PEDIATRIC ORAL SURGERY

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IMAN S.NAZZAL

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Introduction

Oral Surgery is a recognized international specialty in dentistry. It includes the diagnosis, surgical and related treatment of diseases, injuries and defects involving both the functional and esthetic aspects of the hard and soft tissues of the head, mouth, teeth, gums, jaws and neck. [AAOMS]

Because examining a new patient introduced to oral surgery department is a significant event for the most patients, the examiner must display a professional attitude in order to develop the patient's trust. Ensuring the patient's cooperation is an important part of achieving the correct diagnosis. [Pedlar and John, 2nd edition]

The classis system of diagnosis in all branches of medicine and surgery comprises the following: history taking, clinical examination, and then the dentist can use some special methods of examination like radiography , blood tests, or biopsy. [Howe, 2nd edition] Alteration or deviation from standard treatment modalities may be necessary to avoid injuring the developing follicles. To minimize the negative effects of surgery on the developing dentition, careful planning using radiographs, tomography, cone beam computed tomography, and/or 3-D imaging techniques is ne-cessary to provide valuable information to assess the presence, absence, location, and/or quality of individual crown and root development. [AAPD]

Surgery performed on pediatric patients involves a number of special considerations unique to this population. Several critical issues deserve to be addressed. These include: preoperative medical and dental evaluation, behavioral considerations, growth and development, developing dentition, pathology; and perioperative care. [AAPD]

Special attention should be given to the assessment of the social, emotional, and psychological status of the pediatric patient prior to surgery. Children have many unvoiced fears concerning the surgical experience, and their psychological management requires that the dentist be cognizant of their emotional status. Answering questions

concerning the surgery is important and should be done in the presence of the parent. [AAPD]

Consent

All patients must be fully informed before any decision concerning treatment is made and no treatment should be performed without a patient's full consent. The UK department of health provides extensive advise on consent on its website. For patients under 16 years old of age it is generally accepted that a parent or legal guardian will give consent on the child's behalf. However, it is important to remember that a minor may withhold consent, if they are able to understand the issues involved- this must also be respected. For adults who are not able to give consent it is appropriate to involve close family members or legal guardians and another non-involved individual , such as the medical practitioner, in determining whether the patient would consent to the procedure if they were able. [Pedlar and John, 2nd edition]

Surgical instruments

Extraction forceps: the design of forceps has remained remarkably constant over many years; it is difficult to improve on basic shapes.

Elevators: are single bladed instruments used as levers or wedges, placed between tooth and bone and turned around their long axis to dislodge the tooth or root. There are two main classes: Straight elevators including Coupland's chisel. And the smaller straight Warwick James; angled elevators which are ideal for elevation of the fractured roots of deciduous molars. [Pedlar and John, 2nd edition]

Scalpel and cutting blades: the Bard-Parker type is the most widely used scalpel in the practice of oral surgery. The no. 15 blade is the pattern used most frequently in oral surgery.

Chisels and bone files: for bone removal.

Tissue retractors and periosteal elevators: the handle or shank of the ideal retractor should gently displace the check and the lip, thus facilitating the surgeon's view and be comfortable to hold.

Hemostat : is a vital surgical tool used in almost any surgical procedure, usually to control bleeding. Therefore, it is not uncommon to see the initial incision lined with hemostats closing blood vessels awaiting ligation during the initial phases of surgery. They belong to a group of instruments that pivot (similar to scissors, includes needle holders, tissue holders and various clamps), and where the structure of the tip determines their function.

The trans-alveolar approach / Mucoperiosteal flaps

Some times gum tissue and/or bone may cover over or surround a tooth in a fashion that makes it difficult for the dentist to view and/or access it. If so, a gum tissue flap will need to be created and retracted (and some bone tissue may need to be removed) so the dentists can gain the access they require.

The idea is that when this gum tissue flap is reflected it allows the dentist access to both the tooth -or remaining fractured root- and bone tissue that lies underneath. As its name implies, a tissue flap has an outline where even though it can be reflected it is still substantially attached to other undisturbed areas of gingival tissue. [Pedlar and John, 2nd edition]

The normal course of events is one where a flap is created and reflected. Whatever bone removal is needed is accomplished and the tooth is removed. The flap is then returned to its original position and sutured in place. As opposed to the hypothetical situation where bone and its overlying tissue might be removed together, the fact that a tissue flap is repositioned so it covers back over most of the extraction site provides a significant benefit for the healing process.

When preparing to "lay" a flap, a dentist or oral surgeon will first use a local anesthetic agent to anesthetize the tooth extraction site and nearby tissues. They will then use a scalpel to cut the flap. The outline of the flap will be scored with the blade of the scalpel, cutting directly through the gum tissue down to the bone. Since the patient is numb, no pain will be felt. The patient will, however, feel the pressure of the scalpel on their jawbone.

Once the outline has been scored, the dentist will reflect the flap using a "periosteal elevator". One edge of the flap will lie directly on the gingival margin. Somewhere along this margin the dentist will insert the tissue "elevator" (periosteal elevator). As it is pushed underneath the outline of the flap, the gingival flap will peal back thus exposing the underlying bone and tooth.

When compared to the width of the space where the patient's tooth has been extracted, a tissue flap may look like it involves a comparatively large area. If so, it's because there are a couple of design factors that the dentist or oral surgeon must take into consideration when making a tissue flap. Since the whole idea of creating a tissue flap is one of visibility and access, the flap must be large enough that it fills these needs. If the flap is too small, the dentist will tend to pull and stretch the gum tissue, thus creating more tissue trauma than if the flap had simply been designed large enough in the first place. Additionally, the dentist will need a firm base over which to suture the flap back into place. This means that the edges of the flap must extend over and rest upon undisturbed bone. And finally, the flap must provide adequate blood supply for its movable portion. For this reason, the base portion of a flap will always be broader in length than its free edge. [Howe, 2nd edition]

There can also be cases where the initial attempt at removing a tooth may have failed and therefore surgical intervention is required. Possibly the crown of the tooth broke off, leaving just the root. Or else a portion of the root itself separated and remains in the tooth socket. If so, a "simple extraction" may need to be transformed into a "surgical extraction" so it can be completed.

Flap Design;

There are several principles underlying the design of the mucoperiosteal flap; the flap must give adequate access to the site of interest- usually extended from one tooth behind

concerned tooth to one tooth in front, be designed to maintain a good blood supply, be amenable to repair with its margin on sound bone, and not risk damage to adjacent structures. Postoperative healing is facilitated by ensuring that the base of the flap is broader than its free end, and thus contains an unimpaired blood-supply. [Howe. 2nd edition]

The incision should be made with firm pressure upon a sharp scalpel through both the mucous and periosteal layers of the gingiva down to the bone. It is best to make incisions of adequate length in one operation for extensions and "second cuts" usually render the flap margin ragged and delay healing. If the gingival margin of a standing tooth is involved in the flap it should be incised vertically, and not just levered away from the neck of the tooth. [Howe. 2nd edition]

The flaps which are large in the horizontal or anteroposterior dimension heal just as quickly as smaller flaps and have many advantages.

Envelop flap: the incision is made to any length depending on the amount of exposure needed around the necks of the teeth along the free gingival margin on the buccal or lingual aspects including the interdental papilla. It is mainly used for the extraction of tooth or root.

A Two sided "Triangular" flap: in addition to the envelop flap a vertical releasing incision is used in order to have a better access to the area. This vertical releasing incision is made on one side of the envelop going divergent to the buccal vestibule. The vertical incision should be made on the interproximal area as the tissues here are thick. Either include or exclude the interdental papilla, and to avoid periodontal defects don’t lie the incision on the facial aspect of the tooth.

A three sided "Rhomboid" flap: is a modification of the mentioned above flaps; a second releasing vertical incision is made opposite to the one made first. Here, make sure that the base of the flap is wider than its apex to ensure good blood supply.

Semilunar flap: useful when only the periapical area of the tooth is required to be exposed. The incision is taken 5 mm away from the gingival margin. This incision is useful to prevent post surgical periodontal defects of the interdental defects. [Malik 2008][Pedlar and John, 2nd edition]

Malik 2008 described the main complications of flaps surgery in three main problems: flap tearing, flap necrosis, and flap dehiscence "gapping". To prevent tearing of the flap, reflect it as one unit, and enlarge it adequately to ensure good visual access. Wide base is the key factor to prevent necrosis, and design the flap in such a way that the sutures will be placed over the solid healthy bone to avoid gapping of the wound.

Suturing

In oral surgery, the last phase of a surgical operation is represented by the tissues suture, that allows the wound lips edges approximation and their stabilization, to promote haemostasis, to avoid the alimentary residues accumulation on the incision line and allow the first intention healing. A good suture avoids that the displacing forces generated by the muscular insertions, functional movements and by the external agents destabilize or cause the surgical wound deiscence. [Minozzi et al., 2009]

The ideal suture must be suitable to every type of operation, easy to handle and practice, with a high resistance, sterile, without contraction, able to form a small and solid knot, to induce a minimal tissue reaction, must be not electrolytic, capillary, thrombogenic and able to induce allergic reactions, must not create a favorable situation with the bacterial growth and must reabsorb itself when its function is finished, with the minimal tissue reaction and in the less time possible. Unfortunately, a suture that has all these characteristics doesn’t exists. [Minozzi et al., 2009]

The sutures of synthetic origin derive from the glycolic acid, the galactic acid, the polyamides as the nylon, the polyesters, the polymers that derive from vinyl, as the ethylene and the propylene. Based on the capacity to loss the tensile strength, the natural and the synthetic threads are divided in *absorbables*, characterized by a complete degradation until 60 days, and *nonresorbables*. Belong to the first group (absorbable threads) the catgut, the collagen, the glycolic acid and the galactic acid. Belong to the

second group (nonresorbable threads) the silk, the cotton, the linen, the metals, the polyamides, the polyesters, the polypropylene, the polytetrafluoroethylene (PTFE), better known with the name GORETEX. Depending on the dentist's determination, an appointment for suture removal is typically scheduled for somewhere between six and ten days after the stitches were originally placed. The reabsoption happens, if the threads are natural, with the action of lymphocytes and macrophages; if the threads are synthetic the reabsorption happens with a hydrolytic scission of the polymeric chain. . [Minozzi et al., 2009]

Suturing technique:

First the dentist will check and insure that the edges and surfaces of the bone that will lie underneath the flap are rounded and smooth. If they need adjusting, the dentist will recontour them with the dental drill or a bone file. With either method the patient, will feel the vibration or touch of the smoothing process but otherwise it will be painless. The dentist will now position the tissue flap back to pretty much its original position and then place whatever sutures are needed. The number of stitches that the dentist does place will vary with each individual case, simply depending how many they feel are necessary to adequately stabilize the flap. The stitches will run from the tissue flap to adjacent, stable (undisturbed, firm) gum tissue. And tied either by "instrument tie" (fig 1) or by "one-handed tie" but make sure that sutures should never be tied tightly. [Howe 2nd edition] [Pedlar & Johns 2nd edition] [Animated teeth.com]

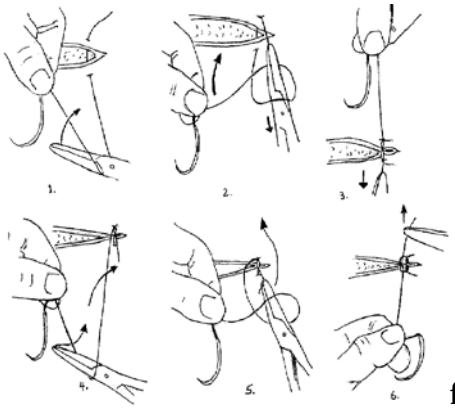


fig 1. instrument tie

Many suture materials and suturing techniques are advocated for the use in the practice of oral surgery, but for most purposes sterile black silk , gauge 000, is the material of choice, and the insertion of simple interrupted suture or interrupted horizontal mattress sutures are the favorable techniques. [Howe 2nd edition]

There is one aspect of sutures that has an inhibiting effect on the wound healing process. To the tissues in which they are placed, sutures are a foreign object and they will be recognized as such. Their presence will trigger inflammation and "foreign body" reaction, which will delay the healing process to some minor degree. Stitches are placed in wounds for specific reasons. If these reasons do not exist, you're actually better off without them. [Minozzi et al., 2009]

Removing stitches is usually easy, quick and pain free. In most cases, on the same day that oral surgery is performed, the dentist will schedule a return appointment for the patient during which the stitches will be removed. The timing of this appointment can vary (and is up to the discretion of the dentist) but usually sutures are removed somewhere between 7 and 10 days after they were originally placed. [Malik 2008]

The process of removing stitches is quite easy. The dentist will simply use a pair of scissors and clip the suture thread. They will then grab one of the free ends (the knotted end) with dental tweezers and simply pull the thread out. There is no need for anesthesia.

Interceptive surgical management of eruption disturbances

A- Ankylosed teeth:

The ankylosed infra-erupted primary tooth has stopped its vertical movement relative to others along the occlusal plane such that marginal ridges are not at the same height as adjacent teeth [Noble et al., 2007][Kennedy, 2009] The prevalence of submerged deciduous teeth in children varies from 1.3 to 3.5%. The most commonly affected teeth are the deciduous mandibular second molars.[Mishra et al 2010]

The earlier that ankylosis and infra-occlusion occurs, the greater potential there is for the problems. The further that an ankylosed primary molar is allowed to become infra-occluded, the more challenging is its surgical removal. This can lead to alveolar problems in the underlying premolar. Furthermore there is increased likelihood of space loss and severe tipping of adjacent teeth. Also, this compromises the alveolar bone level both vertically and bucco-lingually for future prosthetic replacement where space is to be left open for restoration of an underlying missing premolar.[Kennedy, 2009]

Early extraction of ankylosed molars is unnecessary when the infraocclusion is not rapidly progressing or severe. Severe ankylosis is defined as submergence of the ankylosed tooth below the cementoenamel junction of adjacent teeth. The effects on alveolar development depend on the degree of ankylosis. [Kreshenblat et al., 2011]

Extraction may be considered with fast progression, severe infraocclusion, and a slow rate of resorption of the ankylosed tooth, and space maintenance may be recommended. It is may be recommended when the permanent successor is in the wrong position. It is best to avoid early extraction, to avoid the risk of surgical trauma to the succedaneous tooth bud. A nontraumatic and nonsurgical approach must be taken to remove ankylosed teeth which may be in very close proximity to the developing follicle. A surgical approach to extraction of severely infraoccluded teeth may result in damage to the succedaneous teeth. Space loss may be found after extraction, and the need of space maintainers must be carefully considered before extractions. [Kreshenblat et al., 2011]

Reported consequences of submerged deciduous teeth in the literature are many including: delayed exfoliation, reduced alveolar bone support, delayed eruption of successor, malocclusion, damage to adjacent teeth, and loss of arch length. [Teague et al., 1999]

When considering treatment options for the submerged deciduous molars, the most important influencing factor is the presence or absence of the permanent successor.

If the permanent successor is present the submerged ankylosed tooth should be left in space unless there is a good reason for extraction; thereby preventing a potential

traumatic extraction for the child and the dentist. Teague et al. 1999 summarized the reasons for extraction as one of the following circumstances: progressive, deep infra occluded tooth below the gingival margin, severe tipping of the adjacent teeth, ectopic eruption of the permanent successor without resorption of the deciduous root, or other reasons like caries and abscess formation.

The removal of the infra occluded and ankylosed tooth may entail technical difficulties and often means fracture of the roots, which some times have to be left in bone. There is evidence that infra occluded deciduous molars in the upper jaw show fusion with the bone wall of the maxillary sinus. In these cases, extraction may create a pathway into the sinus and lead to further complications. [Kurol 1985]

A child with mild to moderate submergence of a deciduous molar without tipping of the adjacent teeth or overeruption of the opposing teeth should have his ankylosed tooth retained in place until normal exfoliation but the occlusal surface should be restored to prevent such consequences. The techniques available are: preformed stainless steel crowns, direct restoration of the occlusal surface, or indirect composite onlays. [Teague et al., 1999]

If the permanent successor is absent root resorption is slow and spontaneous exfoliation is less likely. Treatment depends upon the patient's age, the condition of the deciduous molar, the patient preferences and suitability for treatment, and the jaw relationship and occlusion. Although the most satisfactory option in an adult patient is to retain the submerged tooth with regular reviews, the patient should understand that those teeth have uncertain prognosis because of the variable degree of root resorption and progression of submergence. [Teague et al., 1999]

If extraction is decided unilaterally or bilaterally, space maintenance may be required and an orthodontic opinion should be sought. The options are to accept the space, close the space orthodontically, restore with fixed/removable prosthesis, or use dental implants in the future.

Methods of surgical extraction and removing ankylosed teeth:

According to the extraction method described by Kurol in his longitudinal study ; under local anesthesia , a mucoperiosteal flap is raised, then loosen the tooth with an elevator and extract it using a forceps, suture back the flap and give the child 0.1% chlohexidine solution for rinsing the mouth twice daily for a week. [Kurol 1985]

Once the root has fractured the dentist must consider the following factors; aggressive surgical removal of all root tips may cause damage to the succedaneous teeth. Thus if the tooth root is clearly visible and can be removed easily with an elevator or root tip pick, remove the root. But if several attempts fail or if the root tip is very small or is situated very deep within the alveolus, the root is best left to be resorbed, most probably by the erupting permanent tooth. [Pinkham text book]

Tooth sectioning:

One example of manipulating the physical nature of the extraction process surgically is termed "tooth sectioning". Due to their size, shape (curved, hooked or crooked), relative positioning (widely divergent)or early ankylosed teeth, the anatomical form of multi-rooted teeth can prove to be an obstacle to the extraction process. By sectioning a tooth into parts, the dentist can change the nature of the extraction (divides and conquers). The dentist can now focus on removing each individual tooth portion separately. [Malik 2008] Another indication for sectioning is primary molars with roots encircling the successor's crown in order to protect the permanent tooth's location. [AAPD]

In some instances factors like very dense bone (such as that surrounding teeth that function under a heavy load) or in elastic bone (a change often associated with aging) can dictate that prior to removing a tooth some of its surrounding bone must first be removed. This bone removal may or may not be performed in conjunction with tooth sectioning. If still this method did not work. [Malik 2008] [Animated teeth.com]

Bone removal:

The amount of bone removed should be limited to the amount required to attain the objectives and should be carefully sited systematically performed. There are several methods to remove bone, and it is often a good practice to employ more than one method of bone removal during one operation.

Chisel: a chisel has a beveled and flat surface, the bevel must be towards the bone to be sacrificed; thus ensuring that a clean cut non-bruised bone edges are left after bone removal .

When the bone is dense and sclerotic a dental bur should be used to remove bone. A round bur in a straight handpiece is mostly preferred. Great care should be taken to avoid overheating by the rotating bur. It should run slowly under efficient water jet.

Recently, a piezoelectric knife was introduced to enhance periodontal surgical procedures. The micrometric cut of the scalpel allows for maximum intraoperative precision with minimal tissue damage, and the selective ultrasonic frequency of the scalpel minimizes the risk to adjacent soft tissues.

The wound healing response in the alveolar crest following ostectomy and osteoplasty has been the subject of many investigations. Wilderman et al recorded minimal initial bone resorption ranging from 0.14 to 4.47 mm (average of 1.2 mm), followed by alveolar regrowth ranging from 0.14 to 1.15 mm (average of 0.8 mm) in a human histologic study that examined the reparative potential of tissue following mucogingival flap and osseous surgery. [Vercelloti et al., 2005]

Vercelloti et al., 2005 found that thicker bone with marrow spaces exhibited less resorption and greater repair when compared with thin bone. It appears that Piezoelectric surgery provided more favourable osseous repair and remodeling than carbide bur or diamond bur when surgical ostectomy and osteoplasty procedures were performed. Therefore, piezoelectric surgery could be regarded as being efficacious for use in osseous surgery.

Decoronation:

It is the removal of the crown just below the cervical bone margin. Decoronation of ankylosed teeth in infraposition was introduced in 1984 by Malmgren and co-workers . This method is used all over the world today. It has been clinically shown that the procedure preserves the alveolar width and rebuilds lost vertical bone of the alveolar ridge in growing individuals. The biological explanation is that the decoronated root serves as a matrix for new bone development during resorption of the root and that the lost vertical alveolar bone is rebuilt during eruption of adjacent teeth. First a new periosteum is formed over the decoronated root, allowing vertical alveolar growth. Then the interdental fibers that have been severed by the decoronation procedure are reorganized between adjacent teeth. The continued eruption of these teeth mediates marginal bone apposition via the dental-periosteal fiber complex. The erupting teeth are linked with the periosteum covering the top of the alveolar socket and indirectly via the alveolar gingival fibers, which are inserted in the alveolar crest and in the lamina propria of the interdental papilla. Both structures can generate a traction force resulting in bone apposition on top of the alveolar crest. This theoretical biological explanation is based on known anatomical features, known eruption processes and clinical observations. [Malmgren et al., 2006]

Even an uncomplicated extraction will reduce the alveolar bone volume. This reduction has been estimated to be 18–25% of the bone mass and might jeopardize future implant therapy. It is also important to keep in mind that tooth eruption continues even after active growth of the jaws (usually 1/10 of a millimeter per year). Decoronation can overcome such problems due to extraction. [Malmgren et al., 2006]

B-Supernumerary teeth

A supernumerary tooth is defined as any tooth or odontogenic structure that is formed from a tooth germ in excess of the usual number for any given region of the dental arch. They may be single, multiple, unilateral, or bilateral in their distribution, occurring in the maxilla and/or the mandible, and present in both the primary and permanent dentitions but with a predilection for the premaxilla. [Omar et al., 2010]

Supernumerary teeth may be found during a routine, clinical, or radiographic examination, and may not be responsible for any discernable adverse effects on adjacent teeth. A panoramic radiograph or a complete periapical series sometimes cannot provide complete information on the 3-dimensional (3D) relationship between supernumerary teeth, or ectopically impacted teeth, and adjacent structures. So Kawashita et al., 2009 advised the use of computed tomography (CT) and considered it can provide more useful information for diagnosis and planning treatment, especially in cases of multiple supernumerary teeth. [Kawashaki et al., 2009] [Omar et al., 2010]

Supernumerary teeth may: compromise the esthetics; delay the eruption of adjacent teeth; induce crowding/malocclusion; cause dentigerous cyst formation; complicate alveolar bone grafting; compromise the sighting of implants; and impinge on nerves leading to paresthesia and/or pain. In these cases, removal of the supernumeraries is vital to resolve the complications and prevent further damage. [Omar et al., 2010]

In cases, where no future orthodontic treatment is foreseen and no complications are evident, it is reasonable to recommend that no immediate surgical intervention is essential. [Omar et al., 2010]

Supernumerary teeth in the primary dentition have less effect upon adjacent teeth than they do in the permanent dentition because the developmental spacing can accommodate

an extra tooth without producing an irregularity, and will probably erupt and exfoliate without being noticed. [Primosch et al., 1981]

Surgical removal of supernumerary teeth:

Timing for surgical extraction for supernumerary teeth is still controversial. with some authors recommending immediate removal following their identification. This approach, however, has no chronological basis. Others favor a delayed or conditional removal, which appears logical. Furthermore, it has been reported that supernumerary teeth have a tendency to resorb and disappear if left untreated and this was seen in 37% from the sample examined and followed by Koch et al., 1986.

Omar et al., 2010 has studied the timing of surgical removal of the unerupted supernumerary teeth and classified the risk in relation to Demerjian teeth development stages (table 1) as follows: surgical removal of the unerupted supernumerary teeth at stage C (4-5 years old) exhibited minimal complications, which implies that there is less chance of surgical damage to the adjacent permanent teeth when early intervention is implemented. Surgical removal of a supernumerary tooth is best delayed if the adjacent permanent teeth are at stage D (5-6 years old), unless the removal is justified due to existing pathology. And surgical removal of a supernumerary tooth when the child is 6- to 7-years-old (stage E) carries minimal risk of arresting the root development of the adjacent permanent teeth. While surgical removal at stage H {>10-years-old) resulted in the highest number of complications, followed by removal at stage F (approximately 7-9 years old).

Table 2. DENTAL MATURITY ASSESSMENT (DENTAL AGE), BASED ON CROWN AND ROOT DEVELOPMENT AND THE CHRONOLOGICAL AGE, ACCORDING TO DEMIRJIAN (1978)

Dental stage		Description
	C 4-5 ys*	The enamel formation is completed at the occlusal surface, with extension and convergence toward the cervical region. Dentinal deposits started to form, with curved shape outline of pulp chamber at the occlusal surface.
	D 5-6 ys	The crown formation is completed down to the cementoenamel junction. The superior border of the pulp chamber has a definite curved form, being concave toward the cervical region. Pulpal horns projection may be present. The beginning of root formation is seen in the form of a spicule.
	E 6-7 ys	The crown is completely formed and the pulp chamber has formed straight lines with continuity broken by the presence of a large pulp horn. The root length is less than the crown height.
	F 7-9 ys	The pulp chamber roughly forms an isosceles triangle. The apex ends in a funnel shape. The root length is equal to or greater than the crown height.
	G 9-10 ys	The root length is greater than that in stage F. The root canal walls are parallel. The apex is still or partially open.
	H >10 ys	The apex is completely closed. The periodontal membrane is of uniform width around the apex.

* Chronological age of each dental stage based on 126 southern Chinese children

table 1. adopted from Omar et al. 2010

Radiographic Examination

Correct radiographic examination is essential prior to surgery to indicate buccal or palatal impaction and plan the site and design of flap intended for surgical removal.

A radiographic examination is indicated if abnormal clinical signs are found. An anterior occlusal or periapical radiograph is useful to show the incisor region in detail. The buccolingual position of unerupted supernumeraries can be determined using the parallax radiographic principle. The horizontal tube shift method utilizes two periapical radiographs taken with different horizontal tube positions, whereas an occlusal film together with a panorex view are routinely used for vertical parallax. If the supernumerary moves in the same direction as the tube shift it lays in a palatal position, but if it moves in the opposite direction then it lies buccally. Intraoral views may give a misleading impression of the depth of the tooth. A true lateral radiograph of the incisor

region assists in locating the supernumeraries that are lying deeply in the palate and enables the practitioner to decide whether a buccal rather than a palatal approach should be used to remove them. [Garvey et al., 1999] [Pedlar & Johns 2nd edition]

Mesiodens

The term of mesiodens is used to refer to an unerupted supernumerary tooth in the midline of maxilla, between the central incisors. Common associated complications include impaction of maxillary incisors, malpositioning of incisors, diastema formation, crowding, rotation, dilaceration, and root resorption of adjacent teeth. Other complications are formation of the primordial or follicular cysts with associated destruction of bone and oronasal fistulas. [Kolkarni et al., 2010]

The treatment objective for a nonerupting permanent mesiodens is to minimize eruption problems for the per-manent incisors. Surgical management will vary depending on the size, shape, and number of supernumeraries and the patient's dental development.[AAPD] Extraction of an unerupted primary or permanent mesio-dens is recommended during the mixed dentition to allow the normal eruptive force of the permanent incisor to bring itself into the oral cavity.[AAPD]

The method of surgical extraction is well described in Prismoch 1981 study, in reporting a case of mesiodens removing. A full thickness mucoperiosteal flap is reflected. The nasopalatine structures can be severed without adverse effects. If desired, the flap can be held in a retracted position by sutures looped around the molars. If necessary, the primary incisors as well as any overlying bone may be removed to locate the supernumerary tooth. Chisels are better for bone removal than burs because of less likelihood of damage to adjacent structures. However, damage to adjacent structures rarely occurs if a conservative approach is used since the supernumerary lies in a different anatomic plane. The supernumerary is located and identified prior to extraction. The entire follicle should be removed to prevent recurrence or residual cyst formation.

Kulkarni et al 2010 reported a case for a 12 year old child with 4 supernumerary teeth in the premaxilla that were partially erupted. Treatment planning included surgical removal of the mesiodens followed by exposure of the maxillary right central incisor and orthodontic correction of the distolabially displaced central incisors. Surgical phase was described in the following mannar, after administration of local anesthetic, an incision was made on the alveolar ridge along with two releasing incisions using a no. 15 blade. A mucoperiosteal flap was reflected to expose the four mesiodens completely, and they were surgically removed . The mucoperiosteal flap was trimmed to expose the maxillary right central incisor. The surgical site was irrigated with povidone iodione– saline solution. The flap was repositioned, approximated, and closed with 3-0 silk sutures. One week later, the sutures were removed. Normal healing was observed. [Kulkarni et al., 2010]

Extraction of supernumerary impacted premolars

When an instanding premolar is deeply embedded, a lingual mucoperiosteal flap is raised and lingual bone removed to expose the maximum convexity of the crown, a buccal flap is then raised and any bone covering the crown is removed, with slight distal or buccal elevation of the tooth it will be out from the socket. If the premolar is totally impacted , take care of the mental nerve during incising the vertical incision of the buccal flap, and during bone removal. In most times it is necessary to divide the tooth in order to effect its delivery. In this case divide the crown from the root , and try to elevate them separately. [Howe 2nd edition]

C - Surgical exposure of impacted permanent incisors;

Uneruption of the maxillary central incisors may be associated with the presence of mesiodens or supernumerary teeth, blocking the path of eruption, but may also be associated with delayed shedding of the deciduous predecessor. Other causes are less clear, and accredited to soft tissue obstruction, but what has been recognized is that removal of any obstruction, soft or hard, may result in spontaneous eruption. [Crean et al., 2000] However it has been reported in some studies that early extraction of a supernumerary tooth from the path of eruption a permanent incisor can result in fibrotic

gingiva at the area of surgical removal and delay or prevent spontaneous eruption.[Shah et al., 2010]

There are 4 main criteria for active treatment of delayed eruption of the permanent teeth. First, if failure of eruption of the permanent incisor is the child's chief presenting complaint, treatment is usually appropriate. Although the permanent incisor may eventually erupt spontaneously, the process could take up to a full year, and the parents and/or the child may not want to wait this long. Children of this age are often targets for teasing and bullying by their peers, so the request for treatment on esthetic grounds and the significant psychological benefits of orthodontic guidance should not be discounted. If there is at least 3 mm of bone between the incisal edge of the impacted tooth and the oral cavity, spontaneous eruption could take much longer than usual, and treatment may be appropriate. The delay in eruption may allow adjacent teeth to drift into the empty space, which may further impede eruption of the unerupted tooth. Finally, the developmental stage of the unerupted incisor root will help in determining if treatment is appropriate. If the impacted tooth is mature or the apex of the tooth has closed the natural eruptive potential is lost, and the tooth will need active orthodontic guidance. [Shah et al., 2010]

The traditional surgical treatments for unerupted incisors include gingivectomy to expose at least one-half to one-third of the crown, apically repositioned flap (if gingivectomy does not leave enough attached gingiva) and closed eruption techniques, for teeth which are mid alveolus or positioned high in the vestibule adjacent to the nasal spine. [Crean et al., 2000] [Shah et al., 2010]

When the incisors are palpable above the reflection of the mucous membrane they may be exposed with ease by incising the mucosa. This however may give a shallow labial sulcus with a deficiency of attached mucoperiosteum. This problem can be solved by using a "modified apically repositioned flap"; this done by incising well on the palatal side of the buried tooth and the resultant mucoperiosteal flap is widely undermined and rotated forwards and upwards to line a labial sulcus; in this manner the amount of the

attached mucosa is increased and gingival health preserved. [Howe 2nd edition] [Crean et al., 2000]

Because some studies reported that apically repositioned flaps can result in marginal and gingival bone loss, possibly due to accelerated passive apical migration of labial epithelial attachment. [Crean et al., 2000] Crean et al., described a case in which they used a *modified apically repositioned flap*, they incorporated palatal mucosa into the apically repositioned flap (fig 2), resulting in the successful establishment of an attached gingival margin, where routine flap design would have seriously compromised the eventual outcome.



fig 2 . incorporation of the palatal mucosa in the flap

If the unerupted tooth is in a favourable position, an open-flap approach followed by a closed-eruption technique can be used, as the outcome with this method is more esthetically pleasing than the result obtained when the maxillary anterior teeth are uncovered with an apically positioned flap. If a closed-eruption technique is to be used, it is important that a gold chain or ligature wire be attached to the bracket or button on the unerupted tooth at the time of surgical exposure, so that this tooth can be incorporated into the partial orthodontic appliance even in the subgingival position. [Shah et al., 2010] Closed eruption techniques, although attempting to mimic the natural eruption process with reduced scarring following the procedure, may still result in reduced zones of attached gingivae, nevertheless, this is far less of a problem than with gingivectomy or apically positioned flaps. [Crean et al., 2010]

D - Surgical exposure of impacted canines;

Ectopic eruption and impaction of maxillary permanent canines is a frequently encountered clinical problem. The diagnosis and treatment of this problem usually

requires the expertise and cooperation of the general practitioner, pediatric dentist, oral surgeon, and periodontist as well as the orthodontist.

Localization and determination of a tooth's exact position is the foremost step in surgical exposure of an impacted tooth. This can often be done by palpation in labial impactions. However, the use of periapical radiographs and occlusal radiographs plays a major role in palatal and middle alveolar impactions. Use of the buccal object rule is helpful in determining the location of impacted teeth. [Howe 2nd edition]

Ectopic labially positioned canines may erupt on their own without either surgical exposure or orthodontic treatment, frequently high in the sulcus or alveolar ridge. Conversely, palatally impacted canines seldom erupt without intervention It is believed that this impeded eruption is caused by the thickness of the palatal cortical bone as well as the dense, thick, and resistant palatal mucosa. [Bishara et al., 1998]

Historically, a number of methods have been described for exposure of impacted teeth: celluloid crown, pack the wound area to maintain exposure, recommended gutta-percha packing, pins, orthodontic bands, and wire ligature. But the three most significant advances historically for exposure are: palatal flap for exposure, direct-bonding brackets, and soft tissue management. The palatal flap provided access and visibility. Direct bonding reduced morbidity by minimizing wound size and reduced tissue overgrowth and additional surgeries by having a bracket placed at the time of exposure. [Vijayalakshmi et al., 2009]

Various surgical techniques can be employed to uncover impacted teeth. The vertical location of the permanent tooth position to deciduous tooth and the amount of gingiva available, will determine the selection of the appropriate technique. The goal of these mucogingival interceptive surgeries is to prevent the ectopic permanent tooth from developing periodontal lesions in its most incipient stage. [Vijayalakshmi et al., 2009]

Management of Buccaly impacted canines:

Labially or buccally erupting teeth show reduced dimensions of gingiva; as abnormal eruption of permanent teeth restricts or eliminates the keratinized tissue between the erupting cusp and the deciduous tooth. A lack of attached gingiva poses a potential risk for gingival recession in labially or buccally erupted teeth due to the possibility of accumulation of plaque and/or traumatic tooth-brushing during subsequent orthodontic treatment. A good understanding between the orthodontist and the periodontist along with proper management of periodontal tissues can prevent these problems.

Labially impacted teeth with a favorable vertical position may be treated initially by surgically exposing them but without the application of a traction force. Some authors consider that in younger patients, the tooth will erupt on its own after surgical exposure, whereas in older patients, traction is almost always indicated. The absence of an adequate band of attached gingiva around the erupting canine may cause inflammation of the periodontium. [Bishara et al., 1998]

A gingivectomy procedure for exposure could lead to removal of all the attached gingiva for the canine, and result in an alveolar mucosal attachment. An adequate band of attached gingiva can be achieved by either apically repositioning a flap with attached gingiva, or by grafting keratinized gingiva from the palate to the site of exposure. [Vijayalakshmi et al., 2009] Vanarsdall and Corn have suggested that the flap containing the keratinized tissue should be placed to cover the CEJ and 2 to 3 mm of the crown. [Bishara et al., 1998]

The first method-apically positioned flap was described in Vijayalakshmi et al., 2009 study reporting a case: A split-thickness flap was raised by sharp dissection using a number 15 scalpel blade along the tip of the unerupted canine. Vertical releasing incisions were carried high enough into the vestibule to permit apical positioning of the flaps. The flap was wide enough to maintain adequate vascularity. The flap was raised to permit the exposure of impacted tooth. (fig 3) Osteoplasty was done to expose the crown portion for bracket placement. The flap was apically positioned and stabilized with 4-0 silk sutures (fig 4).

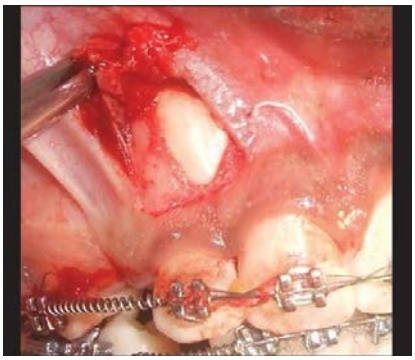


Fig 3. apical positioned flap



fig 4. flap sutured apically

Management of palately impacted canines:

Two of the most commonly used methods for palately impacted canines management are: *surgical exposure and allowing for natural eruption*; this method is most useful when the canine has a correct axial inclination and does not need to be uprighted during its eruption. The progress of canine eruption should be monitored using reference points such as an adjacent tooth or the arch wire. The main disadvantages of this approach are the spontaneous but slow canine eruption, the increased treatment time, and the inability to influence the path of eruption of the impacted canine.[Bishara et al., 1998] The results in the literature suggest that excisional exposure permitting free eruption of palatally displaced maxillary canines is successful in the great majority of cases. [Ferguson et al., 1997]

The second approach is *surgical exposure with the placement of an auxiliary attachment.* Orthodontic forces are subsequently applied to the attachment to move the impacted tooth. [Bishara et al., 1998]

Two approaches are generally recommended in regards to the timing of placing the attachment: Lewis preferred a two-step approach. First the canine is surgically uncovered and the area packed with a surgical dressing to avoid filling-in of tissues around the tooth. After wound healing, within 3 to 8 weeks, the pack is removed and an attachment is placed on the impacted tooth. The second method is a one-step approach, that is, the attachment is placed on the tooth at the time of surgical exposure. [Bishara et al., 1998]

It is concluded from the literature that exposure of the CEJ is a critical variable and should be avoided as a surgical objective during surgery. [Bishara et al., 1998]

A study compared the two methods of exposure and resulted in that, in 30.7 per cent of cases exposed and bracketed a second surgical intervention was required, compared with 15.3 per cent in the simple exposure group. Bracketing, though effective, is a more costly and time-consuming procedure, and it is suggested that simple exposure provides an equally efficient and predictable method of managing the palatally impacted canine with obvious clinical and financial benefits. [Ferguson et al., 1997]

Impacted third molars

Panoramic or periapical radiographic examination is indicated in late adolescence to assess the presence, position, and development of third molars. AAOMS recommends that a decision to remove or retain third molars should be made before the middle of the third decade.

However, the age of the patient is only a secondary consideration. Referral to an oral and maxillofacial surgeon for consultation and subsequent treatment may be indicated. When a decision is made to retain impacted third molars, they should be monitored for change in position and/or development of pathology, which may necessitate later removal. [AAPD]

E - Gingival overgrowth:

Gingival overgrowth frequently occurs in the oral cavity. Inflammation, a response of the immune system elicited by infection or injury of tissues, may cause this condition. The enlarged tissue may also be a result of hyperplasia, which is an increase in cell number, or hypertrophy, which refers to an increase in cell size; both conditions can be physiologic or pathologic. Some etiologic factors and mechanisms involved in gingival overgrowth are well known, while others are not clear. Among others, bacterial plaque, hormones, drugs, and genetic disorders can be mentioned. Gingivitis, the most common form, is caused by bacterial plaque, and adequate oral hygiene will usually restore a healthy gingiva. Sex hormones during puberty in both sexes and pregnancy in women, associated or not with inadequate nutrition and oral hygiene, are well recognized to

induce gingival enlargements. Systemic hormonal stimulation and, more specifically, the use of contraceptives have also been reported to stimulate the occurrence of this condition. Drug induced gingival overgrowth can be broadly divided into three categories: anti-convulsants, calcium channel blockers and immuno-suppressants.[Lobau et al., 2007] [Ahmad et al., 2009]

Gingival fibromatosis

Gingival fibromatosis (GF) is a heterogeneous group of disorders characterized by progressive enlargement of gingiva caused by increase in submucosal connective tissue elements. Idiopathic gingival fibromatosis (IGF) is a rare, benign, asymptomatic, nonhemorrhagic, and nonexudative proliferative fibrous lesion of the gingival tissue. A slowly progressive fibrous enlargement devoid of inflammatory erythema of the maxillary and mandibular gingiva without a family history is a feature of idiopathic fibromatosis of the gingiva. Characteristically, this massive gingival enlargement appears to covet the tooth surfaces and displace the teeth. While the cause of the disease is unknown, there appears to be a genetic predisposition. [Ramnaryan et al., 2011] The gingiva in IGF is usually pink in color. Enlargement may be generalized or localized to specific areas such as the maxillary tuberosity and labial gingiva around lower molars. Severity may vary from mild involvement of 1 quadrant to severe involvement of all the quadrants. Effects of the lesion include diastema, malposition of teeth, and prolonged retention of primary teeth resulting in esthetic and functional problems. In extreme cases, the lips ate everted by the excess gingival bulk and are incompetent. The enlargement is most intense during the eruption of the primary and permanent teeth, and minimal or nondetectable growth is observed in adults. [Ramnaryan et al., 2011] It is rarely present at birth or arises in adulthood. .[Lobau et al., 2007] [Ramnaryan et al., 2011]

Overgrowth of tissue needs to be surgically removed. Various treatment modalities have been suggested, but controversy still remains regarding the exact period in which it should be accomplished. [Ramnaryan et al., 2011] According to many authors, the best time for surgical intervention is when all the permanent dentition have erupted, because the risk of recurrence is higher preceding that. [Lobau et al., 2007] [Ramnaryan et al.,

2011] Various techniques used for the excision of enlarged gingiva include external or internal bevel gingivectomy in association with gingivoplasty, an apically positioned flap, electrocautery, and carbon dioxide laser.

Gingivectomy and gingivoplasty:

Conventional Scalpel Surgery:

Gingivectomy is the surgical excision of the wall of a periodontal pocket. Gingivoplasty is the reshaping of the gingiva to obtain correct physiologic contour. Both of these procedures are usually carried out as part of the same procedure.

Steps of gingivectomy procedure are as follows: use a pocket marking forceps to measure the depth of overgrowth and puncture the gingiva to show the depth from the outside, a series of punctures are made including the interdental area. The initial incision is made using a kidney shaped knife (No. 7) , the angulation should be ideally at about 45 degrees to the long access of the teeth (fig 5). Interdental tissues are then severed by (No. 11 knife). Tissues removed by means of the concave ended (No. 10) knife or by using curettes. Remove all tissue tags and leave a smooth wound surface to avoid excessive granulation tissue postoperatively. [Howe ., 2nd edition]



fig 5. scalpel technique

Gingivectomy by Electro surgery

It is performed with the needle electrode, supplemented by the small, ovoid, loop or the diamond shaped electrodes for festooning. A blending, cutting and coagulating current is

used. for all reshaping procedure the electrode is activated and moved in a precise shaving motion. For hemostasis, the ball electrode is used. Hemorrhage must be controlled with direct pressure, then the surface is very lightly touched with a coagulating current. Electrosurgery permits an adequate contouring of the tissue and controls hemorrhage. But it cannot be used in patients who have poorly shielded cardiac pacemakers. And the treatment gives out an unpleasant odor. It should be noticed if the electrosurgery touches the bone it causes irreparable damage. The heat generated can cause tissue damage and loss of periodontal support. [eDoctor.com] Further details about electrosurgery are explained later in this review.

A clinical trial conducted by Arembad et al. using a split mouth technique and random selection of operative techniques, gingivectomy was performed from first premolar to first premolar by electrosurgery on one side and by periodontal knives on the other side on thirty occasions. By clinical, photographic, cytologica! and histological methods of evaluation plus crevicular fluid measurement, no differences in healing between the two surgical modalities over a three week period were demonstrated. Little post operative pain was experienced but where there was pain it did not differ in severity between the two surgical procedures. [Aremband et al 1973]

Laser Gingivectomy

The most common lasers used in gingivectomy are the carbondioxide lasers and the neodymium:yttrium-aluminum-garnet, which have wave lengths of 10600nm and 1064nm respectively in the nm range. The carbon dioxide laser has been used for the excision of gingival growths, although healing is delayed compared with healing after surgical gingivectomy. Precautionary measures to avoid reflecting the laser beam on instrument surfaces which could result in injury to neighbouring tissue and eyes of the operator needs to be taken. [eDoctor.com]

A case described by Mason & Hopper 1994 of gingival fibromatosis in a 10-year-old boy, in which gingival tissue was removed using a CO2 laser. The advantages of this method over conventional surgery were minimal bleeding and pain, allowing treatment of

all quadrants in one visit. The disadvantages were the potential risks to the teeth and to the endotracheal tube. In this case laser treatment achieved a good result with minimal post-operative discomfort, which is an important consideration for children. [Mason & Hopper 1994]

Labou et al., 2007 described a case for 3 months old baby who had signs of gingival fibromatosis and it was decided to perform a series of gingivectomies following the chronology of eruption of the primary teeth. Although electrocautery and carbon dioxide laser has been described in the literature, they considred conventional external bevel gingivectomy is more frequently used and is also considered to be an efficient method to remove large quantities of gingival tissue. While Ramnaryan et al. 2011 considered CO2 laser is the first choice for gingival surgery in such cases. Ramer et al., advocated quadrant-wise gingivectomy with periodontal pack placement for 1 week, followed by 0,2% chlorhexidine oral rinse twice a day for 2 weeks after each surgery.

F - Surgical management of intruded teeth

Intrusion is apical displacement of the tooth into the alveolar bone, a rare injury seen to represent only 0.3-2% of traumas affecting the permanent dentition. The damage caused to the hard and soft tissues (i.e. gingival tissues, periodontal ligament, alveolar bone and pulp) in these injuries arises a multitude of complications including loss of gingival attachment, marginal bone loss and root resorption. Furthermore, pulpal necrosis and failure of root formation are frequent in cases of injury to immature teeth. These reasons associated with poor post-treatment outcomes have made the management of intrusive luxations a controversial topic. Historically, suggested treatment methods include- Spontaneous re-eruption, immediate surgical repositioning and fixation, orthodontic repositioning and a combination of surgical and orthodontic therapy. There is no single agreed-on-approach to treatment. For a completely intruded immature tooth immediate surgical repositioning has been documented as the treatment of choice. [Garge et al., 2008] [Andreason 8th edition]

If the tooth is completely intruded, it should be located and flap raised to expose the crown of underlying intruded tooth, gently and carefully luxate the tooth with dental forceps and bring it back into the desired position. Take in your consideration that the root has never left the alveolus, so care should be taken to prevent inadvertently touching the root surface. Splint the tooth for 10-14 days, and then make necessary endodontic management. [Garge et al., 2008] [Andreason 8th edition] [Kirzioglo et al.,2009]

In the case reported by Garge et al., 2008, permanent maxillary incisor was completely intruded into the alveolar bone and was embedded with root surface in intimate relationship with bone and thus high chances of ankylosis and root resorption were anticipated. Aim of the treatment was to restore the tooth in its original position by decompressing the injured tissue and re-establishing normal relationship between tooth and bone. Thus passive repositioning was not considered as the treatment option. Orthodontic repositioning was not considered as placing brackets on the intruded tooth was not feasible with various disadvantages accompanied with this method. It is time consuming with a long retention period, making patients co-operation a critical factor. Immediate surgical repositioning was opted as the treatment of choice as it extrudes and saves the tooth in one step procedure. It is simpler and less time-consuming than orthodontic repositioning.

The immediate surgical repositioning method is recommended, in most cases, for full intruded teeth and it can facilitate the orthodontic bonding for subsequent tooth movement since immediate orthodontic force on traumatically intruded teeth would facilitate the dental extrusion, allow an early endodontic access and it can be considered a way to prevent the appearance of ankylosis. This method also can increase the risk of external root resorption and marginal bone loss. [Mederiros et al.,2008]

G- Eruption cyst "eruption hematoma":

The eruption cyst is a soft tissue cyst that results from a separation of the dental follicle from the crown of an erupting tooth. Fluid accumulation occurs within this created fol-

licular space. Eruption cysts most commonly are found in the mandibular molar region. Color of these lesions can range from normal to blue-black or brown, depending on the amount of blood in the cystic fluid. [AAPD] The blood is se-condary to trauma. If trauma is intense, these blood-filled le-sions sometimes are referred to as eruption hematomas. Because the tooth erupts through the lesion, no treatment is necessary. If the cyst does not rupture spontaneously or the lesion becomes infected, the roof of the cyst may be opened surgically. [AAPD]

Navageni et al recommended that surgical intervention is required when the eruption cyst hurt, bleed, infected, or esthetic problems arise. Treatment has to be performed in order for the child to lead a healthy and comfortable life. [Navageni et al., 2011]

Interventional treatment may not be necessary because the cyst ruptures spontaneously, thus permitting the tooth to erupt. If this does not occur, simple excision of the roof of the cyst generally permits speedy eruption of the tooth. Simple incision or partial excision of the overlying tissue to expose the crown and drain the fluid is indicated when the underlying tooth is not erupting or the cyst is enlarging. [Navageni et al., 2011]

A novel treatment modality has been suggested by Boj et al., which consists of use of Er, Cr-YSGG laser for treatment of eruption cysts. It has certain advantages over conventional lancing with scalpel. They can be listed as non-requirement of anesthesia, no excessive operative bleeding, does not produce heat or friction and patient will be comfortable. It is bactericidal and has coagulative effects, tissue healing is better and faster, and it is not associated with postoperative pain.

Interceptive surgical management of soft tissue defects

A - Ankyloglossia:

Tongue-tie or ankyloglossia is described as a congenital condition with an unusually thickened, tightened or shortened frenulum (membrane or string under the tongue). The frenulum may vary in length, elasticity and placement along the underside of the tongue to the floor of the mouth, which then can affect infants' breastfeeding skills in different

ways and can affect other activities of the child such as feeding, dental hygiene, and speech. [Edmunds et al.,2011]

The lingual frenulum recedes as a natural process of the child's growth and development that occurs during the first 6 months to 6 years of life. Ankyloglossia occurs when the lingual frenulum persists as an anatomical abnormality. The severity of ankyloglossia varies from absence of clinical significance to a completely fixed tongue to the floor of the mouth. [Chaoubal et al., 2011]

The ankyloglossia can be classified into 4 classes based on Kotlow's assessment (Free tongue classification :length of tongue from the insertion of the lingual frenum into the base of the tongue to the tip of the tongue) as follows; Class I: Mild ankyloglossia: 12 to 16 mm, Class II: Moderate ankyloglossia: 8 to 11 mm, Class III: Severe ankyloglossia: 3 to 7 mm, Class IV: Complete ankyloglossia: Less than 3 mm. [Chaoubal et al., 2011]

Rafolli et al. compared two methods to evaluate the severity of the ankyloglossia in a child, in technique A the length of the frenulum is directly measured by recording the distance between the insertion of the lingual frenulum into oral floor and the tongue, in technique B the length of frenulum is indirectly evaluated by measuring the distance between the incisal border of the upper central incisor and the incisal border of the lower homolateral central incisor. Children with lower values (2.0 cm for A; 2.3 for B) were defined as having various grades of ankyloglossia, and divided into 3 grades (mild moderate and severe) as in the following table [Rafolli et al., 2005] :

Table 2 Classification of levels of ankyloglossia		
Technique B	Technique A	
<2.3 cm	<2cm	Level of normality
		Level of ankyloglossia
1.7–2.2 cm	1.6–1.9 cm	Mild
0.4–1.6 cm	0.8–1.5 cm	Moderate
0.3 cm	0.7 cm	Severe

Class III and IV tongue-tie category according to Kotlow's assessment should be given special consideration because they severely restrict the tongue's movement. [Chaoubal et al., 2011]

A normal range of motion of the tongue is indicated by the following criteria: The tip of the tongue should be able to protrude outside the mouth; without clefting, the tip of the tongue should be able to sweep the upper and lower lips easily; without straining, when the tongue is retruded, it should not blanch the tissues lingual to the anterior teeth; and the lingual frenum should not create a diastema between the mandibular central incisors. [Chaoubal et al., 2011]

Ankyloglossia may resolve spontaneously or affected individuals may learn to compensate adequately for their decreased lingual mobility. Some individuals, however, benefit from surgical intervention frenotomy, frenectomy or frenuloplasty for their tongue-tie. Patients should be educated about the possible long-term effects of tongue-tie so that they may make an informed choice regarding possible therapy. [Chaoubal et al., 2011]

Surgical method

The tongue is grasped and pulled upwards and frenal attachment is released using a transverse incision and sewn up vertically . Care must be taken to avoid damaging the submandibular salivary gland opening, either with the incision or with the sutures. [Pedlar & Johns 2nd edition]

Chauubal et al., described the frenectomy done in the case report in the following manner, first a curved hemostat is inserted to the bottom of the lingual frenum at the depth of the vestibule and clamped into position followed by giving two incisions at the superior and the inferior aspect of the hemostat. This way, the intervening frenum is removed and a diamond shaped wound result (fig 5). Then with the help of the same

hemostat, release the muscle fibers so as to achieve a good tension free closure of the wound edges, after which the wound edges must be approximated with (4-0) black braided silk sutures (fig 6) for the tissues to heal by primary intention thereby minimizing the scar tissue formation.

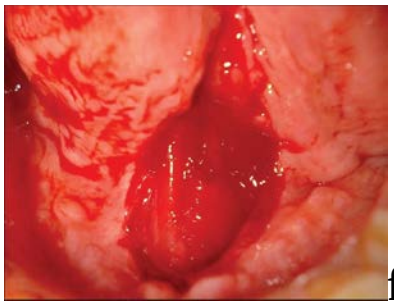


fig 4

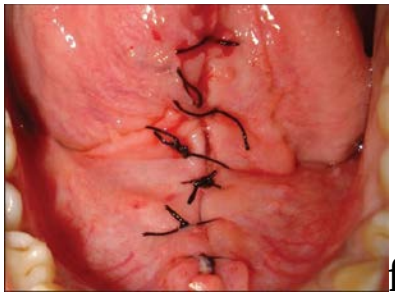


fig 5

Doshi et al. 2010 reported a case with complete ankyloglossia in which 940 nm diode laser was used for treatment and compared it with conventional surgical technique and concluded that the advantages of laser include a bloodless operating field, no postoperative infection or pain, and no suturing is needed. (fig 6)



fig 6 "immediate post-op. view"

Method of laser frenectomy was described in the following manner : An initiated tip of 300 μm is used at a 2.75-W pulse interval, 1.0 ms and pulse length 1.0 ms, with an average power of 1.37 W in a pulsed mode . The tip should be initiated by firing it at 1.4 W in continuous mode and allowing it to dip into the initiator device, which is a piece of cork. After initiation, the tip is carbonized. The tip is moved from the apex of frenum to the base in a brushing stroke, cutting the frenum. [Doshi et al. 2010]

Diathermy "electrosurgery" is also reported in the literature as a good method to treat ankyloglossia with the advantage of minimal postoperative bleeding. [Tuli & Singh 2010]

B - Abnormal labial frenum

The labial frenum is an anatomical structure formed by a mucous membrane and connective tissue. It has a wide and relatively deep origin or base on the interior surface of the upper lip and extends to the middle portion of the buccal surface of the alveolar process, between the central incisors. Here, it is attached to the periosteum's external layer, the maxillary suture's connective tissue, and the alveolar process. The frenum is a dynamic and changeable structure and is subject to variations in shape, size, and position during the different stages of growth and development. During growth, it tends to diminish in size and importance. In young children, the frenum is generally wide and thick, becoming thinner and smaller during growth. It has several shapes as illustrated in (fig 7) [Piaz-Dizan et al., 2006]

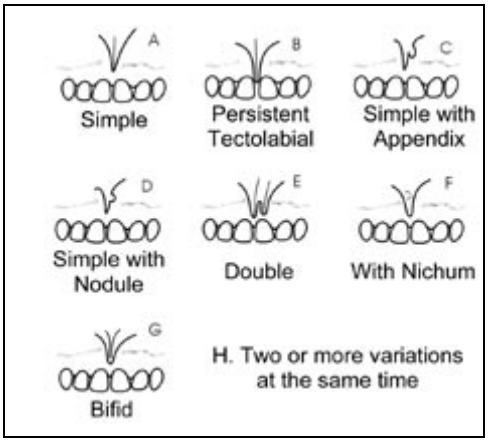


fig 7. labial frenum classification

The rule of labial and lingual frenectomy timing decision is for the upper labial frenum the presence of a maxillary diastema does not prompt early frenectomy. Wait until the permanent lateral incisore and canines erupt. But for mandibular frenum problems it should be treated when first noticed to prevent a mucogingival defect from developing. [Ohio-state.edu] According to the AAPD treatment is suggested when the attachment exerts a traumatic force on the gingiva causing the papilla to blanch when the upper lip is

pulled. If orthodontic treatment is indicated, the frenectomy should be performed only after the diastema is closed as much as possible to achieve stable results. [AAPD]

Frenectomy procedure is done in the following manner: the upper lip is held out at right angles to the anterior surface of the maxilla by an assistant through out the operation, this is not only tenses the frenum and facilitates the dissection but aids hemostasis. An incision down to bone is made on either side of the frenum. When palatal ends of these incisions are joined together the attachment of the underlying fibrous tissue to the bone is severed and the frenum springs upwards into the lip. The detached frenum and the fibrous tissue underlying it are then dissected out of the undersurface of the lip, care being taken to preserve as much mucous membrane as is practicable. The median suture is then completely cleared of fibrous tissue by the use of either a Mitchell trimmer or a small rose-head bur. The mucosa on the undersurface of the lip is then undercut widely and approximated with interrupted sutures. A periodontal pack is then applied over the surgical site. [Howe 2nd edition]

A modification for the technique mentioned above is the Z-plasty (fig 8); used to preserve the sulcus depth usually for prosthetic needs. After the fleshy frenum has been excised , two oblique incisions are made down to periosteum, the triangular shaped flaps are raised to expose underlying bone and the flaps are reversed so that the inferior triangular flap now becomes the most superior, and the wound closed. [Pedlar 2nd edition]

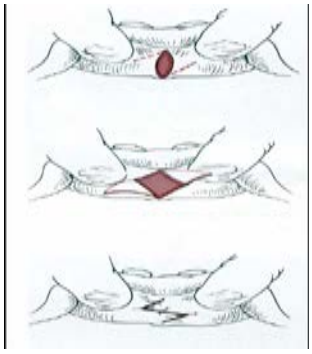


fig 8. Z-plasty technique

Frenotomy is done with similar steps; the mucous membrane is incised on either side of the fibrous band from the alveolar attachment to a point well out into the lip. The lower end of the fibrous band is gripped in a pair of haemostatic forceps, its alveolar attachment

severed , and the whole band excised. This exposes the intact periosteum which is still attached to the bone, to which the mucous membrane should be sutured. [Howe 2nd edition]

In order to avoid confusion between the two terms "frenectomy" and "frenotomy", frenectomy is defined as removing the entire fibrous tissue usually for orthodontic reasons, while frenotomy is designed to eliminate the fibrous band which raises the mucosa to form the frenum, and usually done for prosthodontic treatment, and this is applied to both labial and lingual frenum surgeries. [Howe 2nd edtion]

C - Management of mucogingival defects and gingival recession

Soft tissue recession, defined as exposure of the root surface caused by an apical shift of the gingival margin, results in an unesthetic appearance, root hypersensitivity and root caries. The treatment of choice for recession coverage should address the biological as well as the patients esthetic demands. [Latha et al., 2009] The selection of one surgical technique over another depends on several factors, some of which are related to the defect (the size of the recession defect, the presence or absence of keratinized tissue adjacent to the defect, the width and height of the interdental soft tissue, the depth of the vestibulum or the presence of frenuli) while others are related to the patient. [Zuchelli et al., 2003]

Amongst the various surgical techniques that have been advocated for the treatment of gingival recession the bilaminar technique (i.e partially disepithelized or connective tissue graft covered by a pedicle flap) has shown better root coverage predictability and esthetics. The primary disadvantage of this procedure is the necessity of a second surgical site and postoperative morbidity. [Latha et al., 2009] [Zuchelli et al., 2003]

Several modifications to the original bilaminar procedure described, resulting in more predictable outcomes, in terms of root coverage, and greater aesthetic satisfaction for the patients. These modifications related both the type of graft (partially or completely

disepithelized) harvested from the palate and the design (envelope-type or with vertical releasing incision) of the covering flap. Some authors used an envelope or repositioned flap to cover the epithelial-connective tissue graft partially. Others utilized coronally advanced flaps with or without vertical-releasing incisions, or laterally moved papillae flaps to cover connective tissue grafts. In all the mentioned surgical approaches, the size of the graft exceeded that of the bone dehiscence and it was positioned (and sutured) at the level of the CEJ. [Zuchelli et al., 2003]

A case reported by Latha et al. 2009 described repairing a a Miller's class 1 gingival recession in correspondence to the upper canine by using rotated papillary pedicle graft in combination with the coronally advanced flap using surgical loupe (2.5X magnification) as illustrated in (fig 9), A trapezoidal partial thickness flap is raised (fig 9,B). Distal papilla is de-epithelized (fig 9,C). The de-epthelized papilla along with the periosteum attached to the bone is reflected and rotated 90 degrees to cover the recession defect. The papilla is sutured to the connective tissue bed (fig 9,D) . Flap coronally positioned to cover the graft (fig 9,E). Three months after treatment (fig 9,F). Complete root coverage and excellent esthetics at 12 months postoperatively (fig 9,G). [Latha et al., 2009]

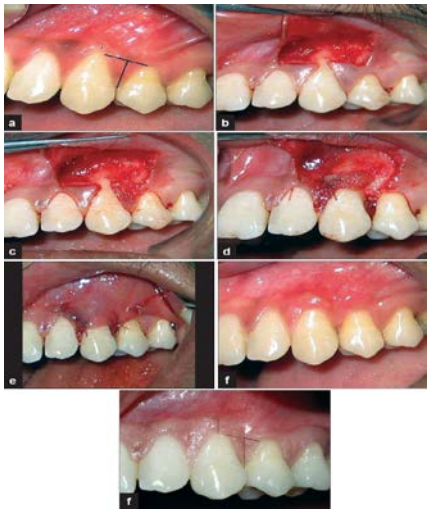


fig 9 technique of rotated papillary pedicle flap

Biopsy of oral soft tissue lesions

Patients often present with intraoral pathology in the general dental practice setting. Therefore, it is crucial that dental practitioners are aware of how to deal with pathology when it presents and have an understanding of investigative techniques that might assist in making a diagnosis. This is important irrespective of whether the dentist is the person actually undertaking the procedure or the investigation.

Biopsy is defined as the complete or partial removal of a lesion for laboratory examination to aid definitive diagnosis.

Biopsy is indicated for the assessment of any unexplained oral mucosal abnormality that persists despite treatment or the removal of local irritants. Malignancy is suspected when persistent oral mucosal lesions are red or red and white or when they are ulcerated, indurated, or fixed to deeper tissues. Persistent lesions that bleed easily or grow rapidly should also alert the clinician to the possibility of malignancy. Unexplained pigmented oral lesions are of concern if they are new or changed. Biopsy is recommended unless the pigmented area has been present and unchanged for 5 years or longer. [Ephros et al., 2011]

Even experienced clinicians have difficulty in distinguishing truly innocuous oral mucosal changes and those that represent dysplasia or early invasive cancer. Therefore, the decision to forego biopsy in an apparently benign lesion should be made with great care and only when the patient understands the need for close follow-up and agrees to comply. [Ephros et al., 2011]

Franklin and Jones stated that *adequate* and *appropriate* collection of tissue is essential for accurate examination, diagnosis and ultimately treatment. Therefore, for dentists who undertake biopsy procedures, understanding what is adequate and appropriate is important. An appropriate biopsy contains tissue that is representative of the lesion; this is dependent on three main factors, namely, selection of the biopsy site, the type of biopsy and finally the adequate submission of the specimen to the laboratory. The amount

of tissue submitted is important. Whilst a biopsy does not necessarily have to be large, very small or superficial biopsies can be inadequate and not diagnostically useful – small biopsies can also be lost or become distorted during processing. It is important that there is an adequate amount of tissue for assessment. Finally, an accurate and relevant clinical description of the lesion can assist the pathologist in the diagnosis. [Logan et al., 2010]

A - Biopsy Techniques

Excisional biopsy:

This is the ideal approach for small superficial lesions less than 1 cm in diameter, where the clinical appearance suggests that it is benign. Most of these procedures are done under local anesthesia. Where regional blocks could not be performed, the local anesthetic should be injected at a distance away from the lesion to avoid distortion of the tissue at the operating site. [Pedlar 2nd edition]

In excisional biopsy is decided, complete excision of the lesion is usually the only form of treatment available, and so no further operation is required. [Howe 2nd edition]

Technique : fix the lesion with one or more sutures, which can be used later to move and control the specimen, and to tense the soft tissues during its removal. In vascular areas such as the tongue and lips, excessive hemorrhage may be controlled either by the application of pressure by an assistant or by the insertion of stay sutures, which enclose a large amount of soft tissue and render it ischemic when tension is applied. Traction is applied to the lesion, thus raising it from its bed and stretching the mucosa around its attachment. Incise the base of the lesion from the underlying mucosa and place it immediately into an already labeled specimen bottle containing fixing solution. And suture the area. [Howe 2nd edition]

Excisional biopsy is most commonly indicated in cases of fibroepithelial polyps, pyogenic granuloma, squamous papillomas, epulis, and some minor salivary gland tumors and retention cysts and mucoseles. [Oliver et al., 2004] [Pedlar 2nd edition]

For pedunculated lesions they can be excised by simple division of the base the pedicle. Papillomas that have a viral origin some surgeons like to use electrosurgery,. For larger sessile lesions (broad based) excision should be made on an elliptical incision; this is made around the base of the lesion and should include a 1-2 mm margin of normal tissue. [Pedlar 2nd edition]

Incisional biopsy:

This technique is indicated when the diagnosis is in doubt, and complete excision of the lesion is impractical in terms of size, complexity, or the patients ability to cope with the surgery. Mostly it is indicated in cases of suspected malignancy.[Pedlar 2nd edition]

Technique: the biopsy must be taken from a representative part of the lesion and include a suitable edge of normal tissue. This allows the sample to be held at the normal tissue margin and thereby avoids introducing surgical artifact. An elliptical incision is suitable, with a sharp dissection technique using a scalpel and scissors. It is important to get deep enough in specimen to get into connective tissues. Where the field of mucosal abnormality is extensive, it may be necessary to carry out multiple incisional biopsies. If this technique is carried out it is important to draw a diagram of the lesion to make orientation clear to the pathologist. [Pedlar 2nd edition]

The centre of larger tumours should be avoided as this is often necrotic and will not yield diagnostic material. A recent study has demonstrated that cytokeratins were present in the peripheral blood of two out of ten patients 15 minutes after the incisional biopsy of an oral squamous cell carcinoma, thereby demonstrating that there was dissemination of cancer cells which may result in metastasis. The authors of this study suggested that chemotherapeutic drugs should be administered prior to biopsy to minimize the risk of metastasis in such patients. However, the incidence of blood borne metastasis in relation to oral cancer is low, but this area merits further investigation. [Oliver et al., 2004]

Fine Needle Aspiration Biopsy (FNAB):

FNAB is primarily used for biopsies of palpable masses and deep lesions with difficult access. It is also widely used in the head and neck regions, such as in the thyroid, lymph nodes, major salivary glands and others neoplasias. In the oral cavity, the FNAB method is rarely used. The most common masses biopsied in this manner are odontogenic tumors, intraosseous lesions, minor salivary gland tumors, sublingual salivary glands and other oral regions. However, some reports have described the relevance of FNAB for the diagnosis of oral cavity lesions and oropharyngeal lesions. The most commonly described advantages of the FNAB method are the preoperative diagnoses of lesions, clinical follow-up, the ability to avoid unnecessary damage to crucial structures of the oral cavity, more comfort for the patient and a low risk of infection and tissue damage. The most commonly reported disadvantages are the fact that there is little space to perform the backward and forward movement necessary to complete the procedure, and the difficulty involved in fixing the lesion. [Saleh et al., 2008] The most common diagnostic problem reported during the use of FNAB in the oral cavity is an insufficient amount of material collected for analysis due to the difficulty of applying the technique in this region. [Saleh et al., 2008] [Santos et al., 2011]

Santos et al. 2011 conducted a clinical trial in 50 patients to compare the accuracy of the results of FNAB with incisonal and excisional biopsies, the inconclusive rate of the FNAB was 16/50. FNAB displayed a high success rate for identifying both malignant and benign lesions, but a low accuracy for making a final diagnosis.

Technique: a 10- 20 ml syringe with a 21 gauge is installed in a specially designed holder, the needle is inserted into the center of the deep tissue mass and the plunger pulled back, drawing a small core tissue sample into the needle. [Pedlar 2nd edition]

Smears:

Can be used to sample the surface of epithelial lesions, especially when the lesion is not heavily keratinized. This technique can be used as an adjunct to biopsy for monitoring widespread lesions, which may undergo malignant transformation. [Pedlar 2nd edition]

B - Care of the specimen :

the sample must not be allowed to be dry out and should be placed immediately in a tissue fixative, usually 10% neutral buffered formalin. These are pre-requisites for the pathologist to have tissue adequately prepared for histologic interpretation. Some pathologists prefer to receive all specimens fresh, on saline soaked gauze, provided the specimen reaches the laboratory within one hour of being taken. [Pedlar 2nd edition]

Ensure the specimen is placed in an adequate volume of fixative, this should be at least ten times the volume of the specimen. Occasionally, formalin is further diluted with water by ancillary staff or specimens are placed in alternative solutions such as saline or water which results in poor fixation and artefactual change. [Oliver et al., 2004] Formalin fixes specimens by forming intermolecular bridges between proteins and cross-links between protein end-groups. If this process does not occur, soon after removal from the body the specimen will undergo autolysis rendering the tissues progressively undecipherable histologically. A disadvantage of the protein cross-linking produced by formalin is that the specimen is rendered unsuitable for immunofluorescent antibody staining. The diagnosis of vesiculobullous autoimmune disorders is aided by direct immunofluorescence of perilesional tissue which requires fresh material that can be immediately frozen. Most other immunohistochemical methods used in diagnosis can now be performed on fixed tissue with the use of antigen retrieval. Occasionally, specimens are required for electron microscopy, these should ideally be fixed in glutaraldehyde, but formalin is an acceptable alternative; again this will require some pre-arrangement. Specimens for cytogenetics may be required to confirm genetic changes in rare tumours (for example, synovial sarcoma), these should be submitted in universal transport medium which has been stored at 4°C. [Oliver et al., 2004] [Logan et al., 2010]

C - Special considerations

A surgical factors that can introduce artefacts or tissue distortion include removal of tissue by laser or electrosurgery. These techniques can induce thermal artefacts including carbonization, nuclear elongation and vacuolar degeneration of tissue that, in some instances, may affect the ability of the pathologist to accurately assess the tissue, particularly in small specimens. Hence it is best to excise with a scalpel and use electrosurgery to control hemorrhage at the biopsy site. [Logan et al. 2010]

Major vessels and nerves should be avoided and to minimize the risk of damage to smaller structures, incisions should be made parallel to their expected position. For example, in the palate, incisions should run parallel to the palatal nerves (ie antero-posteriorly) rather than across the nerves (medio-laterally). [Oliver et al., 2004]

D - Laboratory report:

Label the specimen container with the patient's name, date of birth, date of biopsy and the site of the biopsy together with the hospital number if appropriate. The site of the biopsy is especially important if there are specimens from more than one site in an individual patient. [Pedlar 2nd edition]

If more than one specimen has to be placed in the same container, they must be clearly marked, which is most readily done by means of sutures; but do not rely on describing the shapes of the pieces of tissue submitted because when they are fixed this will probably have altered or their shape might be distorted. [Oliver et al.,2004]

Accompanying information such as those illustrated in table 3 will enable a more comprehensive interpretation of the specimen, in turn, producing a more meaningful and useful report to the clinician. Adequate clinical history supplied on the request form relevant to the suspected diagnosis is essential to enable the pathologist to provide a useful and meaningful diagnosis. Additionally, on the request form, it is desirable to have previous biopsy numbers to enable comparison to be made if necessary.

Table 3 Information to accompany mucosal biopsies
Patient demographic data
Description of the clinical appearance of the lesion and suspected diagnosis

The site of the biopsy
The relationship of the lesion to restorations, particularly amalgam
A detailed drug history
Medical history including blood dyscrasias
Smoking and alcohol consumption

It is advised that all patients give informed written consent to having a biopsy as it is an unusual procedure for patients particularly in general dental practice (Dental Protection, personal communication). It would be appropriate to include on the consent form the indication for the biopsy and details of possible risks involved with biopsy procedures. These risks are mostly site related; paraesthesia can be induced in the lips or the tongue, swelling and bruising can result from procedures in the tongue, lips and buccal mucosa, and procedures in the floor of the mouth can lead to submandibular or sublingual duct damage. [Oliver et al.,2004]

E - Treatment of conditions with excisional biopsy

Mucoceles:

The term "mucocele" is used to define the accumulation of mucus secreted from salivary glands and their ducts in the oral cavity's subepithelial tissue. Mucoceles are benign soft tissue masses resultant from the retention or extravasations of mucus in the surrounding tissues of the lamina propria . These benign growths are believed to be traumatic in origin. Mucus is the product of secretion of minor salivary glands and the sublingual gland. Mucoceles more commonly present as translucent bluish nodules that arise on the lower labial mucosa. [Nico et al., 2008] [Pedron et al., 2010]

Treatment options for mucoceles include surgical excision, marsupialization, micromarsupialization, cryosurgery, laser vaporization, and laser excision. Management of a mucocele in children can be complicated by occasional behavior problems during treatment. With the advent of high-intensity lasers, this type of lesion may be treated efficiently due to its prompt hemostasis and no need to suture. [Pedron et al., 2010]

Surgical excision as described by Grucia et al. 2009, a number 15 blade mounted in a number 3 handle is used. An elliptic incision is made to fully enucleate the lesion along with the overlying mucosa and the affected glands. The operation might get more complicated when the lesion ruptured, since the loss of references made it more difficult to ensure complete elimination of the lesion. The wound then is finally sutured.
Grucia et al. 2009 compared scalpel surgery with excsision using CO2 laser and concluded that Oral mucocele ablation with the CO2 laser offers more predictable results and fewer complications and recurrences than conventional resection with the scalpel. [Grucia et al. 2009]

Cryosurgery (cryotherapy) is the application of extreme cold to destroy abnormal or diseased tissue. Cryosurgery for mucocele treatment was described in Sommergger et al. 1988 study in the following manner, Liquid nitrogen was administered from a CS-76 unit manufactured by Frigitronics (Shelton, Connecticut), which uses an intermittent open spray technique. Liquid nitrogen was then applied to the center of the cysts and spraying continued until the visible front had advanced 2 mm beyond the margin of the lesion. Freeze time varied between 15 and 30 seconds. Each freeze was allowed to thaw completely before a second freeze-thaw cycle was started. A second treatment cycle was performed in 22 of 31 oral cysts treated in the study. [Sommergger et al. 1988]

Treatment of mucoceles with a high-intensity diode laser provided satisfactory results also. As the incidence of mucoceles in children is relatively high, this technique may represent an improvement over other techniques and an adequate protocol for this lesion in a pediatric population. Appropriate power-set parameters must be considered for this type of procedure to avoid excessive thermal damage to the soft tissues and consequent unfavorable postoperative symptoms. [Pedron et al., 2010]

Pyogenic Granuloma:

Pyogenic granuloma a benign, acquired, vascular neoplasm of the skin and mucous membranes, is common in children. Papules develop most commonly on the head, neck, and extremities, especially the fingers and periungual area. Minimal trauma often triggers

profuse bleeding that is difficult to control, leading to a visit to the emergency room. Treatments vary and include surgical excision with primary closure, shave excision at the base followed by electrocautery, cryotherapy with liquid nitrogen, carbon dioxide (CO_2) laser vaporization, and pulsed dye laser therapy. Recurrences and development of multiple satellite lesions after therapy have been reported frequently in the literature. [Pagliai et al., 2004]

Tay et al., 1997 evaluated the use of pulsed dye laser in the treatment of patients with pyogenic granuloma. They showed that laser treatment resulted in complete clearance in 91% of cases. However, in two patients, treatment failed and the lesion was removed by shave excision and electrocautery. The authors concluded that the pulsed dye laser is safe and effective for treatment of small, minimally elevated, pyogenic granulomas in children and should be considered a treatment option. [Tay et al., 1997]

Distraction Osteogenesis

Distraction osteogenesis is a new variation of more traditional orthognatic surgical procedures for the correction of dental facial deformities. It is most commonly used for the correction of more severe deformities and syndromes that were untreatable in the past. It can be applied to both the maxilla and the mandible and can be used in children at ages previously untreatable. It has shown excellent results with both predictability and stability of results. The technique has gone a long way in reducing the need for osteotomies and grafting in the treatment of dentofacial and craniofacial deformities. [Andrade et al., 2011]

In distraction osteogenesis a corticotomy is used to fracture the bone into two segments, and the two bone ends of the bone are gradually moved apart during the distraction phase, allowing new bone to form in the gap. When the desired or possible length is reached, a consolidation phase follows in which the bone is allowed to keep healing. Distraction osteogenesis has the benefit of simultaneously increasing bone length and the volume of surrounding soft tissues. [Wikipedia.com]

The concept of Distraction Osteogenesis has been directly adopted from orthopaedic practice, where bulky extraoral appliances were used. However, the special anatomic features of the facial bones, tooth buds, curvature of the mandible, multiple bones in the midface and poor compliance in children, pose technical difficulties in placement of extraoral devices. To overcome few of these difficulties smaller and submerged intraoral devices have been designed, when used judiciously they give excellent results. [Andrade et al., 2011]

These procedures can be used to treat a wide range of facial deformities but it is most appropriate in syndromic patients and children with conditions such as cleft palate, severe asymmetry, severe mandibular hypoplasia with resulting airway compromise, facial clefts, Treacher-Collins syndrome, Pierre-Robin sequence and hemifacial microsomia. [Wikipedia.com]

Distraction devices used for craniofacial osteodistraction can generally be classified (Figure 10) into two basic types: external and internal devices

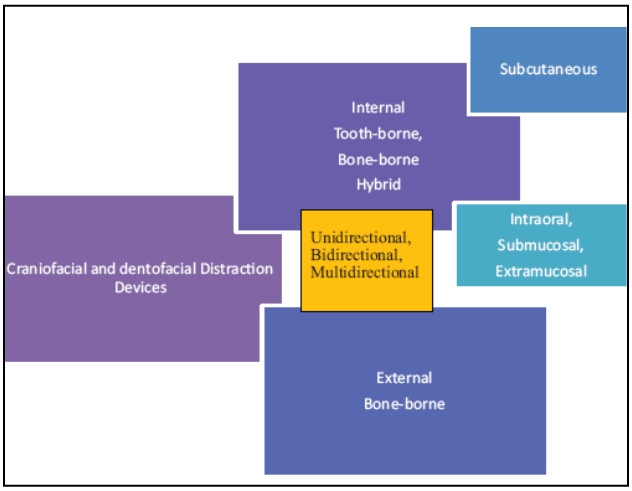


fig 10. DO devises classification

The external devices are attached to the bone by percutaneous pins connected externally to fixation clamps. The fixation clamps, in turn, are joined together by a distraction rod which when activated, effectively pushes the clamps and the attached bone segments apart, generating new bone in its path. Depending on the direction of lengthening, devices

have been classified as unidirectional, bidirectional, or multidirectional devices. Internal devices are placed subcutaneously or within the oral cavity i.e. intraorally. They can be placed above i.e. extra mucosal or below i.e. sub mucosal or buried under the soft tissue. Devices attached to the bone are bone-borne; to the teeth are tooth borne or attached to the teeth and bones are the hybrid type of distraction appliances. (fig 11)[Andrade et al., 2011]

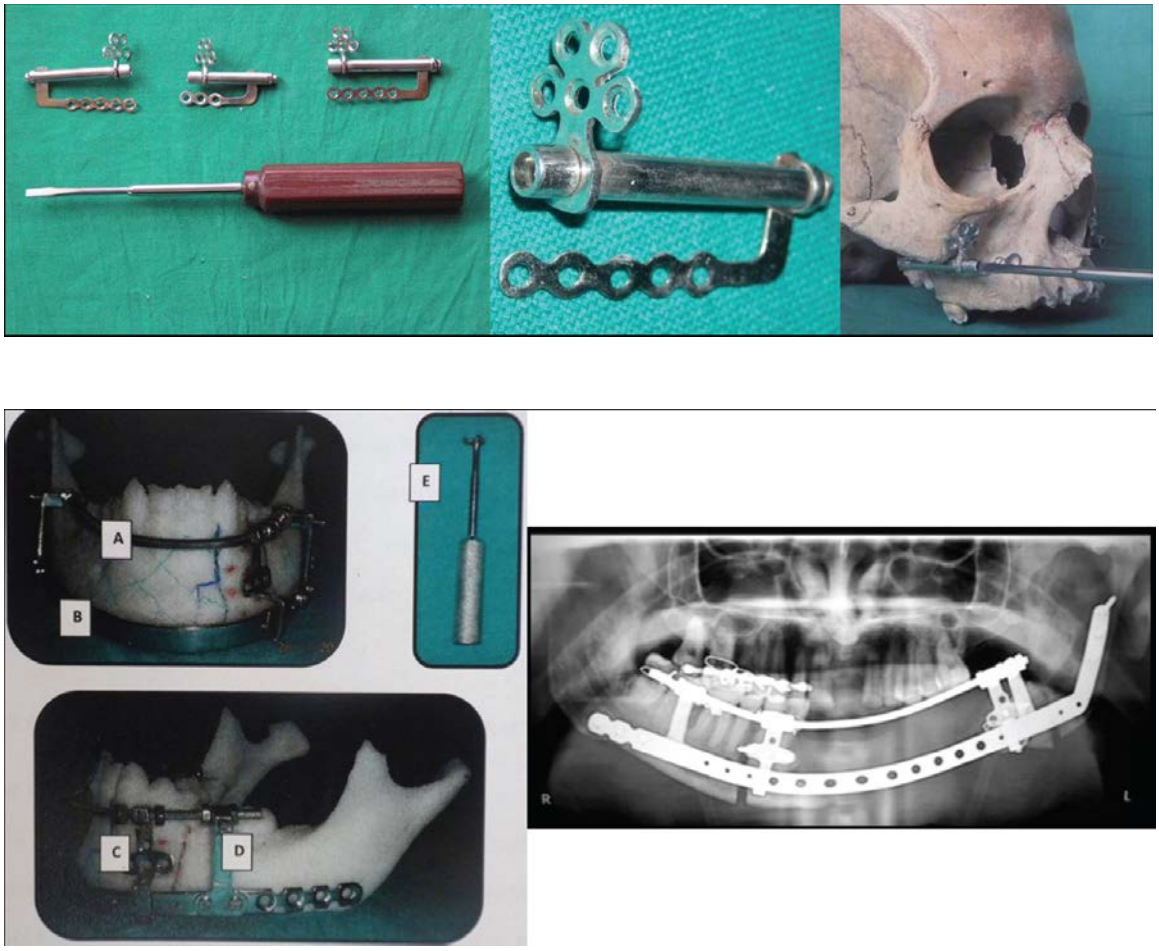


Fig 11. distraction devices

In distraction osteogenesis procedures involving the face, it is critical that bone movements be carefully planned before a device is implanted. No existing device is capable of changing its trajectory mid-course, and small skeletal changes lead to large changes in the structure of the face. Recently researchers have developed state-of-the-art software capable of simulating the entire process of distraction osteogenesis. .[Andrade et

al., 2010] The 3-D planning tool uses data from CT scans to create a segmented model of the patient's skull, and it then calculates the vector of movement required to achieve desirable bone positioning. Outcome CT scans can be overlaid on the original model to assess the effectiveness of the procedure. In the future, researchers hope that the distraction devices used in maxillofacial procedures will continue to improve, along with the corresponding software.

Alveolar ridge distraction

An application of the bone transport technique is the augmentation of the maxillary and mandibular alveolar ridges. Alveolar distraction osteogenesis (ADO) has evolved as a promising procedure for alveolar ridge augmentation prior to implant placement.

These deformities were managed by a variety of surgical techniques, such as autogenous onlay bone grafting, alloplastic augmentation, connective tissue grafting or guided tissue regeneration. Each of these modalities, however, had their limitations. Alternatively, osteodistraction of the alveolar process provides superior reconstruction of these types of defects. [Andrade et al., 2010] ADO offers a couple of unique advantages since it avoids donor site morbidity and provides predictable gain of hard and soft tissues. Further advantages are low infection rate, decreased bone resorption, and a short bone consolidation period prior to implantation. [Ettl et al., 2009]

On the other hand, there is a variety of complications that has been reported in the context of ADO. Specifically, the problem of oral vector tip of the transport segment, semilunar excavation of the augmented buccal bone, fracture of basal bone, and various device failures have been recognized. Moreover, due to the widespread use of distractors according to variable protocols, there is no consensus on several therapeutic aspects like the duration of the latency period or the amount of overcorrection required. [Ettl et al., 2009]

It is reported in many studies in the literature that bone loss in patients with free autogenous onlay grafts amounts up to 42%, while data for mean bone resorption during the consolidation period of ADO are highly variable and range from "insignificant" to about 30%.[Ettl et al., 2009]

Fig 12 shows the surgical steps of ADO.

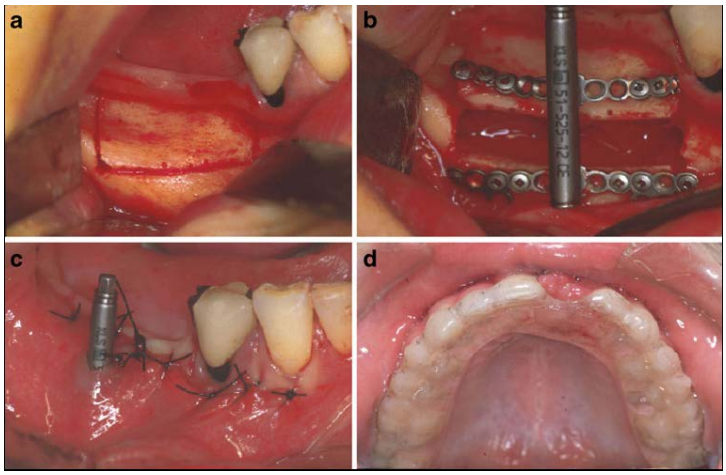


Fig 12. a Elevated mucoperiosteal flap with marked osteotomy lines after horizontal incision in height of the alveolar crest with vertical releasing incisions. B Activation test of fixed distractor (1.5 mm device). c Closed mucoperiosteal flap with exposed rod for activation. d Miniplast splint with lingual support of the transport segment

Other surgical techniques:

A -Electrosurgery

electrosurgery (ES) has been defined as the intentional passage of high-frequency waveforms, or currents, through the tissues of the body to achieve a controllable surgical effect, By varying the mode of application of this type of cnrrent, the clinician can use ES for cutting or coagulating soft tissues. Tissues are naturally resistant to high-frequency waveforms; when these waveforms pass through it. intense intracellular heat is produced within the tissues contacted by the active electrode tip. This heat volatilizes cells, and as the electrode is guided through the tissue, it leaves a path of cell destruction in the form of an incision or surface coagulation. [Gnanasekhar et al., 1998] [Tuli et al., 2010]

Electrosurgery unit

The ES unit consists of four components: *The current generator* produces the high-freqnency waveforms, which range from 1 to 4 MHz, The higher frequencies are better because they produce less lateral heat. The power output of RS units ranges from 70 to 100 W. *The active electrode* is the one through which the high-frequency waveforms enter the tissue being operated. A wide range of active electrodes are available, but all of them basically belong to one of three types of electrode: Single-wire electrodes are used for incision or excision; loop electrodes are used for tissue planing; and heavy, bulkier ball electrodes are used for coagulation. *The passive electrode (ground plate)* is a flat plate that has a broad, indirect contact with the patient's body. Like an antennae, it receives the waveform that has entered the patient's body and allows it to return to the unit. *The on-off switch* activates or deactivates the ES unit. This can be operated by a foot control or by a switch on the hand piece. The foot control is preferred because the operator will usually find it difficult to control the switch and the cutting stroke at the same time with the same hand. [Gnanasekhar et al., 1998]

In a comparative study of electrosurgical and scalpel wounds, it was observed that healing of electrosurgical wounds was delayed. Electrosurgical wounds had more inflammatory response and more tissue destruction. But in both kinds of wound the viability of osteoblasts was the same, and there was no increase in the osteoclasts, which would indicate that no bone resorption had occurred. . [Gnanasekhar et al., 1998]

Advantages of electrosurgery

1, Tissue separation is clean, with little or no bleeding. Although ES in most of the cases does not require postoperative suturing, if the surgery is done in highly vascularized and mobile area like the tongue primary closure with sutures is mandatory even is there is little bleeding at the time os surgery; to prevent the risk of secondary hemorrhage. [Gnanasekhar et al., 1998] 2, A clear view of the surgical site is provided. 3, Planing of

soft tissue is possible. 4, Access to difficult-to-reach areas is increased. 5, Healing discomfort and scar formation are minimal, 6, Chair time and operator fatigue are reduced. 7, The technique is pressure less and precise. [Tuli et al., 2010]

Disadvantages of electrosurgery

1. The initial cost of the ES equipment is far greater than tbe cost of a scalpel. 2. The odor of burning tissue is present if high-volume suction is not used. 3. Although ES units are compatible with most modem pacemakers of today, it cannot be used on patients with older pacemakers that are not shielded against external interference. 4. Electrosurgery units cannot be used near inflammable gases. [Gnanasekhar et al., 1998]

Electrosurgery is indicated in many surgical treatments; exicional biopsies, removal of small intra oral soft tissue lumps, gingival hypertrophy treatments and gingivictomies are some examples.

B - Lasers in Dentistry

Many benign pathologies or oral anomalies that affect children's soft tissues can be treated by dentists. Conventional treatment of these pathologies involves the use of the cold knife, cautery knife (electrocautery) or cryosurgery (using a gas expansion system or a cotton bud soaked in liquid nitrogen). Recent advances have shown that laser treatment can be added as an alternative or complement to conventional methods. [Boj et al., 2011] There is extensive recent literature on soft tissue management with CO2 lasers in children as this procedure is considered safe and has many intra-operative benefits. Authors also have used the Nd:YAG laser in children, whilst others consider that the combination of Nd:YAG and diodes is more effective . In recent years, the number of papers on the use of Er,Cr:YSGG lasers in paediatric dentistry has increased as this type of laser is commonly used for hard tissue applications. The Er,Cr:YSGG laser is a hydrokinetic

system based on photon liberation in an air-water spray, which causes strong explosions in the water droplets. [Kopp et al., 2004]

The *optical fibre delivery system* ends in a sapphire crystal tip. The *handpiece* is similar to that of a conventional turbine, which facilitates clinical management. Cutting effectiveness is attained when the tissue is 1-1.5 mm from the tip.

The laser eliminates the need for sutures and reduces post-operative oedema, bleeding, infection and pain, and thus the use of medication. The same laser at a different output can be used to manipulate hard tissues. Therefore, it is a very versatile option in paediatric dentistry for labial fraenectomies. Using a combination of a diode laser to manipulate soft tissues and the Er:YAG laser for the periosteum and the final collagen fibres is good alternative for frenectomy procedures to be accomplished.

In the past, soft tissue surgical procedures were often rejected in children, as problems with co-operation meant that they could not be performed without general anaesthetic. Several authors have stated that the use of lasers in soft and hard tissues causes less discomfort and is well-accepted by young patients and their parents. Thus, lasers can reduce psychological trauma and fear during the dental visit .

Although there is no evidence based science, lasers are very useful in oral surgery in paediatric dentistry, as it involves a reduction in the amount of local analgesia and in the duration of intervention, the technique is easy, and the laser produces a haemostatic effect that enhances visibility of the surgical area, which is a major advantage in children's small mouths. Scarring is also minimal (no tissue retraction). [Boj et al., 2011]

Use of the dental laser remains limited, with cost and effectiveness being the primary barriers. The cost of a dental laser ranges from $8,000 to $50,000, where a pneumatic dental drill costs between $200 and $500. The lasers are also incapable of performing some routine dental operations. And care should be taken to avoid unwanted thermal injuries for adjacent structures. [Wikepidia.com]

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