**Early loss of primary teeth and space maintenance**

Early loss of primary teeth can result in

1. Loss of arch length and crowding of the permanent dentition
2. Opposing teeth can over-erupt and more distal teeth can drift and tilt mesially.
3. Impaction of permanent teeth (due to space loss)
4. Esthetic difficulties in anterior area
5. Food impaction areas, increased caries and periodontal disease and other negative aspects of malocclusion
6. It was found that children who had premature loss of one or more primary canines or molars are more likely to receive orthodontic treatment in the permanent dentition

The best space maintainer is the primary teeth, we would like to keep them until the right time

**How to plan whether we need the space maintainer or not?(planning factors )**

1. **Time elapse since loss**

**The most space loss occurs in the first 6 monthsafter extraction**

Space closure occurs more rapidly in the maxilla than in the mandible

It is best to insert the appliance as soon as possible after the extraction and construct the appliance before the extraction if possible. So, Most of the time it takes 2 appointments , First one for impression and extraction,the second for placement and cementation of the appliance.Or we can take an impression and postpone extraction if not acute, and the next visit we do extraction , wait 10 min for bleeding to stop and then put the space maintainer.

1. **Dental age (not as the chronological age)**

Tooth erupt when ¾ of the root in complete

We have to check general dental condition of the child, and to check the eruption of permanent successors .the eruption timing of the permanent successors may be affected by the premature loss of the primary predecessor :

If extraction happens early >>>>delay of eruption of the permanent

If extraction happens late >>>>>acceleration of the eruption of the permanent

* This effect decreases with increasing age

“the E is lost at the age of 11 and the 5 erupt at 11-12”

1. **X-rays**

We always need a periapical x-ray before we decide to put a space maintainer

We look at the bone overlying the permanent teeth beneath

As a guide ,**1 mm of bone as measured in a bitewing radiographs will need 4-5 months to be resorbed** , it's not that reliable but gives u an idea if u have 1mm of bone u will probably need a space maintainer because the permanent will take time to erupt

Also if there is a complete loss of bone, the tooth will erupt very fast before the completion of the root, only the crown is formed and the teeth erupt, so here the tooth is very mobile, it is only crown .

1. **Eruption of neighboring teeth**

The sequence of eruption is very important, **we will have the max space loss when the adjacent teeth have an active force of eruption.**if there is a bulge of the lower 6 which is erupting, in this case we try to save the E .(if the 6 is actively erupting, it is the worst time to extract the E )

The amount of space loss is usually less if the permanent molars are fully erupted and into occlusion at the time of extraction of the primary molar

Loss of maxillary Es result in the greatest amount of space closure up to about 8 mm space loss in a quadrant

Loss of mandibular Es shows the second greatest amount of space loss of about 4 mm in a quadrant

Upper 6s move bodily while lower 6s tend to tilt mesially.

Loss of upper and lower Ds shows almost equal amount of space closure compared to one another, the amount is most affected by the time of the loss (when 6s are fully erupted, the amount of space loss is less)

Sometimes there isaltered eruption path of permanent tooth**.**So if u took an x-ray especially the lower 5 u look at them and the 5 is inclined distally, in this case it will take much longer time to erupt, which is one indication of a space maintainer after the extraction of the E

So u take the E out which will accelerate the eruption of 5 and put a space maintainer until the 5 correct its path and erupt. Because inclination of 5 will delay the eruption so u take the E out to accelerate the eruption but u need to put a space maintainer to hold a space for 5 to correct its path and erupt.

1. **space analysis..**

a space analysis should ideally be done. If the space analysis indicates a positive arch length or deficiency of less than 1 to 2 mm per quadrant a space maintainer may be efficient in ordering the tooth position

if we have to extract a primary tooth and we found that its successor is missing, we need to consult an orthodontist whether we need to maintain the space or go for space closure without the use of a space maintainer.

1. **Oral hygiene of the patient (caries riskassesment)**

We always like to put space maintainer when indicated unless the oral hygiene is poor because we will harm the patient more than we would help him, so if the child has high caries risk it is contraindicated to place a space maintainer in their mouth until the OH improves, so caries risk assessment to predict whether the disease is likely to develop and the rate of progression in a patient who has caries in their mouth .

Having a space maintainer in a patient's mouth will increase the caries risk. So if OH was poor and the patient did not attend the review appointments, about 3 years later the patient will come and his/her 6s are carious and that is worse than spaces loss which can be repaired by orthodontic treatment

Poor band fit or poor cementation may lead to food accumulation and consequent decalcification

If OH is poor, motivate the patient and then reassess

If child and parent are not motivated and are not regular attenders, this may contraindicate the placement of a space maintainer

Before deciding to put a space maintainer you need to balance the occlusal disturbances that may result if one is not used, against the potential plaque accumulation and caries the appliance may cause

**Classification of space maintainers**

Fixed/removable

Unilateral/bilateral

Maxillary/manbibular

**Fixed space maintainer***(most common used)*

There are bands on abutment teeth ,there is wire in the space to prevent the movement of teeth and also provide space for the erupting tooth ,They are fixed in the patient mouth .

**Advantages:**

* Patient compliance not required, since the appliance is worn continuously.
* It provides sufficient space for the permanent teeth to erupt

**Disadvantages:**

* The banded tooth is susceptible to caries, following de-cementation food accumulation may occur.
* Opposing teeth may over erupt cuz there is no opposing acrylic teeth
* It does not restore function
* Its only provides space not function but it is not a huge disadvantage cuz children don’t need so many teeth to eat, unlike removable one.

**Removable space maintainer:**

They look like acrylic partial denture.

**Advantages**:

* It provides **functional space maintenance**
* Opposing teeth are prevented from over eruption

**Disadvantages:**

* It needs compliance of the children
* Frequent breakage and loss

**Examples on space maintainers**

**\*Lingual arch space maintainer**: there are bands on the 6’s and a wire touching the lower **permanent anteriors** (lower jaw).

If 6’s are erupted usually the removable space maintainersisn’t used, the pt. can eat on 6’s. Fixed can be used, sure if they are indicated.

**Indications of lingual arch : (imp)**

* Bilateral loss of primary molars
* Loss of more than 1 unit in one quadrant: if E and D are missing for example.(we don’t use band and loop in this case)
* Loss of primary canines

**\*Bands and loops space maintainer:**

We will use them the most .There are bands on the E’s or 6’s and there is a loop part contacting the C.

**Indication:**

- Loss of one unit per quadrant

e.x: extracted D, band on E, loop extend mesially touching canine, preventing E from moving mesially, the space will be kept until eruption of 4.

**\*Variation from bands and loops maintainer:\***

**(Crown and loop space maintainer):**

It is used when there is loss in one unit and the abutment tooth is restore by SSC. The main problem if the loop debondedfrom the crown, it cannot be fixed.

What we usually do in the clinic is that if the abutment needs a crown we crown it and then choose an appropriate band for the crown and do a band and loop space maintainer cemented on the crown

If the extracted tooth has been erupted, we can cut the loop part and keep the crown in place.

Most common problem is breakage from weakest place (welding point) what we can do?? It is difficult to remove the stain less crown from primary teeth. So we consider the crown as a tooth, and put a band around it, take an impression and send to lab, for cementation we must roughen the inside part of band. If failure; just remove the band and redo.

**\*We can use bilateral bands and loops:** loss of one unit bilaterally, especially Ds, it is more comfortable than lingual arch SM , we put bands on two E’s with their loops.

* **For the upper jaw there are also 2 types of bilateral space maintainers .They are:**

**-Nance**

**-Trans palatal arch**

**Nance :**

* Bands on the 6’s
* Small acrylic button rest on the palate. If the teeth want to move forward, they will be prevented by the acrylic bottom, So no mesial movement.

The problem with it

* Tissue irritation
* Food collection underneath the acrylic bottom so u will need a very motivated child, the child should floss under the acrylic button , The pt. is advised to use dental floss under acrylic button.

As a space maintainer is the best to use in the upper jaw.

So if we have a critical space,we will use Nance but as we said the only problem is the oral hygiene.

**Trans palatal arch(TPA)**

Bilateral

Cleaner appliance to use than nance

The wire is **not** touching the palate

The space maintenance depends on the **rigidity** of the wire, 6s prevented from moving by the rigidity of the wire.

The wire dose not collect food underneath

The space maintenance depends on the **rigidity** of the wire, 6s prevented from moving by the rigidity of the wire.

**Disadvantages:**

Comparing to nance, it will allow some movement tipping and rotation, So we will get minimal space loss

Mostly we will do this kind in the clinics, Because the oral hygiene is not critical as nance , *NANCE only used when critical space loss).*

**Removable appliance (just like partial dentures)**:

indications :

usually loss of multiple teeth bilaterally **in upper or lower jaw**

**Unilateral removable space maintainer**:

They are too small so there is a danger of swallowing and chewing the appliance, so we never use them.

# each 3 months we must see the pt. to check cementation, when the permanent tooth start eruption, just remove the appliance. ”

\*Early loss of primary incisors:

Mostly upper A’s & B’s, result in little space loss, especially if canines are erupted. We must assure the parents not to worry that much. Unless, little child and canines are still un-erupted or thumb sucking habit present.

Prosthesis maybe constructed if desired, mainly for aesthetic and speech development.

Also fixed space maintainers maybe used {fixed bands on E’s & wire& anterior part fixed to the wire with teeth}. We don’t like them that much; in case of too young pt .they may affect the growth of maxilla and cooperation is questionable.

If older children, we may use removable, but the compliance is problem: loss, breakage…

Loss of permanent incisors (due to dental trauma or avulsion) needs immediate space maintenance. If not; space loss and midline shift may occur.

Loss of Cs : bilateral loss leads to lingual collapse, decreased arch length and increased overjet and overbite , unilateral loss leads to the above plus midline shift . so we use ligual arch as a space maintainer .

Loss of Ds : the effect of losing them after the eruptions of 6s is much less than losing them before the eruption of 6s , so less space loss . if we have unilateral loss we use band and loop space maintainer , and if we have bilateral loss we use band and loop bilateral space maintainer , we don’t use the lingual arch space maintainer until the eruption of permanent central incisors , because the lingual arch rests against the cingulum of lower anteriors , if we use it on primary anteriors , it won't work , they're about to exfoliate so won't offer enough resistance , so it's a contraindication to use the lingual arch on primary anteriors.

If the 6s have erupted and we have bilateral loss of Ds , we can use Trans Palatal Arch or NANCE .

Loss of Es : we prefer not to lose them , if we have unilateral loss we use band and loop , and consider the eruption sequence , because the 4 will erupt before the 5 , we have to replace the band and loop at some point , so we prefer to use bilateral space maintainer . if we have bilateral loss of Es in the upper jaw , we use TPA or NANCE , and the lingual arch in the mandible .

SPECIAL CONDITION : Sometimes we have to extract the E before the eruption of the 6 ,we use distal shoe space maintainer , to prevent mesial movement or tipping of the 6 . so this is an indication for the use of distal shoe space maintainer , distal segment is extended into the tissue ( gingiva ) , and attached to the 6 subgingivally to guide its eruption .

DISADVANTAGES:

1- very hard to construct , we have to take an xray ( pre,op and post.op ) , it's going to be hard to determine where to place the distal arm , it need s a good technician .

2- it's invasive , it goes into the tissues , so we have to give the pt LA before cementation , and the pt may not be cooperative .

 3-after the eruption of 6 we have to replace the distal shoe with band and loop on the 6

.CONTRAINDICATIONS :

 medically compromised pts with congenital heart defects are contraindicated because it'll lead to infective endocarditis .

so if we can't use the distal shoe we try to save the E as much as possible, by :

1- doing pulpetomy which has a high success rate .

 2- pulpectomy if the roots are sound .

 3- wait until the eruption of 6 which will be mesially tipped or moved and then use a space maintainer later on .

4- pressure concept : using an appliance that has an acrylic part to exert pressure on the soft tissues mesial to the 6 to maintain the space and guide the 6 to erupt vertically .

Adverse effects of space maintainers :

1- caries .

 2- impeding tooth eruption .

3- undesirable tooth movement .

4- soft tissue impingement and pain .

How to construct a space maintainer at the clinic :

 1- design and band selection before taking the impression .

2- band adaptation .

 3- taking the impression with band around the tooth .

4- pour the impression .

5- appliance construction

. 6- appliance fitting and cementation .

Band selection : takes sometime for beginners , we choose the smallest band that fits the height of contour of the tooth , you can use band seater , or use your finger or mirror to set the band around the abutment tooth . so you wrap the band , push it so its margins adapt the tooth morpohology , the occlusal margins of the band are apical to the interproximal ridges ,and the gingival margins are in the sulcus of the tooth to prevent food impaction , it should be out of occlusion . then you take an alginate impression , and if we're using band and loop we take an impression for half of the arch . after taking the impression we remove the band from the patients mouth then place it on the impression as if it's in the patients mouth . stabilize the band on the impression by sticky wax then pour the impression by plaster or stone .we prefer to use stone if we intend to extract a tooth in order for the technician to cut the tooth from the cast . then construction of a flat base to prevent dropping the cast during application of the appliance , make sure that the loop part touching the mid part of the tooth mesial to the space . you check the appliance for fitting or not , if not well fitted you need to adjust it , then you cement using GIC or Polycarboxylate Cement , but we prefer GIC to release fluoride , remove excess cement, then give instructions to the patient an parents .

INSTRUCTIONS after cementation :

1- avoid hard or sticky food .

2- appliance should be brushed after everymeal ,and the band and loop should be clean .

3- we need to see the patient every 3 months .

 4- ask the patient not to manipulate the wire with fingers or tongue .

 5- set an emergency appointment if the appliance is loose or it's broken

. 6- if the tooth has erupted before its time also it needs to be checked .

7- long term follow up to remove the space maintainer once the tooth has erupted .

Chairside fabricated space maintainers :

1- ortho wires , used as interim space maintainer .

2- band and loop chairside fabricated .

3- fibery-reinforced composite resins : glass or polyethylene fiber reinforced , used in removable prosthodontics , fixed partial dentures , orthodontic appliance as retention splints , periodontial splints and as space maintainers . composed of densely packed glass fibers in a gel matrix .

ADVANTAGES :

1- no need for a cast model ,

2- can be made in one session

3- no second visits,

4- easy to apply ,

5- esthetically desirable .

DISADVANTAGES :

1-retention is less ,

2- so less success rate . polyethylene fiber-reinforced composite resins are better than glass fiber .
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 Behavior management in children

**Negative reinforcement:**

Negative reinforcement is the strengthening of a pattern of behavior (in our case is to open his mouth) by the removal of a stimulus which the individual perceives as unpleasant (a negative reinforcer such as asking the parents to leave the clinic) as soon as the required behavior is exhibited (we ask the parents to come back to the clinic).

The stimulus is applied to all actions except the required one, thus reinforcing it by removal of a negative stimulus.

It’s not punishment

Punishment is application of an unpleasant stimulus to inappropriate behavior

We have 2 examples of negative reinforcement:
1) selective exclusion of the parent (SEP)
2) hand over mouth exercise (HOME)

Selective exclusion of the parent:

Parental consent is required

When inappropriate behavior is exhibited the parent is asked to leave.
Ideally; the parent should be able to hear, but be out of sight of the child.
When appropriate behavior is exhibited the parent is asked to return, thus reinforcing that behavior.

Hand over mouth exercise:

It involves restraining the child in the dental chair with the help of the assistant, placing a hand over the mouth to allow the child to hear.
The nose must not be covered.
The dentist then talks quietly to the child explaining that the hand will be removed as soon as crying stops.

As soon as this happens the hand is removed and the child praised. If protests start again the hand is replaced.

This is a very extreme technique

The technique aims to gain the child’s attention and enable communication, reinforce good behavior and establish that avoidance is futile.

Those who advocate the technique recommend it for children 4-9 years of age when communication is lost or during temper tantrums.

Parental consent is important and the technique should never be used on children too young or with mental or emotional handicapped.

This technique is the most controversial of all behavior management technique used by dentists

It’s not a recommended technique

**Empathy:**

. The use of an empathetic approach (verbally and non-verbally) has been shown to be more likely to result in treatment completion than other methods of verbal communication.

It helps the child to feel that as an individual he or she has been acknowledged with the use of open personal questions bringing about a trustful relationship

**Coping strategies:**

 Coping strategies refer to the specific efforts both behavioral and psychological that people employ to master, tolerate, reduce or minimize stressful events

While stress is an inevitable aspect of the human condition it’s coping that makes a big difference in adaption to stress

Cognitively based coping strategies appear to be more efficacious in older children (8-13 years old) with younger children benefitting more so from coping strategies which offer emotional support.

Older children show more coping behavior when staff or parents make coping promoting statements.

You should combine empathy and coping statements

Most coping strategies children use:

“I do what the dentist tells me to”

“I think it’s good for my teeth”

“I tell myself it will be over soon”

“I think of other things”

“I like it when the nurse holds my hand”

**Other alternative techniques:**

Magic trick

The use of distraction by a magic trick has been shown to be an effective alternative behavioral management strategy in strong-willed young children.

It’s used to persuade strong-willed 3-6 years old young children who refused to sit in the dental chair in the first visit with a more conventional method than tell-show-do (TSD)

Motivational interviewing (MI)

For teenagers mainly who are not willing to change their approach in oral hygiene or dental attendants

A type of counseling which can be employed by individuals trained in this technique (special training) and has been found to be especially effective at overcoming adolescent ambivalence to behavior change.

Motivational interviewing needs time and training.

It has been shown to be effective although the systematic review found it to be not that much effective.

The main point that it can be used with adolescent trying to change their behavior

Memory restructuring strategy

We are trying to make editing for the bad experience the child had at the dentist

A technique that aims to help children develop positive memories of their dental treatment and as such may be effective in reducing fear and improving behavior.

Hypnosis

Hypnosis is an artificially induced altered state of consciousness in which the individual becomes more susceptible to suggestion.

Hypnosis has a greater impact on younger children and was associated with fewer undesirable behaviors during the dental procedures.

Snoezelen environment

Used with autistic kids

A multisensory activation for their sensations

It consists of a partially dimmed room with lighting effects, vibroacoustic stimuli and deep pressure.

It has a positive effect on children.

Child centered approach

It covers everything

It involves all members of the dental team to interact with the child

This approach is employed from the moment the child enters the clinic

**Advanced form of behavior management**

Protective stabilization

The restriction of patient’s freedom of movement, with or without the patient’s permission,to decrease risk of injury while allowing safe completion of treatment.

The restriction may involve other human/humans, a patient stabilization device, or a combination thereof.

Indications:

1) Very young child

-Knee to knee examination or treatment

-Patient requires immediate diagnosis and/or urgent limited treatment and cannot cooperate due to emotional and cognitive developmental levels, lack of maturity, medical or physical condition

2) Emergent care is needed and uncontrolled movements risk the safety of the patient, staff, dentist, or parent without the use of protective stabilization.

3) Previously cooperative patient quickly becomes uncooperative during the appointment in order to protect the patient safety and completion of the treatment

4) After sedation to help reduce uncontrolled movement, because the patient may become uncooperative during treatment.

5) Patients with special health care needs may experience uncontrolled movements which can harm them or significantly interfere with the quality of care

Protective stabilization has the potential to produce serious consequences such as:
-physical or psychological harm
-loss of dignity
-violation of the patient’s rights

**Children’s perception of pain:**

Varies widely particularly with age.

The response is further determined by the child’s coping ability influenced by family values, level of general anxiety and intelligence.

Children up to 2 years of age are unable to distinguish between pressure and pain.

After the age of approximately 2 and up to the age of 10 years, children begin to have some understanding of hurt and begin to distinguish it from pressure or a heavy push.

It’s not always possible to identify which children will respond by being cooperative when challenged with local anesthesia or dental treatment

When the child is anxious; he will perceive pain more.

Painful procedures cause fear and anxiety, which intensify pain.

Good behavior management reduces anxiety, which in turn reduces the perceived intensity of pain,and reduces the experience of anxiety.

Analgesics can be used to manage pain in children

Analgesics are considered temporary measures to a number of oral conditions such as ulcers and pulpitis

Children may need pain control for a day or two before the removal of carious teeth

It’s considered as temporarily solution until we can treat him in the clinic

Most commonly prescribed analgesics is paracetamol or acetaminophen and NSAIDS

Paracetamol:

-unlike the aspirin, acetaminophen doesn’t inhibit platelet function, it also causes less gastric ulcer

Has not been implicated in reye’s syndrome

Main disadvantage that it doesn’t have anti-inflammatory property so it’s not as potent as NSAIDS

May lead to toxicity which will lead to acute liver failure

Dosage:

1-6 year: 125 -250 mg every 4-6 hours

6-12: 250-500mg every 4-6 hours

It’s either pills or solution (liquid)

NSAIDS:

The added advantage is being anti-inflammatory and therefore may benefit in the case of pulpitis or when the child is pyrexic

Most commonly prescribed is ibuprofen

Over dosage may cause nausea, vomiting, and epigastric pain

Ibuprofen should be avoided in patients with asthma

NSAIDs are known to cause gastric ulceration

Dosage:

100-200mg daily in divided dose

4-10mg /kg dose every 6-10 hours

In very young children (2-3 years) most probably sedation won’t be effective

Sedation is used for anxious child but at the same time he should be cooperative

The majority of pediatric dental patients can be managed in the conventional dental environment. This is accomplished by relying on sound behavior management techniques

There are certain considerations for sedation or GA:

-the age of the child

-the degree of surgical trauma involved

-the perceived anxiety

-how the patient has responded previously

-the complexity of the operative procedure

-the medical status of the child

**Age**

The younger the child the greater the likelihood for GA

2 years old with multiple carious cavitieswill likely require treatment under GA

Older children with surgical trauma most probably will need sedation or GA

It is unlikely for a 15 year old to be under GA

If we want to expose and impacted canine most of the patients will need GA

Usually if the patient is very young (below 2 years) they will end up treated under GA

**The degree of surgical trauma**

A single extraction ismost likely to be carried under LAwhereas removal of the four first permanent molars is most likely to be carried out under GA.

**Anxiety**

Excessive anxiety especially after an attempt at treatment under LA or sedation might lead to simple treatment such as conservative dentistry being carried out under GA

**Medical status of the child**

The degree of intellectual and/or physical impairment in handicapped children is alsoa factor to be considered.

Sedation

Sedation is a technique in which the use of a drug or drugs produces a state of depression of the central nervous system (CNS) enabling treatment to be carried out successfully.

During sedation the patient will be able to independently maintain his or her airway, independently maintain open mouth and respond to verbal commands.

In addition the patient will retainadequate function of protective reflexes (such as the laryngeal reflex).

The drugs and techniques used should carry a margin of safety wide enough to render unintended loss of consciousness unlikely.

The level of sedation must be such that the patient remains conscious, retains protective reflexes, and is able to understand and respond to verbal commands.

Before we start the patient must go thorough medical, dental and anxiety history assessment.

In children respiratory depression and loss of protective reflexes may occur rapidly and unexpectedly; so we should be more careful

Informed consent is mandatory (a signed consent)

Aims of sedation:

-To enable the provision of quality dental care

-To manage destructive behavior

-To promote a positive psychological response to dental treatment

-To retain the patient quickly to a physiological state in which a safe discharge is possible

Advantages:

-We are avoiding GA (most important one)

-Improvement in operating conditions

-Rehabilitation of dentally anxious children and adolescence

These advantages areunpredictable especially with oral sedation

There is a need for a supervised recovery and close supervision at home for the remainder of the day of the operation.

ASA (American society of anesthesiologist) classification:

Classification for the medical status of the patient

ASA I: healthy patients

ASA II: mild systemic disease (mild diabetes)

ASA I and ASA II are the only groups that can undergo sedation in the clinic

In severe systemic disease, sedation can be done but must be in hospital condition for the support system to be present if any complication happened.

Complications:

Hypoxia, nausea, vomiting, inadvertent loss of consciousness (over sedation that can end up in GA)

Morbidity and mortality increase with young age and with worsening ASA classifications.

Children are different from adults and sedation may be unpredictable. They are more likely to become hypoxic

We should monitor the sedated child

The clinical status of a sedated child:

-the patient able to respond verbally to questions

-the patient is able to maintain independently an open mouth (that’s why it’s not indicated to use mouth prop)

-the patient is able to maintain independently a patent airway

-the ability to swallow

-the child is a normal pink color

Or we can monitor the child by pulse oximeter

The pulse oximeter is a noninvasive method of measuring arterial oxygen saturation using a sensor probe placed on the patient’s finger or earlobe.

It has a red light source to detect the relative difference in the absorption of light between saturated and desaturated hemoglobinduring arterial pulsation.

Child’s normal oxygen saturation is 97-100%.

Adequate oxygenation of the tissues occurs above 95%, while oxygen saturation lower than this is considered hypoxemia.

The routes of administration of sedative drugs used in clinical pediatric dentistry are:

* Oral
* Intravenous
* Inhalational
* Transmucosal (e.g. nasal, rectal, sublingual).

**Oral sedation**

In which we give the child the drug orally, and then we wait till the effect of the drug starts and then we start the dental procedures

* **Advantages**
* Convenience.
* Economy
* Lack of toxicity. We weigh the child and give him/her the appropriate dose accordingly.
* **Disadvantages**
* Variability of effect. It depends on the amount of absorption of the drug
* Onset time. It takes a relatively long time; about 1 hour.
* **Oral sedation**
* Diazepam .mostly.
* Midazolam
* Chloral hydrate
* **Clinical Technique**
* On arrival of the patient check whether, preoperative instructions have been followed.
* Weigh the patient and estimate the dose of diazepam.
* Have the dosage checked by a second person.
* Administer diazepam ~1 h before the treatment.
* Allow the patient to sit in a 'quiet' room.
* Once ready, start and complete the treatment with (or without) LA.
* Once the treatment is complete, allow the patient to recover in the quiet room until ready to return home.
* Reiterate the postoperative instructions to escort.

**Intravenous sedation**

Limited use in children, although there is a slow but steady trend to extending its use especially in adolescents.

* Midazolam , mostly.
* Propofol
* **Advantages**
* Quick onset of action.
* Titration. We can increase the dose according to the patient's reaction
* Reversal possible: Flumazenil (if overdose occured)
* **Disadvantages**
* The needle.
* Clinical training.

Sometimes, especially in the USA , when the patient is sedated, we use methods to immobilize him/her 🡪🡪🡪

**Restraint/Protective Stabilization:**-The restriction of patient’s freedom of movement, with or without the patient’s permission, to decrease risk of injury while allowing safe completion of treatment.

e.g.: Papoose Board



**Inhalation sedation / N2O sedation**

* Nitrous Oxide is known to the public as ‘laughing gas’
* N2O is a slightly sweet smelling, colorless inert gas.
* It is compressed in cylinders as a liquid that vaporizes on release.
* N2O sedation is dentistry’s most basic and widely used form of sedation.
* Nitrous oxide produces analgesic and anxiolytic effects. However it is not enough to use it without LA especially while doing pulp treatments.
* Serious complications seem rare with N2O sedation.
* In over 45 years, there has not been any mortalityor serious morbidity recorded. (Roberts 1990)
* Inhalation of an oxygen-nitrous oxide gas mixture inrelatively low concentrations, usually 20-50% nitrous oxide.The operator is able to titrate the gas against each individual patient.
* In dentistry, nitrous oxide is typically used as an anxiolytic.
* Most often it is administered through a nasal mask.

**Objectives of Nitrous Oxide sedation**

* Reduce or eliminate anxiety
* Reduce untoward movement and reaction to dental treatment
* Enhance communication and patient cooperation
* Raise the pain reaction threshold
* Increase tolerance for longer appointments
* Aid in the treatment of the mentally/ physically disabled or medically handicapped persons
* Reduce gagging

**Clinical technique**

* The patient should be started out breathing 100% oxygen and then slowly allowed to breathe increasing amounts of N2O until the desired effect is achieved.
* It is important that the patient be reminded to breathe through the nose in order for the gas to work.
* As the N2O begins to exert its pharmacological effects, the patient is subjected to a steady flow of reassuring and semi-hypnotic suggestion. This maintains rapport with the patient.
* The patient should be questioned as to how they are feeling to ensure an optimal level of nitrous is being administered.
* Therapeutic levels will vary from patient to patient.
* If the nitrous level being administered is too low, the patient will not be receiving an effective anxiolytic dose.
* If the nitrous level is too high, unwanted side effects may occur.
* To bring about recovery, administer 100% oxygen for 2 minutes.
* The patient should breathe ambient air for a further 5 minutes before leaving the dental chair. (less than oral and I.V)
* Safety cut-out devices installed within equipment. It is not possible to administer 100% N2O.

**-Advantages**

* Rapid onset and recovery time
* Titration.
* Lack of serious side effects.

**-Disadvantages of Nitrous Oxide sedation**

* Lack of potency
* Dependent largely on psychological reassurance
* Interference of the nasal hood with injection in the anterior maxillary region
* Patient must be able to breathe through the nose
* Nitrous oxide pollution and potential occupational exposure health hazards (especially on female dental staff- repeated miscarriage)

**General Anesthesia**

-A controlled state of unconsciousness accompanied by a loss of protective reflexes, including the ability to maintain an airway independently and respond purposefully to physical stimulation and verbal command.

There are categories of patients on whom the only reasonable anesthetic alternative treatment is general anesthesia

 **Circumstances and conditions suitable for GA**

* Severe pulpitis requiring immediate relief.
* Acute soft tissue swelling requiring removal of the infected tooth/teeth.
* Surgical drainage of an acute infected swelling.
* Single or multiple extractions in a young child unsuitable for conscious sedation.
* Symptomatic teeth in more than one quadrant.
* Moderately traumatic or complex extractions e.g. extraction of broken-down permanent molars.
* Teeth requiring surgical removal or exposure.(canines!)
* Biopsy of a hard or soft tissue lesion.
* -Debridement and suturing of orofacial wounds.
* -Examination under GA, for a special needs child where clinical evidence exists that there is a dental problem which warrants treatment under GA.

Once the child is subjected to GA, we have to treat him/her comprehensively and to treat all carious teeth , and unrestorable teeth. Teeth with poor long-term prognosis should be taken out.

Good treatment planning should be done especially when deciding to extract permanent first molars with MIH.

When the loss of one or more permanent unit is to be included in the treatment planning, an orthodontic and pediatric dentist consultation should be considered .

The child should be seen regularly after the GA to maintain a good oral hygiene and fluoride application and to decrease his/her dental fear.

Failure to provide prevention after GA will lead to the child undergoing further treatments, usually exractions under GA .

We like to give LA before, and analgesia after extraction and before the child wakes up to reduce the postoperative pain

NSAIDs are more potent than acidaminophen and specially in multiple pain provoking or traumatic procedures

**Risk of general anesthesia:**

* Mortality: ~ 3 per million.

 **Morbidity:**

* Symptoms associated with the procedure.
* Distress at induction and during recovery.
* Prolonged crying.
* Nausea.
* Postoperative bleeding.
* Although SCCs are the best restorative option for children **under GA** , it was found that they have more morbidity post operatively and patients take longer time to adapt to them .

-The potential for disastrous complications is greater than any other technique of pain control.

-**Requires the presence of an anesthesiologist in a hospital setting**.

-There will always be a need for general anesthesia in dentistry for children.