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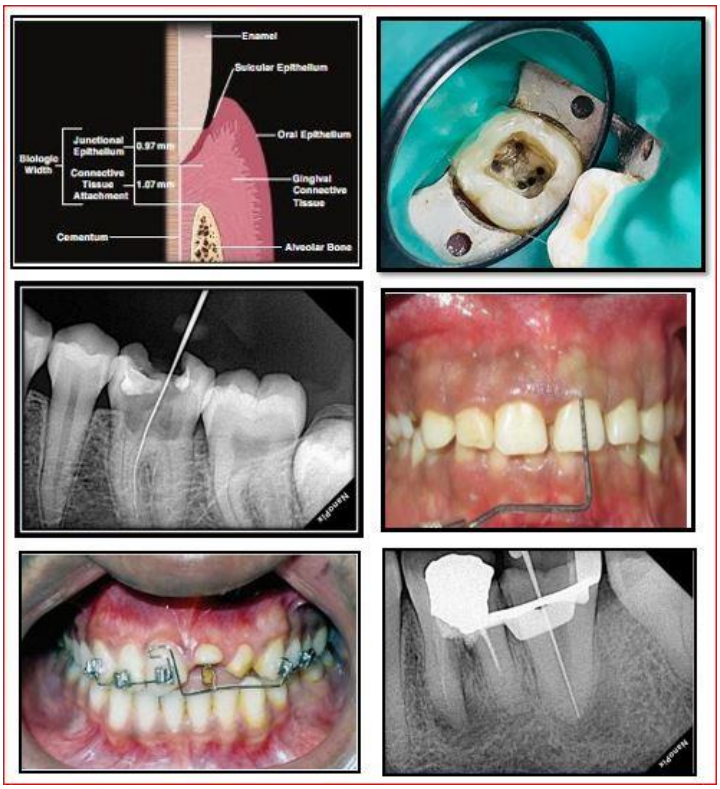

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From the desk of Editor-in-Chief

With immense pleasure I would like to announce that we are publishing the Volume 05 (Issue 02 – July - Dec 2023) of MIDSR Journal of Dental Research after the successful publication of four volumes. ***"Everything is possible when you have right people to support"***, I would like to extend my heartfelt thanks to the authors and our management for their constant faith in me and their utter support.

The Volume 05 (Issue 02- July- Dec 2023) has been created with the great efforts of providing the quality manuscripts rather than the quantity, the volume contains case reports on clinical approach of a tooth with radix entomolaris and middle distal canal, perforation repair using MTA as reparative material & C shaped canal morphology. Also, review articles on surgery first approach, biologic width & oral submucous fibrosis.

I dedicate this issue to all the faculty members of MIDSR Dental College, Latur who immediately responded to the call for manuscripts and submitted their valuable work to the journal.

Dr. Suresh K. Kangane,
Principal,
MIDSR Dental College, Latur.

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CLINICAL APPROACH OF A TOOTH WITH RADIX ENTOMOLARIS AND MIDDLE DISTAL CANAL: A CASE REPORT

Dr. Amol Badgire[1], Dr. Ramchandra Kabir[2], Dr. Pooja Kendre[3], Dr. Anita Kale[4], Dr. Ajit Shinde[5], Dr. Yogesh Chanchalwad[6]
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Abstract:

The first permanent teeth to erupt in the oral cavity are the mandibular first molars. They are the most commonly affected by dental caries. Mandibular first molars has two roots and three canals anatomically. The presence of an extra root or a supernumerary root has been related to the tooth in very rare cases. Radix Entomolaris refers to the presence of root lingual to the distal root of molars, whereas Radix Paramolaris refers to the presence of this root buccal to the mesial root. Variations in tooth anatomy can lead to the possibility of veiled canals. In order to achieve successful endodontic treatment, these extra canals must be located, prepared, and obturated.

Keywords: Root canal therapy, Mandibular first permanent molar, Middle distal canal, Radix Entomolaris, Radix Paramolaris.

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INTRODUCTION

Endodontic therapy aims to properly seal the root canals and remove all pulp space in order to prevent reinfection. A successful root canal treatment may result from an understanding of the variations in particular root canal morphology.[1]

Swartz, Skidmore, and Griffen reported that the success rate for mandibular first permanent molars is significantly lower than that of other teeth. The major causes of recurrent infection in molars that have had endodontic treatment are most likely the missing canals and the inability to completely eradicate all bacteria and debris from the root canals. Consequently, it's critical that physicians are aware of and comprehend the differences in the mandibular first molar's root canal shape.[2]

Studies by Barker et al. (1974) and Vertucci and William (1974) revealed the presence of independent middle mesial canals in the mesial root of lower first permanent molars. According to a literature review by Baugh and Wallace (2004), the incidence of a third mid-mesial canal in mandibular first molars ranges from 1 to 15%. The mid-mesial canal may connect apically with the mesio-lingual or mesio-buccal canals. It can also have an additional canal with a separate canal orifice, or it can be independent with a separate foramen.[2]

A study conducted in 1971 by Skidmore and Bjorndal found that in mandibular first molar teeth, 71.1% of the distal roots have one root canal, 28.9% have two, and in rare instances, three root canals. The Vertucci Type I configuration was found in 62.7% of cases, the Type II configuration (where the pulp canal splits into two near the crown and joins at the apex to form one root canal) in 14.5% of cases, and the Type IV configuration (where the pulp canal separates into two distinct canals and extends till the root apex

separately) in 12.4% of cases reported for the distal root of first mandibular molars. A study that was released in 2010 included this information. In the distal roots of the mandibular first molars, there may also be three root canals. Between 0.2% and 3% of the mandibular first molar's distal root has three root canals. (Figure 3). It has been conclusively confirmed by several studies that the mandibular first permanent molar may have more than four root canals.[2]

Prevalence of Radix Entomolaris

Radix Entomolaris (RE) in the mandibular first permanent molar is associated with particular ethnic groups. Five to thirty percent of populations are mongoloid, including Chinese, Eskimo, and American Indian populations. Nonetheless, it is less than 5% in populations from Eurasia and India and less than 3% in populations from Africa.[3]

Radix Entomolaris is a condition that primarily affects the first molars, but it can also affect the second, and third mandibular permanent molar teeth. Furthermore, research has reported a 50–67% frequency of bilateral occurrences.[4]

Etiology Of RE

The exact cause of the condition is yet unknown, but Calberson et al. (2007) suggest that it may have been influenced by outside variables during odontogenesis. Significant gene expression that leads to a more prominent phenotypic manifestation can also be influenced by racial genetic factors.[5]

Morphology of Radix Entomolaris

It is possible for the distal root of RE to be completely or partially fixed to the coronal third of the disto-lingual root. De Moor et al. (2004) classified the distinct RE variants into three types based on the curvature of buccal-lingual orientation.[6]

A straight root or root canal is referred to as type I. Type II refers to a straight root or root canal that has a curved entrance at first. Type III describes a root canal with two curves: one in the coronal third and the other starting in the middle and extending to the apical third.

Case Report

A 17- year old female reported to the Department Of Conservative Dentistry and Endodontics at MIDSR Dental College and Hospital, with a chief complaint of food lodgement and pain in the right lower first molar region. The dull, gnawing pain began about a month ago and was moderately intense. The mandibular right lower first molar was found to have an exposed pulp and a deep distoproximal and occlusal caries on clinical examination. Both the mesial and distal roots displayed periapical radiolucency (Figure 1). When the tooth was palpated, it felt moderately painful and was extremely tender to the touch. When a suspect tooth was pulp tested using an electric pulp tester, it did not respond.

Figure 1.pre-operative radiograph

Following anesthesia, a rubber dam was used to isolate the tooth.A large round bur was used to open the access, and an EZ bur (Dentsply) was used to refine the access cavity. There was a catch in the area between the main distal canals after using a sharp endodontic explorer to find the orifices. 6 and 8 K Files were inserted into the canal using a watch winding motion. Figure 2 shows the location of five orifices, two on the mesial root and three on the distal roots.

The working length was determined by 15 k file. The radiograph showed an independent Middle distal canal and radix entomolaris (Figure 3). The ProTaper Gold File system (Dentsply) were used for biomechanical preparation, by using the crown-down technique. During biomechanical preparation, 5% sodium hypochlorite solution and 17% EDTA (Ethylenediaminetetraacetic acid) were used as irrigants. The canals were prepared up to F1 size. After chemo-mechanical preparation, the patient was given a closed dressing and scheduled for obturation seven days later. The tooth was asymptomatic, so a

master cone radiograph was obtained at the follow-up visit (Figure 4). To dry the canals, paper tips were utilized. Obturation was completed with ProTaper F1 cones and zinc oxide eugenol sealer. A radiograph (Figure 5) was taken after obturation. To close the access cavity, a permanent restoration was used.

Figure 2. Clinical photograph showing five distinct canals with 46

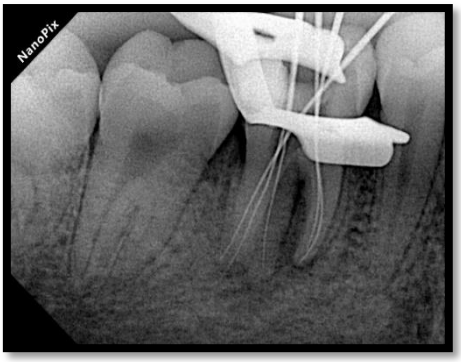

Figure 3.working length

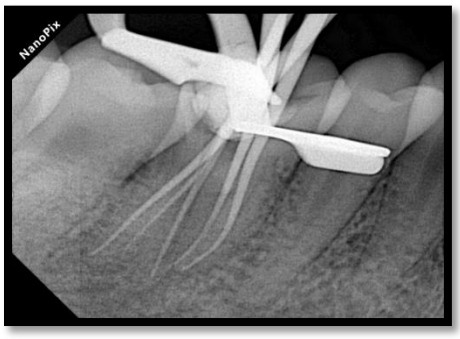

Figure 4. Master cone selection

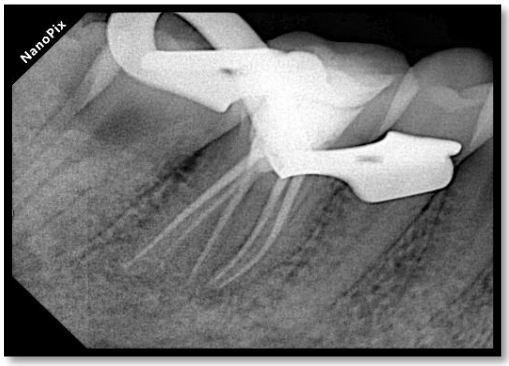

Figure 5. Post-obturation radiographs

DISCUSSION

The permanent mandibular first molar can be present with varied anatomy. The detection of canals is important for successful endodontic treatment and satisfactory long-term prognosis. Radix entomolaris can be present as a separate mature root or as a conical extension. It has been further classified as:
Based on the location of the cervical part, Carlsen & Alexandersen (1990) divided radix entomolaris (RE) into four categories: Type A: The distal root complex, which has two cone-shaped macrostructures, is lingually to the RE. 2. Type B: the RE has a single cone-shaped macrostructure and is situated lingually to the distal root complex. 3. Type C: The mesial root complex and the RE are situated lingually. 4. Type AC: Between the mesial and distal root complexes, lingually, is where the RE is situated. De Moor et al. (2004) categorized the following as radix entomolaris according to the root canal's or the root's curvature: 1. a root canal, sometimes referred to as a straight root. 2. Type 2: an apical and middle straighter third, with a curved coronal third. 3. Type 3 consists of two curves: a buccally oriented second curve that originates in the coronal third, and a first curve that begins in the middle or apical third. Song JS et al. (2010) added two additional recently defined variations of RE, according to: 1. Small type: length shorter than half of the length of the distobuccal root.

2. Conical type: smaller than the small type and without a root canal.[7]

By initially locating the lingual orifice, a straight line access to treat a RE without excessive dentin removal can be achieved. Using this method will prevent perforations. It is advised to manually preflare in order to avoid instrument separation. With a comparatively longer canal length and a smaller curvature radius, RE has the highest degrees of curvature. It is recommended to use manual canal preflaring with SS files to prevent instrument fracture because the risk of instrument fracture increases significantly with decreasing radius of curvature. Using a glide path in conjunction with precise calculations of working length and canal curvature would reduce procedure errors such as ledging and transportation. Finally, it is stated that a more conservative, rounder, and more centered canal preparation can be achieved with nickel titanium rotary files and the crown down technique than with stainless steel instruments in RE. The taper of the file should not exceed 0.06. 8

CONCLUSION

According to reports, the frequency of the Radix entomolaris with middle distal canal ranges from 0.2% to 3% in various populations. The endodontic result is facilitated and potential errors are avoided with an early diagnosis and treatment plan implemented using the right techniques and instruments. Finding the tooth's morphology may be made easier with accurate radiograph interpretation at various angulations. After the condition has been identified, instruments like flexible files, orifice locators, and magnification aids can be used to manage the additional canals and roots.

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Perforation repair using Mineral Trioxide Aggregate as reparative material: A Case Report

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Abstract:
Furcation perforation is an iatrogenic perforation in furcation area in multi-rooted molars during access cavity preparation. Iatrogenic perforations occur as a result of inappropriate use of endodontic instruments, atypical tooth position in the arch. lack of knowledge in dental anatomy, calcified pulp chamber, endodontic procedure through prosthetic crowns. The successful perforation management include, level and location, size, repair time, access and visibility of the perforation, periodontal status of the tooth and biocompatibility of perforation repair material
Keywords: perforation, root canal anatomy, MTA, root canal treatment.

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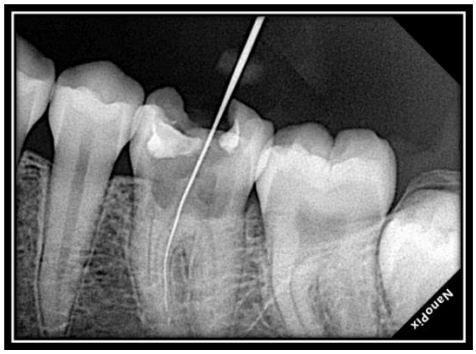
INTRODUCTION

Artificial communications between the tooth and supporting tissues that develop pathologically or iatrogenically are called perforations. The root canal therapy's long-term prognosis may be significantly impacted by these perforations. Pathological communication is generated by resorption and caries, whereas iatrogenic communication is formed after root canal therapy.[1] the primary consequence of a perforation is the loss of teeth and subsequent inflammation of the periodontal tissues. Postponing the repair of the perforation may result in a poor outcome. The many types of perforations are categorized according to their location: coronal, furcation, post space, and root canal. Furcation perforation is an iatrogenic perforation that occurs during the preparation of the access cavity in multirooted molars. Atypical tooth positioning inside the arch and improper use of endodontic instruments can lead to iatrogenic perforations. ignorance of endodontic treatment using prosthetic crowns, calcified pulp chambers, and tooth anatomy.[2] .A few factors that contribute to effective perforation management are the perforation's size, location, and level as well as its accessibility and visibility, the tooth's periodontal health, and the biocompatibility of the material used to repair it.[3]. A clear diagnosis of a perforation based on radiographic findings and symptoms can increase the likelihood that a perforation repair operation will be successful.

CASE PRESENTATION

A 45-year-old male patient arrived at the conservative dentistry and endodontics department complaining of pain in his lower right rear area of his jaw that had persisted for the previous eight days. After reviewing the principal complaint's history, it was determined that tooth #46's pulpal therapy had begun ten days prior. Fever, pus discharge, or edema had not previously occurred. Medical history did not matter. "Previously initiated pulp therapy with

symptomatic apical periodontitis" is the diagnosis for this tooth. The patient gave their informed permission for this case to be published. The extraoral examination revealed no noteworthy results. A periapical picture was included in the radiography examination. The radiograph showed furcal perforation.

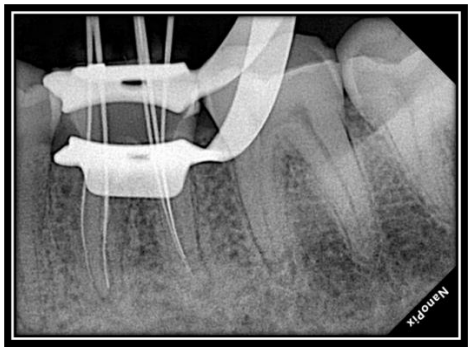


Pre-operative Radiograph

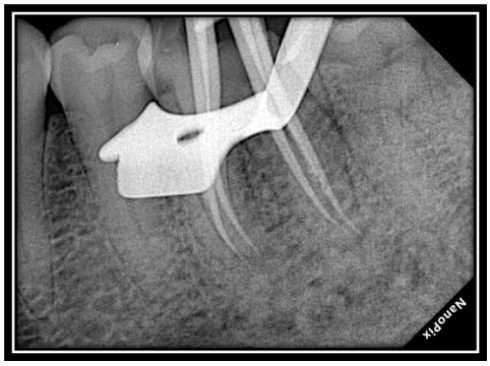
Furcation perforation was confirmed with the help of a radiograph the treatment plan of the case was to continue and complete the root canal treatment of #46 along with perforation repair with a predicted fair prognosis. Bleeding was arrested with the help of a cotton pellet.

Clinical Photograph with Site of Perforation

Following the provision of local anesthetic, treatment commenced. 46 root canals were thoroughly traversed, and the length of the working canal was established. The Crown down procedure was used for cleaning and shaping, while regular saline and diluted 3 percent sodium hypochlorite were used for irrigation. Extrusion of sodium hypochlorite into the periodontal tissues was avoided with great care. Protaper Gold F1 was used for the mesiobuccal ,mesiolingual, distolingual, distobuccal, and middistal canals.



Working Length Determination



Master Cone Selection

Postobturation and Perforation Repair

A single cone method was used to obturate the canals. The material chosen for perforation repair was mineral trioxide aggregate. On a glass slab, mineral trioxide aggregate was worked with. MTA material was carried at the perforation site with the help of an MTA carrier. Above the furcation perforation, MTA was positioned. A cotton pellet was used to damped and condense MTA. Over it was a glass ionomer repair. The patient was prescribed antibiotics and analgesics. Following the surgery, the patient's pain decreased, and the following day, they showed no symptoms. Patient was recalled after 30 days for follow up.

Postoperative Follow-up Radiograph

DISCUSSION

Perforation acts as an open channel for bacteria to enter, either from the root canal or periodontal tissues, or both, eliciting an inflammatory response that can lead to fistulae and bone resorptive processes.[4] when a perforation occurs laterally or in the furcation area, gingival epithelium may overgrow towards the perforation site, worsening the tooth's prognosis. Depending on the size and location of the perforation, repair can be accomplished using either a conservative, non-surgical technique or surgical intervention. All perforations must be sealed to prevent the entry of noxious elements from within the tooth that will cause complications.5 A more number of perforation repair materials are available in the market , that include Indium foil, Amalgam , Plaster of Paris, Zinc Oxide Eugenol, Cavit Glass Ionomer Cement, Composite, Super EBA, IRM, Gutta Percha, Dentin chips, Decalcified Freezed Dried Bone, Calcium Phosphate Cement, Tricalcium Phosphate Cement, Hydroxyapatite, Calcium hydroxide Portland Cement, Mineral Trioxide Aggregate, Biodentine, Bioaggregate Endosequence, etc. Many of these materials are not used now because their disadvantages outweigh their benefits. Mineral Trioxide aggregate showed good treatment outcomes owing to its biocompatibility and low tissue toxicity. MTA can provide an adequate seal in the presence of moisture and blood which is the most significant advantage when it is used as a furcation repair material. MTA has an alkaline pH of 12.5 and aids in periodontal ligament regeneration and cementogenesis.6 this case of furcation perforation was managed with MTA. Since there was contact with the periodontium and contamination from blood and moisture, a material was to be selected which was set in the presence of moisture. 7 relating all of these properties, MTA is the most commonly used perforation repair material.

CONCLUSION

A perforation is an unfortunate mishap during treatment that can happen to the best of us. Regardless of the approach, surgical or non-surgical; there are certain factors that can significantly affect the success of repair. The clinician should have thorough knowledge about tooth anatomy, sound clinical judgement and adequate operative skills so as to avoid a perforation.

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C Shaped Canal Morphology in a Mandibular Second Molar: A Case Report

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Abstract:
The root canal anatomy of mandibular second molars is complex and varies greatly, with the most common arrangement consisting of 2 mesial canals along with a distal canal. There are other variations as well, like a C-shaped canal system, two canals, and four canals. The diagnosis and treatment of a mandibular second molar with an unusual root canal configuration—one canal in a single conical root—are discussed in this case study. After a clinical evaluation and radiographic analysis of the case, tooth #37 was found to have symptomatic irreversible pulpitis and symptomatic apical periodontitis. Root canal therapy and composite buildup were then scheduled. Clinicians need to be knowledgeable about the different tooth anatomy and have the necessary training and expertise to enable them to make the most of the appropriate therapeutic and diagnostic resources at their disposal in order to maximise the standard of dental care given to their patients.
Keywords: C shaped canal, 2nd Mandibular Molar, Root canal treatment.

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INTRODUCTION

One of the human body's most complex anatomical structures is the root canal system. A thorough understanding of tooth anatomy is necessary for the best long-term outcome from root canal therapy. Preventing and treating pulp bacterial disorders is the main objective of endodontic therapy[1]. Identification, chemo-mechanical cleaning, and shaping of the root canal systems are necessary to accomplish these goals[3]. Variations in the shape of canal configurations, auxiliary canals, bifurcations, trifurcations, isthmuses, and anastomoses make endodontic treatment difficult. Insufficient understanding of the intricate architecture of teeth may be the cause of failure in root canal therapy[3]. Because of their complicated anatomy, missing canals during root canal therapy may result in treatment failure.

With regard to their complex anatomy, missing canals during root canal therapy may result in treatment failure. Achieving a satisfactory obturation and negotiation of every root canal significantly improves the overall course of treatment[2]. The most common two well-defined roots in mandibular molars are the mesial root, which has two canals, and the distal root, which has one or two canals. The form, configuration, and quantity of root canal alterations in mandibular second molars have been thoroughly studied in endodontic literature[4]. Additionally, additional recognised anatomic differences in mandibular molar teeth include the existence of one, two, four, or a C-shaped canal, as well as taurodontism in a single root[4]. In an Indian population, Reuben et al. found that the frequency of a single canal was 1 out of 125.
This increases the overall prevalence rate to approximately 1% [5]. Furthermore, 1.3%[6] of second

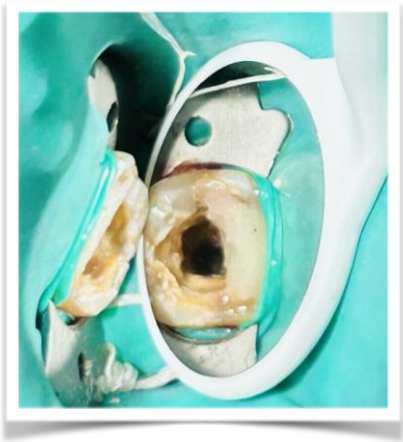
molars had the Vertucci type 1 canal structure, according to Weine et al. Vertucci types I, II, IV, and V have been used to classify the mesial canal design in single-rooted mandibular molars, but Vertucci type I [7] is typically reported for the distal root canal layout. In a Saudi Arabian population, Alfadley et al. have shown the uncommon presence of a Vertucci type I canal in a second molar[8]. Since it lowers the likelihood of root canal treatment failures, a thorough understanding of the anatomy and variations of the root canal is crucial. Variations in the shape of the root canal are a persistent issue, especially in teeth with numerous roots to root canal treatment and successful diagnosis. Extra canals, apical deltas as well as and lateral canals are examples of common morphological alterations in canals, and their frequency and significance have been extensively studied[9]. The aim of this case study is to discuss a unique root canal morphology that has not been frequently documented in endodontic literature, pertaining to a mandibular second molar with a single root and single canal.

CASE REPORT

A 37-year-old male patient arrived at the MIDSR Dental College, Latur, to see the conservative dentistry and endodontics department. His main complaint was pain in the area of his lower left back teeth, which had been there for the previous eight days. Upon reviewing the chief complaint's medical history, it was discovered that tooth #37's pulpal therapy had begun in a private clinic ten days prior, but had not yet been finished. No prior history of fever, pus discharge, night pain, or swelling was present. Medical history did not matter. "Previously started pulpal treatment with symptomatic apical periodontitis" was the diagnosis given for this tooth. The patient gave their informed consent before this case was published. The patient refused to have tooth #36 retreated in any way. An extraoral examination turned up nothing noteworthy. A periapical radiograph was used to make the radiographic assessment. Since tooth #37 was an effective tooth with a favourable prognosis, the decision was made to proceed with and finish the root canal therapy.

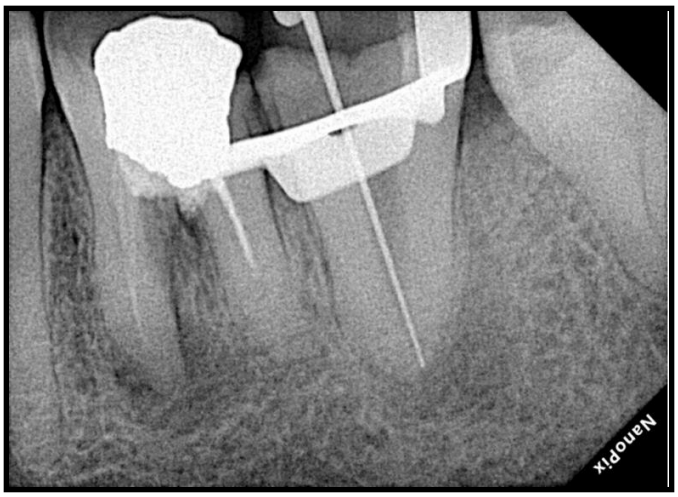
Pre-operative Radiograph

The course of treatment was completed in two visits. On the first visit, a single carpule (1.8 millilitres) of 2% lidocaine mixed with 1:80,000 epinephrine was used to locally anaesthetize an inferior alveolar nerve block. For tooth isolation, a rubber dam was used. Secondary caries and the occclusal temporary restoration were removed. With a high-speed handpiece and endodontic bur round-diamond-FG in regular-shank, a traditional method for preparing access cavities was established. Composite resin was used for preendo buildup.



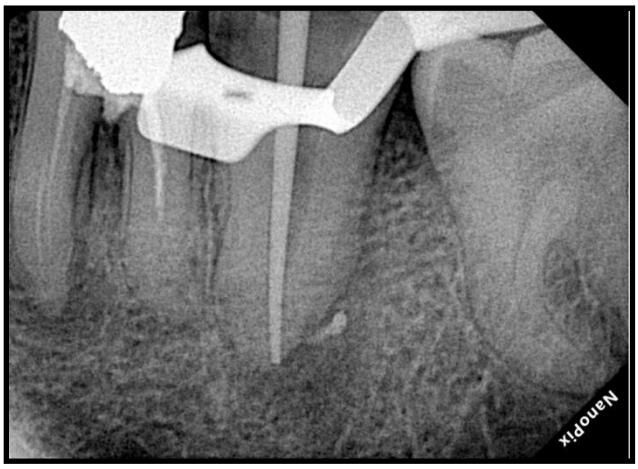
Clinical Photograph after Preendo Buildup

The canal working length was determined using Jmorita RootZX II apex locator and preliminary radiographs.



Working Length Determination

Using the ProTaper Next rotary system (Dentsply Sirona, USA) up to the file size F3, cleaning and shaping were accomplished. 5.25% sodium hypochlorite (NaOCl) was used to irrigate the canal extensively, and ethylenediaminetetraacetic acid (EDTA) was used for the final irrigation. Throughout the pulpal therapy, recapitulation and canal patency verification were carried out. After that, a zinc oxide restoration based on eugenol was used to temporise the tooth. On the second appointment, the interim repair was taken out. After using sterile absorbent paper tips to dry the canals, an AH plus resin-based sealer was applied. A combination of cold lateral compaction and size F3 gutta-percha was used to obturate the canals. Glass-ionomer restoration was used to temporarily restore the tooth. After a week, the patient was checked on again to report root canal therapy completed to a satisfactory degree. After that, the patient was referred to the prosthodontics department so that a full-coverage restoration could be made.



Master Cone Selection

Post-Operative Radiograph

DISCUSSION

This case study discusses a mandibular second molar with a single root and single canal that had an unusual root canal morphology. An optimal result from a root canal treatment starts with a carefully planned access cavity preparation. When a highly complicated root canal system lacks a good access opening, it becomes difficult to instrument and irrigate it. Any racial group may experience the development of aberrant canal anatomy, depending on a number of factors including sex, age, and population ethnicity. Single canals can be diagnosed with the aid of several instruments. These instruments include various radiography techniques like cone beam computed tomographic imaging

(CBCT) and visual inspection under magnification. The diagnosis of canal abnormalities is also aided by multiple angled radiographs.

One of the most prevalent variations is the mandibular second molar's C-shaped canal. With a 21.8% incidence. For example, in a case report published in 2000, Fava et al. described a patient who had one root and one canal in each of their upper maxillary molars and mandibular second molars10. After evaluating the Iranian subpopulation's canal configuration, Rahimi et al. (2008) reported that 4.3% of the population had Vertucci Type I. It's interesting to note that bilateral presence of uncommon results in an individual was reported by Sabala et al. (1994)12. Their symmetrical analysis revealed 56% symmetry in the total amount of root canals between both left and right teeth in the same subject, and 100% symmetry in the number of roots14.

Second molar root canal therapy can be difficult. The majority of iatrogenic access opening errors happen when looking for additional or missing canals. If the clinician is well-informed about the general location and dimensions of the pulp chamber, iatrogenic errors may be minimised. The dentist ought to be aware that, despite the higher incidence of extra canals, there are situations in which there may be fewer canals than the commonly assumed canal shape. Second molars are located posteriorly, so thorough access cavity preparation is necessary to prevent any accidents.

CONCLUSION

The mandibular second molar with its unique anatomy—a single root and single canal—is highlighted in the case study. A satisfactory course of treatment for such cases can be achieved with a careful and comprehensive examination of the tooth supported by multiple radiographs.

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"Surgery First Approach-Revolutionizing Treatment Strategies": A Review Article

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Abstract:
Variations in the skeletal, dental, and surrounding soft tissues interaction lead to skeletal malocclusions. Orthognathic surgery and orthodontics must be used in conjunction to treat these malocclusions in adults. Orthodontists and surgeons refer to the technique for orthognathic surgery without presurgical orthodontic treatment as the "surgery-first approach" (SFA).1 SFA has become increasingly popular in the last few decades because of the high number of young individuals undergoing cosmetic surgery. Due of the prolonged recovery period associated with traditional orthognathic surgery, the surgery first orthognathic approach (SFOA) was developed.2, 3 in this approach, orthodontic treatment is administered to settle the occlusion and align the teeth after orthognathic surgery. The implementation of a surgical first approach triggers the Regional Acceleratory Phenomenon (RAP), an important factor in reducing the total duration of treatment.3, 4 the purpose of this article is to give a general overview of the SFOA's history, indications, benefits, drawbacks, treatment planning considerations, mounting and setup procedures, regional acceleratory phenomena, stability, and future.

Keywords: Surgery first approach, conventional orthognathic surgery, skeletal malocclusion, regional acceleratory phenomenon

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INTRODUCTION:

In modern society, facial beauty is regarded as an important feature. Surgical orthodontics is the art and science of integrating orthodontics and oral and maxillofacial surgery to repair musculoskeletal, dentoalveolar, and soft tissue abnormalities of the jaws and associated structures. Hullihen created the phrase "orthognathic surgery" in 1849, when surgical operations in orthodontics were rare.[1, 2]

Until the 1960s, pre-surgical orthodontic preparation for patients requiring orthognathic surgery was uncommon. It takes a long time to complete this process. To address the drawbacks and inconveniences of presurgical orthodontics, Behrman and Behrman introduced the surgery first orthognathic approach in 1988. Other issues include worsening of the facial profile, masticatory discomfort during presurgical orthodontic treatment, and psychosocial problems related to the delay in attending to the patient's complaint. Additionally, because of the long-term orthodontic preparation, there may be complications such as dental caries, gingival hyperplasia, and root resorption.[3, 4]

The surgical method is being used more often because of the growing desire for flawless immediate aesthetics. When orthognathic surgery was first carried out, maxillary or mandibular movement was restricted because orthodontic treatment was not

provided.5, 6 consequently, to achieve the proper setback and maintain good facial and occlusal esthetics, surgeons understood that misaligned teeth needed to be orthodontically straightened before surgery. Many surgeons started integrating orthodontic treatment with orthognathic surgery in the 1970s. Overcoming the forces of natural compensation is the primary goal of presurgical orthodontic treatment.7, 8

Surgery First Approach:

The surgery-first method prioritizes facial aesthetics over occlusion, whereas the conventional technique prioritizes occlusion over facial aesthetics. The surgery-first method creates a "transitional occlusion postoperatively" by using osteotomy to address skeletal issues as well as dental compensation.9

But given that a skeletal discrepancy is the primary cause of the dentofacial deformity being treated with orthognathic surgery, one may wonder, why not address the skeletal discrepancy first, as it is the underlying cause of the dentofacial deformity? This makes sense and seems reasonable. The requirement to resolve postoperative occlusal instability, however, presents a challenge.10, 11

The SFOA technique is essentially a "face-first" strategy in which the primary complaint of the patient is addressed right away by enhancing the soft tissue profile of the face, which in turn increases the patient's compliance with the course of treatment.

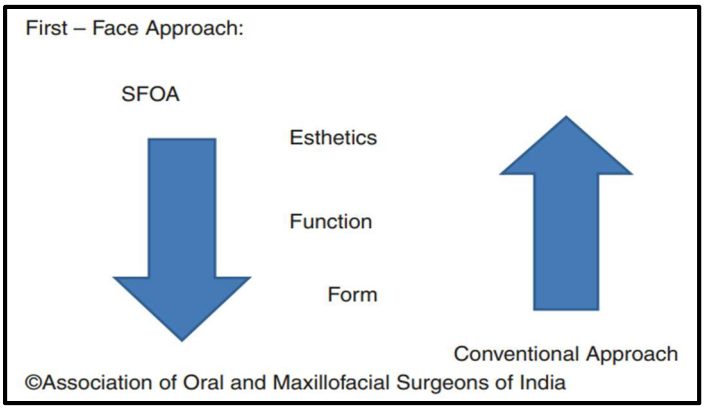

Fig. 1: The flow diagram demonstrating fundamental differences and the order of priority between the SFOA and conventional approach.

Due to the localized acceleratory effect, the surgical line produces higher bone turnover in a comparatively shorter amount of time, allowing the patient to recognize the enhanced facial appearance more quickly. SFA is widely utilized in Asian nations like Korea and Japan.[12]

Advantages of the SFA:

1. The potential for a shorter overall treatment duration
2. There is absolutely no need for an exaggeratedly unattractive appearance in the pre-surgical orthodontic phase.
3. Very little interference with the patient's social life
4. A patient-centered methodology; prompt enhancement of facial aesthetics
5. A productive surgical and orthodontic schedule with adequate recovery time to address skeletal and facial alterations.[13]

Disadvantages of the SFA

According to certain researches, the mandibular counter clockwise rotation is less predictable when using the SFA, and it can be challenging to apply the SFA to severe transverse deficiency. Below is a summary of the SFA's potential drawbacks. –

1. A lengthy dental set-up simulation needed for surgical occlusion.
2. More precise and delicate procedures for surgical treatment objectives.
3. The requirement for knowledgeable and precise decision-making when determining if SFA is feasible.
4. The surgical archwire requires complicating wire bending.
5. Third molar extraction is not possible prior to surgery.
6. An extended duration of intermaxillary bone fixation may be required.
7. Imperfect lip and facial profile right after surgery.
8. Chewing issues resulting from an incomplete occlusion right after surgery.

Indications:

In several situations, the initial approach to dentofacial deformity surgery is recommended based on the specific features of the malocclusion. The following are some characteristics of the malocclusion[14]:

1. Properly aligned to slightly crowded front teeth
2. Incisor inclination, normal to slight proclined/retroclined
3. Curve in spee ranging from flat to mild
4. Minimal discrepancies in the transverse plane.
5. A noticeable imbalance in soft tissues in individuals with skeletal class III.
6. Situations where decompensation is not necessary.
7. Individuals seeking instant aesthetic improvement or those seeking to enhance both appearance and functionality.
8. At least three stable occlusal stops, six anterior teeth in a positive overbite, and arch coordination.
9. The patients must be of the correct age to have surgery.

Contraindications:

The following situations make it undesirable to use a surgical first approach:

1. Individuals in need of specific decompensation
2. Severe crowded conditions and poor arch-coordination
3. Severe discrepancy in vertical or horizontal orientation
4. Patients who anticipate excellent dental aesthetics and stable occlusions from their treatments.
5. The upper and lower anteriors exhibit severe proclination.[15]

The difficulties with the traditional "orthodontics-first" method

1. Time-consuming
2. Facial shape deterioration
3. Difficulty masticating or chewing during the preparatory period
4. Psychosocial issues
5. Other issues such as root resorption or injury, gum recession, and tooth decay.

Comparision:

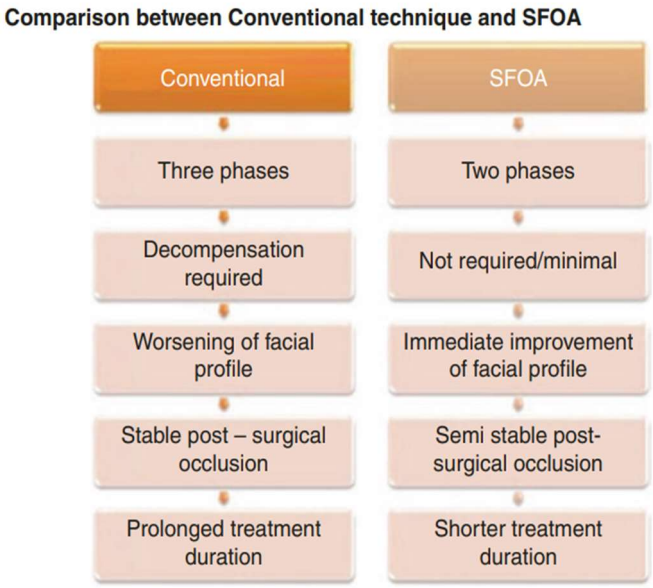

Fig. 2: The comparison chart demonstrating various steps for conventional technique and SFOA

Treatment Planning Considerations:

Every orthognathic surgery case requires careful preparation, particularly if the operation is to be done before orthodontic treatment. After surgery, teeth will decompensate to their normal placements and angulations, so the transitional occlusion needs to accommodate for this movement.

1. In surgery first cases, the molar relationship is employed as a starting point to determine a temporary occlusion because the incisors cannot be used as a reference to forecast the final occlusion.
2. When assessing whether extractions are necessary, the inclination of the upper incisors is important.
3. To enable post-operative upper incisor retraction, extractions may be undertaken if the upper incisor is severely proclined.[3, 16]
   The transverse dimension of the arches often prevents correct interdigitation postoperatively when putting the upper and lower models into occlusion.

4. After surgery, appropriate buccal overjet must be achieved bilaterally, and the midlines must coincide or be near them.

The hardest and longest part of getting ready for surgery-first orthodontics is predicting the final occlusion based on the teeth's existing positions. The occlusion that serves as the surgeon's guidance during surgery and is used to create the surgical splint is known as intended transitional malocclusion, or ITM.[3, 17]

When choosing the ITM, the upper and lower models need to make at least three points of contact, and the molar relationship can be used as a starting point to guide temporary occlusion. When a temporary occlusion cannot be established, orthodontic movement should be started to ease some of the interferences. Depending on whether the vertical issues are connected to dental interferences that are not fixed prior to surgery, they should be treated with postoperative orthodontic treatment or posterior maxilla impaction. Vertical problems are typically related to anteroposterior abnormalities.[17]

In class II Division 1 Malocclusions:

Patients in class II who have retrusive mandibles are likely to benefit most from SFOA. Following mandibular advancement, class II malocclusion creates a super class I or class III relationship immediately following surgery, with an edge-to-edge incisor relationship or bimaxillary dentoalveolar protrusion. Therefore, to address this problem, class III orthodontic mechanics must be used. Alternatively, like in class I bimaxillary protrusion situations, all first premolars can be extracted and then retracted.[18, 19]

In class II Division 2 Malocclusions:

It is challenging to perform SFOA in class II division 2 situations since there is less overjet. In these circumstances, either presurgical orthodontics can be used to obtain reverse overjet, which will allow for the advancement of the mandible to repair the skeletal deformity, or the SFOA operation can be carried out immediately without the need for orthodontics.[18, 19]

In class III Malocclusions:

When surgery is carried out first, class III malocclusion typically transforms into a class II relationship right after the mandibular setback. This class II relationship should be maintained with a surgical splint and necessitates class II orthodontic mechanics following surgery, with anterior teeth adjustment being managed postoperatively.[20]

Treatment Ideas using SFOA for Asymmetric Malocclusions:

One of the main characteristics of an attractive face is symmetry. Surgical intervention is typically necessary to address skeletal asymmetries to improve facial aesthetics and rectify any related malocclusions. The traditional method divides orthodontic treatment into two phases: the presurgical phase eliminates dental compensations, and the postsurgical phase refines the occlusion. Today, presurgical orthodontic phases can be eliminated, small surgical errors can be fixed, and patients can benefit aesthetically from SFOA. To address the asymmetry in these patients, SFOA incorporates asymmetrical single-jaw surgery.[21]

Procedures for Mounting and Setting up Models in SFOA

- Following the completion of the diagnostic and treatment planning, bite registration and standard model mounting are carried out with impressions taken to closely examine the current condition of the occlusion.
- Teeth that have naturally compensated for the current skeletal disparity are simulated in the model setup and rearranged into the expected occlusion, which is comparable to the preoperative orthodontic treatment plan. To achieve the intended preoperative occlusal relationship, all the teeth on the set-up model are rearranged as though orthodontic treatment were being performed on a real patient using traditional orthognathic surgical techniques.

The extent of skeletal movement needed in the maxilla, mandible, or both will be apparent once the models are in the ideal dental occlusion. Next, using the mounted models, a typical technique is used to

simulate the actual orthognathic surgery. This will show the possibility of an occlusal result of using the conventional method.

- After setting up these mounted models into the intended skeletal movements, intermediate and final splints can be created.
- With the development of virtual planning and three-dimensional simulation software, it is now possible to print the three-dimensional intermediate and final splints and execute the same set-up model surgery by scanning the physical models and feeding registration information into the software.[22]

Procedures for Surgery:

The mentioned standard techniques, whether they be the conventional approach or the SFOA technique, are used to perform the surgical procedures in the maxilla, mandible, or chin.

Conventional technique	SFOA technique
1. Initial diagnosis	1. Initial diagnosis
2. Surgical planning—STO	2. Surgical planning—STO
3. Pre surgical orthodontic treatment	**3. Simulation of pre-surgical orthodontic treatment**
	Model mounting and model setup
	4. Simulation of orthognathic surgery
4. Surgical arch wire	5. Surgical arch wire
5. Fabrication of splints	6. Fabrication of splints
6. Orthognathic surgery and post-op care	7. Orthognathic surgery and post-op care
7. Orthodontic rediagnosis	8. Orthodontic rediagnosis
8. Orthodontic treatment	9. Orthodontic treatment
9. Finishing	10. Finishing

Fig. 3: Treatment protocol comparing SFOA technique to conventional technique

Reduced Treatment Time In Surgery-First Approach: Regional Acceleratory Phenomenon:
Frost (1993) presented an explanation of the regional acceleratory phenomena. Following an osteotomy, the healing process is aided by bone remodeling surrounding the healing tissue. Two bone indicators, alkaline phosphatase (ALP) and C terminal telopeptide of type I collagen (ICTP), have been investigated in 22 SFA patients.
The former is linked to osteoblastic activity, whereas the latter is a by-product of bone degradation caused by osteoclastic activity. According to the study's findings, orthognathic surgery causes the dentoalveolus to undergo increased osteoclastic activity and metabolic alterations for three to four months. Following orthognathic surgery, there is a brief spike in bone turnover and remodeling activity, as seen by the postoperative transient elevation in ICTP and ALP.[23, 24]

The Future of "Surgery-First" Approach:
The use of virtual orthodontic setup, which replaces the mounted study model setup, enhanced skull models, and computer-aided design and manufacturing for the creation of intraoperative splints are the key components of the SFOA technique's future.
The orthodontist will be able to forecast each tooth's final location and axial inclination more accurately with the aid of the 3D virtual orthodontic set-up. With the patient's prevailing occlusion in a compensated state, it cannot be used as a guide for skeletal relocation, making this a compelling step prior to the surgeon's skeletal base correction simulation. One aspect that can contribute to the future of SFOA is the usability of interdental corticotomies and temporary anchoring devices (TAD).
By preventing early bracket loading with subsequent problematic tooth extrusion, the TAD allows a broader variety of orthodontic vectors. Interdental corticotomies have the potential to increase RAP and lengthen the orthodontic treatment period.[24, 25]
Stability:
Several investigations comparing the stability of SFA with a traditional method revealed no discernible differences. Transverse alterations have also been compared, and there is no discernible difference between the groups with and without presurgical orthodontics.[26, 27] in cases of malaligned dental arches, the surgeon should be able to conduct

specified osteotomy, intermaxillary fixation with an occlusion bite plate, and provide stability following skeletal realignment.[28]

Postoperative occlusal instability in patients undergoing surgery-first orthodontic treatment is mostly caused by the upper second molar's extrusion. Premature contact also causes greater vertical dimension, forward mandibular displacement after surgery, and postoperative occlusal instability.

In an investigation by Ching et al. comparing postsurgical stability of skeletal class III malocclusion with and without presurgical orthodontic therapy, there was a higher rate of recurrence (27.8% ±4 mm) in the SFOA group.[29, 30]

But following surgery-first orthodontic therapy, occlusal instability can be managed with a surgical stent. By preventing the proximal segment's clockwise rotation and maintaining the distal segment's medial pterygoid and masseter muscles to prevent recurrence, surgical precision can be increased by using 3-dimensional prediction and surgical wafer printing.[31]

CONCLUSION:

One special benefit of performing orthognathic surgery prior to any orthodontic tooth movement (SFOA) is that it can address the patient's primary complaint right away, which will increase the patient's acceptance and compliance with the entire treatment plan. By using the RAP, it also provides the considerable benefit of a reduction in overall treatment duration. When employing orthodontics-first and surgery-first strategies, the ultimate results are comparable in terms of face aesthetics, dental occlusion, and stability.

But it is important to keep in mind that both the orthodontist and the surgeon must proceed with caution because patient selection is crucial. They should also work together as a team during the whole treatment process, from diagnosis to debonding.

The surgical orthodontist team must be aware of the fundamentals of orthodontics, comprehend the boundaries of orthodontic tooth movement, and account for dental decompensation in their initial treatment planning.

After the skeleton is realigned, the surgeon should be able to perform a specified osteotomy, intermaxillary fixation with an occlusion bite plate, and provide stability. Orthognathic surgery's future is focused on shortening treatment times overall without sacrificing results.

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Biologic Width – A Comprehensive Review

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Abstract:
The relationship between periodontal health and the restoration of teeth is special and indivisible. Maintenance of gingival health is essential for tooth and dental restoration's longevity. Violation of any kind to the biological width hampers the normal periodontium. A plethora of Biologic width violations can lead to numerous complications, which are discussed briefly in this article. Despite an increase emphasis on the perio-restorative interference in restorative dentistry, many clinicians have been unable to utilize the concept of biologic width in a practical manner. Biologic width is essential for the preservation of periodontium, which ultimately decides the success of restorative procedures. This article reviews the anatomy, alterations, evaluation, violation, methods to correct the violation of biologic width and its relationship to periodontal health and restorative dentistry.

Keywords: Crown lengthening, dentogingival complex, restoration margin, biologic width violation.

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INTRODUCTION:

To guarantee adequate dental structure for a repair or cosmetic enhancement, teeth may need to be surgically exposed or have their crowns lengthened. This is consistent with basic biology and avoids interfering with biologic width or the periodontal attachment system1.

Understanding how the restorative margin sits in respect to the surrounding gingival tissue is crucial to understanding the connection among periodontal and restorative characteristics. The role that biologic width plays in preserving the health of gingival tissues and forming the gingival form surrounding restorations is something that clinicians must understand. This information is especially important for placing restorative margins, since hiding the point where the margin joins the tooth is the main goal in the aesthetic zone[2].

Historical aspects:

The soft tissue attached to the part of the tooth above the crest of the alveolar bone is measured as the biological width. It refers to the dimensional width of the dentogingival junction that includes the connective tissue beneath it as well as the epithelial connection.

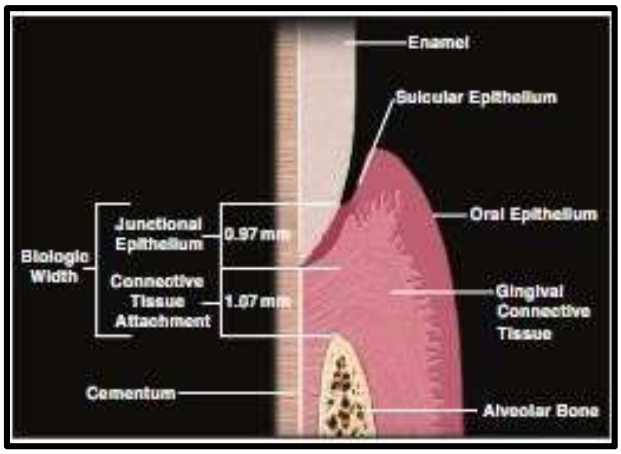

Figure 1: Anatomy of biologic width

Timeline:-

Sr. no.	Year	Author	Work
1.	1959	Seicher	First description
2.	1961	Garguilo, Wentz, Orban	Stated the average measurement precisely as a constant 2.04 mm, with the epithelial attachment measuring 0.97 mm and the connective tissue measuring 1.07 mm. Additionally, a sulcus depth of 0.69 mm was accounted for in this context.
3.	1977	Ingber et al.	Described "Biologic Width"
4.	1977	D. Walter Cohen	First coined the term "Biologic Width"
5.	1984	Nevins and Skurow	Defined biologic width as the sum of the combined supracrestal fibers, the junctional epithelium, and the sulcus which is over 3 mm
6.	1994	Vacek and colleagues	Stated that biologic width increased anteroposteriorly (1.75 to 2.08 mm)[1]
7.	2009 & 2012	Khuller N et al. & Nugala Bet al	Defined biologic width as "the dimension of the soft tissue, which is attached to the portion of the tooth coronal to the crest of the alveolar bone"[3]
8.	2018	World Workshop on the Classification of Periodontal and Peri-Implant Disease and Conditions	Stated biologic width as "Commonly used clinical term to describe the apical - coronal variable dimensions of the supracrestal attached tissues."[4]

Consequently, it is recommended to keep the gingival edge and the bone crest at least 3 mm apart. When the restoration is placed 0.5 mm inside the gingival sulcus, this gap guarantees that there will be enough biologic width present. Protecting periodontal health and avoiding interfering with the biologic dimensions that are indispensable for the health of the surrounding soft tissues are the goals of this guideline[2].

Studies reveal that the biologic width is roughly 2 mm in about 85% of the population. About 13% of the subjects have a distance greater than 2 mm, and 2% of the subjects under investigation had a distance below 2 millimeters. Age and tooth migration from lost occlusal or arch integrity can all affect the biologic width's physiologic placement. Orthodontic treatment can also affect its location. These variances highlight how biologic width is dynamic and sensitive to individual differences as well as dental procedures[6].

Interproximal dentogingival complex:-

As mentioned by Gargiulo and colleagues (1961) and Vacek and colleagues (1994), interproximally, the biologic width is similar to that of the facial surface, but the total dentogingival complexes shows variances. The dentogingival complex is 3.0 mm facially and 4.5 to 5.5 mm interproximally, as highlighted by Kois (1994) and Spear (1999). They emphasized that greater bone scalloping only partially explains the height of the interdental papilla. In 1997, Becker and associates classified differences in gingival scallop (flat, scalloped, and prominent scallop) according to the height variation (2.1, 2.8, and 4.1 mm) of gingival tissue between the face and interproximal regions. 3.0 to 3.5 mm is said to be an average height difference (Wheeler, 1961). According to Spear, the presence of neighboring teeth is necessary to sustain the extra 1.5 to 2.5 mm of interproximal gingival tissue height and interproximal gingival volume.

If there are no neighboring teeth, the interproximal tissue may flatten and assume a biologic width of 3.0 mm with the underlying bone scallop, which could compromise aesthetics. These results are consistent with those of Tarnow and colleagues (1992), who found that greater distances result in a significant loss of gingival height. Specifically, for full coverage of the interdental space by gingival tissue, the distance from the contact point to the osseous crest ought to be between 5 to 5.5 mm. The total number of papilla filling interproximal voids decreased as the distance between teeth grew, according to Cho et al. (2006). Using interproximal denudation, Van der Velon (1982) showed that three years later, interproximal tissue rebounded or recovered by 4.33 mm. This is consistent with the findings of Rusling (1976) and Nyman (1977) about tissue recovery after two years, which were 5.1 and 3.5 mm, respectively. Clinical experience has led some doctors to recommend a minimum of six months (Maynard and Daniel, 1977; Rosenberg and colleagues, 1999; Lanning and colleagues, 2003; Deas and colleagues, 2004) or up to three years (Kois, 1994) for tissue rebound and full maturation[1].

Biologic width in dental implants:

Dental implants also fall under the biologic width concept. A certain peri-implant mucosal breadth, according to certain research, is necessary to maintain the integrity of the soft tissue framework. If this breadth is not enough, there may be a physiological resorption of bone until the required dimension is determined[7].

A study conducted on animals revealed that the peri-implant "biologic width" is roughly 3 to 4 mm in height overall. The epithelial attachment is approximately 2 mm in length, and the supracrestal connective tissue zone is approximately 1 to 2 mm in length. In line with this, a study on human histology discovered that the peri-implant "biologic width," which includes the supracrestal connective tissue and epithelial attachment, has a height of approximately 4 to 4.5 mm[2].

This data is used clinically to detect violations of biologic width. For example, a possible breach of biologic width is indicated when the gingival tissues show inflammation in the absence of any other evident etiologic reasons and the restoration margin is positioned 2 mm or less from the alveolar bone. This knowledge is essential for identifying and resolving problems with dental implant restorations[2].

Clinical significance of biologic width:

Practitioners should know a lot about basic normal anatomy and adhere to the right rules when deciding where to set margins. According to Nevins and Skurow (1984), restoration margin placement should follow these guidelines:

1. It is appropriate to place the restorative margin 0.5 mm below the gingival tissue crest when the sulcus probing depth is 1.5 mm or less.
2. The restorative margin can be positioned half the depth of the sulcus if the sulcus probe depth is greater than 1.5 mm.
3. Gingivectomy may be considered to extend the tooth and create a 1.5 mm space between the gingival tissue and the restorative margin in scenarios where the sulcus probing depth is greater than 2 mm.

The patient can thereafter be managed in accordance with rule 1, with the restorative margin positioned 0.5 mm below the gingival tissue crest[4].

1. **Supragingival Margins:-**

- Impact on Periodontium: Minimal in comparison to other types of margins.
- Because of their color and opacity inconsistency with traditional restorative materials, they are frequently used in non-esthetic areas.
- Benefits: Provides comfort, simplicity, and less gingival irritation.

2. **The Equigingival Margin:-**

- Historical Beliefs: It was once believed that this margin caused more gingival irritation and plaque accumulation than any other.
- Advanced procedures: By using these procedures, it is now feasible to create a smooth, polished interface at the gingival border by artistically blending restorative borders with the tooth.

3. **Subgingival Margin**

- Reasons for Placement: Because of the desire to conceal the tooth/restoration interface, dental cavities, or insufficient tooth structure
- Potential Problems: Placing it too far below the gingival tissue crest can damage the gingival attachment system and result in chronic inflammation. It could be challenging for patients to clean the area thoroughly.
- Repercussions: As the body tries to create space for tissue reattachment within the bone of the alveolar region and the margin, gingival recession and loss of bone may happen.
- Risk factors: More likely to appear in areas where the gingiva is thin and severely scalloped, and when the alveolar bone around the tooth is small.
- Take into account: Stress the need to maintain the adequate gingival third crown contour, appropriate polishing, rounded edges, a sufficient linked gingival zone, and adherence to accepted guidelines (e.g., no deviation from B).

Alterations in biological width:

Restoration of tooth crown defects, whether direct or indirect, that have borders located inside a gingival biologic width area may result in unpredictably low bone loss, gingival inflammation, and loss of the connective tissue attachment. Clinically, periodontal pockets, gingival retraction, and bleeding are possible manifestations of these consequences. These observations have been confirmed by both histology and clinical research.

When Newcomb G. M. (1974) investigated 66 front tooth crowns with edges positioned at different intervals from the epithelial attachment, she discovered that more severe inflammation was caused by deeper subgingival restoration margins. When restoration margins were close to the alveolar bone, Parma-Benfenati S. and co-authors (1986) saw bone resorption in dog teeth up to 5 mm, but when restoration margin were 4 mm from the alveolar bone, no bone resorption happened. Where there was inadequate cortical and interdental bone, there was severe bone resorption.

It was shown by Tal H. and colleagues (1989) that changes in gingival biological width result in the periodontal ligament's destruction. In a one-year study, gingival retraction and loss of bone were more prominent in the experimental group of 43 Class V carious lesions in dog teeth with margins close to the alveolar bone than in the control group, which had amalgam-filled margin at the cementoenamel junction.

Restoration margin within the gingival biologic width area have been shown by Gunay H. and coauthors (2000) to produce periodontal pathology. In regions where the distance between restoration margins and alveolar bone was less than 1 mm, periodontal pockets formed and the index of gingival bleeding increased, according to a 2-year evaluation of 41 patients' 116 restored and 82 healthy teeth. A minimum of 3 mm should be kept between the restoration and the alveolar bone, according to several studies, to maintain periodontal health.

A model describing the periodontium's response to changes in gingival biological width has been published in the literature. It establishes a minimum width of 2 mm necessary for gingiva to adhere to the bone. In cases where this width has been

compromised (less than two mm from the alveolar bone to the restoration margin), gingivitis, or inflammation of the gingiva, develops. This causes the human body to resorb bone in order to make space for the gingival attachment to make contact with the alveolar bone.

The patient's periodontal biotype, which can be divided into two categories with intermediate variants, determines the implications of these alterations.

1. Thin periodontium: 3.5–5 mm in width, less than 1 mm in thickness of connected gingiva, and thin marginal bone.
2. Thick periodontium: thick marginal bone, breadth of 5–6 mm and more, and thickness of attached gingiva to 1.3 mm.

In both situations, the loss of the periodontal ligament and bone may be followed by the development of a periodontal pocket and gingival retraction. When there is little periodontium,

More quickly, marginal bone begins to resorb horizontally. Gingival retraction frequently takes place if the area is well cleaned.

On the other hand, gingival retraction is less frequent and bone loss happens more gradually in those with thick periodontium. However, there is a higher chance of bone abnormalities and undesirable bone shapes developing. Periodontal pockets, difficulties with self-cleaning, and the potential occurrence of: [continuation is required for a comprehensive response] can all result from this condition.

- Root caries,
- Furcation involvement,
- Tooth mobility as a result of the tooth attachment apparatus loss
- Loss of teeth, etc.

It is imperative to preserve the gingival biological width during tooth restoration in order to avert pathological alterations and improve the accuracy of treatment results. When there is less than 2 mm between the margin of the restoration and the marginal bone, clinical crown lengthening should be included in the treatment plan. The relationship between the crown, root, and alveolar bone as well as aesthetic expectations influence the choice to proceed with therapeutic crown lengthening. By carefully balancing functional and aesthetic factors, this method promotes the best possible periodontal health and the success of treatment as a whole.

Evaluation of biologic width:-

1. **Radiographic method** - Finding interproximal biologic width violations can be successfully accomplished by radiographic interpretation. However, because of dental superimposition, radiographs may not be diagnostic in more typical sites such as the mesiofacial and distofacial line angles of teeth. In these circumstances, a patient's sensation of tissue discomfort with the use of a periodontal probe to test restoration margin levels may serve as a trustworthy indicator of the presence of a biologic width violation, as the margin may extend into the attachment.

   The parallel profile radiography (PPR) technique was developed by H. Sushama and Gouri as a novel method of measuring the dento-gingival unit's (DGU) dimensions. According to the authors, the PPR method can precisely determine the length and DGU's thickness. This approach is simple, brief, reproducible, and non-invasive; it provides a useful substitute for determining biologic width and bringing up possible violations[8].

	Normal crest	High crest	Low crest
Mid-facial measurement	3 mm	<3 mm	>3 mm
Proximal measurement	3-4.5 mm	<3 mm	>4.5 mm

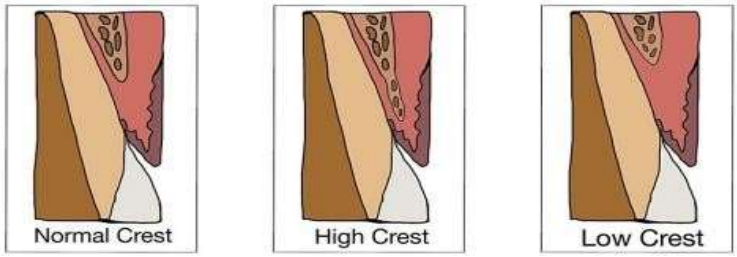

Figure 2: Categories of biologic width

2. **Clinical method -** A more favourable clinical evaluation for biologic width violations can be carried out by measuring the distance between the bone and the restoration margin using a sterile periodontal probe. The probe is carefully introduced from the sulcus to the underlying bone through the anesthetized attachment tissues. Biologic width violation is diagnosed if the distance measured is less than 2 mm at one or more places. To determine the severity of the problem, a circumferential evaluation of the tooth is conducted. It's important to remember, nevertheless, that biologic width violations may still happen in certain patients even in cases where the restoration borders are situated more than 2 mm beyond the level of the alveolar bone.

   Vacek et al. (1994) examined the biologic width phenomena and reported a range of biologic widths that were distinct to a subject. Although their average width measurement of 2 mm agreed with earlier research, they also noted variability, with biologic widths as big as 4.3 mm and as thin as 0.75 mm in certain subjects. This emphasizes the requirement for certain evaluations of biologic width for every patient to ascertain whether further biologic width—beyond 2 mm—is necessary for restorations to blend in with the gingival tissues.

3. **Bone sounding -** This is an additional method to measure biologic width. The biologic or attachment width of the patient is measured by probing to the bone level, and the sulcus depth is subtracted from the resultant value. To ensure accuracy, this process should be carried out on teeth with healthy gingival tissues, and numerous teeth should be evaluated. Bone sounding makes it possible to take into account individual patient variations in sulcus depths. This information is crucial for making a conclusive diagnosis of biologic width violations, figuring out how much correction is required, and setting guidelines for the placement of future restorations.

Figure 3: Assessement of biologic width by bone sounding

Violation of the biologic width:

In restorative dentistry, it is common to encounter situations where restorations need to be extended gingivally for various reasons:

1. Resistance and Retention: To create adequate resistance and retentive form in the preparation.
2. Contour Alterations: To make significant contour alterations due to caries or other tooth deficiencies.
3. Masking Interface: To mask the tooth–restoration interface by locating it subgingivally.
4. Aesthetic Lengthening: To lengthen the tooth for aesthetic reasons.

Nevertheless, if the restoration margin is positioned excessively beneath the gingival tissue crest, it may impede the gingival attachment mechanism, resulting in a breach of biologic width. In an effort to make space for tissue reattachment between the alveolar bone and the margin, the body may experience unpredictable bone loss and gingival tissue recession as a result. In regions where the alveolar bone surrounding the tooth is thin, this is more prone to happen. Tissue recession may be exacerbated by trauma from restorative therapies. The thickness and fibrotic nature of the gingiva as well as the gingival shape are additional characteristics that affect recession risk; thin, heavily scalloped gingiva is more likely to experience recession.[2]

The need for a subgingival restorative margin may be dictated by factors such as caries, tooth fracture, external root resorption, or the need to increase axial

height for retention. Placing the apical margin too close to the bone within the biologic width can lead to chronic inflammation. The short length of junctional epithelium in this scenario is considered a contributing factor. Some believe that a deeply placed subgingival restorative margin close to the alveolar bone crest impairs proper plaque control, promoting inflammatory changes not conducive to a healthy periodontal environment.[6]

Understanding and applying the concept of biologic width is crucial when planning restoration margins, as impinging into this critical space has been associated with plaque accumulation, gingival inflammation, deepened periodontal pockets, gingival recession, attachment loss, and crestal bone loss. In order to avoid encroaching on the biologic width, it is advised that restoration margins be positioned no deeper than 0.5–1.0 mm subgingivally and that there be a minimum of 3 mm separating the restoration from the alveolar crest[7].

Figure 4 and 5: Depicting violation of biologic width

Correction of biologic width violations:

Correction of biologic width is an indication for crown lengthening, and there are two main methods to address biologic width violations:

1. Surgical Correction:

***Procedure:** Includes surgically excising bone to create a space that permits the biologic width to be reestablished in a more apical location, away from the restoration margin.

*** Aim:** to expose the appropriate amount of crown structure in a stable and predictable manner over an extended period of time.

***Preference:** Considered a quicker treatment option when the ensuing crown lengthening results in a more aesthetically acceptable tooth length.

***Method:** A safety zone of 0.5 mm should be eliminated after the bone has been pushed away from the margin by the determined distance of the optimal biologic width for that patient

***Take into account:** There may be a chance of gingival recession following bone removal, particularly if the interproximal bone is removed. This could result in papillary recession and the formation of an unattractive triangle-shaped area under the interproximal contacts.

2. Orthodontic Correction (Extrusion):

***Indications:** If the biologic width violation occurs on the interproximal side, or if the violation occurs across the facial surface and the gingival tissue level is correct, orthodontic extrusion is advised.

***Procedure:** The tooth can emerge gradually, carrying the gingival tissue and alveolar bone with it, by employing a low orthodontic extrusion force. As an alternative, rapid orthodontic extrusion can be used, in which the tooth gradually erupts to the appropriate level over several weeks.

***Supracrestal Fiberotomy:** To stop the tissue and bone from moving with the tooth during rapid orthodontic extrusion, a supracrestal fiberotomy is done once a week, circumferentially around the tooth.

***Stabilization:** The tooth is stabilized for at least 12 weeks to confirm the position of the tissue and bone. Any coronal creep can be corrected surgically if necessary.

The choice between surgical and orthodontic correction depends on factors such as the nature of the biologic width violation, the desired outcome, and the patient's preferences. Both methods aim to restore the proper biologic width and achieve optimal aesthetic and functional results[11].

Figure 6 and 7: Surgical crown lengthening procedure

Figure 8: Orthodontic extrusion

CONCLUSION

The stability of teeth and the health of the periodontal ligament depend heavily on the biologic width. Restoring the periodontium's and the tooth's health should be the main objectives of any restorative procedure in order to guarantee the best possible general health and performance. Clinicians frequently deal with patients including significant caries, subgingival perforation, fragmented teeth, post and core placement in endodontic therapy, etc. in their day-to-day clinical practice. Under these circumstances, the idea of biologic breadth becomes crucial.

Clinicians need to be aware of the critical relationships between different components, paying particular attention to ideas such as biologic breadth, preservation, and crown application.

Lengthening in situations where there has been a breach of biologic width. Complications may arise from improper restorative margins that result in violations of biologic width. Orthodontic methods or surgical crown lengthening can be used to retain the biologic width in cases of such breaches.

It is imperative to stress that biologic width functions as the tooth's and the periodontium's natural seal. Maintaining oral health and avoiding consequences from breaches depend on preserving this biologic width. Clinicians must prioritize gaining a thorough understanding of these ideas in order to ensure the endurance and success of restorative treatments while protecting the overall health of the oral structures.

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Review Article

Oral Submucous Fibrosis: A Review of Literature and Different aspects for Diagnosis and Treatment Modalities

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Abstract:
Southeast Asian patients are the main ones affected by oral submucous fibrosis, a chronic illness of the oral cavity1. Collagen fibrous bands forming in the soft palate, buccal mucosa, labial mucosa, and associated structures are characteristic of it1. One of the known causes is vitamin and iron deficiency; other known causes include chewing betel nut and its products; excessive consumption of spices and chilies; poor nutrition; and immunological factors. However, the exact cause is unknown. Treatment involves both nonsurgical and surgical procedures1.

When treating patients without surgery, Pentoxifylline, lycopene, and other multivitamin supplements are taken in addition to other prescription drugs (like intralesional injections of chymotrypsin, collagenase, hyaluronidase, and steroids).In one surgical procedure, fibrous bands are cut1. Heat treatment, or thermodynamics, can also lessen the severity of submucous fibrosis.

Keywords: Oral submucous fibrosis, Areca nut, Betal nut, medicinal therapy, surgical treatment.

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INTRODUCTION:

Schwartz coined the term "atrophia idiopathica trophica") mucosae oris in 1952 and also gave the first account of OSMF7. Other names for this condition that have been proposed by several authors include idiopathic scleroderma of the mouth, sclerosing stomatitis, and idiopathic palatal fibrosis 4. Pindborg and Sirsat described this illness as "an insidious, chronic disease affecting any part of the oral cavity and sometimes the pharynx." Even though it can occasionally. Occur before or be connected to vesicle formation, it is always associated with the juxtraepithelial inflammatory response. Response, which is followed by fibroblastic alterations in the lamina propria. Epithelial atrophy causes the oral mucosa to stiffen, which results in trismus and the inability to eat.

Sushruta, an ancient medical text, classified a disorder related to OSMF as "Vidari," which falls under the category of diseases of the mouth and throat3. Chewing areca nuts and their products is linked to a well-known and chronic potentially fatal disorder called Open Source Mental Fever (OSMF), which is common among South Asians1. This review's goal is to highlight different OSMF treatment approaches that have been previously published in the literature1.

ETIOPATHOGENESIS:

When the illness was initially discovered in 1952, it was categorized as an idiopathic disorder. Oral submucous fibrosis has a 7%–13% chance of progressing to oral malignant lesions, especially squamous cell carcinoma5. So far, areca nuts, deficiencies in essential vitamins, capsaicin found in chilies, immunological factors, and micronutrient deficiencies in iron and zinc have been identified as the etiological factors[11]. In addition to these variables, some people may be predisposed to OSMF due to a genetic predisposition. Literature suggests various predisposing factors:

1. Areca nut alkaloids cause stimulation of fibroblast leading to proliferation and collagen synthesis[11].
2. Increased number of fibroblasts with a high amount of collagen production due to the long-term intake of areca nut ingredients[12].
3. Catechin and tannins from the areca nut cause stabilization of collagen structure[15].
4. Reduction in secretion of collagenase.
5. Increased production of more stable structured collagen (collagen type I trimer) by fibroblast[5].
6. And upregulation of lysyl oxidase leads to an increase in collagen cross-linkage.
7. Reduced collagen phagocytosis.
8. Activated macrophages and T lymphocytes recreates fibrogenic cytokines which act on fibroblasts.

AIM:

In this article, an attempt is made to include various treatment modalities related to oral submucous fibrosis.

Treatment Options

Pain, a burning sensation, and difficulty eating after trismus are the primary symptoms of OSMF. The degree of clinical involvement of a patient is the primary determinant of their treatment plan in OSMF. Surgery and non-surgical methods are used in the management of OSMF[1].

Conservative Management

Conservative Management involves stoppage of habits, nutritional supplements or supportive therapy and oral physiotherapy[1].

1. Breaking of Habits: People in India are consuming more areca nut, chilies, pan, spices, and commercially produced pan masala and gutka. The most crucial treatment step in the early stages of oral and submucous fibrosis is patient motivation to kick the habit, as this could slow the disease's progression[1].
2. Nutritional supplement or supportive therapy - Magnesium, zinc, copper, iron, selenium, B, C, D, and E vitamins, and iron are examples of micronutrients and minerals that can effectively lower oxidant levels. Reduced fruit and vegetable consumption is associated with a higher risk for cancers and their precursors. Owing to their ability to raise antioxidant levels and provide protection against the increased risk of cancer, fruits and vegetables should be consumed in greater quantities as part of a regular diet. Lycopene, a carotenoid present in tomatoes, has been shown to possess several potent antioxidant and anti-carcinogenic qualities. It has also demonstrated enhanced advantages in precancerous lesions such as leukoplakia[1].

Green tea's polyphenols can boost a cell's defense against reactive oxygen species-induced DNA damage and have significant free radical scavenging activity. It can also trigger apoptosis and lessen the growth of tumor cells. As a result, the potent antioxidant activity of tea polyphenols has been linked to numerous possible positive unique effects of tea. Based on available research, oral submucous fibrosis etiopathogenesis may involve iron deficiency as a cause or consequence[1]. Therefore, the treatment plan should include routine hemoglobin level testing and iron supplementation. (Immune milk contains a fair amount of vitamins, including A, B1, B2, B6, B12, C, nicotinic acid, pantothenic acid, folic acid, iron, copper, and zinc, and it has a strong anti-inflammatory effect. The main factor that will increase improvement is if immunological milk containing IgG antibodies can control cytokine assemblage and limit inflammatory response in patients with OSMF.

c. Oral physiotherapy - A physical exercise program and splints or numerous other devices are part of oral physiotherapy for OSMF patients. To prevent further restriction of mouth movements, mouth-

specific muscle stretching exercises may be helpful. The goal is to apply pressure to fibrous bands. Using a mouth gag and an acrylic surgical screw, a forceful mouth opening is recommended.

d. Microwave diathermy - Heat treatment induces band fibrinolysis. Only the juxta-epithelial connective tissue is heated selectively by microwave diathermy, which also restricts the treatment area. Therefore, it is simple to apply and causes little discomfort. Medical Care includes injecting placentrex, fibrinolytic agents, and steroids intralesional. The goal of medical care is to increase mouth opening and symptoms[1].

e. Steroids - Steroids have been shown to function as immunosuppressive agents, which reduce inflammation in lesions of oral submucous fibrosis and, consequently, the fibro-collagenous condition. Moreover, it inhibits fibroblast proliferation, which reduces the quantity of collagen fibers. For patients with moderate OSMF, topical steroid application or weekly submucosal intralesional injections may prevent additional damage. Local application of steroid ointment may be beneficial for painful oral mucosa and ulcers. It is discovered that a 1.5 cc injection of hydrocortisone locally works well[1].

f. Hyaluronidase - Research indicates that hyaluronidase targets the collagen of OSMF patients more quickly than it does normal collagen. The enzyme hyaluronidase activates specific plasmatic mechanisms, breaks down the hyaluronic acid matrix, and thins the intracellular cemental materials. Resulting in the softening and reduction of fibrous tissue. According to Kakar et al., a local injection of 1500 IU of hyaluronidase and 4 mg of dexamethasone for 7 weeks produced the best results, and this was followed by 3 weeks of hyaluronidase injections[1].

g. Collagenase – As can be seen, one of the mechanisms causing collagen accumulation in OSMF patients is a decreased level of functional collagenase. According to Lin and Lin, intralesional collagenase injections improve mouth opening more than usual and lessen a person's sensitivity to heat, colds, and spices, which relieves symptoms of OSMF[1].

h. Placental extracts- Nucleotides, enzymes, amino acids, steroids, and vitamins are all present in the aqueous extract of the human placenta used in the injection placentrex. Via "biogenic stimulation" and "tissue therapy," it works. In 1933, Filatov reported using it. When implanted or injected into the body following a conflict with pathogenic factors, these tissues or their extracts stimulate the body's metabolic or regenerative processes, which alleviates symptoms[1].

i. Chymotrypsin: Proteolysis can be carried out by the endopeptidase enzyme chymotrypsin. Gamma-interferon (IFN) because IFN-gamma has an immunoregulatory effect, it is important in treating OSMF. According to research by Haque et al., IFN-gamma is thought to be an anti-fibrotic cytokine that affects collagen synthesis by stimulating collagen-stimulated osteoblast-like fibroblasts. This treatment with IFN gamma intra-lesional injections increased mouth opening and relief from symptoms[10].

j. Aloevera- Aloevera has antibacterial, anti-inflammatory, and restorative qualities, as does its extract and resin6. A preliminary study was conducted by Sudarshan et al. to compare the effectiveness of antioxidants and Aloevera in treating oral submucous fibrosis. Research indicates that the application of Aloevera enhances response to all symptoms of OSMF. Aloevera has also been shown to reduce burning sensation and enhance cheek and mouth opening flexibility. According to reports, the Aloevera group improves the patient's quality of life[1].

k. Turmeric-Turmeric's natural yellow pigment, curcumin (diferuloylmethane), has enhanced anti-oxidant, anti-inflammatory, and anti-cancer properties. Together, turmeric oleoresin and oil protect against DNA deterioration. Consequently, it showed greater efficacy in OSMF as a chemo preventive and anti-inflammatory agent. Proved to be an easy, secure, palatable, and economical course of treatment. Curcumin was also used in a study by Rai et al. to treat oral precancerous lesions. The study included 25 patients with OSMF, and it was shown that curcumin could cure them by improving their systemic and local antioxidant status[19].

L. Lycopene- One carotenoid with strong antioxidant qualities is lycopene. Its enhanced ability to quench other free radicals in vitro and its maximum singlet oxygen quenching capacity account for its antioxidant qualities. According to studies, lycopene

inhibits the growth of cancer cells both in vivo and in vitro. It inhibits dysplastic activity in oral premalignant lesions. Because it increases connexin synthesis and creates gap junctional communication, numerous studies have documented its anticancer activity**2**.

m. Interferon (IFN)-gamma-IFN- gamma plays an important role in the reduction of oral submucous fibrosis symptoms as it shows an immunoregulatory effect[9]. Haque et al. studied that IFN-gamma is recognized for its antifibrotic cytokine and proved effective on collagen synthesis by arecoline-stimulated OSMF fibroblasts. The literature suggests that there was inhibition of collagen synthesis in the presence of IFN gamma. Thus, intra-lesional injections of IFN-gamma showed an increase in symptoms like burning sensation & mouth opening[20].

n. Oxitard- Emblica officinalis, Vitis vinifera, Glycyrrhiza glabra, Daucus carota, Mangifera indica, Withania somnifera, Yashada bhasma, and Triticum sativum are the extracts that make up this antioxidant. "Mangifera indica" demonstrates antiviral and antibiotic properties. "Withania somnifera" reduces inflammation, stress, and anxiety while enhancing general health and well-being. One of the best sources of vitamin A is "Daucus carota"[2]. "Glycyrrhiza glabra" is an immune-stimulating plant that also lowers inflammation and regularizes husky speech. Because "Vitis vinifera" is caustic and lowers inflammation, it lessens the burning feeling. "Yashada bhasma" and "Emblica officinalis" both contain zinc and vitamin C, which promotes wound healing and cell formation. Vital minerals found in "Triticum sativum" help to lessen oxidative stress. Each of these elements contributes to a decrease in OSMf symptoms[2].

o. Salvianolic acid- Chinese natives are familiar with and use the dried root of "Salvia miltiorrhiza badge," or Radix Salviae miltiorrhizae (danshen). Danshen contains salvianolic acid B, or Sal-B, an efficient and biologically active ingredient. Sal-B has seven hydroxyls that are phenolic and have high redox potentials, meaning they have antioxidant properties. Jiang et al. evaluated the effectiveness of triamcinolone acetonide and SA-B in easing OSMF symptoms[2].

p. Colchicine – By blocking the synthesis of microtubules and preventing collagen from being extruded from fibroblasts, it lowers the amount of collagen synthesized. In the submucosa, collagenase activity is increased and the increased fibroblast formation is halted. It neutralizes cytokines like TGF-β, IL-6, and IL-4 that are involved in the synthesis of collagen. When administered to patients with liver disorders, potent side effects are not seen at higher doses. 0.5 ml of intralesional injection of hyaluronidase 1,500 IU and oral 500 mg of colchicine were studied by Krishnamoorthy B et al. for the treatment of OSMF[2].

q. Pentoxifylline therapy - A derivative of methyl xanthine, pentoxifylline exhibits dose-related side effects. Its mode of operation consists of 1. There is an increase in microcirculation and a decrease in granulocyte adhesion and platelet aggregation. 2. Leukocyte activation and adhesion are reduced while leukocyte deformability is elevated. It possesses fibrinolytic, anti-plasmin, and anti-thrombin properties. 3. It may cause neutrophils to degranulation and increase natural killer cells. Activity and prevent the activation of B- and T cells. 4. Aids in preserving homeostasis and cellular integrity following acute injury. 5. Demonstrated to enhance vascularity and lessen symptoms in individuals with oral submucous fibrosis. Pentoxifylline was described by Rajendran et al. as an adjunct medication for OSMF treatment. Following a 7-month trial and a 6- to 12-month follow-up, the patients' symptoms and signs decreased in comparison to the control group1.

r. Tulsi (Ocimum sanctum Linn) - Tulsi is regarded as the queen of herbs because of its many therapeutic benefits. Its analgesic, anti-inflammatory, anti-stress, and antioxidant qualities improve its application in OSMF. Tulsi's anticarcinogenic properties are a result of its diverse contents. The carcinogens increase NF-KB activity, which ursolic acid (UA) suppresses. IKBα and p65 are not phosphorylated when UA is present. Moreover, apoptosis limits the initial stages of the increased production of cancer cells. Strong antioxidants include rosmarinic acid. Comparing the anti-inflammatory qualities of ibugesic and paracetamol, they are equal. By stimulating the adrenal gland, it lowers cortisol levels, which has an

anti-stressor effect. Srivastav et al. conducted studies on 41 OSMF patients using turmeric in conjunction with the treatment2. In a small group of twenty OSMF patients, Madhulatha et al. assessed the effectiveness of 500 mg of herbal Tulsi paste given twice daily for one month. Both studies yielded satisfactory results2.

s. Tea pigments- tea pigments are created by the oxidation of polyphenols found in tea leaves. The flavones found in tea pigments have anti-inflammatory, antioxidant, and anti-tumor effects. Aflatoxin and polyphenols both inhibit nuclear factor-kappa B (NF-kappa) activity, which in turn controls the rise in proinflammatory cytokine production. The tea pigments also lessen blood viscosity, enhance microcirculation, and control the activity of superoxide dismutase. These qualities thus support its application in the management of OSMF2.

t. Immunomodulators- Levamisole is an immunomodulatory anti-helminthic medication. It strengthens humoral and cellular immunity. Hence employed as a voluntary regimen for the management of OSMF. Jirge et al. conducted a randomized, single-blind clinical trial wherein 50 mg of levamisole was administered three times a day for three consecutive days in a week, compared to three alternate weeks with capsule antitoxin. Serum levels of IgA, IgM, and IgG increased, and mouth opening improved in the levamisole group. There was also a decrease in the burning sensation. To improve immunity, speed up the healing process, and lower the risk of malignant transformation, levamisole should be used as an adjuvant therapy in future research2.

u. Molecularly targeted therapies- According to recent research, TGFβ regulates the synthesis and breakdown of extracellular matrix (ECM) products, which is a key factor in the pathophysiology of OSMF and has been shown to be a helpful treatment option for the disease.

Imatinib

Imatinib inhibits TGFβ signaling pathways to exhibit anti-fibrotic properties. Demonstrates promising outcomes in preclinical models when used as an antifibrotic medication to treat scleroderma. Demonstrates a role that has been shown to be effective in treating OSMF2.

Pirfenidone (PFD)

Pirfenidone (5(1H)-pyridone) has been used recently to treat idiopathic lung fibrosis (ILF), an inflammatory condition also mediated by transforming growth factor beta (TGF-β). Is an anti-fibrotic agent with anti-inflammatory properties. Therefore, it is regarded as an anti-fibrotic agent that is helpful in treating OSMF conditions that are mediated by TGF-β. PFD functions by suppressing proinflammatory cytokines TNF-α, fibroblast growth factor (b-FGF), and tissue inhibitors of metalloproteinases-1 (TIMP1), all of which are elevated in OSMF. Ninetenedanib. Mostly prescribed as a second-line treatment for adenocarcinoma subtype lung cancer. It lowers excessive ECM production and stops the TGF-β1 receptor from becoming phosphorylated, both of which are advantageous in OSMF. By targeting the PDGF receptors-α and β, it lowers the PDGF level, which is elevated in OSMF. It also goes after the receptor for the fibroblast growth factor2. 1, -2, and -3 and consequently lowers the amount of fibroblast growth factor, which may serve as a biomarker for OSMF's malignant transformation2.

Simtuzumab

Simtuzumab-Collagen cross-linking is catalyzed by lysyl oxidase-like 2 (LOXL2), which is implicated in the pathophysiology of OSMF. An antibody that targets the human LOXL2 is called simtuzumab, which has been humanized2.

u. Hyperbaric oxygen therapy (HBO) - Studies have demonstrated that TNF-α and IL-1 can enhance collagenase synthesis and fibroblast proliferation in vitro. TNF-α can cause increased fibrosis by blocking the phagocytes that break down collagen. HBO inhibits TNF-α and IL-1, 6, 8, promotes wound healing, and lowers fibrosis to control its action. HBO increases angiogenesis improvement by enhancing vascular VEGF expression while concurrently lowering the levels of hypoxia-inducible factor-1α (HIF-1α). Hence employed in the management of OSMF2.

v. Personalized precision medicine (PPM-) PPM is a modern immunotherapy treatment option where

genomic, proteomic, and metabolic analysis is carried out[21].

SURGICAL TREATMENT

When a biopsy reveals dysplastic or neoplastic changes, or when a patient has limited mouth opening, surgery is the best option. Several surgical techniques consist of[8]:

1. Fibrotomy
2. Fibrotomy with graft replacements
3. Treatment through lasers
4. Therapy including mononuclear stem cells

Fibrotomy- The surgical procedure involves cutting away fibrous bands and forcing open the mouth, leaving the surface of the wound raw. Relapses are the most typical post-Fibrotomy complication[1].

Fibrotomy with graft replacement- The primary goal of surgery is always to surgically remove the fibrotic bands, which can cause scarring and a reduction in mouth opening issue, a number of surgeons recommended different interposition graft materials. The idea is to make an incision (sometimes called an excision, but technically correct term is "surgical release of fibrous bands"), widen the region or tissue that was incised by forcing the mouth open, and cover the surgical sites and defects with flaps or artificial biological material[1].

Extra-oral flaps - Various options include split-thickness skin graft. Superficial temporal fascia pedicled flap. Nasolabial flap. Platysma myocutaneous muscle flap.

Intraoral flaps - Palatal island flap, Tongue flap, and buccal fat pad Microvascular free flaps - Radial forearm free flap, Anterolateral thigh flap

Alloplasts - Collagen membrane, artificial dermis.

Laser treatment: Recently, it has been shown that using lasers to treat oral submucous fibrosis is a very effective option[16]. The Er Cr: YSGG laser, which has a wavelength of 2780 nm, can be applied to soft tissue in the mouth without causing thermal damage because it is well absorbed by water1. With laser surgery, there is no blood on the operating field, better visibility, less need for local anesthetic, less risk of bacterial infection, less mechanical tissue trauma, fewer sutures, faster and more uneventful healing, and less post-operative edema, scarring, and tissue shrinkage. In a moderate case of bilateral OSMF, Chaudhary et al. reported success using Er Cr; follow-up results with the YSGG laser were positive.

Mononuclear Stem Cell Therapy: Sankaranarayanan et al. (2013) conducted a number of studies to assess the efficacy of stem cell therapy as a treatment option for OSMF by describing a functional improvement and assessing a five-year follow-up of the outcome1. Four of the seven patients received treatment using stem cells acquired through the point-of-care delivery system, and three patients received treatment using stem cells extracted using the Ficoll method. Histological advancement was accompanied by improvements in the clinical state. Follow-up revealed lessening of symptoms such as blanching, increased mucosal elasticity, less burning when eating spicy food, and more mouth opening. In the follow-up period, it was discovered that the aforementioned outcomes persisted.

CONCLUSION

Depending on the severity and clinical manifestations of the condition, there are a number of treatment options for oral submucous fibrosis, including corticosteroids, hyaluronidase, placentrix, IFN, microwave diathermy, and others. In severe cases such as Fibrotomy, surgical treatment is also thought to be beneficial, as is covering the defect with grafts. As of yet, no single technique has been found to be the most effective way to treat OSMF. A larger number of cases and more parameters must be included in comprehensive clinical trials before a specific treatment modality for OSMF can be determined. According to recent studies, the combination of drugs produces effective treatment options in the management of this disease.

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