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RESEARCH ARTICLE

MINOR ORAL SURGICAL PROCEDURES.

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Abstract

Minor oral surgery includes removal of retained or burried roots, broken teeth, wisdom teeth and cysts of the upper and lower jaw. It also includes apical surgery and removal of small soft tissue lesions like mucocele, ranula, high labial or lingual frenum etc in the mouth. These procedures are carried out under local anesthesia with or without iv sedation and have relatively short recovery period.

Introduction:-

Children are life's greatest gifts. The joy, curiosity and energy all wrapped up in tiny humans. This curiosity and lesser motor coordination usually leads to increased incidence of falls in children which leads to traumatic dental injuries. Trauma to the oral region may damage teeth, lips, cheeks, tongue, and temporomandibular joints. These traumatic injuries are the second most important issue in dentistry, after the tooth decay. According to the records the greatest incidence of trauma to the primary teeth occurs at 2 to 3 years of age, when motor coordination is developing. In children between 6‑12 years, sport accidents, falling off bicycle, and crashing may cause dental injury . Adolescents are also not left behind in occurrence of facial trauma as they are frequently involved in activities like boxing, skiing, riding, and swimming. Dentoalveolar injuries are more frequently seen due to these trauma but are usually associated with minor facial injuries and can have significant negative functional, esthetic, and psychological effects on children. As the parents report to a dentist for any emergency care of teeth, the dentist need to be well equipped to provide the very best care in managing traumatic injuries whether dental or facial which could be done in office setting through local anesthesia and sometimes sedation as minor oral surgical procedure.

Other than trauma commonly seen problems in the oral cavity which need minor surgical procedures are high frenal attachment, a small cyst, hyperplasia of gingiva either localized or generalized, supernumerary teeth, mucocele and ranula .These procedures are minor in nature and requires rarely hospitalization. Thus these procedures should constitute a major part of the practice of dentistry.

Minor oral surgical procedures performed on pediatric patients involves a number of special considerations like preoperative evaluation, anesthetic considerations and postoperative care. Preoperative evaluation involves history taking and doing an examination. As obtaining information from a child can be difficult, usually it is best to obtain the history from parents. The anesthetic considerations include the techniques of administration of local anesthesia

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in children which are different to those in the adult due to anatomic considerations and age of the child. Postoperative care varies in children as it depends on the age, metabolic activities, severity of the condition etc.
Patients with underlying diseases like cardiovascular disease, bleeding disorders, epilepsy, etc should be given particular attention and all necessary preventive measures should be taken, in cooperation with the physician treating the patients, in order to avoid potential complications during and after the surgical procedure. The main concern of the dentist performing surgical procedures should involve fundamental principles of surgery, asepsis and antisepsis, to prevent pathogenic microbes from entering the body as well as spread of certain infectious diseases from one patient to another.

The ability to carry out minor oral surgical procedures can be a daunting task for the busy dental general practitioner only when he lacks in absolute knowledge. Hence, the modern day dental surgeon, who performs this surgery must have in-depth knowledge of surgical principles, case selection, indications and contraindications of the procedure .In view of above knowledge, an attempt has been made to pen down the therapeutic protocols regarding the minor oral surgical procedures in dentistry. This review paper discussed the treatment aspects of frenectomy, ankyloglossia, mucocele,ranula, reimplantation and supernumerary teeth.

Discussion:-

Labial Frenectomy

Labial frenectomy is an invasive procedure that is typically performed to remove the small bit of tissue, called frenum or frenulum, between the lip and front teeth, mostly in the upper jaw.

Prevalence

According to Jonnathan et al(2018) ,level of insertion of maxillary labial frenum was seen inserted more frequently in the alveolar mucosa in children of 10–12 years' age group (58.3%). The gingival and incisive papillary insertion was more common in children of 6–9 years' and 3–5 years' age groups.

Pathophysiology

Normally frenum is a thin fold of mucous membrane with enclosed muscle fibers that attach the lips to the alveolar mucosa and underlying periosteum. Abnormal frenum may be caused by the insertion of labial frenum into the notch in the alveolar bone, so that a band of heavy fibrous stissue lie between the central incisors. The two central incisors may erupt widely separated from one another and the rim of bone surrounding each tooth may not extend to the median suture. In such cases, no bone is deposited inferior to the frenum. A V-shaped bony cleft develops between two central incisors and thus transseptal fibers fail to proliferate across the midline cleft and the space may never close11.

Syndromes Associated With Abnormal Frenum

1. Ehlers-Danlos syndrome
2. Ellis-van Creveld syndrome, and
3. Orofacial-digital syndrome
4. Holoprosencephaly (absence of frenum is seen)

Classification

Depending upon the extension of attachment of fibres, frena have been classified by placek et al (figure 5):
1) Mucosal: When the frenal fibers are attached up to mucogingival junction. 2) Gingival: When fibers are inserted within attached gingiva. 3) Papillary: When fibers are extending into interdental papilla. 4) Papilla penetrating: When the frenal fibers cross the alveolar process and extends up to the palatine papilla.
Clinically, papillary and papilla penetrating frenum are considered as pathological.

Clinical Features

1. Loss of papilla and recession
2. Midline diastema
3. Malocclusion of the teeth
4. Psychological disturbances to individual

Diagnosis
The abnormal frena are detected visually by applying tension over the frenum to see the movement of the papillary tip or the blanch which is produced due to ischemia in the region.

Tension test
The frenum is characterized as pathogenic when it is unusually wide or when there is no apparent zone of the attached gingiva along the midline or the interdental papilla shifts when the frenum is extended.

Blanch test
Lift the upper lip and pull in outward and look for blanching of the soft tissues lingual to and between two central incisors.

Treatment
Frenectomy
Frenectomy is the complete removal of the frenum, including its attachment to the underlying bone.

Indications of frenectomy
The frenum is characterized as pathogenic and is indicated for removal when
1. An aberrant frenal attachment is present, which causes a midline diastema.
2. A flattened papilla with the frenum closely attached to the gingival margin is present, which causes a gingival recession and a hindrance in maintaining the oral hygiene.
3. An aberrant frenum with an inadequately attached gingiva and a shallow vestibule is seen.

Techniques of frenectomy
Frenectomy can be accomplished either by:

Conventional technique
The conventional technique involves excision of the frenum by using a scalpel.

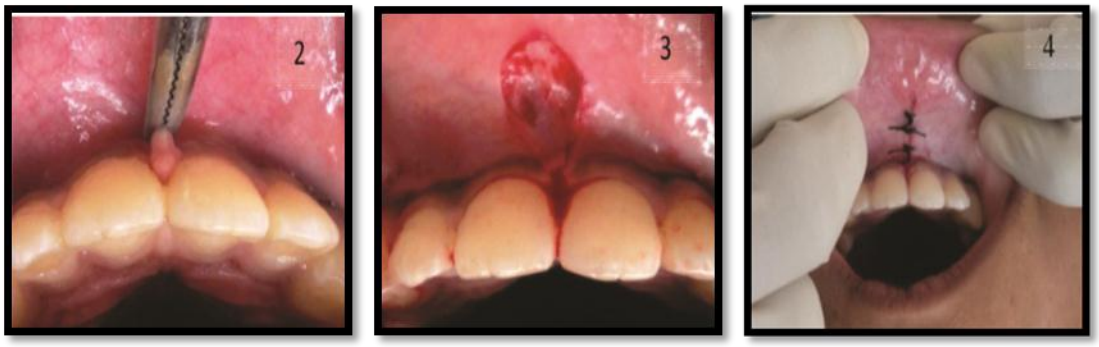
Electrosurgery
This technique is recommended for patients with bleeding disorders and non-compliant patients.

Lasers
Most conservative and accepted treatment by the patients.

Conventional Technique
The classical technique was introduced by Archer (1961) and Kruger (1964). This technique is an excision type frenectomy.

Armamentarium
Haemostat, scalpel blade no.15, gauze sponges, 4-0 black silk sutures, suture pliers, scissors, and a periodontal dressing (Coe-pak).

Technique (Figure 1)
The area is anaesthetized with a local infiltration by using 2% lignocaine with 1:80000 adrenaline. The frenum is engaged with a haemostat which is inserted into the depth of the vestibule and incisions are placed on the upper and the undersurface of the haemostat until the haemostat is free. The triangular resected portion of the frenum with the haemostat is removed. A blunt dissection is done on the bone to relieve the fibrous attachment. The edges of the diamond shaped wound are sutured by using 4-0 black silk with interrupted sutures. The area is covered with a periodontal pack. The pack and the sutures are removed 1 week post-operatively.



Frenum held with hemostat b) Wide wound surface area. c) Sutures placed

Figure 1:-Conventional technique.

Modifications Of Conventional Frenectomy

1. Paralleling technique
2. Miller's technique,
3. V-Y plasty and
4. Z-plasty

Paralleling technique

Armamentarium

Hemostat, scalpel blade no.15, gauze sponges, 4-0 black silk sutures, suture pliers, scissors, and a periodontal dressing (Coe-pak).

Technique (Figure 2)

In case of paralleling technique two paralleling incisions are made on the side of ridge of the frenum this will reduce the removal of excess mucosal tissue. After that deep dissection for the muscle fibers are done to remove the attachment. This will decrease the chances of recurrence. Then the thin incised tissue is removed by making sharp cut above and below frenum. Primary closure is possible in this case throughout the length of frenum because of close approximation of margin produced by thin paralleling incision. Primary closure and less removal of gingival and mucosal tissues could be the reason for less postoperative pain and speech discomfort3.

a) Paralleling incision placed b) Narrow wound area c) Sutures placed

Figure 2:-Paralleling technique.

Miller's Technique

The Miller's technique was advocated by Miller PD in 1985.The ideal time for performing this surgery is after the orthodontic movement is complete and about 6 weeks before the appliances are removed to allow healing and tissue maturation.

Armamentarium

Hemostat, scalpel blade no.15, gauze sponges, 5-0 black silk sutures, suture pliers, scissors, and a periodontal dressing (Coe-pak).

Technique (Figure 3)

The area is anaesthetized with a local infiltration by using 2% lignocaine with 1:80000 adrenaline. Excision of the frenulum and exposure of the labial alveolar bone in the midline. A horizontal incision is made to separate the

frenulum from the interdental papilla. A laterally positioned pedicle graft (split thickness) is obtained and it is sutured across the midline. A periodontal dressing is placed.

a) Frenum excised c)Lateral pedicle graft obtained d) Graft sutured

Figure 3:-Miller's technique.

Z plasty

Armamentarium

Scalpel blade no.15, gauze sponges, tissue forceps, 5-0 vicryl sutures, suture pliers, scissors, and a periodontal dressing (Coe-pak).

Technique (Figure 4)

The area is anaesthetized with a local infiltration by using 2 % lignocaine with 1:80000 adrenaline. The length of the frenum is incised with the scalpel and at each end, limbs at between 60º and 90º angulation, incisions are made in equal length to that of the band. By using fine tissue forceps, with care not to damage the apices of the flaps, the submucosal tissues are dissected beyond the base of each flap, into the loose nonattached tissue planes. Thus, double rotation flaps which are at least 1 cm long are obtained. The resultant flaps which are created are mobilized and transposed through 90º to close the vertical incisions horizontally Absorbable 5-0 vicryl sutures are placed, first through the apices of the flaps, to ascertain the adequacy of the flap repositioning and then they are evenly spaced along the edges of the flaps, to close the wound along the cut edges of the attached mucoperiosteum and the labial mucosa. A periodontal dressing is placed. After 1 week, the dressing is removed, while the remnants of the sutures are left, as resorbable sutures are used.

a)Incision placed b)Two triangular flaps obtained. c)Flaps sutured

Figure 4:-Z-plasty technique.

V-y plasty

Armamentarium

Hemostat, scalpel blade no.15, gauze sponges, 4-0 black silk sutures, suture pliers, scissors, and a periodontal dressing (Coe-pak).

Technique (Figure 5)

The area is anaesthetized with a local infiltration by using 2 % lignocaine with 1:80000 adrenaline, the frenum is held with the hemostat and an incision is made in the form of V on the undersurface of the frenal attachment. The frenum is relocated at an apical position and the V shaped incision is converted into a Y, while it is sutured with 4-0 silk sutures. A periodontal pack is placed. The periodontal pack and the sutures were removed at 1 week of follow-up.

a) Frenum held with hemostat b) Frenum incised c) V-shaped incision sutured

Figure 5:-V-Yplasty technique.

Advantage Of Conventional Frenectomy

1. Cost effective
2. Decreased chances of recurrence.

Disadvantage Of Conventional Frenectomy

1. Requires sutures
2. Postoperative bleeding, pain or swelling.

Electrosurgery

Electrosurgery is the use of a high frequency electrical energy in the radio transmission frequency band applied directly to tissue to induce histological effects. It is a surgical technique performed on soft tissue using controlled, high-frequency electrical (radio) currents in the range of 1.5 to 7.5 million cycles per second, or megahertz. In 1928 William Cameron developed the first dental electrosurgical unit4.

Types Of Electrodes

There are 3 classes of electrodes:

1. Single-wire electrodes for incising or excising;
2. Loop electrodes for planning tissue; and
3. Heavy, bulkier electrodes for coagulation procedures.

Precautions/ Guidelines

Following factors should be considered while using electrosurgery for better result;

Select smallest possible electrode.

The thicker the electrode, the greater the amount of lateral heat hence large electrodes cause more tissue damage than small ones.

Incision should be made at the rate of 7mm/s,

The quicker the active electrode is passed over the tissue, the lesser the lateral heat. The active electrode must not remain in contact with tissue for more than 1 to 2 seconds at a time to prevent overheating of the tissue surface.

Allow cooling period of 8 s between successive incisions

A cooling period of at least 8 seconds between subsequent incisions in the same area is necessary to assure that lateral heat production capable of initiating adverse tissue responses does not occur.

Avoid contact of metallic restorations

Contact of an active electrode with metallic restorations should be limited to periods less than 0.4 seconds. Longer periods of contact may result in pulpal necrosis.

Use appropriate electric power.

A higher frequency unit tuned to optimal power output is used to set, to generate a fully rectified filtered waveform.

Armamentarium

An electrocautery unit with the loop electrode and a hemostat.

Technique (figure 6)
The area is anaesthetized with local infiltration by using 2% lignocaine with 1:80000 adrenaline. Frenum is held with hemostat at the depth of the vestibule and two incisions are placed using needle electrode. Muscle fibers are then separated using loop electrode. Coagulation is achieved by using ball electrode. Immediate post-operative views showed arrest of bleeding and no requisite for sutures. One week post-operative view showed presence of slough in the operated site indicating healing process. One month post-operative view showed complete healing of tissues.

a)Frenum held b) Frenum excised c) Postoperative.
Figure 6:-Electrosurgery technique.

Advantages
1. Permits adequate contouring of tissues.
2. Controls the hemorrhage.
3. Access to difficult - to - reach areas is increased.
4. Healing discomfort and scar formation is very minimal.
5. Chair time and operator fatigue are reduced.
6. The technique is pressure less and precise.

Disadvantages
Expensive
1. Cost of the electrosurgical unit is far greater than the cost of a scalpel.
2. Difficult to use in poorly shielded cardiac pace makers. As there are chances of shortened pacer battery life and arrhythmias.
3. Unpleasant odor As the treatment causes dehydration of tissue which might lead to unpleasant odour
4. Technique sensitive If used in proximity to bone heat generated by injudicious use can cause tissue damage and loss of periodontal support. Caution must be carried out to avoid contact with the bone since irreparable damages can occur.

Recent Advances In Frenectomy
In the era of periodontal plastic surgery, more conservative and precise techniques are being adopted to create more functional and aesthetic results. The soft tissue laser is now a viable alternative to the scalpel in soft tissue surgery.

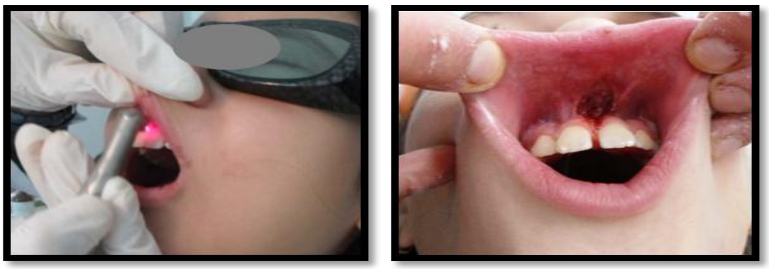
Lasers such as Nd:YAG, Co2, and Er:YAG had been used for frenectomy procedures. Diode laser is considered as an excellent soft tissue laser as it does not interact with dental hard tissues.

Diode Laser
The diode laser was introduced in dentistry and oral surgery in the mid-90s. Diode laser with wavelengths ranging from 810 to 980 nm in a continuous or pulsed mode is used as a possible modality for soft tissue surgery in the oral cavity. The pump source is an electrical current from which photons are produced in which the laser active medium is semiconductor in nature. Based on the photothermal effect of the diode laser, the lesions of the oral mucosa are removed with an excision technique, or by ablation/vaporization procedures. The device has specifications such as relatively small size, portable and lower cost than the other laser equipment. Examples of diode lasers are Holmium Yttrium Aluminium Garnet(Ho:YAG), Neodymium-Doped Yttrium Aluminium Garnet(Nd:YAG) etc.

Armamentarium
Diode laser unit.

Technique (Figure 7)

For the diode laser technique, the area is anesthetized with 2% lignocaine with 1:80,000 adrenaline (LOX 2% adrenaline). The diode laser (Photon Plus; Zolar Tech Technology and MFG Co. Inc., Canada, wavelength 980 nm) at power setting of 10 W fiber tip was used in a contact mode and moved, in a paint brush stroke, from the base to the apex of the frenum thereby excising it. Any remnant fiber over the periosteum is removed by gently sweeping the laser tip and the ablated remnant tissue is cleaned with gauze soaked in saline. The area was covered with a periodontal dressing (COE–PAK, GC America Inc., ALSIP, IL, USA). Subjects were recalled on the 7th day for suture removal.



a)Non-contact hand piece d)Rhomboid laser wound.

Figure 7:-Diode laser technique.

Advantages

1. Relatively bloodless surgical and postsurgical event,
2. Ability to precisely coagulate, vaporize, or cut tissue,
3. Sterilization of the wound site,
4. Minimal swelling and scarring,
5. No suturing in most cases,
6. Little mechanical trauma,
7. Reduction of surgical time,
8. Decreased postsurgical pain
9. High patient acceptance.

Disadvantages

1. It might cause lateral heat damage to the adjacent mucosa of the incision by long term heating.
2. Delayed wound healing might be there due to the presence of exuding of the tissue in the treated area for a short period of time.
3. It requires additional training and education for various clinical applications and types of lasers.
4. Expensive.

Postoperative Instructions

1. Avoid taking hot, spicy, citrus and hard foods for few days.
2. Soft diet instructions
3. Meticulous oral hygiene advised
4. Use an analgesic for postoperative pain.

Ankyloglossia

The lingual frenum is a mucosal fold that connects the bottom of the body of the tongue to the floor of the mouth and to the mandibular bone. When the frenum is thick and very tight and/or its place of insertion limits the mobility of the tongue, it can result in ankyloglossia (from the Greek "ankylos" which means tied and "glossa" which means tongue). Ankyloglossia also known as tongue tie, is a congenital oral disorder that may decrease mobility of the tongue tip.

Prevalence

Prevalence of ankyloglossia by Patil et al (2013)5showed 3.5% of the tongue lesions, with a male to female ratio of 2.5:1.0.

Aetiology

Ankyloglossia is a congenital anomaly and its range varies from 0.1% to 4.8%6.both genetic and environmental factors are involved in its etiology.

Molecular analysis
Molecular analysis show that point mutations on the chromosome number tbx22 can cause cleft palate together with ankyloglossia.

Hereditary condition
Epidermolysis bullosa is a hereditary congenital disorder usually associated with ankyloglossia. It is characterized by soft tissue blistering, which results in tissue separation and scarring.as an outcome, adhesions are developed which might result in reduced tongue mobility.

Associated Syndromes
1. Simpson-Golabi-Behemel Syndrome,
2. Optiz Syndrome,
3. Beckwitz-Wiedemann Syndrome,
4. Orofacial-digital Syndrome;
5. Vander woude and
6. Pierre robin

Clinical Symptoms
Infant symptoms and signs include
1. Poor nipple latch and suck,
2. Clicking sound whilst nursing due to poor suction,
3. Ineffective milk transfer,
4. Inadequate weight gain,
5. Irritability,
6. Colic,
7. Fussiness and arching away from the breast,
8. Difficulty grasping on the breast,
9. Chewing of the nipple,
10. Falling asleep at the breast.

Maternal symptoms and signs
1. Nipple pain,
2. Mastalgia,
3. Low milk supply,
4. Mastitis,
5. Untimely weaning,
6. Blocked ducts,
7. Disappointment with breastfeeding.

Symptoms in adults
1. Speech impediment
2. Atypical swallowing
3. Impossibility to sweep upper /lower lips
4. Limitation of the tongue to reach the palatal retroincisal spot when the mouth is wide open
5. Shape of the tongue distorted and or invagination at the tongue tip during the protrusion outside the mouth.

Classification
Anatomical Classification
Anatomical classification is based on the length and elasticity of the tongue which is given by Wallace in 1960.

Partial ankyloglossia
Partial ankyloglossia is the presence of a sublingual frenulum which changes the appearance and/or function of the infant's tongue because of its decreased length, lack of elasticity or attachment too distal beneath the tongue or too close to or onto the gingival ridge.

Complete ankyloglossia
Complete ankyloglossia is a condition in which there is extensive fusion of the tongue to the floor of the mouth which is extremely rare.

Morphological Classification
Morphological classification is based on the distance from the tip of the tongue to the attachment of the frenum, has been suggested by Kotlow [1999]7.

Clinically acceptable normal range of free tongue: greater than 16 mm
1. Class I: Mild ankyloglossia (12‑16 mm)
2. Class II: Moderate ankyloglossia (8‑11 mm)
3. Class III: Severe ankyloglossia (3‑7 mm)
4. Class IV: Complete ankyloglossia (<3 mm).

Diagnosis
Diagnostic criteria for tongue tie is based on the length of the lingual frenulum, amplitude of tongue movement, heart-shaped look when the tongue is protruded and thickness of the fibrous membrane. The examination of lingual frenulum should consider the morphological and functional aspects of the tongue.

Hazelbakers Assessment Tool (Table 1)
For a correct diagnosis the function deserves more consideration than the appearance. In children or adults we have to evaluate the possibility of the tongue to touch with its tip the retro-incisal papilla on the palate, the heart shape during the lingual protrusion, reduction of sublingual space, difficulty during the lingual movements, space between central inferior incisors due to the tensile force exerted by the lingual frenum during speech and deglutition. Furthermore, the affected children cannot lick their lips or an ice cream or cannot play a musical instrument. Hazelbakers assessment tool for appearance and function of the tongue.

Appearance Function
Appearance of tongue when lifted

round/square
1. slight cleft in tip apparent
2. heart/v-shaped Lateralization

complete
1. body of tongue but no tongue tip
2. none

Elasticity of frenulum
1. very elastic
2. moderately elastic

little or no elasticity
1. Lift of tongue
2. tip to mid mouth
3. only edges to mid mouth
4. tip stays at lower alveolar ridge/rise to mid mouth only with jaw closure.
5. Length of lingual frenulum when tongue lifted
6. 2:>1cm
7. 1: 1cm

8. 0:<1cm Extension of tongue
9. 2:tip over lower lip
10. 1:tp over lower gum only
11. 0: neither of the above or anterior mid tongue humps.
12. Attachment of lingual frenulum to tongue
13. 2:posterior to tip
14. 1:at tip
15. 0:notched tip Spread of anterior tongue
16. 2:complete
17. 1:moderate or partial
18. 0:little or none
19. Attachment of lingual frenulum of inferior alveolar ridge
20. 2:attached to floor of mouth or well below ridge1:attached just below ridge
21. 0:attached at ridge Cupping
22. 2:entire edge ,firm cup
23. 1:side edges only, moderate cup
24. 0:poor or no cup
25. Peristalsis
26. 2:complete,anterior or posterior
27. 1:Partial originating posterior
28. 0:none or reverse
29. Snapback
30. 2:none
31. 1:periodic
32. 0: frequent or with each suck.

Table 1:-Hazelbakers assessment tool.

Appearance	Function
Appearance of tongue when lifted 2: round/square 1:slight cleft in tip apparent 0:heart/v-shaped	Lateralization 2:complete 1:body of tongue but no tongue tip 0:none
Elasticity of frenulum 2:very elastic 1:moderately elastic 0:little or no elasticity	Lift of tongue 2:tip to mid mouth 1:only edges to mid mouth 0: tip stays at lower alveolar ridge/rise to mid mouth only with jaw closure.
Length of lingual frenulum when tongue lifted 2:>1cm 1: 1cm 0:<1cm	Extension of tongue 2:tip over lower lip 1:tp over lower gum only 0: neither of the above or anterior mid tongue humps.
Attachment of lingual frenulum to tongue 2:posterior to tip 1:at tip 0:notched tip	Spread of anterior tongue 2:complete 1:moderate or partial 0:little or none
Attachment of lingual frenulum of inferior alveolar ridge 2:attached to floor of mouth or well below ridge1:attached just below ridge 0:attached at ridge	Cupping 2:entire edge ,firm cup 1:side edges only, moderate cup 0:poor or no cup
	Peristalsis 2:complete,anterior or posterior 1:Partial originating posterior 0:none or reverse
	Snapback

	2:none 1:periodic 0: frequent or with each suck.

Evaluation of scoring

1. 14 = perfect score;
2. 11 = acceptable
3. < 11=Frenectomy is required.

Speech Articulation Test

A simple speech articulation test has been suggested in which if the elevation of the tongue tip is restricted, the articulation of 1 or more of the tongue sounds- such as "t", "d", "l", "th" and "s" will not be accurate.

Treatment

Several conservative, as well as surgical options, exist for the management of tongue tie. It includes speech therapy, otolaryngotherapy, frenotomy, frenectomy, frenuloplasty and laser frenectomy.

Speech Therapy

A functional assessment of the lingual frenum is essential to decide the need for speech therapy or surgical intervention. A speech therapy may be indicated for children who have not an excessive brevity of frenum, because they highlight difficulties in articulatory features, sometimes associated with a pathological swallowing and postural changes, but in history there are no important problems during breastfeeding.

otolaryngotherapy

Patient is advised to an otolaryngotherapist for the assessment of tongue related problems due to ankyloglossia.If the intervention of a speech therapist and otolaryngotherapist fails to resolve speech and tongue related problems, then it may be necessary to consider surgical protocol.

Surgical Techniques

Historical background

During the 18th century, midwives used to divide the lingual frenulum with their sharp fingernails. For over a century, a grooved tablespoon was created specifically to release the tongue-ties. Pediatricians used similar devices over decades but recurrence was common.

Traditional frenectomy technique is performed using local anaesthesia, scalpels for incisions according to the technique and sutures. All this requires surgical dexterity as well as the capacity to work with small patients. Laser technique is an excellent alternative to traditional surgery. It is simple and rapid to perform, well accepted and tolerated by patients, requires a minimal anaesthesia, with an asymptomatic postoperative period, without relapse.

Techniques

Surgical techniques include frenotomy and frenectomy.

Frenotomy

Frenotomy is a simple cutting of the frenulum without excision of the tissue.

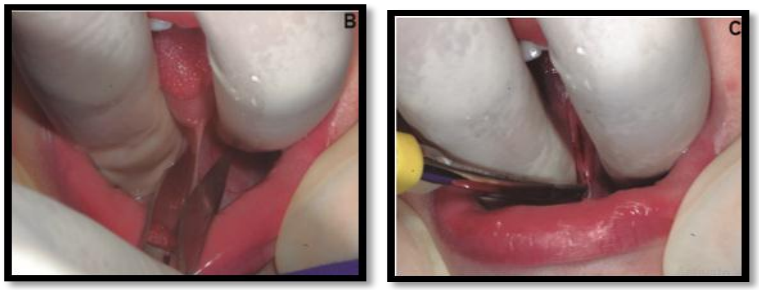
Armamentarium

Gauze piece, sterile blade or Goldman Fox scissors.

Procedure (Figure 8)

It is the procedure where frenum is cut or divided. It is accompanied without anaesthesia and with minimal discomfort in infants. The parent or assistant holds the head and stabilizes. The infant is made to sit supine to prevent tongue from falling back. The tongue is held with gauze and lifted gently, and then two gloved fingers of clinician's left hand are held under the tongue to lift and support tongue. The frenum is then divided/cut using small sterile blade/ Goldman Fox scissors, in a single motion, at the thinnest portion through the white, fascia-like tissue along a line parallel with the tongue. Occasionally complete release may be accomplished with a single cut.

However when the frenum is quiet tight 2-3 sequential cuts are required for retraction.Since the frenum is poorly vascularized and innervated it is at the clinician's advantage to use this simple procedure without any complication.



a)Tongue being held up b) Frenulum was cut.
Figure8:-Frenotomy.

Advantages
1. Conservative, simple and quick procedure that may be performed in the dental office settings during initial consultation.
2. Minimal discomfort.
3. After the procedure, feeding may be resumed immediately and is without apparent discomfort.
4. No specific follow up care is required.

Disadvantage
1. There are chances of recurrence,
2. At times there is need to perform complementary procedures to release the tongue satisfactorily.

Postoperative Instrucions For Frenotomy
Parents should be advised that post-operative white fibrin clot might be seen to form at the incision site during the first couple of days, and they should be reassured that it is part of healing process and not to mistake for an infection.
Follow up in 1-2 weeks should be made.

Frenectomy
Frenectomy is defined as complete excision, i.e., removal of the whole frenulum.The technique is same as that of labial frenectomy but in lingual frenectomy hemostat, grooved director are used as additional armamentarium8.

Frenectomy With The Use Of One Hemostat
Advantage
The hemostats are used to delimit the area to be excised as well as to guide the incisions.

Disadvantage
Two incisions has to be placed.

Frenectomy With The Use Of Two Hemostats
Advantage
When two hemostats are used, the risk of inadvertent soft tissue laceration is decreased.

Disadvantage
When the frenulum is too short, the use of two hemostats may not be feasible due to space limitation.

Frenectomy with the use of a grooved director
Advantage
Grooved director allows firm control of the tongue during anesthesia and serves as a guide for the incision at the upper aspect of the frenulum.

Disadvantage
1. Grooved director does not eliminate the need for tongue traction.

2. Tongue retraction with a silk suture in order to stabilize the tongue during dissection and suture of the wound is still required.

Frenectomy Using Electrocautery
Same as that in labial frenectomy.

Recentadvances in the treatment of ankyloglossia
Laser for treatment of ankyloglossia
Laser have been found to be very effective and minimally invasive procedure with immediate improvement in speech. Many lasers are available including Er:YAG,CO2 and Nd:YAG.Each of these Lasers exhibits specific properties depending on their position in the electromagnetic spectrum.

Same as that in recent advances of labial frenectomy.

Postoperativeinstructions For Lingual Frenectomy
1. Sucking of ice chips during first 24 hours,
2. Avoidance of any hot, hard or spicy food stuff.
3. Performance of postoperative tongue exercises after first 24 hours(postoperatively tongue exercise included touching of tongue to the palatine rugae while keeping mouth opened, rolling tongue side to side touching corner of the mouth, stretching of the tongue with a protrusive action).
4. Patients were instructed to continue this exercise 3‑4 times daily for 2 min until the incision healed and
5. Sutures were removed carefully 1‑week after surgery

Gingivectomy
Gingivectomy was first introduced by Robicsek in 1883 and the gingivectomy technique has been defined by Grant et al(1979) as the excision of the soft-tissue wall of the pocket9.It provides visibility and accessibility for complete calculus removal and thorough smoothing of the roots. This creates a favorable environment for gingival healing and restoration of a physiologic gingival contour.

Indications
1. Elimination of suprabony pockets, regardless of their depth, if the pocket wall is fibrous and firm.
2. Elimination of gingival enlargements
3. Elimination of suprabony periodontal abscesses.

Contraindications
1. The need for bone surgery or examination of the bone shape and morphology.
2. Situations in which the bottom of the pocket is apical to the mucogingival junction In these situations initial incisions would be made in the alveolar mucosa, so pocket elimination will result in complete elimination of the attached tissue.
3. Esthetic considerations, particularly in the anterior maxilla in which osseous
4. recontouring is unnecessary.

Syndromes Associated With Gingival Enlargement (Table 4)
1. Ramon Syndrome
2. Juvenile hyaline fibromatosis (Murray-Peretic-Drescher syndrome)
3. Zimmerman-Laband syndrome
4. Rutherford syndrome
5. Jones syndrome
6. Borronedermato-cardio-skeletal syndrome (Autosomal recessive/X-linked recessive)

Surgical Techniques
Gingivectomy technique may be performed by means of scalpels, electrodes, lasers or chemicals.

Surgical Gingivectomy
Surgical gingivectomy is a conventional technique performed using scalpel.

Procedure

1. STEP 1: The pockets on each surface are explored with a periodontal probe and marked with a pocket marker. Each pocket is marked in several areas to outline its course on each surface.
2. STEP2: Periodontal knives (e.g. Kirkland knives) are used for incisions on the facial and lingual surfaces and those distal to the terminal tooth in the arch.Orban periodontal knives are used for interdental incisions. Bard-parker blades #12 and #15 as well as scissors are used as auxiliary instruments.
3. The incision is started apical to the points marking the course of the pockets and is directed coronally to a point between the base of the pocket and the crest of the bone. It should be as close as possible to the bone without exposing it, to remove the soft tissue coronal to the bone.
4. Either interrupted or continuous incisions may be used. The incision should be beveled at approximately 45 degrees to the tooth surface and recreate the normal festooned pattern of the gingiva. Failure to bevel the incision will leave a broad, fibrous plateau, which will take a longer time to develop a physiologic contour.
5. STEP 3: Remove the excised pocket wasll, clean the area and closely examine the root surface.
6. STEP 4: Carefully curette the granulation tissue and remove any remaining calculus and necrotic cementum to leave a smooth and clean surface.
7. STEP 5: Cover the area with a surgical pack.

a) Gum surface marked b) Incision made Kirkland knife c) Incision with orban knife

Figure 9:-Conventional gingivectomy technique.

Advantages

1. Ease of use,
2. Precise incision with well-defined margins,
3. Relatively fast and uneventful healing,
4. No unwanted lateral tissue damage can be used to bone proximity and economic.

Disadvantages

1. Need of anesthesia,
2. Excessive bleeding,
3. Inadequate visibility caused by blood in the operating field,
4. Non-sterilized incision cut.

Gingivectomy By Electrosurgery

Electrosurgery has been used since 1928 in dentistry for soft tissue procedures like gingivectomy, gingivoplasty, soft tissue growth excision, crown lengthening etc.

Procedure

The removal of gingival enlargements is performed with the needle electrode, supplemented by the small ovoid loop or the diamond-shaped electrodes for festooning. A blended cutting and coagulating current is used in all reshaping procedures, the electrode is activated and moved in a concise shaving motion.

In the treatment of acute periodontal abscess, the incision to establish drainage can be made with the needle electrode without exerting pressure. The incision remains open because the edges are sealed by the current. After the acute symptoms subside, the regular procedure for the treatment of the periodontal abscess is followed.

For hemostasis, the ball electrode is used. Hemorrhage must be controlled by direct pressure first then the surface is lightly touched with a coagulating current. Electrosurgery is helpful for the control of isolated bleeding points. Bleeding areas located interproximally are reached with a thin, bar-shaped electrode (figure 10).

Figure 10:-Gingivectomy using electrosurgery.

Advantage
1. Cuts are made with ease when the device is set correctly,
2. Hemostasis is immediate and consistent,
3. The wound is nearly painless and
4. The tip is self-disinfecting.

Disadvantages
1. Need of anesthetic agent for cutting,
2. Unavoidable burning-flesh odor,
3. Low tactile sense,
4. Does not allow for their use around implants,
5. Bone can be damaged,
6. Dangerous in an explosive environment,
7. Contraindicated in pacemakers,
8. Poor postoperative healing who have undergone irradiation, diabetes or blood dyscrasias.

Gingivectomy By Chemosurgery
Technique to remove the gingiva using chemicals, such as 5% paraformaldehyde or potassium hydroxide.

Advantages
1. Less armamentarium
2. Less chair side time

Disadvantages
1. The depth of action cannot be controlled, therefore, healthy attached tissue underlying the pocket may be injured.
2. Gingival remodeling cannot be accomplished effectively.

Laser Gingivectomy
The lasers most often used in dentistry are the carbon dioxide and the neodymium: yttrium-aluminium-garnet (Nd: YAG), which have wavelengths of 10,600 nm and 1064 nm, respectively, both in the infrared range.

Procedure
Patient is advised diode laser gingivectomy (810 nm) as an adjunct to nonsurgical periodontal treatment on sites with gingival enlargement. The diode laser gingivectomy is performed under topical lignocaine anaesthetic gel, applied for 3 minutes prior to operation. The gingivectomy is performed with gentle, sweeping brush strokes with a power output of 1.2 W, continuous wave (CW) using the laser fibre tip (400 µm in diameter).gingivectomy and gingivoplasty of upper and lower anterior teeth is carried out. Ablation is performed using light brushing strokes and the tip is kept in continuous motion. Remnants of the abladed tissue are removed using sterile gauze dampened with saline. Gingivoplasty is done in the interdental papilla and marginal gingival to create a normal physiological contour by changing the tip angulations. This procedure is done until the desired architecture of marginal gingival is

achieved. High-volume suction is used to evacuate the laser plume and charred odour. Hemostasis is checked. Safety glasses are worn by the operator; patient and assistant. Any instrument with mirrored surface is avoided to avoid reflection of the laser beam to other (figure 11).

a)Intraoperative b) Immediate after the procedure

Figure11:-Laser assisted gingivectomy.

Advantage

1. Minimal or no anesthetic is required,
2. No harm to dental hard tissues. Their judicious use does not injure the dental pulp, because of low or no heat production.
3. They are compact and portable in design with efficient and reliable benefits for use in soft tissue oral surgical procedures.
4. Laser assisted surgeries are easy to perform with less discomfort, minimal or no bleeding due to sealing of capillaries by protein denaturation and stimulation of clotting factor VII production,
5. Shorten healing time with reduced postoperative bleeding and edema.

Disadvantages

1. Eye damage by laser light, so protective glasses are required.
2. Cutting is slower than that with electrosurgery with burning flesh odor.
3. Working area should free of combustible gases. During laser use, laser plume requires use of a high-filtration face mask.

Success Rate

According to Mavrogiannis et al (2006)10there was significantly less recurrence of drug- induced gingival overgrowth in patients treated with laser excision, compared with those treated by conventional gingivectomy.

Postoperative Instructions After Gingivectomy

1. Do not rinse vigorously in the first 2 hours.
2. While lips and tongue are numb, be careful not to bite them or push on any protective dressing.
3. The day after surgery, use warm salt water to lightly rinse after each meal and before bedtime.
4. The day after surgery, floss and brush areas not operated.
5. On the fourth day after surgery, floss and brush operated areas not covered with a dressing.
6. Do not use water spray devices.

Mucocele

Mucoceles, one of the most common nonmalignant masses of the oral cavity, are probably the most common disease of the accessory (minor) salivary glands. It affect both genders in all age groups, with the peak age of incidence between 10 and 29 years. The lesions are more common in the inner portion of the lower lip, although they can also be found in the buccal mucosa, tongue and on the floor of the mouth. . The size of oral mucoceles varies from 1 mm to several centimeters in diameter and their duration may range from days to years.

Prevalence

International

According to Martins et al (2011)11 the prevalence of all oral mucoceles is 2.5 lesions/1000 population with no gender predilection.

National
According to Chandramani et al(2014)12 oral mucoceles were highly prevalent in the age group of 15-24 years, were seen in 51.72% of males and 48.28% of females, with a ratio of 1.07:1.

Classification
Based on the underlying etiopathogenesis, these lesions classically have been divided into retention mucoceles and extravasation mucoceles13.

Retention Mucocele
Retention mucoceles consist of a well-defined cystic cavity presenting an epithelial wall lined with cuboid or squamous cells are less frequent and are seen particularly in elderly patients. They are uniformly distributed throughout all the territories that contain minor salivary glands (frequently on upper lip, hard palate, floor of mouth and maxillary sinus). According to Chandramani et al (2014)12 the retention type accounts for about 15.52%.

Etiology
Obstruction of salivary gland duct.
The retention mucocele is caused by obstruction of a minor salivary gland duct by calculus or possibly by the contraction of scar tissue around an injured minor salivary gland duct. The blockage of salivary flow causes the accumulation of saliva and dilation of the duct. Eventually, an aneurysm-like lesion forms, which can be lined by the epithelium of the dilated duct.

Pathogenesis
The pathogenesis of the retention mucocele is still uncertain. It is believed that with the increase in age, there is a natural reduction in salivary secretion, promoting the formation of a mucous plug that causes partial or total obstruction of the salivary gland system duct, resulting in dilation of the duct and increase in intraluminal pressure.

Clinical features (figure12)
1. Solitary, usually asymptomatic, mobile,non-tender,
2. Covered by intact epithelium,
3. Color same as surrounding tissue,
4. Commonly seen in adults over 50 years of age,
5. Common in palate, cheek,floor of mouth and uncommon in upper lip rare in lower lip.

Figure 12:-Retention mucocele.

Histopathology
In the case of retention mucoceles a cyst cavity can be found, this is generally well defined with an epithelial wall covered with a row of cuboidal or fat cells produced from the excretory duct of the salivary glands . The retention mucoceles show no inflammatory reaction and are true cysts with an epithelial covering (figure 13).

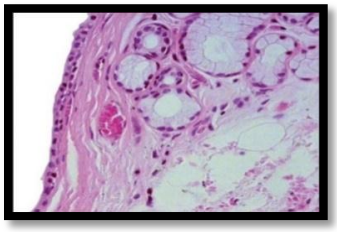


Figure 13:-Histopathology of retention mucocele.

Extravasation Mucocele

Extravasation mucoceles are in fact pseudocysts lacking a well-defined wall, and are composed of compressed elements of the surrounding connective tissue, and inflammatory components. They account for over 80% of all mucoceles, and are more common in individuals under 30 years of age. They are fundamentally located in the lower lip (80%, Girish et al, 2016).

Etiology

Trauma

The formation of an extravasation mucocele is believed to be the result of trauma to a minor salivary gland excretory duct. Laceration of the duct results in the pooling of saliva in the adjacent submucosal tissue and consequent swelling.

Pathogenesis

1. The extravasation type will undergo three evolutionary phases. In the first phase there will be spillage of mucus from salivary duct into the surrounding tissue in which some leucocytes and histiocytes are seen.
2. In second phase, granulomas will appear due to the presence of histiocytes, macrophages, and giant multinucleated cells associated with foreign body reaction. This second phase is called as resorption phase.
3. Later in the third phase there will be a formation of pseudo capsule without epithelium around the mucosa due to connective cells.

Clinical features (figure 14)

1. Bluish nodule (normally color if deep) usually covered by epithelium,
2. Slightly painful and have associated acute inflammatory reaction,
3. Most frequently seen in lower lip and buccal mucosa rare in upper lip,
4. Commonly seen in adolescents and children.

Figure 14:-Extravasation mucocele.

Histopathology

Extravasation mucoceles are pseudocysts without defined walls. The extravasated mucous is surrounded by a layer of inflammatory cells and then by a reactive granulation tissue made up of fibroblasts caused by an immune reaction. Even though there is no epithelial covering around the mucosa, this is well encapsulated by the granulation tissue (figure 15).

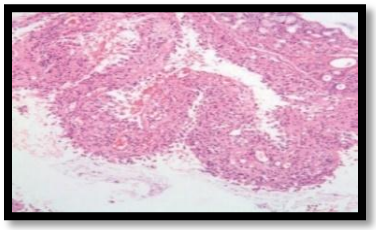


Figure 15:-Histopathology of extravasation mucocele.

Diagnosis

The appearance of mucocele is pathognomonic, and so the data about the lesion location, history of trauma, rapid appearance, variations in size, bluish color and the consistency.

Clinical examination, Fine needle aspiration cytology, Computed tomography, Magnetic resonance imaging,Ultrasonography.

Ranula
Ranula was first reported during the period of Hippocrates and Celsius. The word ranula has been derived from the Latin word "Rana" which means the frog (figure 24). This is because it resembles the translucent belly of a frog. Ranula is formed by rupture of excretory duct of the salivary gland, which is followed by rupture of saliva into the surrounding tissues.Salivary secretions from sublingual gland is also rich in protein and amylase and hence it has been suggested that ranulas are commonly caused by ruptured sublingual excretory ducts. The high protein content of the fluid in the ranula stimulates inflammatory reaction causing pseudocyst formation.

Prevalence
According to Saraniya Packiri et al (2017)14the prevalence of pediatric ranula was 1.15:1 (F:M) with a slight predilection towards the female population.

Etiology
The etiology is unknown, but it has been associated with congenital anomalies trauma and diseases of the sublingual gland.

Congenital ranula
Congenitally, ranula occurs following imperforate salivary gland duct and ostial stenosis leading to cyst formation. The prevalence of congenital ranula is 0.74%.
Trauma
Trauma or surgery to the floor of the mouth, neck region which may rupture the sublingual gland acini.

Classification
There are two different types of ranulas based on pathogenesis.

True cyst
This type of ranula has an epithelial lining. This type of ranula is usually caused due to obstruction of ducts of sublingual gland or ducts of one of the minor salivary glands.

Pseudocyst
This type of ranula does not have an epithelial lining. This is caused due to ductal injury of commonly the sublingual salivary gland, extravasation of saliva and accumulation into the submucous tissue. Sometimes this type of ranula is surrounded by granulation tissue or condensed connective tissue.

According to the variations of its extension, ranula has been classified into three clinical types
1. Sublingual type
2. Sublingual-submandibular type and
3. Submandibular type.

The sublingual type is a simple ranula, while the sublingual-submandibular type and submandibular type are plunging ranula.

Clinically ranula has been classified into two types (figure 16)

Intra oral (simple) ranula
This type of ranula is confined to the floor of the mouth. It is known to slowly enlarge in size into painless fluctuant swelling.

Plunging (cervical) type ranula
Plunging ranulas commonly arise from sublingual salivary gland.It is seen as a painless swelling in the neck that gradually increases in size.

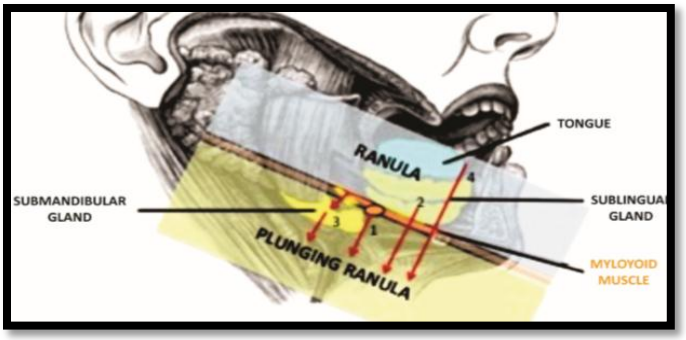


Figure 16:-Clinical types of ranula.

Pathogenesis

Intraoral ranula

There are two different concepts for the pathogenesis of ranula. One is true cyst due to ductal obstruction with an epithelial lining, and the other is a pseudocyst due to obstruction of ductal injury and extravasation of mucus without an epithelial lining.

Plunging ranula

Plunging and sublingual plunging ranulas cause swelling in the neck by one of the four mechanisms:

1. Sublingual gland may project through the myolohyoid muscle, or alternatively an ectopic salivary gland may present on the cervical side of the mylohyoid.Mucus secretion from these ectopic glands may drain into neck mass.
2. A hiatus or dehiscence in the mylohyoid muscle may occur. This defect is observed along the lateral aspect of the anterior two third of the muscle. Mucus from sublingual gland may pass through this defect and reach the submandibular space.
3. Plunging ranulas occur iatrogenically as a result of removal of oral ranulas. It may develop secondarily after surgical procedures such as implant placement, removal of sialolith and duct transposition.
4. A duct from the sublingual gland may join the submandibular gland or its duct, allowing the ranula to form in continuity with the submandibular gland. Therefore, ranula my reach the neck from behind the mylohyoid muscle. This abnormal communication may cause stasis of salivary flow in the duct leading to extravasation of the saliva into the neck in the submandibular region.

Neonate ranula

The cause of ranula in neonates is not known. When the duct orifice is not patent this may end up with congenital sialocele which is a true cyst with epithelial lining. This is thought to result from a congenital failure of canalization of the terminal end of the duct.

Diagnosis

Clinical examination,Needle aspiration, Sialographic examination ,Ultrasonography, Computed tomography,Magnetic resonance imaging, Pathologic examination .

Clinical Presentation

1. Is a smooth cystic swelling under the tongue, usually to one side.
2. It is often transparent or bluish in appearance with overlying small blood vessels.
3. In a deeper ranula there will be a greater thickness of tissue separating the lesion from the oral cavity and the blue translucent appearance may not be a feature.
4. Asymptomatic in presentation.
5. Large swellings may push the tongue backwards and affect speech, mastication, respiration, and swallowing due to the upward and medial displacement of the tongue.

Treatment Of Mucocele And Ranula

Size of the lesion is the most important factor to determine the approach for the treatment of mucocele and ranula. Conventional surgical removal like marsupialization, excision of the submandibular gland or combined excision of

both the ranula and sublingual gland, is the most common method used to treat these lesions. Other treatment options includeCO2 laser ablation, cryosurgery, intralesional corticosteroid injectionandmicromarsupialization.

Conventional techniques

Drainage

Conventionally the only treatment employed was drainage. With the patient under local anaesthesia, saliva was aspirated using a wide-bore needle to completely decompress the ranula, or the oral floor was incised using a size 11 scalpel.

Recurence Rate

Verma G (2013)15 reported recurrence rate after incision and drainage was 70% to 100%.

Marsupialization

Marsupialization (the opening of a cyst to the surface) has been used frequently in the treatment of ranula/mucocele. It is the oldest and most widely reported treatment method.

Indication

For ranula/mucocele less than 2 cm in diameter.

Armamentarium

Mersilk 3/0 suture material, hemostat, white head varnish and gauze piece.

Procedure (Figure 17)

Marsupialization of the lesion is done under local anesthesia. Marking the cystic swelling of ranula is followed by suturing the cystic wall to the mucosa of the floor of the oral cavity at the periphery of the lesion using mersilk 3/0 by deep penetration of the needle. Then deroofing of the cystic lesion is done. Hemostasis is achieved using hemostat and the cystic cavity is packed with white head varnish socked sterile gauge. Suture removed after 7 days.

a) Sutures placed b) Deroofing of the lesion c) Immediate postoperative

Figure 17:-Marsupialization of ranula.

Advantages

1. Simplicity,
2. Low morbidity,
3. Minimal removal of normal tissue.

Disadvantage

1. Difficulty in identifying the cut surface of the collapsed cyst for suturing.
2. High recurrence rate (61-89%).

Recurence Rates

Verma G (2013)15 reported recurrence rate after marsupialization was 36.4% to 80%.

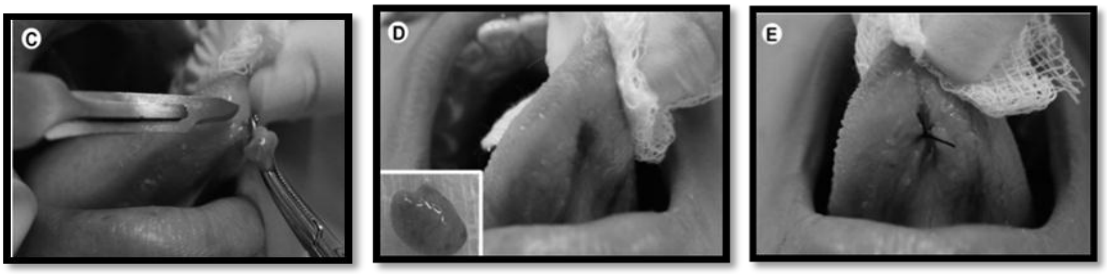
Enucleation

Surgical enucleation is the most widely used form of treatment and consists in complete removal of the lesion during the surgical procedure.

Indication
Mucocele and ranula > 2cm.

Armamentarium
Carpule syringe, Halsted tweezers, scalpel blade #15, suture material.

Procedure (Figure 18)
A topical anesthetic is applied around the lesions for 3 min followed by an infiltrative local anesthesia at 4 equidistant points around the lesions, using short needles mounted in an aspirating Carpule syringe. The base of the lesions is clamped with Halstead tweezers, incised with a scalpel blade #15, and the lesions are removed and sent to histopathological analysis. The soft tissues are sutured with a silk thread. Postoperative care recommendation and prescription of pain relievers are done and the patients returned to the dental clinic 7 days later for removal of sutures and clinical follow-up of the healing process.



a) Excision of the lesion b) Excised tissue c) Suture placed

Figure 18:-Excision of the mucocele.

Advantages
1. Complete removal of the lesion.
2. Less recurrence rate

Disadvantages
Large wound area.

Recurence Rates
Verma G (2013)15reported recurrence rate after excision of ranula was18.7% to 85%.

Electrocautery
Electrocautery is a technique in which low voltage and relatively high amperage are used to heat a metal instrument tip. This can be produced either with commercial alternating current with a step-down transformer or by a battery, such as in a small Concept cautery.

Indication
Mucocele

Procedure (Figure 19)
A local infiltrative anesthesia is infiltrated around the lesion. Before infiltration, a topical anesthetic gel for 2 minutes is applied. The lip is then everted with digital pressure to increase the lesion's prominence. A thick silk thread is passed through the lesion at its largest diameter and a surgical knot was made followed by excisional biopsy using electrocautery. Analgesic was prescribed on the first post operatory day to prevent any possible pain.

a) Excision b) Postoperative
Figure19:-Electrocautery technique

Advantages
1. Minimizing the chances of pain,
2. Less postoperative bleeding.

Disadvantages
Lateral heat damage

Cryosurgery
Cryosurgery is another effective method. The procedure uses a gas expansion cryoprobe with a 10-mm-diameter round tip. Bodner and Tal (1991) performed three applications at the same site in a single session without the need of local anesthesia. The selected cryodose for each application was a 30-s freeze at -81°C followed by an approximately 1-min thaw.

Indication
To treat various soft tissue pathologies like ranula/mucocele in oral and maxillofacial surgery.

Procedure (Figure 20)
Local anesthesia is given to anesthetize the surrounding structures. A closed system consisting of a cryoprobe and nitrous oxide gas is used. Nitrous oxide is released from a high pressure inside the cryotip which is placed directly on the lesion. The lesion is exposed directly to three consecutive "freeze-thaw cycles" and each cycle lasted for 5–10 s. The cryoprobe is moved from the center of the lesion to the borders until the lesion appeared white and frozen, resembling an ice ball.

a) Application of cryoprobe b) Immediate after treatment.
Figure 20:-Cryotherapy of ranula.

Advantages
1. A bloodless operating field,
2. Precise incision,
3. Easy surgery,
4. Decreased postoperative swelling,
5. Minimized scar tissue ,
6. Reduced edema and postoperative pain.

Disadvantages
1. Unpredictable degree of swelling,
2. Lack of precision of depth in area of freezing,
3. Slight degree of necrosis, and
4. Sloughing which results in delayed healing which can be a bit problematic.

Recurence Rate
Kurozu (1983)16reported the recurrence rate of 15% after cryosurgery.

Recent advannces in the treatment of mucocele/ranula
micro-marsupialization
Micro-marsupialization is a procedure carried out to drain the accumulated saliva by passing a suture thread along the largest diameter of the lesion. The introduction of a suture also permits the formation of an epithelial tract to form between the surface and the underlying salivary glandular tissues. The technique was first described by Morton and Bartley.

Indications
Ranula/mucocele.

Armamentarium
3-0 silk suture material, gauze piece.

Procedure (Figure 21)
Micro‑marsupialization procedure is performed after the application of topical anesthetic (2% lignocaine gel) for approximately 3 min or surgical site is infiltrated with 2% lignocaine hydrochloride injection. A 3‑0 silk suture is passed through the lesion along its widest diameter taking care not to reach the underlying tissue, and a surgical knot is made. Mucoceles are then compressed slightly to extravasate as much accumulated saliva as possible around the suture. Patients are advised to apply 0.5% chlorhexidine gel postoperatively to prevent secondary infection. Sutures are then removed after 7 days.

a) Intraoperative view, b) Immediate postoperative
Figure 21:-Micromarsupilization technique.

Advantages
1. Rapid and simple to perform,
2. Less invasive,
3. Well tolerated by the patients,
4. Least traumatic technique,
5. Effective alternative especially in uncooperative, mentally retarded, pediatric age group patients, and all patients not fit for surgical procedure.

Disadvantages
Need multiple visits.

Recurrence Rate
According to Giradi et al (2016)17the recurrence rate of mucocele was 20%.

Laser

In 1985, Frame JW introduced laser for the treatment of ranula/mucocele. Ranula has a high water content, which is vaporized by carbon dioxide laser. The heat generated causes coagulation of blood vessels resulting in haemostasis.Carbon dioxide laser is effective in management of pediatric ranula/mucocele, with limited side effects. In case of recurrence of ranula/mucocele, surgical approach with the removal of associated salivary gland is the best treatment option.

Procedure (Figure 22)

Infiltration given, the lesion is excised using soft diode laser in wavelength of 940 nm, 400 µm diameter tip at 1.5 W in continuous mode. The incision is placed on the uppermost site of the lesion and complete excision is performed.

a)Application of laser b) Immediate postoperative

Figure 22:-Laser technique.

Advantages

1. Minimal intraoperative bleeding and swelling,
2. Postoperative pain,
3. Very less surgical time, scarring, and coagulation,
4. No need of suturing after excision.

Disadvantages

Expensive

Recurrence Rate

According to Saraniya et al (2017)18the recurrence rate of ranula is 0.52%.

Intralesional Injection Of Ok 432 (Picibanil)

The use of OK-432 in ranula treatment was first reported by Ikarashi et al(1987) in the treatment of a plunging ranula in an adult patient. OK-432 is a lyophilized state human-driven group A streptococcus pyogenes strain which is produced by processing with heat and benzylpenicilline.

Indication

Mucocele/ranula.

Mechanism Of Action

Effect mechanism of OK-432 has been explained with inflammatory response produced. Inflammatory cells coming into cyst postinjection and stimulate the immune response. Endothelium permeability increases, with the release of various cytokines such as interleukin-6, tumor necrosis factor, interferon gama. And this caused the contraction of cyst by increasing the drainage of lesion to lymph ducts. Other than this, increasing the number of OK-432 natural killer and T-lymphocyte increases the contraction of cyst.

Procedure

In patients who undergo OK-432 treatment, a history of penicillin allergy should be elucidated as the OK-432 formulation contains benzyl penicillin.The application was performed with 0.1 mg of OK-432 (defined as 1 Klinische Einheit (KE) unit) mixed with 10 ml of saline.The ranula content, often described as a yellowish mucoid fluid, was aspired as much as possible. Then the OK-432 mixture was added to the cyst in the same volume as the aspirated liquid. This procedure was often performed without the need for local anesthetic. Syringes used were

between 18-27 gauge and depend on the location of the cystic lesion as well as the clinical situation of the patient. Recommended OK-432 mixture should be given between 0.1−0.5 KE.

Advantages
1. No local anesthesia was required during procedure.
2. The treatment was painless and time for procedure was brief, therefore children and anxious patients can be well tolerated.
3. The nerve injury and cosmetic problems could be avoided.
4. Secondary infection and hemorrhage are rare.
5. Recurrences are less frequent.

Disadvantages
1. Expensive
2. Drug is not readily available
3. Chances to occur post-operative symptoms like fever(due to increased immune response).

Recurrence Rate
According to Arunachalam et al (2010)19 Sclerotherapy with OK-432 is a good substitute for surgery and recurrence noted was 14.3%.

Homotoxicological Drug
A non-invasive technique to overcome the side effect of OK-432 was nickel gluconate- mercurius heel- potentised swine organ preparation (a homotoxicological drug). The duration of oral administration of the drug varied from six weeks to a maximum of six months. These drugs accelerate pseudocyst resorption, glandular repairing and physiological function.

Dosage
1. Nickel gluconate: 0.5mg on alternate days
2. Mercurius heel: 1 tablet 3 times a day(for unweaned 1/3 dosage, for early childhood ½ dosage)
3. Potentised swine organ preparation: 0.1 ng (nanogram) twice a week for 4-6 weeks,decreasing 0.1ng every 10 days.

Advantages
Higher success rate in large lesion, as there is increased sensitivity to the action of drugs due to high vascularity.

Disadvantages
1. Increased volume and tension in the swelling for 24 hours,
2. Asthenia.

Reimplantation
Reimplanation is a form of autogenous transplantation where an avulsed or intentionally extracted tooth is reinserted in its original position in the mouth with or without endodontic therapy or root resection in vitro .

Preservation of natural dentition is the primary goal of any conservative treatment modality. It can be replantation of an avulsed tooth, intentional replantation or autotransplantation.The purpose of all these remains the same.

Indications
1. Teeth avulsed due to trauma when these are out of the mouth for a short period
2. When conventional endodontic treatment is not possible to carry out within the mouth
3. When surgical endodontics is ruled out in want of appropriate access.
4. Periodontally diseased teeth that are excessively mobile.
5. Extruded teeth.
6. Decidous anteriors can be reimplanted for esthetic reasons as well as for maintenance of space.
7. Teeth accidently extracted or luxated due to improper use of elevators.

Contraindications

1. Grossly decayed tooth
2. Severe periodontal condition
3. Non cooperating patient
4. Medical conditions like immunosuppression, uncontrolled diabetes etc.

Avulsion

Avulsion of teeth results in total displacement of tooth out of its socket. Modern clinical practice offers a wide variety of treatment to replace the missing teeth like replantation, removable prosthesis, fixed partial denture and implant. Fixed partial denture and implants are generally not indicated in children until the skeletal growth is completed. Thus replantation of teeth is considered to be the best optimal treatment option following avulsion.

Treatment Factors

Maturity of the root

The immature teeth showed better prognosis than mature teeth as the immature tooth has the potential to establish revascularization.

Extralveolar dry time

Complete healing can be guaranted if the tooth is replanted in the first 5 minutes.Every effort should be made to replant the tooth within the first 15-20 minutes.Replantation within 45 minutes of avulsion is considered immediate replantation.

Medium of storage

Storage media in order of preference and availability are;milk,saliva9either in the vestibule of the mouth or in a container into which the patient spits),physiologic saline or water.Water is the least desirable storage medium because of the hypotonic environment which causes rapid cell lysis and increased inflammation on replantation.Cell culture media such as Hank's Balanced Salt Solution in specialized transport containers; have shown superior ability in maintaining the viability of the periodontal fibres for extended periods.

Preoperative Assessment

Preparation Of The Socket

The socket should be undisturbed before replantation.Emphasis is placed on the removal of obstacles within the socket to facilitate the replacement of the tooth into the socket.It should be lightly aspirated if blood clot is seen.If the alveolar bone has collapsed a blunt instrument should be inserted carefully into the socket in an attempt to reposition the wall(figure 23).

Figure 23:-Aspiration of blood clot.

Preparation of the root

Preparation of the root is dependent on the maturity of the tooth (open versus closed apex) and on the dry time of the tooth before it was placed in a storage medium. Eliminate the necrotic tissue from the root surface. The procedure can be performed mechanically or chemically using EDTA 24%, citric acid, or sodium hypochlorite.Hold the tooth by the crown and irrigate the root surface with sterile saline(figure 24).

Fig 24:-Preparation of the root

Management
Depending upon above factors different therapeutic protocols are followed:

Mature apex
Extraoral dry time
15-20 minutes extraoral dry storage

The periodontal ligament cells are most likely to be viable.Thus immediate replantation can be performed in these cases.

Procedure
1. The tooth should always be picked up by the crown portion.
2. The tooth should be rinsed off first in a physiologic solution, such as HBSS, milk or 0.9% normal saline to remove visible debris.
3. The visible debris on the root surface should never be removed mechanically.
4. Tooth should be replanted by applying light digital pressure, if stronger pressure is applied, it might cause crushing of the root PDL cells and lead to the increased possibility of ankyloglosis.
5. The apex of the tooth should never be amputated to accommodate in complete sealing the socket.

20-60 minutes extra oral dry storage

The PDL cells may be viable but compromised.
Procedure
1. In such situations avulsed tooth is need to be stored in HBSS for 30 minutes before replantation as it replaces the depleted cell metabolites and reconstitute the cells that would otherwise die.
2. Replantation is similarly done as described for extraoral dry storage of less than 20 minutes.
3. More than 60 minutes extra oral dry storage.
4. The PDL cells are non-viable. It is not possible to reconstitute the PDL cells by soaking it in the pH-balanced solution. The avulsed tooth, however can still have a significant incidence of success if treated as follows.

Procedure
1. The necrotic PDL should be removed carefully for example with gauze or the tooth might be soaked in a saturated citric acid for 3 minutes and rinsed off with a physiologic solution. Citric acid expose the collagen fibres on root cementum and promote a contact surface for reattachment of PDL collagen fibres.
2. It is then soaked in a 2% sodium fluoride solution for 20 minutes. Treatment of root surface with sodium fluoride will slow down the osseous replacement of tooth.
3. The root canal treatment can be performed either extra orally or can be done after 7-10 days following replantation depending upon the severity of other injuries and age of the patient.
4. If endodontic treatment is carried out during first visit, debridement of the root canal should be done, then the canal should be dried and obturated with calcium hydroxide and the access restored.
5. The tooth should be radiographically monitored for signs of resorption during regular follow up visits.
6. If there are no signs of resorption after 9 to 12 months ,then obturation with gutta ppercha is done.

Immature apex

Extra oral time
15-20 minutes extra oral dry storage

Procedure
1. When the avulsed tooth has an immature apex,the condition of the PDL as well as the potential for pulpal revascularization must be considered.
2. The avulsed tooth that is extra oral for less than 15 minutes has a fairly viable PDL but we need to consider the possibility of contamination by bacteria especially in such cases of open apex.
3. The tooth should not be replanted immediately but should be soaked in 1 mg of doxycycline in 20 ml physiologic saline for 5 minutes before replantation because of its antibacterial efficacy (figure 25).
4. After soaking in 1mg doxycycline in 20 ml of physiologic saline, the tooth can be replanted assuming that the pulpal tissue is vital and revascularization would be stimulated by the process of disinfection followed by replantation. Moreover there are chances of physiologic closure of open apex due to revascularization.
5. Thus the tooth should be radiographically examined during periodic follow up visits to evaluate the closure of apex.

Figure 25:-Soaking in doxycycline 20-60 minutes extra oral dry storage

Procedure
1. When the dry storage is less than 60 minutes, the cells of the PDL have not become necrotic but are metabolically and physiologically compromised.
2. The tooth should be soaked in a pH-balanced reconstituting medium such as HBSS, for 30 minutes.
3. Then the tooth should be soaked in solution of 1 mg doxycycline in 20 ml of physiologic saline before replantation.
4. Then the tooth should be radiographically examined during periodic follow up visits to evaluate the closure of apex.
5. More than 60 minute's extra oral dry storage

When an avulsed tooth has been extra oral and dry stored for this length of time, there is usually complete PDL cell necrosis.It is not possible to reconstitute the PDL cells and soaking in the pH-balanced solution is unnecessary. In addition,there is little likelihood of the pulp revascularizing.

The avulsed tooth, however can still have a significant incidence of success if treated as follows.

Procedure
1. The necrotic PDL should be removed carefully for example with gauze or the tooth might be soaked in a saturated citric acid for 3 minutes and rinsed off with a physiologic solution.Citric acid expose the collagen fibres on root cementum and promote a contact surface for reattachment of periodontal ligament collagen fibres.
2. It is then soaked in a 2% sodium fluoride for 20 minutes, then soaked in a 1 mg/20 ml doxycycline solution for 5 minutes.Treatment of root surface with sodium fluoride will prevent the inflammatory resorption and ankylosis in short- term.
3. As the chances of pulp revascularization is not possible, in these casesthe endodontic cleaning and shaping of the canal is performed extraorally with the tooth in the hand.
4. Then apexification procedure can be initiated with calcium hydroxide.
5. Following this tooth is replanted and tooth should be radiographically examined during periodic follow up visits to evaluate the formation of calcific barrier.

6. Once the calcific barrier is formed or if there are no signs of resorption, then obturation with gutta percha is done.

Follow Up
1. Splint removal done after 4 weeks.
2. Clinical and radiographic evaluation should be done after 4 weeks, 3 months,6 months and then yearly thereafter.

Success Rates
According to shaaf et al(2016)20, replanted avulsed tooth survival rate was 83.9%.

Transplantation
Transplantation is the insertion of a tooth from one place to another place in the mouth (autotransplantation) or from mouth of one individual to the mouth of the other individual (allotransplantation).

Types Of Transplantation
Tooth transplantation is mainly divided into two types:

Allotransplantation
Allotransplantation (homogenous), where a tooth is transferred from one individual to a different individual of the same species.

Drawbacks
1. Histocompatibility between donor and recipient, which often leads to a rapid destruction and loss of the grafted tooth.
2. The potential for infection from the hepatitis B visrus or human immunodeficiency virus is increased.

Success rate
Yang et al (1990)21 reported a successful case of homologous tooth transplantation. A maxillary second premolar obtained from a tooth bank was implanted into a fresh central incisor extraction site. A 3-yr follow-up radiograph indicated satisfactory apical healing and minimal replacement resorption. Clinically, the transplantation site was free of symptoms and there was no evidence of periodontal disease or tooth mobility.

Autotransplantation
Autotransplantation (autogenous), where a tooth is transferred from one site to another in the same individual.Autotransplantation of teeth has been done for many years but with varying degrees of success.It has been used to replace missing teeth and teeth of poor prognosis.

Definition
Autotransplantation is defined as the transplantation of embedded, impacted or erupted teeth from one site into extraction sites or surgically prepared sockets in the same person.

Indications
1. When a tooth from the dental arch has to be extracted for any reasons and a non-functional tooth is available in the jaws.
2. When the recipient site is free from inflammation or other bony pathology.
3. A developing mandibular third molar is an ideal donor for the first molar area.Maxillary molars, canine and mandibular premolars are also used for autotransplantation.

Contraindications
1. Lack of proper oral hygiene
2. The impossibility of ensuring a regular follow-up.
3. Inadequate width of the alveolar bone at the recipient site.

Selection criteria
donor tooth criteria
radiographic examination
1. No evidence of progressive inflammatory root resorption
2. Normal PDL space width around the transplanted tooth
3. No disturbance in root development
4. Lamina dura should be intact.

Clinical Examination
1. No pathologic tooth mobility present
2. No indication of marginal attachment loss,
3. No gingival inflammation

Recipient Site Criteria
Radiographic Examination
It should have sound periodontal support

Clinical Examination
1. It should have sufficient dimensions
2. No acute inflammation.

Surgical Procedure
The success of dental replacement therapy by autotransplantation is determined by the quality of the residual periodontal tissues in the root surface of the tooth to be transplanted. The sequence of autotransplantation includes clinical and radiographic examination, diagnosis, treatment planning, a surgical procedure, possible endodontic treatment, restorative treatment, and maintenance.

Armamentarium
Surgical carbide burs, handpiece,wire for slinting,silk suture thread.

Procedure
Preoperative evaluation.
Adequate assessment of the dimensions

The dimensions of the crown,shape of the roots,successful extraction of the donor tooth and health of the recipient site as well as supraeruptions of the antagonistic tooth should be carefully considered before undertaking the procedure.Preoperative antibiotics has to be given.

Incision placed
An incision is made in the gingival crevices extending from the third molar to the premolar area from transplanting a mandibular third molar.Incision of similar design can be made for transplantation of other teeth.

Removal of the tooth to be transplanted (donor tooth)
Tooth has to be extracted atraumatically and is kept in a piece of sterile wet gauze.
Removal of tooth at the recipient site
Tooth which is to be replaced is extracted.

Preparation of the recipient socket
The interdental septum projecting between the roots is trimmed. If the tooth is to be transplanted into an edentulous area, the suitable socket in the bone should be prepared after excising the adequate amount of bone and mucosa. Fresh bleeding is started in the socket.

Replantation and splinting
The donor tooth is placed in the socket taking care to transplant buccal surface bucally.The tooth is maintained in the socket with the help of suture in case of incomplete root formation.If the roots are complete,the tooth can be

splinted in place with the help of wires.It is recommended that in autotransplantation, the donor tooth should be directly shifted to recipient site from donor site for obtaining better results.

Follow Up

1. The splint was removed at 6 weeks postoperative.
2. Clinical and radiographic evaluation was done at 2 weeks, 1month, 3 months and 6 month follow-up.

Success Rates

In recent metaanalysis,the survival rates of autotransplantation at 5 years was 98% for teeth with incomplete root formation(Atala et al 2017)22and 90% for teeth with complete root formation(Czouchrowska et al 2002)23.

Recent Advances In Autotransplantation Technique

More recently,computer aided surgical stimulation (CASS) has been used in the field of oral and maxillofacial surgery including autotransplantation of teeth(Cross et al,2013; Jang,Lee and Kim,2013).Rapid prototyping replicas based on cone beam computed tomography(CBCT)have been used as alternatives to donor teeth for preparation of new sockets,which have proven useful in reducing extraalveolar time and injury to periodontal ligament cells.In order to precisely transfer desired positions of the donor teeth to the clinic and simplify the surgical procedure,clinicians tend to design certain types of individual surgical guides besides replicas.In addition,after transplantation of donor tooth to recipient sites,various position maintaining methods have been used across different studies,including sutures,resin wire splints and titanium screws.

Computer aided surgery

The patients was scanned by CBCT.The mesiodistal diameter as well as shape and length of the roots canals of the donor tooth were observed and recorded.A plaster cast of the mandibular dentition was fabricated for the patient,and subsequently,CBCT scans of the plaster cast were taken(CBCT).

Virtual design of surgical guides

The local surgical splint was generated between occlusal surfaces of the autotransplanted tooth and the opposite tooth. The splint was used to locate position of the replica of the donor tooth, hence it was attached to the digital donor tooth.

Fabrication of surgical guides

Conventional polishing and sterilization process were performed before their application in clinical surgery.

Surgical procedure

The tooth at the recipient socket was extracted beforethe autotransplantation surgery, in order to avoid any consequent infection due to apical inflammation.After the guide template and arch were fabricated ,the patient was called back for surgery under local anesthesia.During surgery,the new socket at the recipient position was prepared using round bur.The replica with the local surgical splint was used as a guide before extraction of the donor tooth.Subsequently,the donor tooth was gently extracted and placed into the new socket, and the surgical template aws used to check and confirm the desired position of the autotransplanted tooth.After the desired position of the donor tooth was achieved,the arch bar was ligated to the teeth with bifilar,a 0.25mm diameter steel wires to fix the autotransplanted tooth.

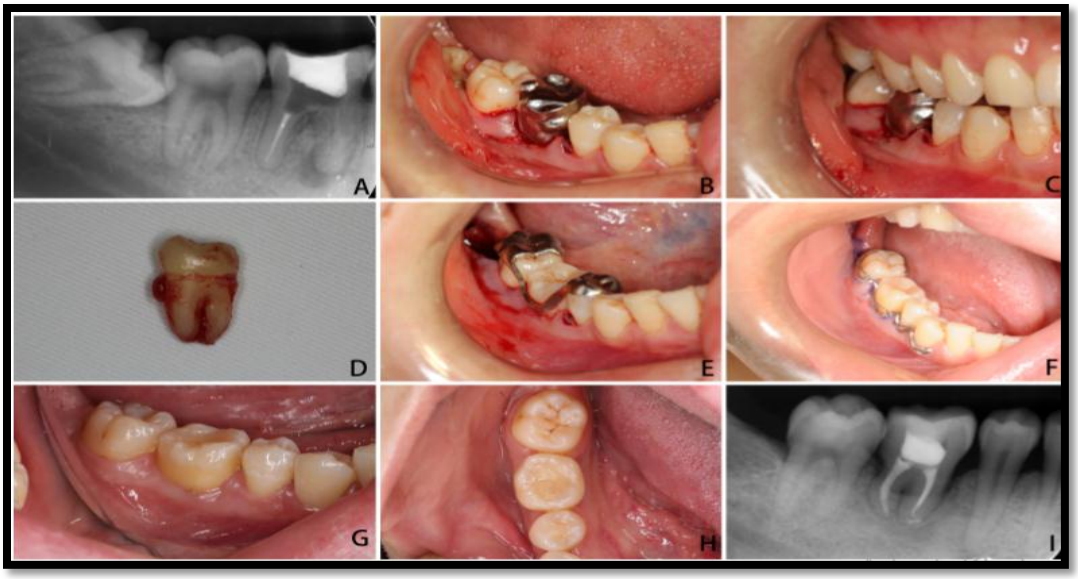


Figure 26:-Surgical procedure.(A) Initial apical film of the first molar and the third molar that was selected to be the donor tooth, (B and C) the new socket at the recipient site was prepared under the guidance of a replica of the donor tooth and a local surgical split, (D) the donor tooth was gently extracted, (E) the donor tooth was immediately transplanted onto the recipient site, and the position of the autotransplanted tooth was checked using an individual surgical template, (F) 1 week after fixation with arch bar, (G and H) 1 year after the autotransplantation surgery: the gingiva was pink and firm and probing depth was ≤3 mm, (I) apical film of the autotransplanted tooth at 1 year.

Follow up

1. Cone beam computed radiography scans were performed immediately after surgery,and recorded data were used to evaluate accuracy of the present approach(CBCT 3).
2. Patients were followed up at 1 week, 2 weeks, 1 month, 3 months, 6 months and 12 months after surgery, which were followed by subsequent annual visits.
3. Clinical examinations were performed at each time point. Pulp vitality of the auto transplanted teeth were evaluated using an electrometric pulp tester at the 2 weeks' time point to assess whether the donor teeth required root canal treatment. The arch bar were removed right after RCT was completed, usually at the 4 week time point.
4. Periapical films were recorded at 3, 6 and 12 months and annually. To evaluate stability, CBCT scans of autotransplanted teeth were performed when the teeth achieved satisfactorily function and stability.

Intentional Replantation

Replantation has been performing for more than 10 centuries.Abu Al Qasim described the first replantation technique using ligatures to splint the replanted tooth.Over years the procedures of intentional replantation have been progressively modified and refined.

Definition

Intentional replantation was defined by Grossman as the purposeful removal of a tooth and its insertion into the socket almost immediately after sealing the apical foramina. He also stated that it is the act of deliberately removing a tooth and- following examination,diagnosis,endodontic manipulation and repair-returning the tooth into its original socket.

Indications

1. All other endodontic non-surgical and surgical treatments have failed or are impossible to perform;
2. Limited mouth opening that prevents the performance of non-surgical or periradicular surgical endodontic procedures;
3. Root-canal obstructions;
4. Restorative or perforation root defects that exist in areas that are not accessible through the usual surgical approach without excessive loss of root length or alveolar bone.

Contraindications
1. Long, curved roots;
2. Advanced periodontal diseases that results in poor periodontal support and tooth mobility;
3. Multi-rooted teeth with diverging roots that make extraction and reimplantation impossible;
4. Teeth with non-restorable caries.

Tooth Replantation Procedure
1. Vitality preservation of a sound periodontal ligament around the extracted root surface is necessary to obtain a successful intentional replantation.
2. The goal of the surgical procedure is to prevent mechanical and chemical damage, during extraction, extraoral time and the replantation.

Atraumatioc Surgical Technique
1. To prevent damage of the periodontal ligament, the use of an elevator during extraction time is avoided.
2. The use of periotome,powered periotome or even piezosurgery will help in removing the tooth with little or no trauma to the root surface and periodontal ligament and decrease the incidence of a root fracture.
3. Using physics forceps is considered as a reliable extraction instrument for a successful intentional replantation.
4. A new method of atraumatic and safe extraction using orthodontic extrusion was also recommended for intentional replantation.

(2 to 3 weeks before extraction,orthodontic extrusion can increase both tooth mobility and periodontal ligament volume permitting an easier extraction without a risk)

Extra-Alveolar Time(<=15 Minutes)
1. Once the tooth has been extracted, care is taken to avoid any contact with the socket wall, and thus prevent damage of the remaining periodontal ligament which is the key in promoting reattachment.
2. Granulation tissue is removed using a small curette without involving any sharp curettage of the socket.
3. To avoid damage to the periodontal ligament, extracted tooth is always held gently on the crown with moist gauze whilst the root end treatment is carried extra orally.
4. 3mm of the apical tip of the root is resected with a high speed diamond bur will permit a thorough preparation of the cavity and placement of a biomaterial as a retrograde seal.
5. Keep the tooth in a humid environment, as in viaspan solution, saline or Hank's buffered salt solution, to maintain it moist (to maintain the periodontal ligament vitality and therefore reduce complications after replantation procedure).
6. Continuous immersion of the tooth in solution is described in order to perform easier root end resection, preparation and placement of root-end fillings.

Splint
1. Tooth is splinted for atleast 2 weeks.
2. Splint type will permit physiological movement during the fixaton period.
3. Suture splint appears to be more favourabe than wire composite splint.suture splinting provides physiological loading on the replanted teeth, which might facilitate periodontal healing.

Antibiotics
Antibiotics may prevent complications and increase the survival rate of replanted teeth.

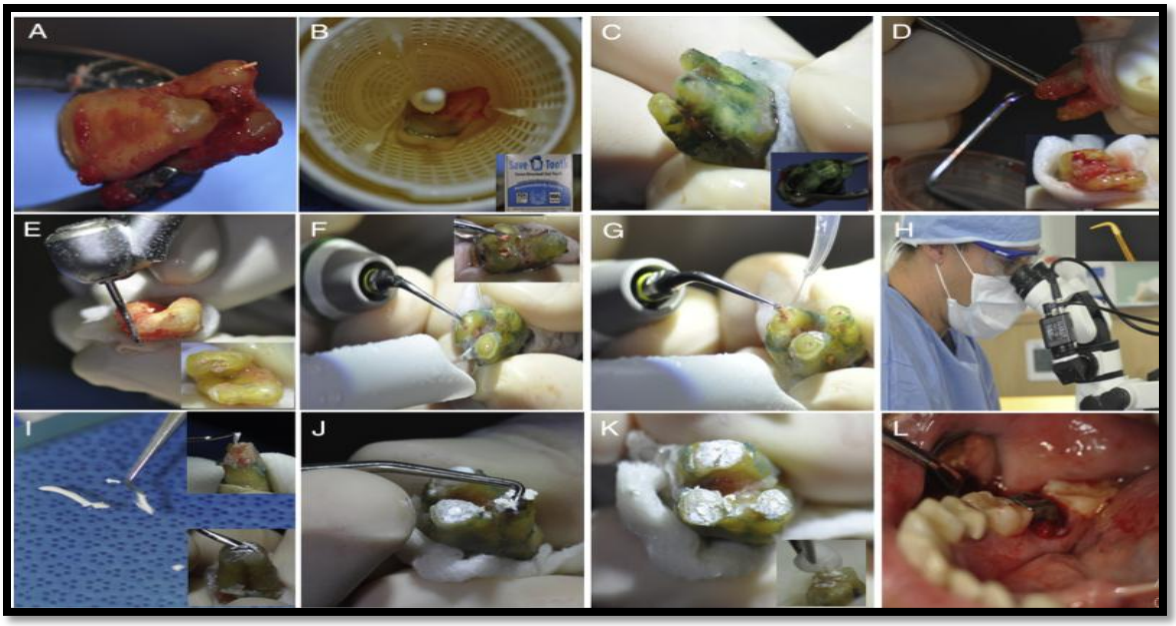


Figure 27:-Protocol used.Atraumatic extraction, the tooth placed in HBSS (A and B).Root inspection . Microscopic analysis (D); root-end resection (E); root-end preparation performed with ultrasonic tips and constant irrigation with saline solution (F and G).Dental operating microscope visualization (H). Root-end filling material is disposed and condensed into prepared tooth (I–K); tooth is replanted into the socket.

Follow Up

1. The teeth were inspected 1,7 and 14 days postoperatively by intraoral examinations.
2. Follow ups were planned for every 6 months.
3. Symptoms like discomfort,tenderness to palpation or percussion, signs of infection/inflammation will be evaluated.

Sucess Rate

According to Cho et al (2016)24,intentional replantation suggested a cumulative 12 year retention rate of 93%.

Postoperative Instructions After Replantation

1. Patient was prescribed antibiotics and analgesics for 5 days ,
2. 0.12% chlorhexidine mouthwash twice a day for 2 weeks (oral hygiene instructions).
3. Adviced to have a soft diet, and not to chew on the surgery site.

Supernumerary Teeth

A supernumerary tooth can be defined as an extra tooth in comparison to the normal dentition. It was first reported between AD 23 and 79.Supernumerary teeth are usually seen in maxillary arch and appearance in the mandibular arch is a rarity.

Prevalence

According to Aggarwal M et al (2016)25the prevalence rates of supernumerary teeth alter between 0.1% and 3.6% in the permanent dentition depending on the particular population. In deciduous teeth, prevalence is lower, amounting to 0.3-0.8%. Males are affected more commonly in the second dentition, with literature informing rates of between 2:1 and 6:1.

Associated Syndromes

1. Gardner syndrome,
2. Ehlers–Danlos syndrome,
3. Cleft lip and palate,
4. Cleidocranial dysplasia.

Etiology

The aetiology of the Supernumerary teeth, however remains unclear. Several theories have been suggested for their occurrence such as the phylogenetic theory, the dichotomy theory, a hyperactive dental lamina and a combination of genetic and environmental factors-unified etiologic explanation.

Phylogenic theory(Smith 1969)

1. Supernumerary teeth are the result of the reversion phenomenon or atavism. Atavism is a type of long-distance heredity or phylogenetic reversion and it is the reappearance of an ancestral condition or type.
2. The 'phylogenetic theory' relates to the phylogenetic process of atavism (evolutionary throwback).
3. The third molar was rarely absent in the primitive dentition and it was comparable in size to the second molar. A fourth molar was often present.
4. Phylogenetic evolution has resulted in a reduction in both the number and the size of teeth and supernumerary premolars may be an evolutionary appearance of the third or fourth premolars of the primitive dentition.

Dichotomy theory(Liu 1995)

1. The 'dichotomy theory' is where a supernumerary tooth is created as a result of dichotomy of the tooth bud.
2. The supernumerary tooth develops from the complete splitting of tooth bud.
3. The tooth bud splits into two equal or different-sized parts resulting in two teeth of equal size or one normal and one dysmorphic tooth, respectively.

Hyperactive dental lamina(Primosh, 1981)

1. A hyperactive dental lamina is the most accepted cause for the development of the supernumerary teeth and it was suggested that supernumerary teeth are formed as a result of local, independent, conditioned hyperactivity of the dental lamina.
2. According to this theory, the lingual extension of an additional tooth bud leads to a eumorphic(supplemental) tooth, while the rudimentary tooth arises from proliferation of epithelial remnants of the dental lamina induced by pressure of the complete dentition (Sykaras, 1975).
3. Hattab and co-workers (1994) believed that hyperdontia is a disorder with pattern of multifactorial inheritance originating from hyperactivity of dental lamina.
4. Remnants of the dental lamina can persist as epithelial pearls or islands (Rests of Serres) within the jaw. If the epithelial remnants are subjected to initiation by induction factors, an extra tooth bud is formed which results in the development of either a supernumerary tooth or odontome.

Combination of genetic and environmental factors(Brook, 1984).

1. A combination of genetic and environmental factors (unified etiologic explanation – is based on the study by Brook (1984). Brook reported that supernumerary teeth are more common in the relatives of affected children than the general population. In the population sample there were differences between sexes, with males more often having supernumerary teeth and megadontia and females more frequently having hypodontia and microdontia.
2. Many causes, both genetic and environmental, have been proposed for supernumerary teeth, hypodontia (congenital absence of teeth), megadontia and microdontia; these anomalies tend to be associated.

Classification

Based on their shape (Primosh, 1981)

Supernumerary teeth are classified as

1. Supplemental -Appearance of a normal tooth.
2. Rudimentary -Not fully developed, immature tooth.
3. Based on their location (Mitchel, 1989)

Supernumerary teeth are classified as

Mesiodens

Mesiodens is a conical supernumerary tooth located in between the maxillary central incisors.These supernumerary teeth are mostly located palatal to permanent incisors, with only a few lying in the line of the arch or labially. They are usually small and short, with a triangular or conical crown (figure 28).

Figure 28:-Mesiodens.

Paramolar

A paramolar is a supernumerary molar, situated buccally or lingually/palatally to one of the molars or in the interproximal space buccal to the second and third molar (figure 29).

Figure 29:-Paramolar.

Distomolar

A distomolar is a supernumerary tooth located distal to a third molar and is commonly rudimentary. It rarely delays the eruption of associated teeth(figure 30).

Figure 30:-Distomolar.

Based on morphological types (Garvey et al., 1999)
Supernumerary teeth are classified as

Conical(occurrence 70-8-%)

Conical-shaped supernumerary teeth are the most common. They present with conical or triangular-shaped crowns and complete root formation. They are found most often as isolated single cases and are usually located between the maxillary central incisors (mesiodens).However, they can also occur as bilateral structures in the premaxilla (figure 31).

Figure 31:-Conical tooth.

Tuberculate (occurrence rate of 10-12%)

The tuberculate supernumerary has a barrel-shaped appearance and a crown consisting of multiple tubercles. It may be invaginated.Unlike conical supernumerary teeth, which have complete root formation, tuberculate types have either incomplete or absent root formation.They are larger than conical supernumerary teeth and are usually found in a palatal position relative to the maxillary incisors. They are often paired and bilateral supernumerary cases have a predominance of tuberculate shaped teeth. It has been suggested that tuberculate supernumeraries may represent a third dentition(figure 31).

Figure 31:-Tuberculate tooth

Supplemental (occurrence rate of 6-8%)

Supplemental supernumerary teeth resemble their respective normal teeth. They usually form at the end of a tooth series. The most common supplemental tooth is the permanent maxillary lateral incisor, although supplemental premolars and molars also occur.The majority of supernumerary teeth in the primary dentition are supplemental and rarely remain unerupted(figure 32).

Figure 32:-Supplemental tooth.

Odontome (occurrence rate of 3-4%)

Odontome are hamartomas (benign, disordered overgrowths of mature tissue) comprising all dental tissues and appearing radiographically well-demarcated, mostly radio-opaque lesions in tooth-bearing areas. There are two different types of odontome like compound and complex. Compound odontomes comprise many separate, small tooth-like structures. A complex odontome is a single, irregular mass of dental tissue that has no morphological resemblance to a tooth(figure 33).

Figure 33:-Compound and complex odontome.

Diagnosis

Occasionally, supernumerary teeth are asymptomatic and may be detected as a chance finding during radiographic examination. Detailed history, clinical examination, thorough investigation, early diagnosis and appropriate treatment of supernumerary teeth are taken into consideration.. In most cases, erupted supernumerary teeth could be diagnosed by general oral examination, and imaging methods could be helped in diagnosis of unerupted extra teeth. An anterior occlusal or periapical radiograph using paralleling technique and panaromic view(Orthopantomograph) are the most useful radiographic investigations to visualize supernumerary teeth.

Radiographic investigations

Intraoral periapical radiographs (iopar)

The unerupted ones are best diagnosed by radiographs like IOPA.

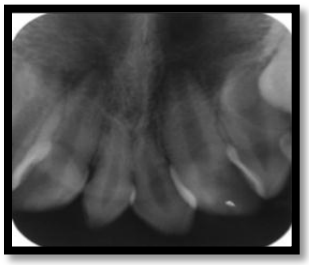


Figure 34:-IOPA showing mesiodens

Occlusal radiograph

An anterior occlusal radiograph is useful to show the incisor region in detail.

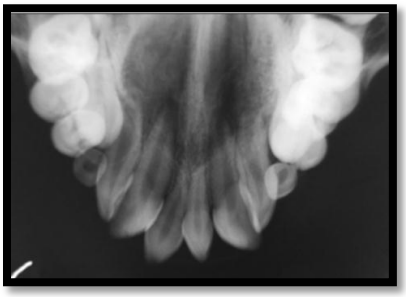


Figure 35:-Occlusal radiograph showing mesiodens.

Panoramic radiographs

It helps in the diagnosis of impacted supernumerary teeth.

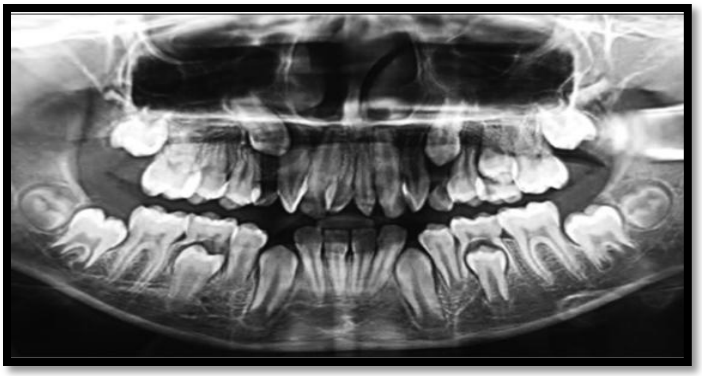


Figure 36:-OPG showing supernumerary teeth.

Parallax technique

The parallax method is the radiographic technique of choice to localize impacted supernumerary maxillary anterior teeth.Buccolingual position of the unerupted mesiodens can be determined by the parallax technique.

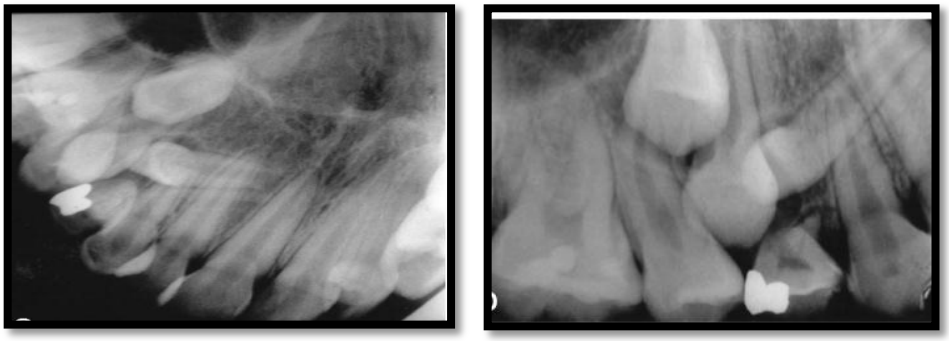


Figure 37:-Parallax radiographs.

Clinical Features

1. Impaction,
2. Delayed eruption or ectopic eruption of adjacent teeth,
3. Prolonged retention of deciduous teeth,
4. Crowding,
5. Development of median diastema,
6. Eruption into the floor of the nasal cavity,
7. Formation of cystic lesions, and
8. Root resorption of adjacent teeth

Treatment

1. As supernumerary teeth can affect the eruption and normal position of adjacent teeth, they often require clinical intervention.
2. There are two schools of thoughts for the removal of supernumerary teeth (Tay et al., 1984). The delayed approach recommends intervention upon apical maturation of the central and lateral incisors, at an age around eight to ten years. The immediate approach calls for removal of the supernumerary teeth soon after the initial diagnosis of their presence (Primosh, 1981).
3. Supernumerary teeth can be either erupted or unerupted.

Extaction of erupted supernumerary teeth

Erupted supernumeraries should be preferentially extracted except in cases where the supernumerary teeth need to be retained. For example, in cases of adjacent tooth clinically missing, in cases where the supernumerary tooth is required as an abutment, or in cases where reshaping of mesiodens is done when the primary incisor is lost prematurely and the permanent incisor is not yet erupted.

Extraction of unerupted supernumerary teeth

Unerupted teeth can be those associated with complications and those not associated with complications. Those not associated with complications can be kept under periodic review .If the unerupted supernumerary tooth is associated with any complications, then it should be surgically removed. Surgical removal can be delayed in cases if the supernumerary tooth is placed close to the apices of the developing permanent teeth or if the formation of the supernumerary teeth is in the initial stages.

Follow Up

1. In the postoperative period of 7 days, healing was assessed.
2. If sutures placed, removal of the suture is done,
3. If required, the patient was referred to the orthodontist.

Conclusion:-

Surgery is a field rife with innovation. Minor oral surgery has made huge strides in technological and methodological advancement in the past few years alone. Procedures are faster and less invasive than ever before. Minor oral surgeries include removing supernumerary teeth, treatment of mucocele or ranula, frenectomy, gingivectomy etc.This library dissertation gives a brief knowledge regarding the commonly performed minor oral surgical procedures in pediatric dentistry.

New techniques, new technology, plus new ways of using existing techniques or technology has always something to report in regards to advancements in surgical technology. As optical imaging, robotics and other high advances contribute to greater precision and less invasive surgical techniques. Keeping in mind that knowledge has a beginning but no end, try to learn something about everything and everything about something. Nothing is permanent but change so in the waves of change we find our true direction in the field of pediatric dentistry.

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