of acrylic behind the upper anteriors.

- When the patient bites, the mandibular incisors contact the bite plane thus disoccluding the posteriors which are free to erupt.
- The height of the anterior bite plane should be just enough to separate the posteriors by 1.5 to 2 mm (Fig. 17.21A).
- The anterior bite plane consists of Adam's clasp on the molar which help in retaining the appliance. A labial bow is also incorporated to counter any forward component of force on the upper anteriors.
- *Use of utility arches:*
 - Utility arches are arch wires that are bent in such away that they bypass the buccal segment and are engaged on the incisors (Fig. 17.22C).
 - They are activated by giving a V bend in the buccal segment of the wire so as to produce a intrusive force on the anteriors (Fig. 17.22D).

Fixed Appliances

Fixed orthodontic appliances can be used to intrude the anteriors.

Methods Used in Fixed Appliances

- *Use of anchorage bends (Fig. 17.22A)*
 - Anchorage bends are given in the arch wire mesial to the molar tubes so that the anterior part of the arch wire lies gingival to the bracket slot.
 - When these arch wires are pulled occlusally and engaged into the brackets, a gingivally directed intrusive force is exerted on the incisors which reduces the deep bite.
- *Use of arch wires with reverse curve of Spee (Fig. 17.22B)*
 - Résilient arch wires that have been curved in direction opposite to that of the curve of Spee can be used to intrude anteriors.
 - When these arch wires are inserted into the molar tubes, the anterior segment curves gingivally.

Myofunctional Appliances

- Deep bites which are due to infraocclusion of molars can be treated by an activator designed and trimmed to allow the extrusion of these teeth.
- The interocclusal acrylic is trimmed gradually to encourage the eruption of the posterior teeth.

OPEN BITE

Introduction

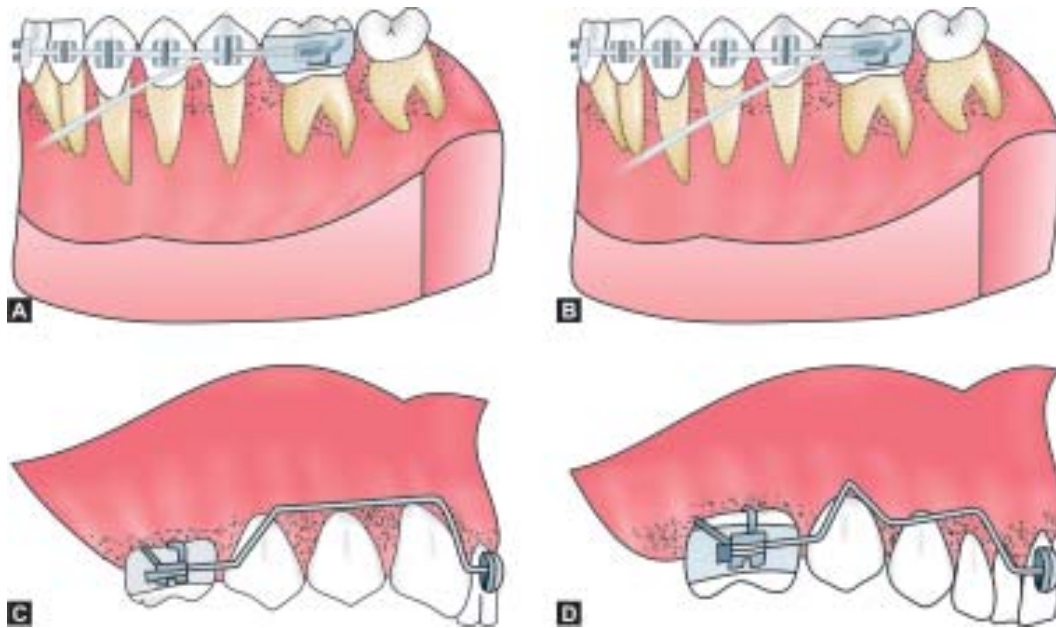
Open bite is a malocclusion that occurs in vertical plane, characterized by lack of vertical overlap between the maxillary and mandibular dentition.

Types

- I. Anterior open bite can be classified as—
 - a. Skeletal anterior open bite
 - b. Dental anterior open bite
- II. Posterior open bite

Anterior Open Bite

Definition: Anterior open bite is a condition where there is no vertical overlap between the upper and lower anteriors.



Figs 17.22A to D: (A) Anchorage bend for intrusion of anterior teeth (B) Arch wire with reverse curve of Spee, (C) Utility arch used for intrusion of anteriors and (D) V bend given for activation of utility arch for anterior intrusion

Causes

- Prolonged thumb sucking habit.
- Tongue thrusting is also implicated for some cases of open bite.
- Also possible etiologic factor is nasopharyngeal airway obstruction and associated mouth breathing.
- Inherited factors such as increased tongue size, and abnormal skeletal growth pattern of the maxilla and mandible can also be responsible for open bite malocclusion.

Features

Skeletal Anterior Open Bite

- Increased lower anterior facial height.
- Increased anterior and decreased posterior facial height.
- Decreased upper anterior facial height.
- Small mandibular body and ramus.
- A steep mandibular plane angle.
- The patient may have a short upper lip with excessive maxillary incisors exposure.
- The patient often has a long and narrow face.

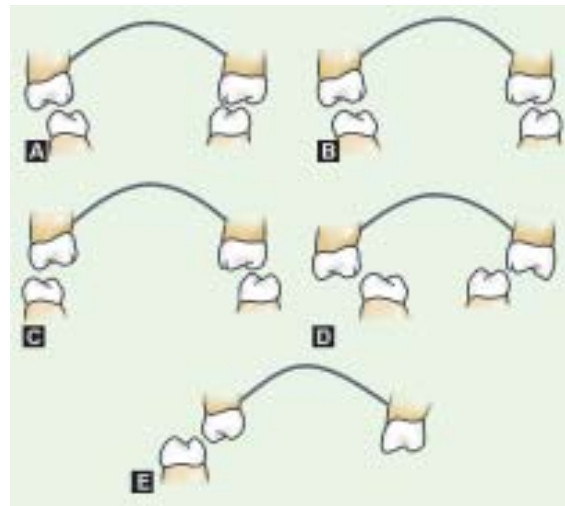
- Cephalometric examination—Reveals a downward and forward rotation of the mandible
 - In some patients, an upward tipping of the maxillary skeletal base can be observed.
 - Also feature commonly observed a vertical maxillary increase.

Dental Anterior Open Bite

- Proclined upper anterior teeth.
- The upper and lower anteriors fail to overlap each other resulting in a space between the maxillary and mandibular anteriors.
- The patient may have a narrow maxillary arch due to lowered tongue posture due to a habit.

Treatment

- *Interception of Oral Habits:* By use of passive habit breaking appliances.
 - The habit breaker can be either a removable or fixed type of crib.
- *Myofunctional Therapy:* Skeletal anterior open bites can be treated during growth using—
 - Functional regulator—Frankel regulator IV or a modified activator.
 - These appliances incorporate bite blocks interposed between the posterior teeth, that have an intrusive action on the upper and lower posterior teeth.
- *Orthodontic Therapy:* Mild to moderate open bites can be successfully managed using fixed mechanotherapy in conjunction with box elastics.
 - This type of elastic is structured to extend between the upper and lower anteriors; this brings about extrusion of the upper and lower anteriors.
- *Surgical Correction:* Not done in child patient.



Figs 17.23A to E: Crossbites in the transverse plane (A) Normal transverse relation (B) Unilateral crossbite (C) Bilateral crossbite (D) Buccal non-occlusion (E) Lingual nonocclusion

Posterior Open Bite

Definition- Posterior open bite is a condition characterized by lack of contact between the posteriors when the teeth are in centric occlusion.

Causes

- Mechanical interference with eruption
- Failure of the eruptive mechanism of the tooth.

Treatment

- Interception of lateral tongue thrust by use of lateral tongue spikes incorporated in appliance.
- The posteriors can be forcefully extruded.

TRANSVERSE PLANE MALOCCLUSION

CROSSBITE

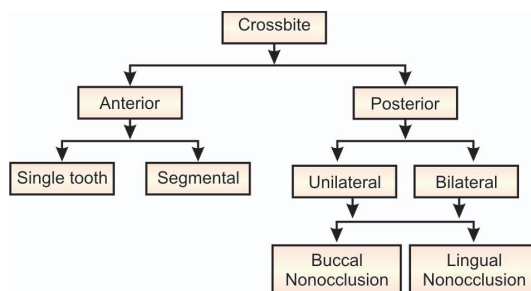
Definition

Grabier defined crossbite as a condition where one or more teeth may be abnormally malposed buccally or lingually or labially with reference to the opposing tooth or teeth (as shown classified in Flow charts 17.1 and 17.2).

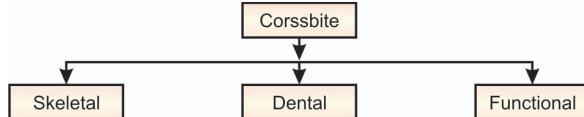
Due to the presence of malposed teeth in any of the quadrant of single or both arch results in bilateral, unilateral, buccal nonocclusion and or lingual nonocclusion varieties of crossbites (Fig. 17.23).

Types

Flow chart 17.1



Flowchart 17.2



Definitions of Different Crossbites

Anterior Crossbite

Is defined as a malocclusion resulting from the lingual position of the maxillary anterior teeth in relationship with the mandibular anterior teeth.

Posterior Crossbite

This refers to an abnormal transverse relationship between upper and lower posterior teeth.

Skeletal Crossbite

This is a condition associated with a discrepancy in the size of the maxilla and the mandible (Defective Embryological Development)

Dental Crossbite

This is a localized condition where one or more teeth are abnormally related to that of opposing arch.

Functional Crossbite

Habitual forward positioning of mandible due to presence of occlusal interference leads to functional anterior crossbite.

Causes

- Retained deciduous tooth causes abnormal deflection of erupting successor causing single tooth anterior crossbite.
- As a result of arch length-tooth material discrepancies various dental crossbites results.
- Presence of habits such as thumb sucking and mouth breathing can cause lowered tongue position so; the tongue now no longer balances the force exerted by the buccal group of musculature leading to development of posterior crossbite.
- Retarded development of maxilla and mandible in any of three planes.

Illustration—Retarded growth of maxilla in transverse as well as sagittal plane produces crossbites in anterior as well as posterior region.

- Cleft palate patients.

- Decreased growth stimulation in the mid-palatal suture
- Unilateral hypo or hyperplastic growth of any of the jaws can cause crossbite.
- Catlan's appliance or lower anterior inclined plane
- Use of double cantilever spring (Z spring)
- Treating skeletal anterior crossbite during growth period by use of
 - *Reverse head gear*: In cases where cause of anterior crossbite is retrognathic maxilla.
 - *Chincup*: In cases where cause of anterior cross bite is prognathic mandible (Figs 17.24 and 17.25).

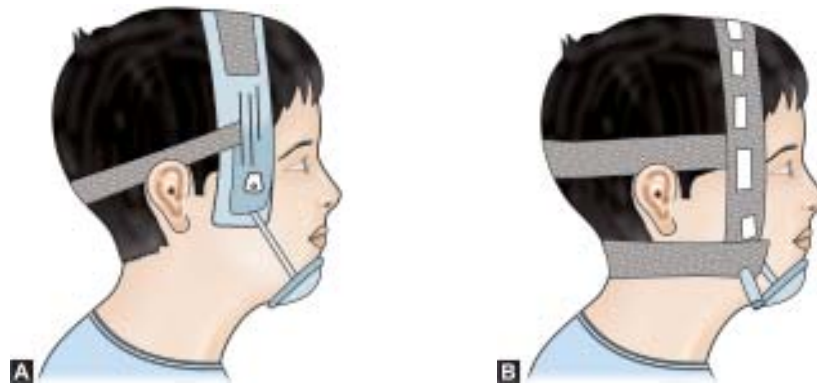
Treatment

Anterior Crossbite

- Use of tongue blade



Figs 17.24A and B: The Vertical pull chin cup. (A) Unitek design. (B) Summit design



Figs 17.25A and B: The occipital pull chin cup. (A) Soft elastic appliance. (B) Interlandi type headgear



Fig. 17.26: Fixed mandibular bonded retainer

- e. Multi looped archwires (fixed appliance therapy)

Posterior Crossbite

- Crossbite elastics
- Coffin spring
- Quad helix
- Rapid maxillary expansion—Hyrax appliance
- Split acrylic removable plates using jack screw
- Fixed appliance therapy (Fig. 17.26).

Chapter 18

Behavior Management

INTRODUCTION

An aspect of the dental treatment of children seems to be predictive of those who can work with children and those who cannot; this aspect is experience.

Dental students and young practitioners may be discouraged by the anxiety they feel and the insecurity they experience when certain children start to misbehave. However, with time and dedication to the techniques taught in dental school, a practitioner's skills in managing child patients become refined; and with this refinement comes self-confidence in this area of dentistry.

MISBEHAVING CHILD DENTAL PATIENTS

The four categories of misbehaving children have been outlined based on the relative frequency with which a dentist encounters them.

Category I : Emotionally Compromised Child

- This first group includes special children who are

emotionally compromised; this is not a large group of children, but they do exist.

- Dental procedures, as well as many other challenges of life, are difficult for these children to endure because of their psychological or emotional problems. It is important to realize that a psychological or emotional disorder may go undiagnosed.

Category II : Shy and Introverted Child

- The second group is the largest group of “shy birds”. These are introverted, poorly socialized children who are afraid of the social challenges associated with going to the dentist.
- The best management technique with these children is to break the barriers of shyness with friendship.

Category III : Frightened Child

The third group is composed of children who have a hard time with dentistry because they are frightened [fear of needles accounts for 90% of the cases].

Category IV : Child Who is Averse to Authority

- Another group of misbehaving children is those who do not like authority.
- These children don't like dental appointments, and their dislike is based on an aversion of complying with adult directives.

DEFINITIONS

Behavioral Pedodontics

It is study of science which helps to understand development of fear, anxiety and anger as it applies to child in dental treatment.

Behavior Management

This is defined as the means by which the dental health team effectively and efficiently performs dental treatment and thereby instills a positive dental attitude.

Behavior Modification

This is defined as the attempt to alter human behavior and emotion in a beneficial way and in accordance with the laws of learning.

Behavior Shaping

This is the procedure which slowly develops behavior by reinforcing a successive approximation of the desired behavior until the desired behavior comes into being.

CLASSIFICATION OF CHILD BEHAVIOR DURING DENTAL PROCEDURES AS SHOWN IN TABLES 18.1 TO 18.4

Table 18.1 : Wilson's classification

• Normal or bold	: The child is brave enough to face new situations is co-operative, and friendly with the dentist
• Tasteful or timid	: The child is shy, but does not interfere with the dental procedures
• Hysterical or rebellious	: Child is influenced by home environment. Throws temper tantrums and is rebellious
• Nervous or fearful	: The child is tense and anxious, feared of dentistry

**Table 18.2 : Frankel's classification
(Frankel's behavior rating scale)**

<i>Rating</i>	<i>Behavior</i>
• Definitely negative (--)	Refuses treatment, cries forcefully, extremely negative behavior associated with fear
• Negative (-)	Reluctant to accept treatment and displays evidence of slight negativism
• Positive (+)	Accepts treatment, but if the child has a bad

(Contd...)

(Contd...)

- Definitely positive (++) experience during treatment, may become uncooperative
Unique behavior, looks forward to and understands the importance of good preventive care

Table 18.3: Wright's classification
(A) *Cooperative (Positive behavior)*

- Cooperative Behavior: Child is cooperative; relaxed with minimal apprehension
 - Lacking Cooperative Ability: Usually seen in young child (0-3 years), disabled child, physical and mental handicap
 - Potentially Cooperative: It has the potential to cooperate, but because of the inherent fears (subjective/objective) the child does not cooperate
- (B) *Uncooperative (Negative behavior)*
- Uncontrolled/hysterical/incorrigible usually seen in—
 - Preschool children at their first dental visit.
 - Temper tantrums, i.e. physical lashing out of legs and arms, loud crying and refuses to cooperate with the dentist.
 - Defiant behavior/obstinate behavior
 - This type can be seen in any age group.
 - Usually in spoilt or stubborn children.
 - These children can be made cooperative.
 - Tense cooperative
 - These children are the borderline between positive and negative behavior.
 - Does not resist treatment but the child is tensed at mind.

(Contd...)

(Contd...)

- Timid behavior/shy
 - Usually seen in overprotective child at the first visit.
 - Is shy but cooperative.
- Whining type
Complaining type of behavior allows for treatment but complains throughout the procedure.
- Stoic behavior
Seen in physically abused children; they are cooperative and passively accept all treatment without any facial expression.

Table 18.4: Lampshire

- *Cooperative:* The child is physically and emotionally relaxed. Is cooperative throughout the entire procedure.
- *Tense cooperative:* The child is tensed, and cooperative at the same time.
- *Outwardly apprehensive:* Avoids treatment initially, usually hides behind mother; eventually accepts dental treatment.
- *Fearful:* Requires considerable support so as to overcome the fears of dental treatment.
- *Stubborn/defiant:* Passively resists treatment by using techniques that have been successful in other situations.
- *Hyper motive:* The child is actually agitated and resorts to screaming, nicking, etc.
- *Handicapped:* Physically/mentally, emotionally handicapped.
- Emotionally immature.

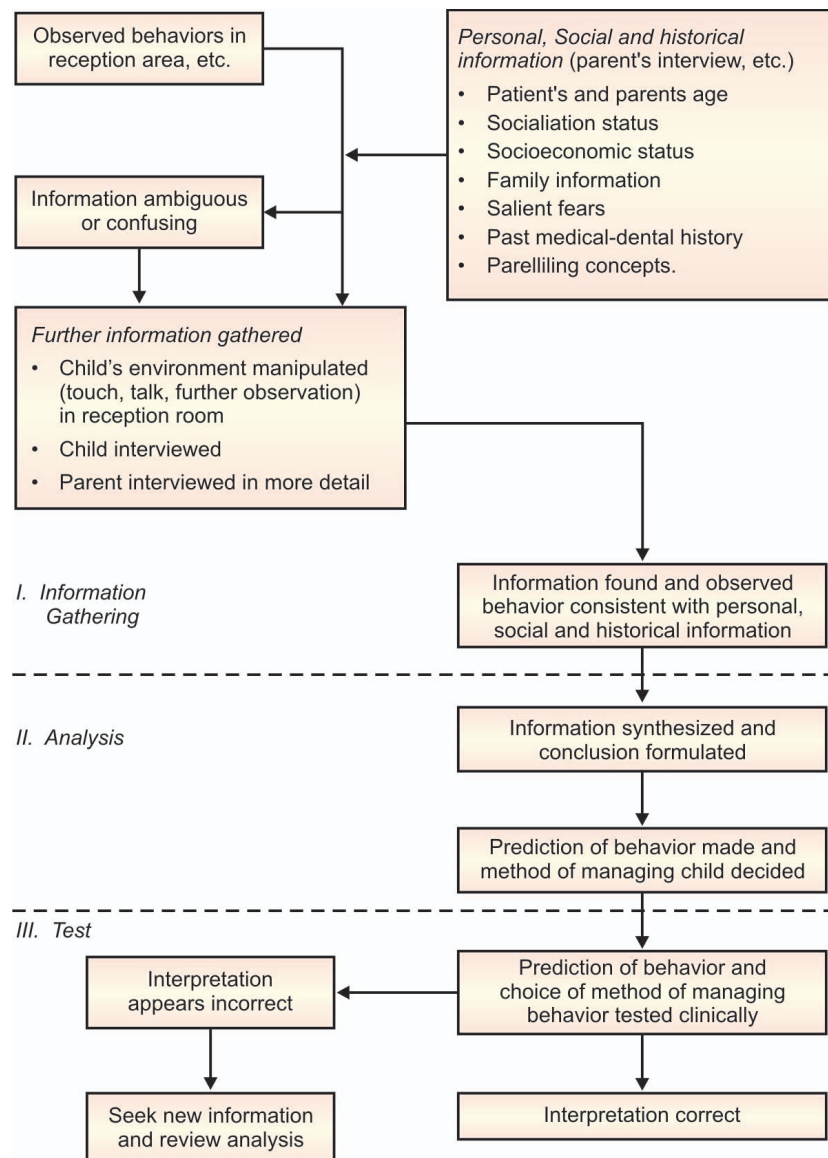
Pain

Sterback defines pain as “an abstract” concept which refers to:

- A personal, private sensation of hurt.

- A harmful stimulus which signals current or impending tissue damage.
- A pattern of responses which operate to protect the organism from harm.

Methods for observing, analyzing, and predicting behavior of child patient



APPROACHES OF BEHAVIOR MANAGEMENT

To manage pain and anxiety of child patient

- Nonpharmacological approach
 - Various behavior management techniques
 - Hypnosis.
- Pharmacological approach
 - Local anesthesia.
 - Relative analgesia
 - Oral or rectal sedation
 - Intravenous sedation
 - General anesthesia.

NONPHARMACOLOGICAL APPROACH

Various behavior management techniques

- | | |
|------------------------|---|
| Tell-show-do | : Informing then demonstrating, and finally performing part of a procedure. |
| Playful humour | : Using fun labels and suggesting use of imagination. |
| Distraction | : Ignoring and then directing attention away from a behavior, thought or feeling to something else. |
| Positive reinforcement | : Tangible or social reward in response to a desired behavior. |
| Modeling | : Providing an example or demonstration about how to do. |
| Shaping | : Successive approximations to a desired behavior. |
| Fading | : Providing external means to promote positive behavior and then gradually removing the external control. |

Systematic desensitization : Reducing anxiety by first presenting an object or situation that evokes little fear, then progressively introducing stimuli that are more fear provoking.

Communication : Use of verbal and nonverbal communication to promote positive behavior in children:

- Respect
- Show interest in the child as an individual
- Share free information
- Give well-stated instructions
- Communicate at the child's level
- Focus on the positive
- Show ethnic, cultural and gender sensitivity.

Reduction of maternal anxiety : A positive relationship between increased anxiety of the mother and negative behavior of the child. Attempts by the dentist should be made to reduce the maternal anxiety prior to the child's first dental clinic visit.

Dental Child Patient Management by Domain

There are five basic domains for securing the cooperation of children during the dental experience.

Physical Domain

The physical domain has proven to be useful in treating emergencies on hysterical children and children who cannot be reached in language because of their age.

- The physical domain ranges from the use of hand restraint by a dental assistant to the use of tools such as—
 - Papoose board.
 - Pedi-wrap
 - Tape, sheets with tape
 - Cloth wraps and belts
 - Mouth props.
- The use of methods in the physical domain necessitates explanations to parents, guardians, or caretakers.

Illustration

The use of a papoose board on a normal child demands informed consent.

Pharmacological Domain

This domain include modalities as safe and easy to deliver as nitrous oxide/oxygen to the profound management provided by general anesthesia in a hospital setting. The smaller the child, the more dramatic the danger; again this domain requires parental understanding about the techniques.

Aversive Domain

A technique can be described as aversive if use of the technique on a child is objectionable enough that the child will cooperate in order to avoid the technique.

Hand-over-mouth exercise (HOME) is regarded as aversive technique.

Reward-oriented Domain

Reward can be used to secure the cooperation of child.

Note: Parents must not promise things like ice-cream or toys as a reward for going to the dentist before the dental appointment. The child may misread the intention of parents concluding that dental appointment would be difficult.

Linguistic Domain

- Linguistic techniques are those communication techniques that involve the conversation of the dentist with the child and the child with the dentist.
- The linguistic domain demands that the dentist be a communicator. The dentist will be a teacher, a coach, a rewarder, a psychologist, a distracter and an authority figure when using linguistic techniques.

PHARMACOLOGICAL APPROACH

Local Anesthesia

Successful local anesthesia depends on—

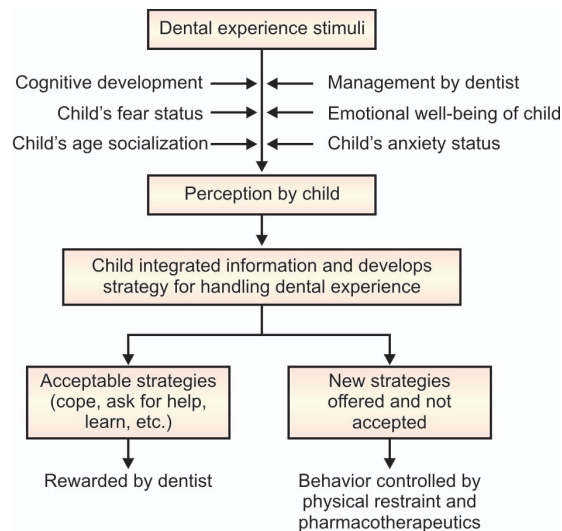
- Communication with the child.
- Good topical anesthesia, allowing adequate time for it to act.
- Slow injection of warm solution.
- Avoid direct palatal injections—Inject through the interdental papilla after adequate buccal infiltration.

2 percent lignocaine = 20 mg/ml

2.2 ml/carpule = 44 mg/carpule

A 20 kg child (approximately 5-year-old) can tolerate a maximum dose of 2 percent lignocaine with vasoconstrictor of :

$7 \text{ mg/kg} \times 20 \text{ kg} = 140 \text{ mg}$ equivalent of 3 carpules (6.6 ml).



Relative Analgesia (Nitrous Oxide Sedation)

Nitrous oxide sedation is of great benefit in relieving anxiety. It works well on children who are anxious but cooperative. An uncooperative child will often not allow the mask to be placed over the nose. It also requires a child of sufficient age to understand what is happening during the procedure.

A trial appointment in order to estimate the correct dosage is beneficial. The use of nitrous oxide sedation undoubtedly offers the clinician working with children a very safe and relatively easy-to-use adjunct to clinical care.

The long-term objective in using relative analgesia is to not have to use it at all ! Through careful and thoughtful behavior management its use can eventually cease, leaving a cooperative child patient coping well with their dental care.

Contraindications

- Upper airways obstructions
- Children with psychoses
- Obstructive pulmonary disease

Conscious Sedation

The term “conscious sedation” is often used where verbal communication is maintained with the child as an indicator of an adequate level of consciousness and maintenance of protective reflexes. In reality, conscious sedation, deep sedation and general anesthesia are a continuum, and it is very easy to proceed from one level to another, especially using intravenous medications.

It is essential in this situation to use appropriate monitoring such as pulse oximetry, and personnel and resuscitation equipment should be available.

Pharmacological Agents may be Administered Orally, Nasally or Rectally

If facilities for general anaesthesia are not available, the following agents may be used beneficially.

Midazolam (Short-acting benzodiazepine)

- Oral or rectal—0.2-0.5 mg/kg.
- Intranasal—0.25 mg/kg
- Intravenous—0.05-0.2 mg/kg.

Diazepam (long-acting benzodiazepine)

Intravenously, rectally or orally—0.25 to 0.5 mg/kg.

Fentanyl: A narcotic for short procedures, such as the extraction of a single tooth or suturing of a laceration, fentanyl may be useful analgesic.

Intravenous: 0.5-1 µg/kg.

General Anesthesia

Nonemergency general anesthesia

- The need for general anesthesia represents the clinician's final solution to a child's dental problem. In most instances, a caring attitude in association with a period of familiarization will allow the child to be treated conservatively.
- The clinician must be certain about the need for the dental work that is planned; when deciding to use a general anesthetic, the clinician must look at the whole picture—
 - A. What is the dental condition?
 - Is there gross dental caries?
 - B. Does the child have a facial swelling?
 - Is the child in pain?
 - C. Is the treatment absolutely necessary?
 - D. Could the patient be managed more conservatively?
 - Has the child undergone a period of familiarization?
 - Has there been a history of emotional trauma associated with the dental environment?

Certain clinical situations automatically indicate the need of a general anesthesia

- Multiple carious and abscessed teeth in very young children
- Severe facial cellulitis
- *Facial trauma*
 - Often it is necessary for the patient to have several routine visits before the clinician can be sure that the dental work needs to be done, such visits allow assessment of whether the child's behavior precludes satisfactory completion of the work.
 - In many instances, parents prevail upon the clinician to arrange general anaesthesia as soon

as possible; this must be avoided because it is usually for the parents' convenience, not the child's benefit. The child must have a sensible treatment plan arranged.

After seeing the child several times, the clinician feels that the child needs dental work but is if manageable a general anesthetic should be considered.

Consent for Treatment

Consent for Children less than 14-year-old

In children under 14 years of age a "consent of minor" form is completed. The parents or guardian must sign the form and a third party, usually the dentist, must witness the signature.

Consent of Children 14-16 Years of Age

Children aged 14-16 years must give their consent for the treatment to be performed. A "responsible informed child" can give this consent.

Consent Over 16 Years

A patient aged 16 years and over must consent for their own treatment and a consent for adult form used.

Basics in Managing Children in the Dental Experience

Preappointment Experience

- The preappointment experience entails bringing the child to the dental office for a tour and orientation. The child is made aware beforehand that absolutely nothing will be done that day.
- The child meets the receptionist, dental assistant and dentist, if things go well certain dental

equipments can be shown and explained in such a way—

“Mr Wind and Mr Water” for the Triplex or “Mr Buzzer” for the handpiece.

- The preappointment experience provides two offerings that make it powerful for the dentist—*First*, it eliminates for the child any unfavourable imagining as to the realities of the dental office and its personnel.

Secondly, linguistically, the experience sets up a greater likelihood that the requests of the dentist at the first real appointment will be objectively dealt with by appropriate promises of action by the child.

Tell-Show-Do

- The tell-show-do method is the backbone of the educational phase of developing an accepting relaxed child dental patient.
- The technique dictates that before doing anything (except the injection of a local anaesthetic or other procedures that defy explanation; such as pulp extirpation), the child be told what will be done and then shown by some sort of stimulation exactly what will happen before the procedure is started.

Illustration

John; I am going to clean your teeth with this special dental toothbrush (prophy angle and rubber cup). You see this soft rubber cup?

Well, when I step on this gas pedal this cup turns; and when it is full of tooth paste it can really make your teeth shine.

Now, John, pinch the cup and you will see how soft it is. Now, let me run it on your fingernail so you can feel how it works.

Okay, John, please open your mouth for me.
Thank you.

Voice Control

- Voice control requires the dentist to interact more as authority into his or her communication with the child.
- The tone of voice is important; it must have an “I am in charge here”. The facial expression of the dentist must also mirror this attitude of confidence.
- Voice control is a useful way of reframing a request that has been refused by the child.
- As a purely linguistic technique, voice control relies on tonality, cadence, and other aspects of the quality of the dentist's communication with the child.

Hand-Over-Mouth Exercise (HOME)

- The HOME technique calls for the dentist to place a hand over the mouth of a hysterically crying child; it is used to intercept tantrums or other fits of rage; it has to paired with voice control (Fig. 18.1).

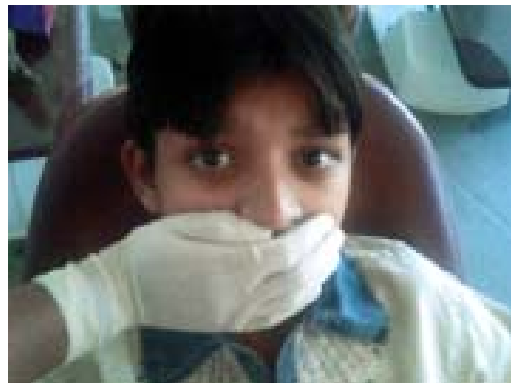


Fig. 18.1: Hand-over-mouth exercise

- The technique is not intended to scare the child; it is intended to get the child's attention and quiet the child so that he or she can hear the dentist what the dentist is saying?
- Obviously, it reframes the seriousness of a previous request. The practice of HOME requires informed consent.

Contraindications to this technique

- Disabled, immature, or medicated children whose understanding of the desires of the dentist is compromised.
- Prevention of the child from breathing is a second basic contraindication.

Physical Restraint

Physical restraint is its own domain, however, the touching of a child's hands during the injection procedure by a dental assistant, stabilization of a leg that was starting to lift from the chair by a dental

assistant, or stabilization of a shoulder by a dentist as a child starts to roll over.

Ontologic Coaching

Physical restraining when paired with language, becomes part of the entire linguistic management of the child this is called ontologic coaching.

Praise and Communication

Praise and communication are self-explanatory. All people, including children, react favourably to praise; furthermore, effective dentistry for children means effective communication of the dentist with the child and *vice versa*. Both allow for distraction of the anxious child language obviously needs to be age appropriate.

Praise and effective communication combined with tell-show-do form an unbeatable linguistic combination for managing the dental experience for the majority of children three years or older.

Chapter 19

Care of Special Child (Handicapped Child)

HANDICAPPED PERSON

The World Health Organization has defined a handicapped person as one who over an appreciable period is prevented by physical or mental conditions from full participation in the normal activities of their age groups including those of a social, recreational, educational and vocational nature.

CLASSIFICATIONS

A. Frank and Winter classified handicapped as—

- Blind or partially sighted
- Deaf or partially deaf
- Educationally subnormal
- Epileptic
- Maladjusted
- Physically handicapped
- Defective of speech
- Senile

B. Nowak classified handicap in nine categories—

1. Convulsive disorder – Epilepsy
2. Systemic disorders – Hypothyroidism

3. Metabolic disorder – Hemophilia
4. Malignant disorder – Anemia
5. Congenital defects – von Willebrand disease
6. Mentally handicapped – Diabetes mellitus
7. Communication disorders – Leukemia
8. Osseous disorders – Congenital heart diseases
9. Physically handicapped – Cleft lip and palate
- Mental retardation
- Deafness
- Blindness
- Autism
- Rickets
- Osteopetrosis
- Poliomyelitis
- Scoliosis

Following Nowak Classification : we shall discuss the following conditions:

CONVULSIVE DISORDER: EPILEPSY

Medical problem : Seizure disorder.

Potential Problem Related to Dental Care

- Occurrence of generalized tonic-clonic seizure in dental office.
- Drug-induced leukopenia and thrombocytopenia (phenytoin, carbamazepine, valproic acid).

Prevention of Complications

- Identification of epileptic patient by history:
 - Type of seizure
 - Age at time of onset
 - Cause of seizures
 - Medications
 - Regularity of physician visits
 - Degree of control
 - Frequency of seizures, last seizure
 - Precipitating factors.
- *History of seizure:* Related injuries
- *Well-controlled:* Provide normal care
- *Poorly controlled:* Consult with physician : may require medication change
- Be alert to adverse effects of anticonvulsants.

Treatment Plan Modification

- Maintenance of optimum oral hygiene
- Surgical reduction of gingival hyperplasia if indicated.
- Replace missing teeth with fixed prosthesis as opposed to removable
- Choose metal over porcelain when possible.

Oral Complications

- Gingival hyperplasia secondary to phenytoin (Dilantin)
- Traumatic oral injuries.

Emergency Care

(Follow normal recommendations)

When the seizure occurs in dental office; the dental chair is lowered to supine position.

- The dentist has to protect the child from injuring himself/herself; a mouth prop of rubber or plastic must be inserted into oral cavity to prevent tongue biting.
- Use of suction is important in preventing aspiration of secretions in any case if this is not possible the head of child must be turned to the side.
- Maintain a patent airway.
- Give oxygen.
- In severe case; where the convulsions do not stop within few minutes; then administer diazepam (1 mg/kg) intravenously slowly upto 10 mg.
- If condition is unmanageable; consult physician admit to hospital.

SYSTEMIC DISORDERS

Hypothyroidism

Potential Problem Related to Dental Care

- Untreated patients with severe hypothyroidism exposed to stressful situations such as trauma, surgical procedures or infection may develop hypothyroid (myxoedema) coma.
- Untreated hypothyroid patients may be very sensitive to actions of narcotics, barbiturates.

Prevention of Complications

- Detection and referral of patients suspected of being hypothyroid for medical evaluation and treatment.

- Avoidance of narcotics, barbiturates and tranquilizers in untreated hypothyroid patients.
- Recognition of initial stage of hypothyroid (myxedema) coma:
 - Hypothermia
 - Bradycardia
 - Hypotension
 - Epileptic seizures.
- Start immediate treatment of myxoedema coma
 - Seek immediate medical aid
 - Hydrocortisone (100-300 mg)
 - CPR as indicated.

Treatment Plan Modifications

- In hypothyroid patients under good medical management, any indicated dental treatment.
- In patients with congenital form of disease and severe mental retardation, assistance with hygiene procedures may be needed.

Oral Complications

- Increased in tongue size
- Delayed eruption of teeth
- Malocclusion
- Gingival edema.

Emergency Care

- Untreated hypothyroid patients
 - Control of pain with nonnarcotic analgesics
 - Avoid precipitation of hypothyroid coma in patients with severe hypothyroidism, thus avoid surgical procedures and treat acute oral infection by conservative measures.
- Patients under good medical management render whatever emergency care is indicated.

Hyperthyroidism (Thyrotoxicosis)

Potential problem related to dental care

- Thyrotoxic crisis (thyroid storm) may be precipitated in untreated or incompletely treated patients with thyrotoxicosis by:
 - Infection
 - Trauma
 - Surgical procedures
 - Stress.
- Patients with untreated or incompletely treated thyrotoxicosis may be very sensitive to action of epinephrine and other pressor amines, thus these agents must not be used; one patient is well-managed from medical stand point; these agents can be resumed.
- Thyrotoxicosis increases risk for hypertension, angina, MI, congestive heart failure, and severe arrhythmias.

Prevention of Complications

- Detection of patients with thyrotoxicosis by history and examination findings.
- Referral for medical evaluation and treatment.
- Avoidance of any dental treatment for patient with thyrotoxicosis until under good medical control. However, any acute oral infection will have to be dealt with by antibiotic therapy and other conservative measures to prevent development of thyrotoxic crisis; suggest consultation with patient's physician during management of acute oral infection.
- Avoidance of epinephrine and other pressor amines in untreated or incompletely treated patient.

- Recognition of early stages of thyrotoxic crisis
 - Severe symptoms of thyrotoxicosis
 - Febrile
 - Abdominal pain
 - Delirious, obtunded or psychotic
- Initiate immediate emergency treatment procedures:
 - Seek immediate medical aid
 - Cool with cold towels
 - Hydrocortisone (100-300 mg)
 - Monitor vital signs
 - Start CPR if needed.

Treatment Plan Modifications

- Once under good medical management; patient may receive any indicated dental treatment.
- If acute infection occurs, physician should be consulted concerning management.

Oral Complications

- Osteoporosis may occur
- Periodontal disease may be more progressive
- Dental caries may be more extensive
- Premature loss of deciduous teeth and early eruption of permanent teeth.
- Early jaw development
- Tumor found in midline of posterior dorsum of tongue must not be surgically removed until possibility of functional thyroid tissue has been ruled out by ^{131}I uptake test.

Emergency Care

1. *Thyrotoxic patients—Conservative treatment:* Antibiotics for infection, analgesics for pain, consultation with physician.

2. *Patients under good medical management:* Emergency dental care as indicated; however ; if problem involves acute infection, consult with patient's physician.

Hemophilia

Medical problem: Congenital disorders of coagulation.
Potential problem related to dental care: Excessive bleeding following dental procedures.

Prevention of Complications

1. *Identification of patient:*
 - *History:* Bleeding problems in relatives, excessive bleeding following trauma or surgery.
 - *Examination finding*
 - Ecchymosis
 - Hemarthrosis
 - Dissecting hematomas.
 - *Screening tests:* Prothrombin time (normal)
 - Activated partial thromboplastin time (prolonged)
 - Bleeding time (normal)
 - Thrombin time (normal).
2. Consultation and referral for diagnosis and treatment and for preparation before dental procedures.
3. *Replacement Options:*
 - Cryoprecipitate
 - Fresh frozen plasma
 - Factor VIII concentrates.
 - Heat-treated concentrates
 - Purified factor VIII
 - Recombinant factor VIII.

4. *Mild and moderate factor VIII deficiency:*
 - 1-desamino-8-darginine vasopressin (DDAVP)
 - Epsilon-amino caproic acid (EACA)
 - Tranexamic acid
 - Fibrin glue
 - Factor VIII replacement for some cases.
5. *Severe factor VIII deficiency:*
 - Agents used in (4) above
 - Higher dose (s) factor VIII
6. *Stable level of inhibitors:*
 - Agents used in (4) above
 - Very high dose (s) factor VIII
7. *Inducible inhibitors:*
 - No elective surgery
 - Agents used in (4) above
 - High doses of porcine factor VIII concentrate
 - Nonactivated prothrombin-complex concentrate
 - Activated prothrombin-complex concentrate
 - Plasmapheresis
8. May be treated on outpatient basis depending on results of consultation (mild to moderate deficiency; no inhibitors).
9. Local measures for control of bleeding splint, thrombin, microfibrillar collagen, etc.
10. Prophylactic antibiotics to prevent postoperative infection in surgical cases can be considered.
11. Avoid aspirin, aspirin containing compounds, and NSAIDs.

Treatment Plan Modification

- No dental procedures unless patient has been prepared based on consultation with hematologist.

- Avoid aspirin, aspirin-containing compounds and NSAIDs-use acetaminophen (Tylenol) with or without codeine.

Oral Complications

- Spontaneous bleeding
- Prolonged bleeding following dental procedures that injure soft tissue or bone
- Petechiae
- Hematomas
- Oral lesions associated with HIV infection in patient who receive infected replacement products.

Emergency Care

- Conservative management of infection and pain, if possible, otherwise, patient must be prepared for surgery (cryoprecipitate, fresh frozen plasma, factor VIII concentrates, desmopressin, epsilon-amino-caproic acid, tranexamic acid).
- Avoid aspirin, aspirin-containing compounds and NSAIDs.

von Willebrand's Disease

Potential Problem Related to Dental Care:

Excessive bleeding following invasive dental procedures.

Prevention of Complications

1. Identification of patients
 - History of bleeding problems in relatives and of excessive bleeding following surgery or trauma, etc.
 - Examination findings
 - Petechiae
 - Hematomas

- Screening tests
 - Prolonged bleeding time
 - Possible prolonged partial thromboplastin time.
- 2. Consultation and referral for diagnosis and treatment and preparation before dental procedures.
- 3. Type I and many type II cases.
 - DDAVP
 - Local measures in (6) below.
- 4. Type III and some type II patients
 - Fresh frozen plasma.
 - Cryoprecipitate
 - Special factor VIII concentrates
 - Local measures in 6 below.
- 5. Local measures for control of bleeding
 - Splints
 - Gel foam with thrombin
 - Oxygel, surgical
- 6. Prophylactic antibiotics to prevent postoperative infection in surgical cases can be considered.
- 7. Avoid aspirin, aspirin-containing compounds, and NSAIDs.

Treatment Plan Modification

No invasive dental procedures, unless patient has been prepared based on consultation with hematologist.

Oral complications

- Spontaneous bleeding
- Prolonged bleeding following dental procedures that injure soft tissue or bone.
- Petechiae
- Hematomas.

Emergency care

Conservative management of infection and pain, if possible otherwise patient must be prepared for surgery (fresh frozen plasma or cryoprecipitate).

Anemia

Iron Deficiency Anemia

Potential Problem Related to Dental Care:

In rare cases severe leukopenia and thrombocytopenia may result in problems like infection and excessive loss of blood.

Prevention of Complications:

- Detection and referral for diagnosis and treatment.
- In females most cases will be caused by physiologic process—menstruation or pregnancy.
- In males most cases will be secondary to underlying disease—peptic ulcer, carcinoma of colon, etc.

G-6-PD Deficiency

Potential problem related to dental care—Accelerated hemolysis of red blood cells.

Prevention of Complications:

- Control infection.
- Avoid drugs containing certain antibiotics, aspirin, acetaminophen.
- These patients often have increased sensitivity to sulfa drugs, aspirin, chloramphenicol.

Treatment Plan Modification: Usually none.

Oral Complication of G-6-PD Deficiency are Usually None

Oral Complications of Iron Deficiency Anemia:

- Paresthesia
- Loss of papillae from tongue
- In rare cases infection and bleeding complications
- Patients with dysphagia seem to have increased incidence of carcinoma of oral and pharyngeal area (Plummer-Vinson syndrome).

Emergency Care:

- Iron deficiency anemia: Usually as indicated (white blood cell count and platelet status should be checked)
- G-6-PD deficiency: As indicated, unless patients having hemolytic crises; then conservative control of pain and infection.

Pernicious Anemia*Potential Problem Related to Dental Care:*

- Infection
- Bleeding
- Delayed healing

Prevention of Complication: Detection and medical treatment (early detection and treatment can prevent permanent neurologic damage)

Treatment Plan Modification: None once patient is under medical care.

Oral Complications: Paresthesia of oral tissues (Burning, Tingling, Numbness)

- Delayed healing (severe cases), infection, red tongue, angular cheilosis.
- Petechial hemorrhages.

Emergency Care: Usually can be rendered without complications, in-patient suspected of having pernicious anemia, suggest conservative treatment until medical diagnosis and therapy established.

Sickle Cell Anemia

Potential Problem Related to Dental Care: Sickle cell crisis.

Prevention of Complications:

- Avoidance of any procedure that would produce acidosis or hypoxia.

• *Drug considerations:*

- Avoid excessive use of barbiturates and narcotics as suppression of respiratory center can occur, leading to acidosis, which can precipitate acute crises.
 - Avoid excessive use of salicylates as "acidosis" may result, again leading to possible acute crisis; codeine and acetaminophen in moderate dosage can be used for pain control.
 - Avoid use of general anesthesia, as hypoxia can lead to precipitation of acute crises.
 - Nitrous oxide may be used, provided 50 percent oxygen is supplied at all times; critical to avoid diffusion hypoxia at termination of nitrous oxide administration.
 - For non-surgical procedures use local anaesthetic without vasoconstrictor. For surgical procedures use 1:100,000 epinephrine in anesthetic solution.
 - Aspirate before injecting.
 - Inject slowly.
 - Use no more than two cartridges.
- Must avoid infection, if infections does occur, treat in aggressive manner—
 - Heat
 - Incise and Drain
 - Antibiotics
 - Corrective treatment: extraction, pulpectomy, etc.
 - Avoid dehydration is patients with infection or patient receiving surgical treatment.

Treatment Plan Modifications

Usually none unless symptoms of severe anemia present, and then only urgent dental needs should be met.

Oral Complications

- Osteoporosis
- Loss of trabecular pattern
- Delayed eruption of teeth
- Hypoplasia of teeth
- Pallor of oral mucosa

Emergency Care

- As indicated unless crisis present then conservative control of pain (with drugs) and infection (with antibiotics)
- Treat infection in aggressive manner
- Avoid dehydration
- Avoid excessive use of barbiturates and narcotics
- Avoid excessive use of salicylates
- Avoid use of general anesthesia
- Moderate doses of codeine and acetaminophen can be used for pain control
- Use only small concentration of epinephrine (1:100,000) in local anesthetic—
 - Aspirate before injecting
 - Inject slowly
 - No more than 2 cartridges.

METABOLIC DISORDER

Diabetes Mellitus

Potential Problem Related to Dental Care

- In uncontrolled diabetic patients
 - Infection
 - Poor wound healing.
- In patients treated with insulin, insulin reaction.
- In diabetic patient, early onset of complications relating to cardiovascular system, eyes, kidneys and nervous system (angina, myocardial infarction,

cerebrovascular accident, renal failure, peripheral neuropathy, blindness, hypertension, congestive heart failure).

Prevention of Complications

- Detection by
 - History
 - Clinical findings
 - Screening blood glucose level.
- Referral for diagnosis and treatment
- Monitor and control hyperglycemia.
- Patient receiving insulin — prevent insulin reaction
 - Advice eating normal meals before appointments
 - Schedule appointments in morning
 - Advice them to inform you of any symptoms of insulin reaction when they first occur
 - Have sugar in some form to give in case of insulin reaction.
- Diabetic patients being treated with insulin who develop oral infection may require increase in insulin dosage, consult with physician in addition to aggressive local and systemic management of infection. (Including antibiotic sensitivity testing).
- Drug considerations
 - Hypoglycemic agents-on rare occasions aplastic anemia, etc.
 - In severe diabetics, avoid general anesthesia.

Treatment Plan Modifications

In well-controlled diabetic patients, no alteration of treatment plan is indicated unless complication of diabetes present such as:

- Hypertension
- Congestive heart failure

- Myocardial infarction
- Angina
- Renal failure.

Oral Complications:

- Accelerated periodontal disease
- Periodontal abscesses
- Xerostomia
- Poor healing
- Infection
- Oral ulcerations
- Candidiasis
- Mucormycosis
- Numbness, burning, or pain in oral tissues.

Emergency Care

- Patients with acute infection; physician should increase insulin dosage if possible, obtain sample of exudates and have antibiotic sensitivity testing performed then start penicillin therapy, if clinical response is poor, laboratory data can be used to select more effective antibiotic.
- Patient with diabetes not under medical treatment—referral and consultation is necessary so diabetes can be brought under control.
- In general, other emergency problems can be dealt with as in normal patients.

MALIGNANT DISORDER**Leukemia****Potential Problem Related to Dental Care**

- Prolonged bleeding
- Infection
- Delayed healing.

Prevention of Complications

- Detection and referral for diagnosis and treatment
- Determination of platelet status on day of any surgical procedure, including scaling of teeth, bleeding time is within normal range, proceed; if not, postpone procedure (platelet count less than 80,000 mm³)
- Avoidance of postoperative infection and osteoradionecrosis by prophylactic use of antibiotics can be considered, modification of regimen for prevention of endocarditis can be used following medical consultation:
 - a. Most situations
 - Give 2 gm penicillin V, orally at least 30 min before procedure.
 - Give 500 mg penicillin V, orally, every 6 hours for remaining part of appointment day.
 - b. Give 1 gm of cephalexin 1 hour before procedure, followed by 250 mg cephalexin, every 6 hours for 1 week.
 - c. For patients allergic to penicillin—
 - Give 300 mg of clindamycin orally 1 hour before procedure. 150 mg every 6 hours for the following 3 to 7 days.
 - Give 500mg of erythromycin, orally, every 6 hours for following 2–5 days.
 - d. Based on special conditions of medical consultation, other agents, dosage and durations of treatment may be indicated.

Treatment Plan Modifications

- During acute stages of disease avoidance of dental care of any kind if at all possible.
- When patient is in state of remission, all active dental disease should be treated and patient placed on good oral hygiene maintenance program.

- Avoidance of long, drawn-out dental procedures.
- Complex restorative procedures usually not indicated for patients with poor prognosis.

Oral Complications

- Infection
- Ulceration
- Gingival bleeding
- Ecchymosis
- Petechiae
- Gingival hyperplasia
- Soft tissue and osseous lesions
- Paresthesias—numbness, burning, tingling
- Candidiasis
- Lymphadenopathy.

Emergency Care

- Conservative; otherwise antibiotic sensitivity testing should be considered, antibiotics for infection, strong analgesics for pain.
- Drainage through pulp chamber rather than extraction.

CONGENITAL DEFECTS

Congenital Heart Diseases

Potential Problem Related to Dental Care

- Infective endocarditis
- Infective endarteritis
- Prolonged bleeding following scaling or surgical procedures, bleeding problem may be present in patients with right-to-left shunting of blood caused by :
 - Thrombocytopenia

- Lack of coagulation factor as result of thrombosis in small vessels.
- Anticoagulation medication used to prevent thrombosis.
- Infection, leukopenia may be present in patients with right to left shunting of blood.
- *Congestive heart failure:*
 - Infection
 - Cardiac arrest
 - Cardiac dysrhythmias
 - Breathing difficulties (caused by pulmonary edema)

Prevention of Complications

- Detection by history and examination findings.
- Referral for medical diagnosis and treatment.
- Consultation with physician before any dental treatment is performed.
- Prophylactic antibiotic coverage before and after any dental procedure.
- Prophylactic antibiotic coverage before and after any dental procedure—
 - Amoxicillin 50 mg/kg : orally 1 hour before procedure, then half initial dose 6 hours later. Children less than 15 kg (33 lb): initial dose, 750 mg amoxicillin. Children 15 – 30 kg (33 to 66 lb): initial dose, 1500 mg amoxicillin. Children over 30 kg (66 lb): initial dose 3000 mg amoxicillin. Given 1 hour before procedure followed 6 hours later with half initial dose.
 - Child patients allergic to penicillin/ amoxicillin. Erythromycin ethylsuccinate or stearte 20 mg/kg 1 hour before procedure then half dose 6 hour after intial dose.

- Child patients allergic to penicillin and intolerant to erythromycin. Clindamycin 10 mg/kg 1 hour before procedure then half dose 6 hours after initial dose.
- Avoidance of dehydration in patients with oral infection.
- Bleeding time and prothrombin time tested before any surgical procedure; consultation with physician if prolonged.
- White blood cell count, if very low antibiotics may be indicated for surgical procedures: consult with physician to determine the need.

Treatment Plan Modification

- Pulpotomy is contraindicated in these patients because of the possibility of subsequent bacteraemias.
- Coordination of treatment, it is often better to treat a child with many carious teeth under general anesthesia and complete all the work in one session. This removes the need to change antibiotics or to wait 1 month between visits. If a child is undergoing anesthesia for other medical procedures try to coordinate the dental work to be performed at the same time.
- Vasoconstrictors: There is no contraindication to the use of vasoconstrictors in local anesthetics.

Oral Complications

- | | |
|------------------------|---------------------|
| (i) Cyanosis | – blue color |
| (ii) Polycythemia | – ruddy color |
| (iii) Thrombocytopenia | – small hemorrhages |
| (iv) Leukopenia | – Infection |

Emergency Care

- *Asymptomatic patients:* As indicated but protect against infective endocarditis or endarteritis.
- *Symptomatic patients:*
 - Consultation with physician before any treatment
 - Analgesics for pain—avoid aspirin, aspirin-containing compounds and NSAIDs, use acetaminophen with or without codein.
 - Antibiotics for infection
 - Avoidance of dehydration in patient with acute infection
 - Patient may have bleeding problem, in such case surgery should be avoided.

Cleft Lip and Palate (Fig. 19.1)

Cleft Lip: The abnormalities in cleft lip are the direct consequence of disruption of the muscles of the upper lip and nasolabial region.

Cleft Palate: Cleft palate results in failure of fusion of the two palatine shelves. This failure may be confined to the soft palate alone or involve both hard and soft palate.

- When the cleft of the hard palate remains attached to the nasal septum and vomer the cleft is termed incomplete.
- When the nasal septum and vomer are completely separated from the palatine processes the cleft is termed complete.

Primary Management

Antenatal Diagnosis

- Antenatal diagnosis of cleft lip, whether unilateral or bilateral is possible by ultrasound scan after 18



Fig. 19.1: Cleft lip and palate

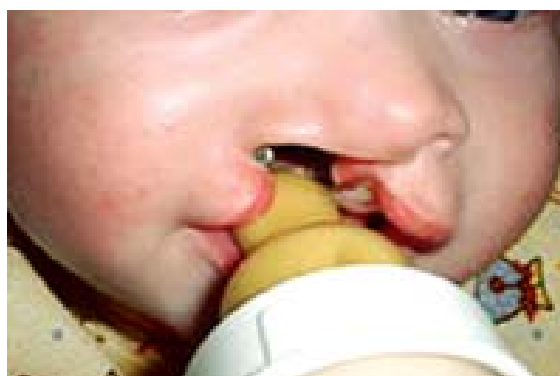


Fig. 19.2: Upright feeding of baby by customized bottle

weeks of gestation, isolated cleft palate cannot be diagnosed on an antenatal scan. When antenatal diagnosis is confirmed, referral to a cleft surgeon is appropriate for counselling to allay fears.

- Photographs of cleft lip shown to parents before surgery.
- Major respiratory obstruction is uncommon and occur exclusively in babies with Pierre Robin sequence; Hypoxic episodes during sleep and feeding can be life-threatening.

Intermittent airway obstruction is more frequent and managed by nursing the baby prone with the use of customized bottle (Fig. 19.2).

- More severe and persistent airway compromise can be managed by “retained nasopharyngeal intubations” to maintain the airway.
- Surgical adhesion of the tongue to lower lip labioglossopexy in the first few days after birth is an alternative but less commonly practiced method of management.

Surgical Techniques

There have been many different surgical techniques and sequences advocated in cleft lip and palate management.

Cleft lip repair is commonly performed between 3 and 6 months of age.

Cleft palate repair is frequently performed between 6-18 months.

The frequently used techniques are—

- (A) Rose-Thompson repair
- (B) Quadrangular flap repair
- (C) Triangular flap repair (Tennison Randall)
- (D) Rotation-advancement repair (Millard)
- (E) Mohler modification of rotation-advancement repair

Cleft lip surgery (Fig. 19.3)

- Skin incisions are developed to restore displaced tissues including skin and cartilage to their normal

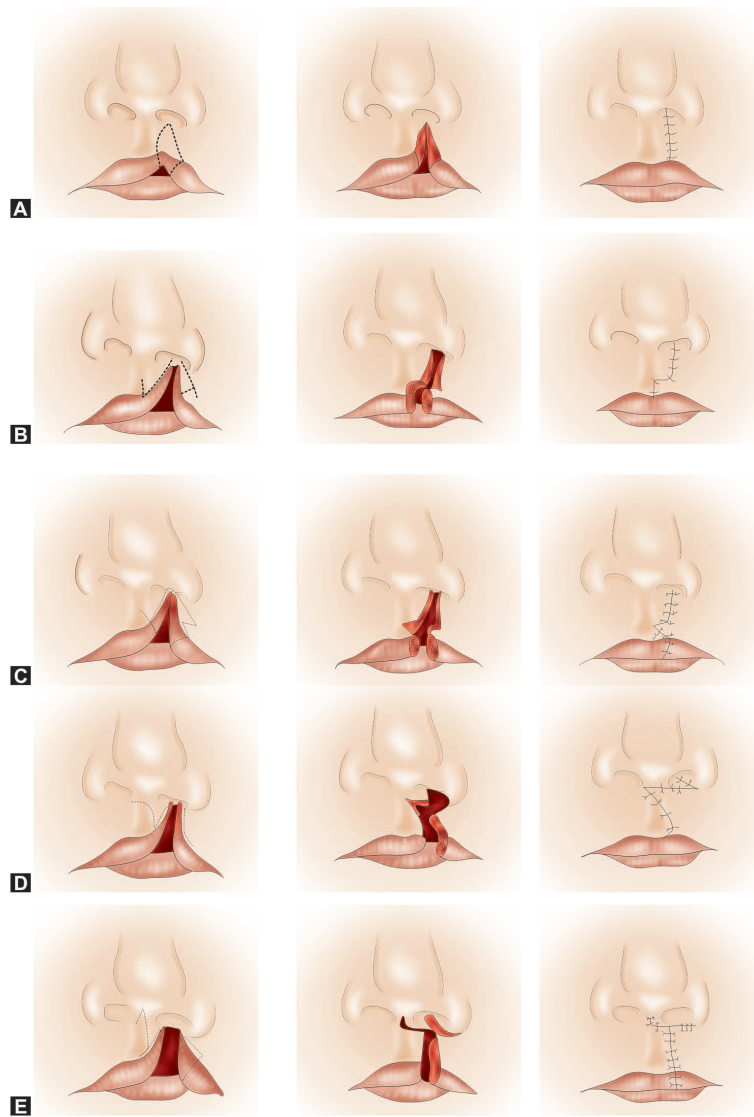


Fig. 19.3: (A) Rose-Thompson repair (B) Quadrangular flap repair (Hagedorn, LeMesurier). (C) Triangular flap repair (Tennison, Randall), (D) Rotation-advancement repair (Millard). (E) Mohler modification of rotation-advancement repair

position to gain access to the facial, nasal and lip musculature.

- Muscular continuity is achieved by subperiosteal undermining over the anterior maxilla.
- Nasolabial muscles are anchored to the premaxilla with nonresorbable sutures.
- Oblique muscles of Orbicularis Oris are sutured to the base of the anterior nasal spine and cartilaginous nasal septum.
- Closure of the cleft lip is completed by suturing the horizontal fibres of orbicularis oris to achieve functioning oral sphincter.

Cleft Palate Surgery

- Cleft palate closure can be achieved by palatoplasty.
- The surgical principle is mobilization and construction of the aberrant soft palate musculature together with closure of the residual hard palate cleft by minimal dissection and subsequent scar formation.
- Excess scar formation in the palate adversely affects growth and development of the maxilla.

Techniques to Close a Cleft Palate

There are a multitude of techniques to close a cleft palate and promote normal function. However, generally techniques can be divided into the types of flaps that are used—

- (a) Bipedicicle flaps—Von Langenbeck's repair
- (b) Anteriorly based on a single pedicle of the greater palatine vessels—proposed by Bardach
- (c) Four flap palatal closure—A Veau-Wardill-Kilner
- (d) Recent advance in palate repair—Furlow's or double-opposing Z-plasty.

Secondary Management

Following primary surgery, regular review by a multidisciplinary team is essential, many aspects of cleft care requires long-term review—

Hearing

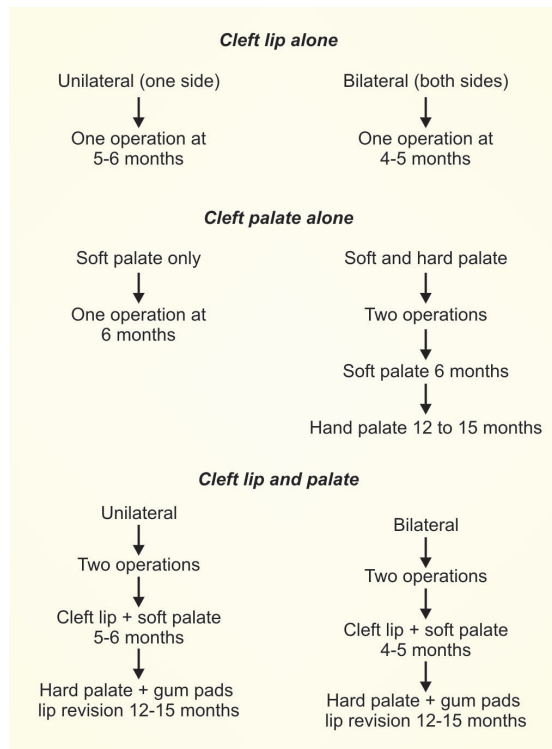
- Eustachian tube dysfunction plays a central role in the pathogenesis of otitis media with effusion babies and children born with a cleft palate.
- It has been recently recognized that child with a craniofacial anomaly including cleft lip and palate is at increasing risk of a sensorineural hearing defect.
- All children born with a cleft lip and palate should undergo assessment before 12 months of age for sensorineural and conductive hearing loss by auditory brainstem responses (ABR) and tympanometry respectively.
- Sensorineural hearing loss is managed with a hearing aid.
- Early (6-12 months old) prophylactic myringotomy and grommet temporarily eliminates middle ear infection.

Speech

Initial speech assessment should be performed early (18 months) and repeated regularly to ensure that problems are identified early and managed appropriately.

Common speech problems associated with cleft lip and palate are:

- (a) *Velopharyngeal incompetence*: This is associated with increased nasal airflow of resonance producing a nasal or 'hypernasal' quality of speech, it frequently reflects poor function of soft palate associated with inadequate muscle repair.

Timing of primary cleft lip and palate procedures

(b) *Articulation problem*: These either arise as a compensatory mechanism to overcome velopharyngeal incompetence or, less commonly, are due to few dental and occlusal abnormalities.

Investigated by:

- Videofluoroscopy
- Nasal airflow studies (aerophonoscopy)
- Nasendoscopy.

Speech problems are managed by:

- Speech and language therapy

- Secondary palatal surgery
 - Intravelar veloplasty (muscular reconstruction of soft palate)
 - Pharyngoplasty.
- Speech-training devices.

Dental

Dental anomalies are common findings in children with cleft lip and/ or palate.

Various anomalies are (occurs at region of left alveolus)

- Delayed eruption of teeth
- Morphological abnormalities are well-documented
- The number of teeth may be reduced (Hypodontia)
- The number of teeth may be increased (Hyperdontia).

Abnormalities can occur in both primary or permanent dentition.

Dental management:

- All children with cleft lip and palate should undergo regular dental examination.
- Preventive measures such as dietary advice, fluoride supplements and fissure sealants.

Orthodontic Management

Many children with cleft lip and palate require orthodontic treatment. Orthodontic treatment is commonly carried out in two phases.

- *Mixed Dentition (8-10 years)*: To expand the maxillary arch as a prelude to alveolar bone graft.
- *Permanent Dentition (14-18 years)*: To align dentition and provide a normal functioning occlusion. This phase of treatment may also

include surgical correction of malpositioned/retrusive maxilla by maxillary osteotomy.

Secondary surgery for cleft lip and palate

- Good outcome in cleft lip and palate is directly attributable to the quality of primary surgery.
- Poorly executed primary surgery leads to residual deformity of the lip, nose together with poor speech.
- Impaired growth of the midface (maxilla) is now attributed to poor and traumatic primary surgery.
- Despite adequate primary surgery, residual problems do occur and are managed with appropriate secondary procedures.

Timing of secondary cleft procedures

<i>Secondary procedures</i>	<i>Age (year)</i>
Lip/nose revision	2-adult
Velopharyngeal surgery	3-8
Alveolar bone graft	7-11
Orthognathic surgery	16+
Rhinoplasty	16+

MENTALLY HANDICAPPED

Mental Retardation

Definition

Mental retardation is defined by American Academy of mental deficiency as—

“Significantly subaverage intellectual functioning, existing concurrently with deficit in adaptive behavior manifested during developmental period”.

Oral Complications

Mentally retarded child patients show high prevalence of caries and periodontal diseases due to overindulgence over cariogenic diet pattern and ignorance of oral hygiene.

Dental anomalies like

- Abnormalities in sequence and time of eruption of teeth
- Enamel hypoplasia
- Malocclusion
- Abnormality in number of teeth.

Treatment plan modification for special child

- The child patient's mental status must be assessed prior to any dental procedure.
- During first visit of child patient to dental office familiarize the patient to dental office, dental personnel to allay fear of unknown.
- Only single instruction must be given at a time.
- Use of simple words with gentle speed of speech is used.
- Tell-show-do approach is used with mild cases and sedation can be appropriately used with moderate cases.
- Dentist must have patience enough to listen carefully when child speaks because usually these patients have trouble with communication.
- Try keep appointments during early morning and try to finish off the dental procedures in short duration of time.
- General anesthesia may be indicated in cases where adequate level of cooperation cannot be achieved or in cases where extensive rehabilitation is required.

COMMUNICATION DISORDERS

Deafness

Oral complications

Due to learning disability and hearing impairment child patient has poor oral hygiene, hypoplastic teeth can also occur in this condition.

Treatment plan modifications

- During the first visit of a child patient; the manner of communication should be elicited along with detailed medical history.
- If the parents/guardian are allowed to remain in operatory room then parents must sit/stand in front of child to allay fear and anxiety of child.
- Start dental procedure in a warm, reassuring manner with facial expressions and smile.
- Adjust the hearing aid while using handpiece as a sounds may be amplified.
- Tell-show-do approach is considered beneficial along with this positive reinforcement modeling, behavior modifications techniques could be utilized.
- Various hearing impaired childrens are lip readers, so speak in a very slow speed with use of simple words.
- General anesthesia may be required for more serious behavioral management problems.

Blindness

A person is considered affected by blindness if the visual acuity does not exceed 20/200 in the better eyes with the correcting lenses or if visual acuity is greater than 20/200 but accompanied by a visual field of no greater than 20 degrees.

Oral Complications

- Trauma to anterior teeth occurs in greater percentage in visually impaired children as compared to children of normal population.
- Due to learning disabilities patients have poor oral hygiene.

- Increased gingival inflammation due to inability to visualize and remove plaque.
- Hypoplastic teeth.
- Child patient had a prolonged immature swallowing pattern due to reluctance to consume solid foods.

Treatment Plan Modifications

- Complete medical history along with degree of visual impairment is ascertained prior to any dental procedure.
- Explain the child patient in his/her first visit in the dental office setting, office personnel and treatment procedures before starting anything.
- Make a gentle physical contact assuring child while dental procedure.
- Dentist must make use of touch, smell and taste technique in place of TST method.
- Oral hygiene should be explained and child is guided through the procedures by the dentist along with the use of audiocassettes and Braille pamphlets.

Autism***Dental Management of the Autistic Child***

Autism was first described in 1943 by the American child psychologist, Leo Kanner. Autism is a type of neuro-developmental disorder, and usually appears within the first three year of a child's life. The hallmark of autism is the lack of communication skills. Affected children also have problems with language, behavior, and social skills.

Autism is a lifelong condition, and its cause is unknown. Environmental and genetic factors do

contribute to the development of autism, but most children with autism have normal physical health.

What is autism?

Autism is neurological disorder that appears during the first three years of life. It is pervasive developmental disorder defined behaviorally as a syndrome consisting of abnormal development of social skills, limitations in the use of interactive language, and sensorimotor defects. Autism superficially affects brain function in the areas responsible for the development of communication and social interaction skills.

Children with autism may appear normal, but the disorder may prevent them from functioning and communicating in socially appropriate ways. The incidence of autistic disorder is seven per 10,000 persons. It is more common in males than females (4:1 ratio).

The rates of caries and periodontal disease in autistic children is comparable to those in the general population.

Causes of Autism

The exact cause of autism is unknown, although it may be linked to brain injury and genetics. There are many biologic causes, but none of them are unique to autism.

Causes of autism include:

- There is a familial genetic tendency for autism. There is a 3-8 percent risk of recurrence if a family already has one autistic child.
- Fragile X syndrome.
- Tuberous sclerosis.
- Prenatal factors such as intrauterine rubella, and cytomegalic inclusion disease.

- Postnatal factors such as untreated phenylketonuria, infantile spasms, and herpes simplex encephalitis.

Signs and Symptoms of Autism

No two children affected by autism display the same behaviors or symptoms.

Early Symptoms of Autism in Infants

- A baby who doesn't babble or gesture by the age of 12 months.
- A baby who lacks eye contact with its mother by the age of 12 months.
- A baby who resists being held or cuddled by its mother.
- A baby who doesn't respond when its mother says its name.
- A baby who appears to be deaf.
- An infant who doesn't say single words by the age of 16 months.

Tips for Recognizing Children with Autism

- Autistic children will often run away from caretakers or health care workers. This activity is called elopement.
- About 50 percent of autistic children are nonverbal.
- Autistic children may appear stubborn.
- They may exhibit echolalia, or may exhibit rambling speech.
- They may exhibit unusual self-stimulating behavior including hand flapping or rocking back and forth.
- They may appear deaf or not responsive to you.
- They may not be able to answer simple questions.
- They may be sensitive to sound, bright light, odors, and touch.
- Seizures occur in 25 percent of autistic children.

Diagnosis of Autism

Experienced clinicians can reliably diagnose autism in children younger than three years of age. The typical presenting symptoms of autistic disorder are delayed speech, or challenging behaviour before the age three.

Indications for Formal Development Evaluation

- No babbling, pointing, or other gestures by age 12 months.
- No single words by 16 months of age.
- No two-word spontaneous phrases by 24 months of age.
- Loss of previously learned language or social skills at any age.

Diagnosing Autism

- Two levels of evaluation are needed: First, a general screening for developmental problems or risk factors. Second, another evaluation is needed to actually establish the diagnosis of autism.
- Metabolic and/or genetic testing to rule out other conditions with manifestations similar to autism.
- Serologic studies, to see if a child has been infected with herpes simplex, intrauterine rubella, cytomegalic inclusion disease.
- Hearing tests, to determine if language delay is due to hearing problem. Two hearing tests are used: the behavioral audiometry test, and the brainstem auditory evoked response test.
- Neuroimaging, such as MRI, is performed if a structural brain lesion is suspected.

Differential Diagnosis for Autism

- Rett's syndrome
- Asperger's disorder

- Childhood disintegrative disorder
- Stereotypic movement disorder
- Selective mutism
- Schizophrenia with childhood onset.

Treatment for Autism

Although there is currently no cure for autism, early diagnosis and intervention can significantly enhance the child's social functioning later in life. Early detection and early intensive remedial education and behavioral therapy are the most important measure which need to be taken. Patience and time are vital to working with these children.

Behavioral Problems in Autism

- Impairment of social skills
- Echolalia
- Sensor motor deficiencies
- Limited interactive language skills
- Seizure disorders.
- Mental retardation. Seventy-five percent of autistic persons have some level of mental retardation
- Stereotypic behavior
- Self-injurious behavior
- Problems with symbolic thinking.

Tips for Dentists

- Offer parents and children the opportunity to tour your dental office, so that they may ask questions, touch equipment, and get used to the place. Allow autistic children to bring comfort items, such as a blanket or a favorite toy.
- Children with autism need sameness and continuity in their environment. A gradual and slow exposure to the dental office and staff is therefore recommended.

- Solicit suggestions from the parent or caregiver on how best to deal with the child.
- Autistic children are easily overwhelmed by sensory overload. This can cause "Stimming" (flapping of arms, rocking, screaming, etc.) Autistic children are hypersensitive to loud noises, sudden movement, and things that are felt.
- Make the first appointment short and positive.
- Approach the autistic child in a quiet, nonthreatening manner. Don't crowd the child.
- Use a "tell-show-do" approach to providing care. Explain the procedure before it occurs. Show the instruments that you will use. Provide frequent praise for acceptable behavior.
- Invite the child to sit alone in the dental chair to become familiar with the treatment setting.
- Autistic will want to know what's going to happen next. Explain what you're doing so it makes sense to them. Explain every treatment before it happens.
- Always tell the autistic child where and why you need to touch them, especially when using dental or medical equipment.
- Talk in direct, short phrases. Talk calmly. Autistics take everything literally so watch what you say. Avoid words or phrases with double meanings.
- Once the dental patient is seated, begin a cursory examination using only your fingers. Keep the light out of the eyes.
- Next, use a toothbrush, or possibly a dental mirror to gain access to the mouth.
- Praise and reinforce good behavior, ignore poor behavior.
- Invite the parent or caregiver to hold the child's hand during the dental examination.
- Some autistic children can be calmed by moderate pressure, such as by using a papoose board to wrap the child. On the other hand, "light" touch (such as by air from the dental air syringe) can agitate them. For instance, you are more likely to have problems wrapping a blood pressure cuff around the arm then by inflating it.
- Some children will need sedation or general anaesthesia so that dental treatment can be accomplished. Sedation of autistic children who are 8 years and older simply does not work.

Part 4

Adolescence

20. Aesthetic Restorative Dentistry for the Adolescence

21. Sports Dentistry and Mouth Protection



Aesthetic Restorative Dentistry for the Adolescence

To have a pleasing, attractive appearance is the dream of most adolescents in our society. An important component of the idealized physical appearance is a radiant smile displaying teeth that are attractive in shape and color and do not distract during speaking and smiling.

The use of dental techniques and newly developed and improved composite resins along with the acid-etch technique have made it possible to restore aesthetic defects with conservative treatment. In return to this effort, dentist receive the satisfaction of seeing a young person developing a healthy self-image that can have a positive effect on his or her maturation into adulthood.

BASIS AND FUNDAMENTALS OF MATERIALS SELECTION

- Choice of materials is an important consideration for dental aesthetic factors. The basis of clinical success of composite restorations depends on adhesive systems which would be able to provide durable bonding of composite to dentin and enamel, effectively sealing the margins of restorations and preventing postoperative sensitivity and microleakage.

- Choice of resin composite for aesthetic restorations can be confusing because of variety of products are available with slightly different physical properties.

Basically the two types of composite resins that can be used are—

- *Microfilled*: Those with filler particles averaging 0.04 mm in diameter.
- *Hybrid*: A blend of different particle sizes, including submicrometer (0.04 mm) and small particle (0.2 to 3 mm)

Currently, most dental manufacturers are producing “Microhybrid” resin composites with an average particle size of less than 1 mm.

- When considering which material to choose for a restoration it is essential—
 - To evaluate the tooth to be restored
 - To evaluate the location of the restoration
 - To evaluate the forces to which the restoration will be subjected.
- *Hybrid resins* have traditionally been chosen as a “universal restorative” since they can be used in most clinical situations.
- *Microfilled resins* are primarily indicated when aesthetic restorations are required.

Illustration: Class V and direct resin veneers, because microfilled resins can be polished to an enamel-like luster with much more ease and in less time than hybrid resins.

- Hybrid material used as a substrate that is subsequently veneered by a microfilled resin composite.
- Regardless of whether a microfilled or hybrid composite resin is chosen, the use of visible light curing products is recommended. In addition to the convenience of extended working time and rapid polymerization, these materials also have lower porosity and are less likely to become discolored than the chemically cured (spatulated two paste) systems.
- Polymerization of light cured composite resins is accomplished by using an intense blue light with a peak wavelength of approx (470 nm) which corresponds to the absorption peak of camphroquinone (CQ), the most popular photoinitiator.
- A typical light-curing polymerization unit used a gun type handpiece that contains the bulb and cooling fan. Then developed other technology, such as *light-emitting diodes* (LED's) to efficiently produce blue light, but the bandwidth of most of these LED light is too narrow and high to produce activation of resin composites that contain camphroquinone photoinitiator. Now, present recommendation is of the use of conventional halogen-tungsten-quartz (HTQ) for composite resin polymerization. The HTQ offers interchangeable light transmission tips to gain access to various areas of mouth; however, light intensity should be periodically checked (via a radio-meter) so that a minimal output of 350 mw/cm² can be maintained.
- Eye protection is important when using the curing lights because direct viewing of light is detrimental to vision.



Fig. 20.1: Light curing unit with composite kit

BASIC CLINICAL TECHNIQUE

Step 1: Shade Selection

- The teeth to be matched should be cleaned with a rubber prophylaxis cup and flour of pumice, tooth dehydration should be avoided because of the concurrent color change.
- Moistened shade tabs should be held near the tooth to be matched, using only room light or indirect sunlight; one should not use the high-intensity operatory light when selecting shades.
- The proper value (Munsell *whitness*) may be determined by *squinting* if shade selection takes more than few seconds. One may need to resensitize the eyes by staring momentarily at a dark blue or gray object.
- Resin composites are usually Keyed to the vita shade guide; unfortunately, a perfect color match

between the resin composite and the vita guide is very uncommon.

- Bleach shades are the range of shades that has increased to match the shades of teeth that have been whitened or “bleached”. Common names for these shades are—Superbright shades or extra light shades.
- Another way to verify the actual shade is to place a small portion of composite resin on the tooth surface, polymerize it, observe the appropriateness of that shade, and then remove it with a hand instrument.

Note: One should not etch the tooth prior to doing this otherwise removal will be difficult.

Step 2: Moisture Control

- It is extremely important to maintain an uncontaminated field during the insertion of composite resins.
- The most reliable way to control moisture is through use of—
 - Well-adapted rubber dam or if not using rubber dam.
 - Place a cotton rolls and 2×2 inch gauze sponges over the tongue to prevent moisture contamination.
 - Commercially available lip and cheek retractor; this plastic device when used in conjunction with gauze sponges, provides excellent access and good field control.

Step 3: Pulp Protection

- Use of a base or liner to protect pulp tissue in deep preparations is generally believed to be important. A glass ionomer liner should be used in deep areas

of cavity preparation that are thought to be within 0.5 to 1.0 mm of pulpal tissue.

- The liner provides chemical adherence to tooth structure and slow release of fluoride.

Step 4: Etching

Etch for 15 sec and later rinse for 5 to 10 seconds.

Step 5: Use of Bonding Agent

After etching and proper rinsing an appropriate dentin enamel bonding agent should be placed.

Step 6: Polymerization Process

Next, to the application of bonding agent light-cured composite resin should be inserted in layers of about 2.0 mm of thickness. To get the similar translucency of enamel and opacity of dentin, various materials are available with a variety of opacities. Materials must be placed in increments in which more opaque material replaces dentin and the more translucent material takes the place of enamel, this effort produces a restoration with a optical properties similar to that of tooth structure.

Step 7: Contouring of the Restoration

Fine sable or camel hair brushes gives a better and easy contouring and also allows proper blending of composite resin into the required form.

Step 8: Finishing of the Restoration

Carbide finishing burs, ultrafine diamond burs, or finishing disks are used for finishing of restorations. To finish the concave surfaces rounded burs may be used and for convex surfaces disks may be used.

Step 9: Polishing of Restoration

With a series of polishing disks or rubber abrasive instruments restoration is polished. To provide finish to the interproximal areas and final finish to the restoration abrasive strips are preferred.

Aesthetic Restorations for the Adolescents would be Considered in following Situations :

- Restoration for the fractured anterior teeth.
- Restoration of discoloured teeth includes
 - Treatment of hypoplastic spots.
 - Treatment of stained teeth (moderately to severely stained)—veneers
 - Bleaching—vital
- Restoration of diastemas
- Aesthetic replacement of teeth—bonded-bridges and splints.

RESTORATION FOR THE FRACTURED ANTERIOR TEETH**Introduction**

There must be careful evaluation clinically and radiographically of fractured tooth to have a reliable diagnosis about the injuries such as these can cause pulpal as well as aesthetic problems.

Clinical findings may range to include a little or no dentin exposure with a minimal thermal and pressure sensitivity to the acute distress of a pulp exposure.

Radiographic finding revealing absence or in case presence of root fracture.

Clinical Technique**Step 1: Pulp Therapy**

Treatment must begin with pulpal therapy considering the first aspect; if pulpotomy or pulpectomy is

required; it must get started simultaneously with restorative procedure.

Step 2: Final Restoration

Composite resin class IV restorations are considered final restoration. Steps followed in restoration are—

- Administer anesthesia and proper placement of rubber dam.
- To develop primary retentive feature it is done by beveling enamel cavosurface margins of a minimum of 1.0-2.0 mm in length by using a medium-grit diamond bur.
Note: Beveling allows maximal bond strength and minimises leakage by exposing the enamel rods to etching.
- Next, application of base or liner to exposed dentin is undertaken.
- Conditioning of tooth is accomplished by 37 percent phosphoric acid etchant which is applied first to enamel and then to dentin; this effort is to prevent the dentin from etching for more than 15 seconds.
- Rinsing for at least 5 seconds is required. Slight moist environment is considered beneficial this prevents collapse of the exposed collagen network.
- Application of primer resin to the dentin which should be in contact with dentin for at least 15 seconds; After 15 seconds the primer must be dried with a gentle stream of air in order to evaporate the solvent without displacing the primer. It is seen that a shiny surface is obtained after this step.
- While using a two-component system, the adhesive resin is applied with a brush over the dried primer and it is then light cured for 10 seconds. Care must be taken to avoid overthickening or over-thinning of the material. At a final step; composite resin is

applied as described previously. After placing, finishing, polishing check the restoration for any interference in various excursive movements.

RESTORATION OF DISCOLORED TEETH

(i) Treatment of Hypoplastic Spots

Yellow-brown spots or any discrete hypoplastic white spots can be improved by—

Enamel microabrasion

This is a preferred clinical technique because it is a treatment that requires less enamel removal and also does not necessitate placement of a restoration.

Clinical technique

Application of an acidic abrasive paste by a reduced—speed handpiece.

Microabrasion is sometimes used in combination with vital bleaching.

Saucer-shaped preparation

This includes making shallow saucer shaped preparation in enamel to remove the intensely colored tooth structure and then restoring it with composite resin.

(ii) Treatment of Stained Teeth (Moderately to Severely Stained)—Veneers

- Porcelain veneers provide a better treatment option for moderate to severe staining of one or more teeth.
- Maxillary anterior teeth are more anticipated for veneers than mandibular anterior teeth.

For the reason: That maxillary anterior teeth are more displayed during smiling and speaking and also often veneers for mandibular teeth are less likely to get successful due to less space and unfavorable forces acting at the junction of tooth and veneer during normal masticatory function.

- Veneers must always be placed with a great priority to periodontal health of the tooth planned for receiving veneers. For veneer to get successful the patient must have excellent periodontal health because after the placement of veneers the consequent contours and margins require a good oral hygiene to maintain gingival health.
- Patient must be aware of avoiding biting on a hard objects and stuff.

Veneers May be Either

- Direct veneers (direct build-up of composite resin in the mouth) or
- Indirect veneers (constructed on laboratory models)

Direct Veneers

Veneers made of light cured composite resins can be constructed directly in the mouth.

Advantages

- Greater operator control
- Placement in one appointment
- No laboratory charges.

Disadvantages

- Require more time and great skill
- More patience on the part of clinician
- Results are difficult to predict.

*Clinical Technique**Step 1: Preparing Stained Tooth*

Darkly stained teeth usually require some amount of enamel removal because a space is required for placement of composite resin which would mask the underlying enamel.

- Celluloid matrices are used in between adjacent teeth.
- After enamel removal, teeth are then pumiced and individually etched, and a bonding agent is applied.

Step 2: Use of Opaquing Agent

It should be kept in notice that with the use of these agents it can produce an unaesthetic flat appearance in the color of final restoration.

When a dark banding is present; a way other should be followed of replacing the tooth structure (remove the band with a round bur) and then replace the tooth structure with an opaque hybrid composite resin.

Step 3: Application of Composite Resin

Microfilled composite resin is applied in a 1.0-1.5 mm thick layer and is contoured later with a brush.

Step 4: Blending the Shades

To create a natural looking and gentle color transition—

- Gingival third of restoration must be usually opaque yellow shade. The remaining enamel should be covered with opaque gray or universal composite overlapping and blending the shades. Also, a incisal one-fourth could be given

nonopaque shade to allow a natural-translucent appearance.

Step 5: Contouring

After all composite resin has been added; contouring is done with the brushes.

Step 6: Polymerization

A wider light curing (e.g. 11 mm diameter) is recommended. The material should be polymerized by exposing each area to the curing light for 40-60 seconds.

Step 7: Finishing and Polishing

Done best with use of burns and disks.

Indirect Veneers

The indirect veneers are also called laboratory—constructed veneers.

Advantages

- Excellent aesthetically pleasing contours can be achieved using composite resin or porcelain laboratory techniques.
- Due to construction of veneers in laboratory the total chair time required is less.

Disadvantages

- The necessity of two appointments.
- The possibility of creating an excess bulk of restorative material.
- Laboratory expenses.

*Clinical Technique**At First Appointment**Step 1: Tooth Preparation (Fig. 20.2)*

- Main goal of achieving a chamfer finish line throughout the surfaces to be covered is achieved by using a medium grit diamond bur.
- Preparation is extended to proximal surfaces just to include the contact points.
- Gingivally, the preparation must extend to cover the stained enamel enough to improve the color.
- The finish line is kept supragingivally to aid in better maintenance of periodontal health of tooth.

Step 2: Impression Making

Following the appropriate tooth preparation an accurate impression is made of prepared tooth with use of elastomeric impression materials, e.g. polysulfide or silicon.

*At Second Appointment**Step 1: Clean the Prepared Tooth*

With pumice and then *isolate*; place celluloid matrices between the adjacent teeth.

Step 2: Trying and Adjustment of Veneer

Trying is done with the help of using water, glycerin or a try-in-paste to help hold to veneers in place : and adjusting the veneers.

After trying and adjusting : Veneers should be cleaned with etching gel and silanated.

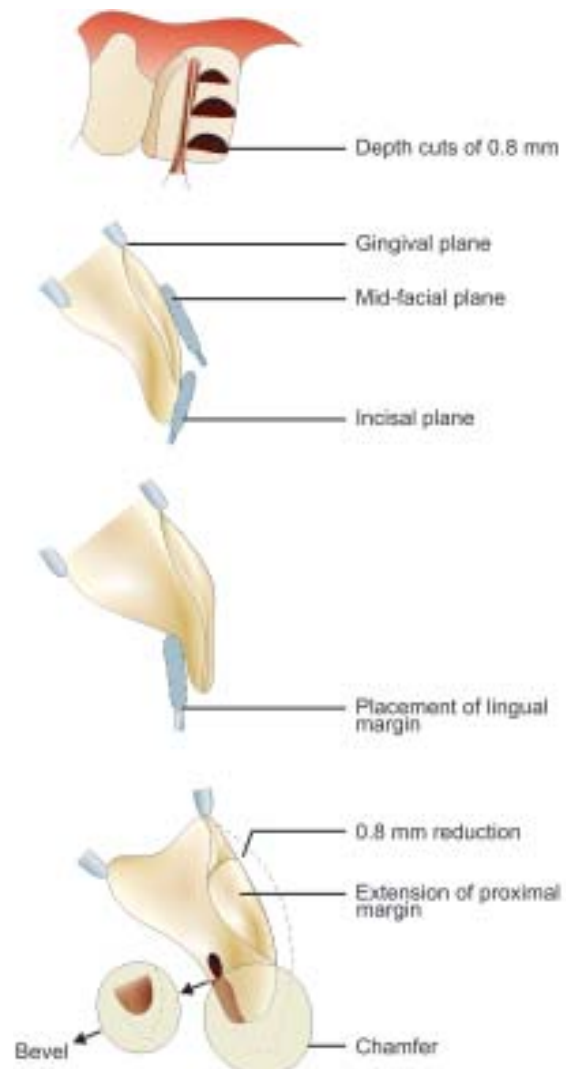


Fig. 20.2: Tooth preparation

Step 3: Placement of Veneers Over Prepared Tooth

- The preparations should be acid-etched individually or in pairs.
- The veneers are bonded in place (light cured or dual cured resins of moderate viscosity are preferred for bonding), beginning with the central incisors.
- Excess of resin is removed with brushes from margins prior to polymerization.

Step 4: Polymerization

Due to some amount of shielding effort of light transmission by veneers; polymerization time of 40-60 seconds in each area should be used.

Step 5: Finishing and Polishing

Finishing and Polishing: Is mostly necessary at the margins and may be done with rubber cups and abrasive strips.

Vital Bleaching

- Vital bleaching involves application of peroxide solutions to increase the whiteness of teeth which are discolored.
- Peroxide bleaching appears to work better in condition when teeth are discolored mildly; when the discoloration which has originated from enamel rather than dentin.
- There are two basic methods—

Power Bleaching

This is an in-office procedure.

Clinical Technique

- Isolate the tooth to be bleached with a rubber dam.

- Concentrated hydrogen-peroxide solution is applied to tooth.
- Heating of teeth is in procedure; usually with an electric lamp.
- With this method of bleaching temporary tooth sensitivity to thermal changes have been reported.
- This method of bleaching usually requires three or more office visit of patient; and also periodic retreatment to maintain the desired color is required.

Night Guard Vital Bleaching

- *A dentist-directed, at-home treatment.*
- The method involves a custom made application trays and a 10 percent carbamide peroxide that the patient applies and wears outside the dental office; usually at night during sleep, for about a period of 2-3 weeks.

RESTORATION OF DIASTEMAS

- Before beginning of restoration of diastemas an important pretreatment consideration of—
 - Size of teeth (length and width)
 - Shape of teeth
 - Size and location of space or spaces is undertaken.
- For some patients the best treatment is partial diastema closure; in which the existing space is made smaller by enlarging the teeth with composite resin but not make the teeth so large that they become aesthetically displeasing.
- Also; a responsibility of dentist is to provide aesthetic possibilities with careful evaluation to be explained to the patient before treatment is begun.

Clinical Technique

Step 1: Measurement of Space to be Restored

Is accomplished by calipers, periodontal probe or Boley gauge.

Note: Space to be eliminated is measured carefully because in an effort to reduce half of space : it usually becomes difficult to determine how much of space that has been actually restored.

Step 2: Cleaning of Teeth, then Shade Selection and Follows the Isolation of Teeth

Step 3: Etching of Entire Labial Surface of Tooth

Rinsing and application of bonding agent.

Note : Entire labial surface of teeth is etched and bonding agent is applied due to the reason that a layer (thin) of composite resin would be covering the labial surface so as to provide a subtle appearance of color transition from composite to tooth.

Step 4: Application of Composite Resin

After etching; rinsing and application of bonding agent composite is applied.

- A viscous and opaque composite resin to start with is applied first at the gingival margin of interproximal area. Material is made to shape and contour in form of smooth-flowing gingival embrasure with the help of an instruments or brushes.
Note: While creating a gingival embrasure a careful precaution is kept of avoiding development of overhanging ledge.
- The entire proximal surface as well as the labial surface of a tooth is build up incrementally and polymerized.

- After restoring a single tooth give a proper finish and contour to the interproximal area.
- To get started with second tooth; a celluloid matrix is placed between teeth.
- Restoration of the second tooth is similar as described for first tooth.

Step 5: Upon Completion

The celluloid matrix which was inserted between teeth is removed.

Restoration is finished and polished. With the use of composite resin various changes in the form of illusions can be created in a restored tooth structure.

Illustration

To create an illusion of a narrower teeth, one should create mesial and distal line angles in composite resin that are positioned slightly nearer the middle of tooth and could be added with developmental depressions (vertical anatomic highlights).

AESTHETIC REPLACEMENT OF TEETH—BONDED BRIDGES AND SPLINTS

Clinical Technique

Step 1: Diagnosis and Treatment Planning

- Careful evaluation of occlusion
- Anterior teeth having the translucent incisal edge which would not allow the complete coverage of edges by the retainers due to unnatural appearance created by metallic or resin coverage; diagnostic study models are helpful.
- The exposed dentin and restoration of teeth significantly reduces the strength of retention of the bridge; for this reason—the teeth must have adequate enamel for bonding.

- Proceed for further steps with proper shade selection of pontics.

Step 2: Tooth Preparation

- For anterior bridges and splints lingual enamel is reduced to (0.5 mm) to provide a space for metal retainer with the help of diamond burs.
- Supragingival chamfer finish line is obtained.
- To aid in resistance and retention, a proximal grooves (small) are prepared.

Step 3: Impression Making

- An accurate impression of the prepared arch is made with elastomeric impression material such as polysulfide or silicon rubber.
- An impression is poured to get a working model; with a sharp red pencil, the extensions of the preparations should be outlined.

Step 4: Seating the Appliance in Place

- *Preparation of Appliance:* The interior surface of the retainer is air abraded with aluminum oxide; the appliance is cleaned in an ultrasonic water bath.
- Preparing abutment teeth for receiving an appliance.
 - Teeth is cleaned, pumiced and isolated.
 - Etching is done of the abutment teeth.
- Composite resin luting cement (autopolymerizing) is mixed and is applied over the appliance.
- Appliance is seated and is held with firm pressure for few minutes so that resin cement gets harden. Following cementation; rubber dam is carefully cut and removed and the excess cement which is remained is removed with diamond or carbide bur.

Chapter 21

Sports Dentistry and Mouth Protection

Sports dentistry has basically two major components—

A. The management of orofacial injuries.

B. The prevention of sports-related orofacial injuries.

First component; (A) calls into play many different skills provided in various branches of dentistry. To provide comprehensive care, a dentist must be knowledgeable in branches of oral surgery, endodontics, operative dentistry, orthodontics, hospital dentistry and patient behavior management. In relation to *second component; (B)* automatically comes to mind when treating patients is the question, why did injury happen?

- Why do so many young athletes have to suffer from such preventable injuries—injuries that can negatively affect the oral health of young athletes for a life time?
- An answer to this realization brings into the focus the second aspect of sports dentistry—“Prevention through sports safety”.

MOUTH PROTECTION FOR CHILD AND ADOLESCENT ATHLETES

- An single most important device for protecting teeth, mouth as well as for reducing the likelihood

of jaw fractures is the use of an intraoral mouth-guard.

- Sports that mandate the use of mouthguards at present time are boxing, football, ice hockey, lacrosse, and women’s field hocking.
- But unfortunately, only a very few organized sports provide mouthguards during practice sessions and in game situations.
- With the use of mouthguards in conjunction with helmets and facemasks has proved effective in reducing both the frequency and severity of craniofacial and intraoral injuries.
- Young athletes who participate in popular team sports such as baseball, basketball, and soccer and in school physical education classes where mouth guards are not required continue to experience a high incidence of intraoral injuries, concussions and even death.
- The most important aspect of dental professional responsibility to a young athletic child and adolescent patient is to act as advocate with sports regulatory agencies, various school boards to promote the use of mouth guards in various sports in which they are mandatory so to prevent future

traumatic sports-related injuries and protect our young athletes.

TYPES OF MOUTHGUARDS

Classification to Categorize Mouthguards:

- Type-I : Stock
- Type-II : Mouth Formed
 - Thermoplastic variety of type II mouth guard.
 - Shell-lined variety of type II mouth guard.
- Type III : Custom-Fabricated (Over a Model)
- Two laboratory technique involved in fabrication of custom athletic mouthguards are—
 - Vacuum forming technique
 - Pressure lamination technique.



Fig. 21.1: Stock mouthguard

Type I : Stock Mouthguards (Fig. 21.1)

- Stock mouthguards are popular due to the reason that; they are inexpensive and are readily available in most sporting goods stores.
- Parents should be warned against a false sense of security; if their child or adolescent wears a stock mouthguard.

Advantage

A single advantage of this type of mouth guard is they are preformed so can be worn directly as manufactured.

Limitations

- They must be held in position by clenching the teeth together.
- They are least retentive.
- They are most bulky of other mouth guards.

- They interfere most with breathing and speech.
- Because; they offer less protection stock mouth guards are not recommended.

Type II : Mouth Formed Mouthguards

- A proper fitting with a better retention is obtained with this type of mouth guard when adjusted by the dentist.

However; results are often unsatisfactory when athletes themselves attempt to fit this type of mouth guard.

Varieties of Type II Mouthguard

The thermoplastic variety—Boil and Bite Technique (Fig. 21.2)

- The material (thermoplastic) is placed in a boiling water until it becomes softened.



Fig. 21.2: Boil and bite mouthguard

- After; it is softened it is inserted into mouth; it is molded to the oral and dental structures.
- To prevent the burning of oral soft tissues or any possible damage to the dental pulp in immature teeth (permanent), care should be exercised in regard to the temperature prior to inserting the softened protector.
- The mouthguard should be of temperature less than 132°F and is inserted wet and must not be inserted in dry mouth.
- To get a tighter fit of mouth guard; this type of mouth guard can be resoftened and remolded.
- The type II thermoplastic variety is the most commonly used athletic mouthguard, but is often bulky and distorts easily.

The Shell Variety

- This variety of type II mouth guard offers a better retention but; the use of this variety has been declined.

- The rigid mouthguard shell is lined with ethyl methacrylate material.
- The liner must be changed before every game, although some athletes dislikes to the taste of freshly mixed ethyl methacrylate material.

Type III : Custom-Fabricated Mouthguard (Fig. 21.3)

- This type of mouthguard has various positive features over previously described mouthguards—
 - Type III mouthguard is far superior to type I and II in terms of adaptation, retention and protection.
 - They are the most comfortable and interfere least with breathing and speech.
 - The most compelling reason to use type III mouth guard is the superior quality of custom-fabricated mouth guards in terms of comfort and player safety.
 - The most important concept is type III mouth guard is maximum protection for maximal prevention which is emphasised.



Fig. 21.3: Custom made mouthguard

- A custom-fabricated mouth guard is in fact is a cost-effective alternative; even though the actual cost is higher than other types of mouth guards; the relative cost is low compared with other equipment such as athletic shoes. The actual cost is far more conservative than the expense associated with treatment of emergency and long-term management of a traumatic athletic injury.

Note: The dental model used for fabrication of the original mouth guard should be preserved so that in the event of damage or loss of the mouth guard; replacement can be easily done if dental model is preserved.

LABORATORY TECHNIQUES

Type III mouthguards are fabricated over a dental model using sheets of thermoplastic material.

Technique 1: Heat-pressure-lamination Technique (Fig. 21.4)

This technique utilises multiple layers of material and is designed for greater adaptation (retention).

Technique 2: Vacuum Forming Technique

Step 1

Complete all necessary restorations and later dental prophylaxis is performed.

Step 2: Impression Making

An impression is made in alginate of the entire maxillary arch with the help of muscle molded rim-lock tray.



Fig. 21.4: Pressure laminated mouthguard

- After impression material is set completely ; impression tray is removed from mouth and impression which is recorded is thoroughly washed and is disinfected with sodium hypochlorite.
- Before pouring the model; excess of water and disinfecting solution is removed with exposing impression to a gentle stream of air.

Step 3: Preparing a Dental Model

- Dental model is poured immediately with a thick mix of dental stone.
- After the dental stone is set completely impression is separated gently from dental model.
- The model is trimmed and finished by removing stone bubbles and filling the voids in model with a small amount of dental stone.
- While fabricating a mouth guard for an athlete who wear a fixed-orthodontic appliance; dental model is modified by reliving with either a plaster or heat resistant block out compound over the area of appliance. So, that mouth guard which would be fabricated on this modified dental model will not interfere with anticipated orthodontic tooth movement.



Fig. 21.5: Vacuum machine

Step 4: Preparation of Mouthguard

- The dental model (finished and modified (if required)) is positioned in centre of vacuum former (Fig. 21.5).
- The heat is switched on in vacuum machine to heat a 5.5 inch square sheet of polyvinyl acetate-polyethylene until the sheet shows a 1-2 inch sag.

- The heat is switched off as the vacuum is switched on while the softened sheet is compressed over the dental model; the vacuum must be kept on for approximately 2 minutes.
- Once, the compressed sheet of material on the dental model is adapted completely and dental model is cooled completely; excess of sheet extending in areas where not required is trimmed with scissors and is peeled away. Palatal region is cut out in U shape with a utility knife.

Step 5

The prepared mouthguard is removed from dental model by soaking the model in water.

Mouthguard is carefully trimmed over some areas like peripheral areas of mouth guards to keep it short of the mucobuccal fold. Relieve frenum to prevent developing sore spots.

Step 6: Final Finishing

Final Finishing of mouth guard is accomplished by using polishing stones or rubber wheels and then flaming the mouth guard lightly with an alcohol torch.

Step 7: Delivery of Mouthguard

The completely fabricated custom made mouthguard is then ready for delivery to the athlete. After placement of mouthguard in mouth; if required adjusted by dentist and then given to the athlete.

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