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Optimizing Outcomes: Case Reports Highlighting the Strategic Choice of Frenectomy Techniques.

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Frenectomy, Diamond technique, Z plasty , v-y plasty, Er:YAG laser

ABSTRACT:

Introduction: The frenum, an inconspicuous yet highly significant fold of mucous membrane that attaches the lips and cheeks to the alveolar region mucosa, exemplifies the intricate interplay between form and function, ultimately dictating oral health. Indications for frenectomy An aberrant frenal position responsible for midline diastema or recurrence of it. Presence of wide thick tissue and due to which bone defect is present. Inadequate attached gingiva, gingival recession and shallow vestibule. Interfering with oral hygiene maintenance.

Objectives: To elucidate the intricacies of the frenectomy procedure, encompassing crucial considerations and nuances that warrant meticulous attention during the surgical intervention.

Conclusion: The presented case reports, supported by three-month follow-up assessments, underscore the attainment of favorable healing outcomes. Notably, the Z plasty technique emerges as a promising frontrunner in frenum management, owing to its intrinsic advantages rooted in tissue flap transposition, which uniformly distributes tissue tension throughout the healing process. This renders it particularly valuable in scenarios involving orthodontic relapse, further enhancing its clinical significance and applicability.

Introduction

The frenum, an inconspicuous yet highly significant fold of mucous membrane that attaches the lips and cheeks to the alveolar region mucosa, exemplifies the intricate interplay between form and function, ultimately dictating oral health. This facet, often overshadowed, bears profound significance. To grasp the intricate nature of frenectomy, one must embark on an exploration of its embryological origins. Embryogenesis orchestrates the development of oral structures through intricate dialogues between epithelial and mesenchymal tissues. Frenum, a product of these intricate interactions, assumes a pivotal role in shaping essential oral components, including the lips, tongue, and cheeks.

The genesis of the frenum can be traced back to the embryonic period, specifically after the third month in utero. It emerges as a post-eruptive remnant of tectolabial bands, eventually manifesting as a delicate connective tissue bridge between the tubercle of the lips and the palatine papilla. Subsequent transformations in this attachment are orchestrated by the evolving alveolar process in tandem with the demands imposed by functional requirements. This dynamic interplay may prompt apical migration or relocation in response to specific functional needs. The frenum's morphology and precise location emerge as a testament to the intricate equilibrium between tissue proliferation and regression, a process that shapes this unassuming yet indispensable oral structure.[1-2]

Histologically, Weigeri's description unveils a complex arrangement within the frenum. It comprises a network of undulating elastic fibers intricately interwoven amidst densely packed bands of elastic fibers. Additionally, peripheral nerve fibers, blood vessels, and occasionally minor salivary glands are encountered, typically situated at the uppermost periphery of the frenum. Interestingly,

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in most instances, these structures exist independently of orbicularis oris muscle fibers. Archer's observations suggest that the depressor septi muscle may also play a role in influencing the architectural composition of the elastic fibers in this region. Located in close proximity to the premaxilla, the frenum possesses the potential to exert an influence on septopremaxillary growth. Specifically, the presence of a robust band of tissue within this region has the capacity to impede the timely closure of a diastema, thereby affecting the overall dental and craniofacial development.[4]

Dewel and Gibbs have postulated that the presence of transseptal fibers in association with the frenum implies that its excision, along with these fibers, might result in a reduction of the forces responsible for bringing the central incisors together.[5-6]

Dr.Samuel Lewis, the midline diastema tends to naturally resolve by the time the lateral incisors and canines erupt..[7]

The presence of this connective tissue helps maintain the harmony between the lips and the developing maxillary bones. However, the presence of heavy bands of connective tissue can lead to the formation of a V-shaped bony defect.[8-9]

Aberrancies are commonly observed in the following syndromes: Ehlers-Danlos syndrome, Infantile hypertrophic pyloric stenosis, Holoprosencephaly, Ellis-van Creveld syndrome, and Oro-facial-digital syndrome.[10]

The primary objective of this article is to elucidate the intricacies of the frenectomy procedure, encompassing crucial considerations and nuances that warrant meticulous attention during the surgical intervention.

Classification

Placek et al has classified according to their attachment extent as follows: [11]

i. Mucosal- fibers attachment limited upto the mucogingival junction
ii. Gingival- fibers are up to within the gingiva
iii. Papillary- fibers extended into interdental papilla
iv. Papilla penetrating- they encroaching and extended up to palatine papilla.

According to Monti classified as three types as follows:[12]

- Elongated- parallel right and left margins
- Triangular- having apical base
- Triangular- having coronal base

Indications for frenectomy

i. An aberrant frenal position responsible for midline diastema or recurrence of it.
ii. Presence of wide thick tissue and due to which bone defect is present.
iii. Inadequate attached gingiva, gingival recession and shallow vestibule.
iv. Interfering with oral hygiene maintenance.

Diagnosis

The higher attachment is detected visually by bringing tension over the respective frenum which shows blanching due to ischemia at that region. And inadequacy of attached gingiva movement seen at gingiva margin or papilla on lip retraction frenum is extended (Blanch Test).

Treatment modalities to excise the frenum:[13]

- Classical frenectomy
- Millers technique
- V-Y plasty
- Z plasty (explained in case no. 2)
- Frenectomy by electrocautery and laser

Diamond Technique

Hold the frenum to deepest depth of vestibule by haemostat, place incision above and below the haemostat working end which creates a diamond shaped wound.

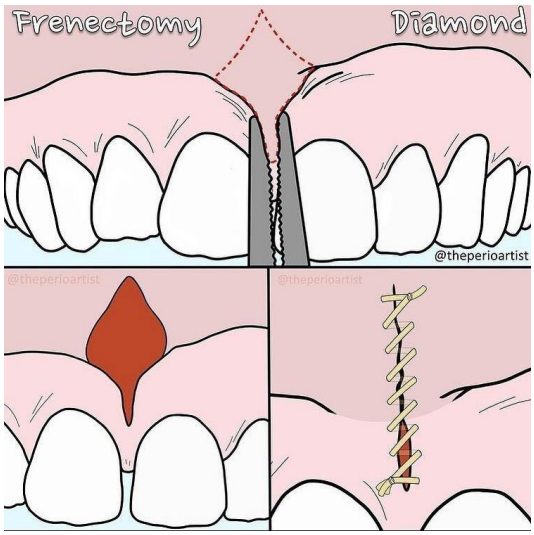

Fig:1 Classical frenectomy diamond technique

Millers technique

To separate the frenulum from the interdental papilla place a horizontal incision. A horizontal incision,

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extending apically to the depth of the vestibule, is made to completely separate the frenum from the alveolar mucosa. Any remnants of frenum tissue found in the midline and on the undersurface of the lip should be excised. Approximately 2-3 mm apical to the marginal gingiva and extending down to the vestibular depth, a vertical parallel incision is created on the mesial side of the lateral incisor. The gingiva and alveolar mucosa between these two incisions are then carefully undermined through partial dissection to raise the flap (Fig:2). At approximately 1-2 mm apical to the gingival sulcus in the attached gingiva, a horizontal incision is made, connecting the coronal ends of the two vertical incisions. The flap is subsequently raised, mobilized mesially, and sutured in order to achieve primary closure across the midline.[13]

Fig:2 Millers technique (lateral pedicle flap technique)

V-Y Plasty

V shaped incision placed at coronal and detachment of fibers till the base of frenum and relocated apically which creating Y shape appearance after the suturing.

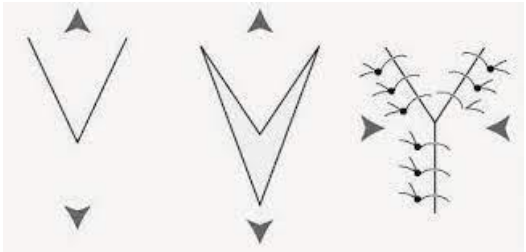

Fig: 3 V-Y Plasty

Clinical cases

The following cases reported in the Department Of Periodontology And Oral Implantology C.S.M.S.S Dental College and Hospital, Kanchanwadi, Aurangabad.

CONSENT

Informed written consent was taken, pre-operative investigations done and oral prophylaxis completed before the surgery.

CASE NO. 1

A 19 years old female patient referred from the orthodontics department of C.S.M.S.S Dental College with high frenal attachment maxillary labial frenum. Clinical examination having midline diastema on lip retraction frenum appears as papilla penetrating type of attachment. **(Fig 4)** And no past medical history. After getting informed consent, labial frenectomy was planned using the classical technique given by Archer (1961) and Kruger (1964).

Fig 4: Papilla penetrating high frenal attachment

Armamentarium

Haemostat, scalpel blade no.15, straight scalpel handle, molt no. 9 periosteal elevator, gauze pieces, 3-0 black silk sutures, suture pliers, scissors, and a periodontal dressing (Coe-pak).

Procedure performed was with classical scalpel technique:[14]

- Local infiltration given by using 2% lignocaine with 1:80000 adrenaline deposited to circumscribed to the frenum and nasopalatine block to prevent the overall discomfort.
- Frenum was hold to deepest depth of vestibule by haemostat.
- Incision placed above and below the haemostat

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working end which creates a diamond shaped wound. Incision should be given in controlled depth within the tissue**(Fig 5)**

Fig 5: Excision of frenum with scalpel

- 3-0 silk suture was given (Fig 6)

The patient were recalled after 1 week for suture removal. **(Fig 7)**

Fig 6: 3-0 silk suture was givenThe wounded area was covered with coe-pack.

Fig 7: Satisfactory healing was seen after 1 week

Then patient was kept under follow up for next 3 months. **(Fig 8)**

Fig 8: After three months of follow up

CASE NO. 2

A 36 year old female patient came with the chief complaint of spaced in upper front teeth region since born and having difficulty during brushing. Clinical examination having midline diastema on lip retraction frenum appears as papilla penetrating type of attachment with small frenum. **(Fig 9)** And no past medical history. After getting informed consent, labial frenectomy was planned using the Z plasty technique.

Fig 9: papilla penetrating type of attachment with small frenum

Procedure performed was with classical scalpel technique:

- Local infiltration given by using 2% lignocaine with 1:80000 adrenaline deposited to circumscribed to the frenum and nasopalatine block to prevent the overall discomfort.
- Initially two close vertical incision was given along the frenum then gradual sharp dissection performed to excise the frenum completely, band of frenum is detached from underlying

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periosteum with the help of periosteal elevator from the palatine papilla tissue. Simultaneously by after removal further undermining and surface incision are placed of same length to previous incision at an 60 degree angulation which creates two flap. **(Fig 10)** Both the flap tissue tension is relieved by undermining incision and small frenum attached fibers also was removed. The created flap should be handle with care due to the delicacy they are thin flaps intra operative trauma will impact during healing.**(Fig 11)**

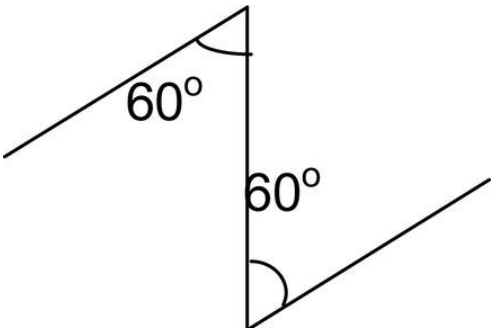

Fig 10: incision angulation

Fig 11: Excision of frenum with scalpel

During approximation first decide where to be pierce with the suturing needle because multiple unwanted piercing will results in scar formation. 3-0 silk suture was given (Fig 12), after transposition of two opposite flap approximation of diagonal lines are seen in Z shape manner Fig 13:(B).[14-15]

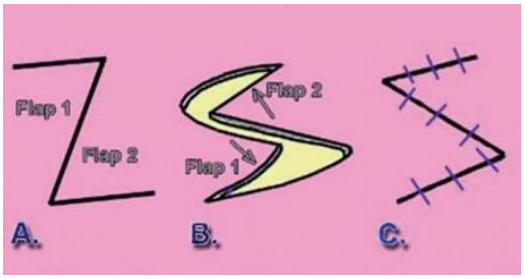

Fig 13:(A) transposition of two opposite flap

Fig 13:(B) 3-0 silk suture was givenThe wounded area was covered with coe-pack.

The patient were recalled after 1 week for suture removal. **(Fig 14)**

Fig 14: Satisfactory healing was seen after 1 week

Then patient was kept under follow up for next 3 months. **(Fig 15)**

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Fig 15: After three months of follow up

Discussion

Failure to address irregularly grown frenula can lead to adverse consequences such as gingival recession and the development of diastema. Fortunately, a repertoire of surgical techniques has been introduced to either remove or reposition these ectopic frenula. The choice of technique employed plays a pivotal role in determining the postoperative experience, including factors such as discomfort, scar formation, lip contracture, papilla recession, and the risk of relapse, often stemming from incomplete dissection of attachments. Scholarly research by Yadav RK et al. (2019), Binti Zaaba et al. (2021), and Kumar R et al. (2015) underscores that the selection of the appropriate technique should be guided by the unique anatomical configuration of the regional structures. Additionally, the choice between instruments, be it the traditional scalpel or cutting-edge laser technology, hinges on the availability of equipment and the expertise of the operator. These considerations emphasize the nuanced nature of frenectomy procedures and the need for a tailored approach to ensure optimal outcomes.[16,17,18]

The configuration of transseptal fibers should not disturb during frenum collagenous band removal, that prevents loss of interdental papilla. According to Devishree et al. the bracing effect due to the continuous collagenous band within the gingiva across the midline that preventing relapse.[13]

In the realm of surgical technique, as expounded by the research of Nuzulul et al., the Z-plasty procedure shines as a beacon of postoperative finesse, notably distinguished by its conspicuous absence of scar emergence. This laudable outcome is attributed to the intricate maneuver of transposing two meticulously fashioned flaps, orchestrating a harmonious realignment that deftly conceals any vestiges of surgical intervention, and thereby bestows an aesthetically unblemished result.[19]

The pernicious consequences of excessive frenal tension manifest in the form of plaque-induced labial recession, an insidious process marked by the unfavorable separation of the sulcus, the gradual evolution of periodontal pockets, and the subsequent apical displacement of the gingival margin. This intricate interplay underscores the significance of recommending frenectomy procedures, particularly in individuals previously subjected to orthodontic treatment, as they harbor an elevated vulnerability to the perils of bone dehiscence. Prudent clinical judgment thus dictates the judicious limitation of incision extent, with a focused objective of selectively alleviating gingival tension, all the while scrupulously conserving the valuable reserve of attached gingiva, a paramount consideration in cases characterized by a delicate biotype.[20]

The region subjected to the scalpel technique exhibits a notable postoperative manifestation of discomfort and edema. In contrast, laser-assisted surgical intervention results in the formation of a delicate stratum of denatured collagen upon the lasered tissue surface. This construct assumes the role of an impermeable membrane or dressing, serving as a barrier against local tissue irritation stemming from both physical and biochemical agents. Notably, it exerts a sealing effect on the lymphatic and blood vessels, consequently mitigating the extravasation of bodily fluids to minimal levels.[12]

Sarmadi et al. (2021)[23], in conjunction with the meta-analysis conducted by Protásio et al. (2022), arrived at the collective consensus that laser-assisted surgical procedures not only exhibited a reduction in surgical duration by approximately 4 minutes but also manifested several ancillary benefits. These included heightened patient compliance, diminished intraoperative discomfort, and a notable reduction in postoperative inconveniences associated with speech and mastication. Conversely, in the context of scalpel-based surgery, suture removal was scheduled for the 7th postoperative day as a standard practice.[24]

Kilinc E et al. (2009) made a distinct choice between Er:YAG and Nd:YAG lasers due to their unique attributes. The Er:YAG laser is particularly proficient in the precise incision of soft tissue. Operating at a wavelength of 2940 nm, it facilitates shallow tissue penetration coupled with an elevated water absorption rate. This laser variety demonstrates a remarkable capacity to be robustly absorbed by water molecules

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within the target region, thereby engendering the phenomenon of photoelectric vaporization. This process causes a rapid increase in water temperature while simultaneously releasing steam pressure from tissue molecules, akin to a controlled microexplosion. This mechanism effectively counteracts the temperature rise, ensuring that the soft tissue remains unscathed, thus preserving the integrity of tissue healing. It is imperative to note that this is primarily attributed to the mitigating effect of water, which serves as a coolant against the thermal energy. However, it was observed that the Er:YAG laser did not exhibit swift hemostasis. Conversely, the Nd:YAG laser, with its wavelength set at 1064 nm, is less efficient in soft tissue dissection but rarely provokes bleeding. The considerable tissue penetration and pronounced hemoglobin absorption of the Nd:YAG laser give rise to an environment that effectively diminishes bacterial populations through localized heating. This, in turn, contributes to local disinfection, fostering an environment conducive to wound healing while concurrently reducing the reliance on antibiotic interventions.[25]

In this illustrative case report, our approach to addressing the aberrant frenum involved the precise application of the scalpel technique. In the first case (Case No. 1), a deliberate excision of the frenum's encompassing connective tissue was executed to diminish the likelihood of relapse or the continued migration of collagen fibers toward their native positions. Consequently, a minor lip contracture ensued as a natural consequence. However, it is noteworthy that the strategic performance of lip retraction exercises during the nascent stages of healing effectively mitigated this concern. In the event that collagen fibers exhibit migratory behavior at a later juncture, the contemplation of additional frenuloplasty becomes a viable consideration. This is particularly relevant given the substantial removal of aberrant fibers in the initial procedure, necessitating the relocation of any remaining, potentially relapsing fibers in subsequent interventions.

In the second case scenario (Case No. 2), characterized by the presence of a thick and broad frenum with a notably short vestibule, the Z plasty technique was judiciously employed. This intricate method yielded highly favorable outcomes, marked by a satisfactory healing process and the conspicuous absence of migrating fibers even upon assessment three months post-surgery. Additionally, a notable vertical lengthening of the vestibule was observed, further enhancing the overall clinical result.

Neglecting to account for soft tissue dynamics in the treatment equation can effectively nullify the impact of all other therapeutic considerations, culminating in an ultimate aesthetic failure.

Conclusion

It is imperative that the management of frenum aberrancies be approached with meticulous care to mitigate the risk of postoperative gingival recession and the formation of alveolar defects. The judicious selection of techniques should be contingent upon the specific characteristics of the frenum attachment. Encouragingly, the presented case reports, with their three-month follow-up evaluations, underscore the achievement of favorable healing outcomes.

Furthermore, the Z plasty technique emerges as a particularly promising avenue for frenum management. Its inherent advantages, stemming from the transposition of tissue flaps, serve to evenly distribute tissue tension throughout the healing process. Consequently, this method holds notable potential for application in cases involving orthodontic relapse scenarios, further bolstering its clinical relevance and utility.

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