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Editorial

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3D Printing in Dental Implantology

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Dental implantology is a traditional approach offered to fully or partially edentulous patients. Successful placing of implants needs specialized skill sets and expertise in order to achieve their viability. 3-D printing along with digital technology have made significant improvements to rate of success and have transformed work process and practices in standards of care in dental implants. Advanced-thinking clinicians and the dental laboratories have harnessed benefits of the digital technology for ensuring best outcomes for the patients as well as providing versatility and savings in time and cost. This paper discusses workflows by which a summarized surgical guide can be obtained.

OVERVIEW

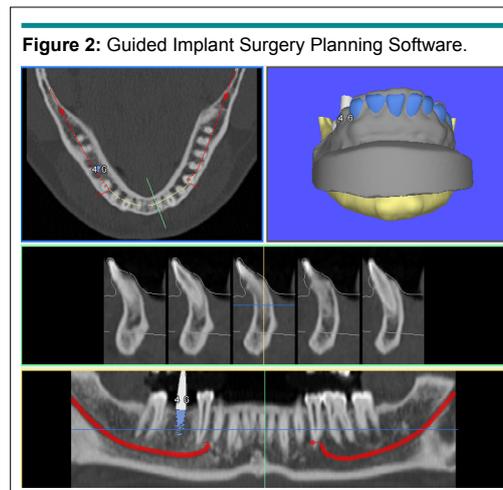
Dental patients look for various options for maintaining long lasting oral health. Implants offer a viable solution for replacing missing teeth with no need to do away with surrounding healthy dentition. By traditional practice, it required patient undergoing set of preparations on adjacent healthy teeth for constructing a bridge. Though this process fulfills the requirement of replacing a tooth, this process has to cut tooth structures of healthy teeth adjacent to missing tooth. Dental implants have removed this requirement and thus are offering a more conservative solution for replacement of missing tooth. The clinician places an implant into site of missing teeth without causing any damage to the adjacent healthy teeth. Placing of the dental implants requires some special considerations taken prior to the process. It is required to ensure that location, size of implant and angulation should be appropriate and also specific to site; the clinician has to take into consideration of biomechanics of bone density, nerves and sinuses of the patient.^{1,2} Conventional surgery was done by hand or the surgical guides were prepared on solid gypsum stone models or used dentures fabricated in laboratory and holes were drilled prior to guide the hand piece of the surgeon. With advancements in digitization and cone beam computed tomography (CBCT) scan, it is now possible to perform truly guided surgery (Figure 1).

Figure 1: Surgical Guide.



GUIDED IMPLANT SURGERY WORKFLOW

Guided implant surgery requires running cone beam scan on patient as a first step as it provides wealth of information about bone, soft tissues, bone density, nerves and location. The digital imaging and communications in medicine (DICOM) file or rendering of the anatomy of the patient is integrated to yield guided surgery software (Figure 2). In this software program clinician and dental technician is able to virtually place the implant and run number of test for ensuring best location outcomes.^{3,4} The impression of the mouth of the patient is captured with analog



PVS method or with a digital intraoral scanner from which model is prepared and scanned.⁵ This generates an optical scan providing a scan to 3D print (STL) file which can be simply and quickly overlaid onto DICOM (cone beam) file and generate a comprehensive STL file for importing in to guided surgery software program. In this guided surgery software, clinician is able to choose type of implant system and size of the implant. The software program automatically creates the implant and enables the clinician to position the implant in bone virtually. After the implant and the location are in line with intraoral scan or with the optically scanned model, they are overlaid and integrated into one open source concise STL file. This file may be now manipulated for designing a surgical guide. Design of the surgical guide in software program presents the clinician with a freedom for achieving optimal results and the best treatment procedures and protocols in order to achieve high standard of care.^{6,7} This procedure makes it easy and fast to plot location and borders of guide. After selecting the plot all affected areas are considered and the software is able to generate a hole virtually where the drill guide sleeve is to be attached.⁸

After the design of implant surgery guide, it is a simple task to export comprehensive STL file to 3D printer for obtaining quickly a seamless surgical guide. The guide gets printed in bio-compatible material for contacting with oral environment for short duration. The material is specifically approved contact with mucosal membrane for short-term period up to 24 hour duration. The hole is to accept either a metal sleeve glued to the guide or pre-designed hole is 3-D printed and used with drill guided sleeve which fits on dental drill and guides clinician to location and depth of the implant placement.^{9,10}

REALIZING BENEFITS

It is possible to broaden the restorative protocol by using the dual scans. These dual scans enable providing additional level of treatment as the patient can be scanned while wearing denture and once again without wearing the denture (this is also achieved digitally). The dual scans offer more information on the guided surgery as now the data about patient's teeth or the necessary future placement of teeth is also included in treatment plan and not only the location and bone considerations.^{9,11}

There are various benefits in using 3D printed surgical guides in the clinical environments. Among its three important benefits, the first one is that of completely customizable control of surgical guide and the treatment protocol. The next important benefit gained by digital dentistry is that it provides a considerably faster treatment protocol and the patient turnaround time. A patient, after coming in can be assessed and just start and complete the treatment in a significantly reduced time period. This advantage elevates the dental experience of the patient and offers a better and faster outcome. Another benefit is that having an in-house 3-D printer for generating the surgical guides offers considerable cost savings.¹²

CONCLUSION

It is the constant endeavor of the dental professionals to seek to improve and enhance the standards of care of their patients; this goal is easier to achieve with the help of 3D printing and digital technology. The professionals who are forward thinking are now using such technological solutions for obtaining diverse treatments and the services for their current and future patients. This technology-driven solution provides business model for the practitioners and the dental laboratories and this model is cost-effective and enhances precision and considerably enhances the dental treatments. And this presents with a better dental experience to the patient and increased viability and longevity of implant based restoration.

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Mini Review

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The Management of Orofacial Pain in Developing Countries: The Current Challenges

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ABSTRACT

In developed countries, orofacial pain is one condition in dentistry that has been well defined, explored, and managed. Unfortunately, unlike the grown and developed management of orofacial pain in developed countries, the management of orofacial pain in developing countries is still poorly performed. The current article discusses about the current management of orofacial pain in developing countries. At the time being, there are several factors that are considered to be the etiology of the unsuccessful management of orofacial pain in developing countries. Lack of knowledge about the symptoms of orofacial pain is considered to be one of them. Therefore, educating more people about orofacial pain and its symptoms should be included in the comprehensive plan of orofacial pain management plan in developing countries. As the problem of orofacial pain in developing countries is happening at the root level, the education should not only cover those who are responsible in treating orofacial pain but also the one who might experience orofacial pain. It is expected that the current article will provide a current insight about the management of orofacial pain in developing countries as we as well the current barriers of orofacial pain management. And furthermore, initiates more studies in the field of orofacial pain in developing countries.

KEY WORDS: Temporomandibular disorder (TMD); Orofacial pain; Etiology.

INTRODUCTION

Despite of the development of treatment modalities in the field of orofacial pain in developed countries that resulted in decreased morbidity of orofacial pain, developing countries are still faced with the high incidence of orofacial pain problems. The correct formula in managing orofacial pain in developing countries is still not properly composed. At least not the one in Asia. The latest epidemiological survey about the prevalence of orofacial pain on 1551 participants in Indonesia in one of its largest provinces revealed that nearly half the surveyed participants (49.9%) had or have been having orofacial pain in the last 6 months.¹

A study conducted by Sipila et al² that studied about the prevalence of orofacial pain and Temporomandibular Disorder (TMD) on 1501 Finnish and Thai people revealed that Thai people had an increased risk of reporting orofacial pain, tooth pain, and pain in the face. Whilst a pilot study in Malaysia conducted on 16 years old students in Kelantan showed that 44% indicated that they had or have been having orofacial pain within the last four weeks. Out of the 44%, 27% stated that they were still experiencing the pain at the time of interview, yet, only 8% out of the 27% sought for professional help.³

Another epidemiological study conducted in India by Oberoi et al⁴ on 500 patients of the Government Dental College and Research revealed that 42.7% out of the 500 patients sample complaint of an orofacial pain symptoms, with toothache being the most common symptoms (57.6%). An epidemiological study in Pakistan reported by Siddiqui et al⁵ showed that

300 participants out of the 700 participants they investigated for the incidence of orofacial pain reported the symptoms of orofacial pain. These high incidence of orofacial pain in developing countries might be due to several possibilities, one of which, the lack of understanding of orofacial pain. Despite of the fact that orofacial pain is clearly defined as pain associated with the soft and or mineralized tissue in the oral and facial region,⁶ not every level of the community member is familiar with this concept. The current article will review the possible correlation between the current epidemiological condition and the management of orofacial pain in developing countries.

Understanding the Current Concept of Orofacial Pain

For so many years, orofacial pain has been defined and known as pain originated only from the tooth. The process of understanding the concept about how pain in the face or oral area might independently occur without the involvement of a tooth took years before it can finally be comprehended.⁷ A study conducted by Borromeo et al⁸ about the level of understanding of the basic concept of orofacial pain among dental students and general dentist concluded that the knowledge about orofacial pain among dental students were quite low, which was also the case with the fresh graduate general dentists. Another study performed by Anggarwai et al⁹ about the knowledge of dentists and specialists on orofacial pain indicated the knowledge gap between these two groups of dental professional, which indicated the need of a more extensive inclusion of chronic orofacial pain material at undergraduate level.

The concept of orofacial pain, including the concept of chronic orofacial pain or pain caused by TMD, has been evolving. One of the concept that clearly marked the evolution of the orofacial pain concept is the one that was proposed by Dworkin et al¹⁰ that stated orofacial pain might be originated from psychological condition.¹⁰ This particular concept has emphasized the importance of evaluating patient's psychological condition during orofacial pain history taking and how several orofacial pain condition showed an interplay between psychological and physiological condition,¹¹⁻¹³ and that considering the psychological condition into the diagnosis and management for chronic orofacial pain will increase its success rate.¹⁴

Despite of the evolution of the concept of orofacial pain as well as the development of its management, it is apparent that these changes have not been well comprehended by related parties, especially those in developing countries. The fact that most dental professionals in developed countries are well aware and educated about the current concept, whereas it not in the case with those in developing countries. This lack of exposure about the concept of orofacial pain will furthermore lead to another consequence, such as the low-level of awareness about the manifestation of orofacial pain and how to manage orofacial pain at its earliest level. The International Association of the Study of Pain (IASP) through its research revealed that there are several factors that are considered as barriers to good pain management

in developing countries, and they are: Lack of education, government policies, fear of opioid addiction, high cost of drugs, and poor patient compliance.¹⁵

The Management of Orofacial Pain in Developing Countries

As any other disorder, the difficulties in composing the correct treatment planning or formula in managing orofacial pain in developing countries might be due to several factors, such as the lack of information about the symptoms of orofacial pain in the community level, the low-level of awareness in the community about the importance of treating orofacial pain at the early stage, the minimal knowledge about the detrimental effect of chronic orofacial pain, and as mentioned before, the lack of updated knowledge about orofacial pain amongst dentists themselves.

One of the most important factors in orofacial pain diagnosis process is the clinical symptoms experienced by the patients. If the patient or the dentist are not aware about the symptoms experienced are orofacial pain symptoms, it will result in an inadequate diagnosis and at a later stage, inadequate treatment planning. It is important for people to know that pain manifests in the oral and facial area is not always originated from the tooth, and that orofacial pain might occur without tooth involvement.¹⁶ Therefore, it is of importance, for the dentist or another health practitioner involved in the management of orofacial pain to have the proper and updated knowledge regarding orofacial pain in order to avoid any inappropriate dental-related treatment regarding the orofacial pain complain.¹⁷

Another important point in managing orofacial pain adequately is by treating it as early as possible. In order to increase the awareness of the early treatment of orofacial pain, it is of importance that orofacial pain is introduced properly to everybody at every level of the community. Not only that it eliminates the chain of pain referring, it will also prevent the patients from suffering from psychological effect due to chronic pain. It is important for the patient to understand the extend of the psychological effect that one might have on themselves. The exposure of orofacial pain and its concept can be performed by exposing orofacial pain symptoms through the dental health program conducted by the community center. As in developing countries, community centers are the first health facilities where people refer themselves. Therefore, the socialization will be most effective.

As mentioned earlier, early management of orofacial pain will prevent patients from suffering from psychological effect of chronic orofacial pain. Chronic orofacial pain, in line with other types of pain experienced by the human body, can be very debilitating at times and affects the patient's daily activities as well as their quality of life.¹⁸ A study by Yazdi et al¹⁹ on 150 patients with chronic orofacial pain revealed that not only chronic orofacial pain has a detrimental effect on the patient's daily life, but it also causes the patient to be more anxious as well as depressed. It is expected that comprehending the debili-

tating effects of chronic orofacial pain will encourage the patients to seek medical treatment related to acute orofacial pain complain as soon as possible. Similar to educating people about the symptoms of orofacial pain, educating the patients and dental professionals about the debilitating effects of orofacial pain can be performed at the community centers in the developing countries.

Another party to be educated about orofacial pain in order to have a comprehensive management plan of orofacial pain in developing countries is the dentist themselves. In Indonesia alone, it was not until 2 years ago that the correct and current concept of orofacial pain was introduced to dental students. Despite of the intense efforts in socializing and familiarizing dental students to orofacial pain, unfortunately, the topic of orofacial pain as well as its competency is still not formally incorporated in the dental curriculum for undergraduate dental students in Indonesia. This current situation might also contribute to the inadequate management of orofacial pain.

A study by Jamalpour et al²⁰ in Iran about the knowledge and beliefs about Temporomandibular Disorders (TMD) and orofacial pain revealed that there was a considerable disagreement between dentist and TMD specialist about the diagnosis and chronic pain behavior domain, which indicated the need and development of the undergraduate dental curriculum concerning this particular aspect. The incorporated competency of orofacial pain is also reflected in the template of the 2012 Nigerian Curriculum of the Medical and Dental undergraduate,²¹ where there was no orofacial pain related diagnosis competency aside from the diagnosis of TMD.

Last but not least, the plan for managing orofacial pain problems in developing countries including Indonesia, can only be appropriately composed if there are sufficient epidemiological data as well as clinical data supporting the intended management plan. Therefore, research that will explore all aspects of orofacial pain in developing countries should always be encouraged, facilitated, and largely published. It is expected when people as well as dentist are properly educated about orofacial pain, the orofacial pain morbidity in developing countries can be effectively reduced and overcome.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Research Letter

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Churro Jumper Arch: A Modified Approach to Improve Efficiency

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ABSTRACT

In this clinical innovation the Churro jumper has been modified, by inserting it on an auxillary wire which is placed on the mandibular arch, instead of directly placing it on the main arch wire, to improve its efficiency.

KEYWORDS: Churro jumper; Utility arch; Class II Malocclusion.

INTRODUCTION

Treating a Class II patient has always been a challenge to the orthodontist, especially in non-compliant adolescents. The Churro jumper, when used as a Class II corrector, can be used unilaterally or bilaterally, is cost effective and can also be used for correction of Class III malocclusion.¹⁻³ In this article the Churro jumper has been modified, by inserting it on an auxillary wire which is placed on the mandibular arch, instead of directly placing it on the main arch wire, to improve its efficiency. This technique prevents loss of alignment of the bicuspids and subsequently reduces treatment duration which would have been required for stepping down the arch wire for picking up the premolar.

PROCEDURE

- The traditional Churro jumper is fabricated in 0.028" wire and polyvinyl impression material is filled in the lumen of the jumper .
- An auxillary wire of dimension 0.019"×0.025" stainless steel was placed in the mandibular arch. It consisted of (a) molar segment inserted into the mandibular auxillary slot, (b) a posterior vertical segment which is formed (length as determined by the vestibular depth) by making a 90° bend gingivally, (c) a vestibular segment which bypasses the premolar brackets, and (d) an anterior vertical segment which hooks on to the main arch wire distal to the canine bracket (Figure 1).

Figure 1: Diagram of Churro Jumper Arch.

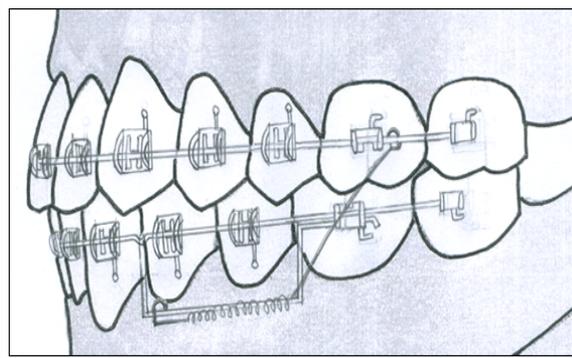


Figure 2: Arch Wire Modification.**Figure 3:** Post-Treatment.

- The auxiliary arch was fabricated such that it was midway in the vestibular area. This care was taken to prevent the loss of appliance activation and soft tissue irritation if placed deeper in the vestibule. The jumper's maxillary circle is attached onto the maxillary headgear tube and the mandibular circle is attached on to the auxiliary wire placed. This reduces the chance of canine bracket debonding as force is applied on the auxiliary wire. Being placed lower down in the arch, the visibility of the appliance was reduced. Force was applied below the centre of resistance of the mandibular teeth, which in turn would reduce lower incisor proclination as a side effect.

CONCLUSION

With this minor alteration in the appliance, the Churro jumper could be used more efficiently. It eliminated the problems which were previously encountered (Figures 2 and 3). The appliance can well be used in conjunction with fully bonded arch and thus, saves the treatment time spent in aligning the bicuspid later.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Case Report

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Bilateral Body of Mandible Fracture in an Oral Submucous Fibrosis Patient: Treatment Modifications

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SUMMARY

Oral submucous fibrosis (OSMF or OSF) is a severely debilitating oral premalignant condition characterized by restricted mouth opening secondary to formation of fibrous bands due to deposition of collagen in the submucosal connective tissue and fibrosis of the lamina propria.^{1,2} In severe cases the oral opening is less than 15 mm and presents difficulty in oral hygiene care and dental care.³ Trismus and decreased laxity of buccal soft tissues make these patients poor candidates for any dental treatment and often present with multiple decayed teeth and periodontal problems. Fracture management in these patients is often challenging. The present case reported with a bilateral compound fracture of mandible due to a road traffic accident. Open reduction and internal fixation was done. The trismus due to oral submucous fibrosis in the patient needed certain treatment modifications which have been reported. Online search for “jaw fracture management in oral submucous fibrosis patients” yielded no results. This paper thus seems to be the first account on the management of such patients in English literature.

INTRODUCTION

Oral submucous fibrosis (OSMF or OSF) is a premalignant condition widely prevalent among areca nut and tobacco chewing population characterized by formation of dense avascular collagenous deposits within the submucosal layers in the connective tissues. Continual habit leads to a relentless progression and significant morbidity and mortality. In severe cases progressive fibrosis results in severely restricted mouth opening and a high risk of squamous cell carcinoma development.

CASE REPORT

The present case reported with a bilateral compound fracture of body of mandible due to a road traffic accident. Occlusion was deranged due to overriding of fracture segments. The patient had a class III malocclusion with a reverse over jet. The oral opening was restricted to about 20 mm (Figure 1). The patient was recorded with a history of pan masala chewing (contains areca nut and lime) for about 8 years with a gradual reduction of mouth opening. Other sign and symptoms of OSMF were also present such as intolerance to spices and hot food items, reduced tongue protrusion, difficulty in chewing and compromised oral hygiene care.

Management of bilateral body fracture of mandible in an OSMF patient

Open reduction and internal fixation of the fracture segments was done by placing a 2.0 mm system titanium miniplates (Synthes Corporation Pvt. Ltd., West Chester, PA, USA). Few modifications undertaken have been outlined as below:

Maxillo-mandibular fixation (MMF): Stiffness and reduced laxity of buccal soft tissue made digital buccal retraction impossible. Hence wiring for MMF required that wires be passed from palatal/lingual interdental spaces to buccal/labial interdental (Figure 1).

Incision: A modified intraoral vestibular incision was used to access the body region. The approach was extended posteriorly for better access to the body and angle region.

Between the canines the incision was made 20-25 mm (normally 10-15 mm) away from the attached gingiva in a curvilinear fashion. In the body region the incision was kept superior to the mental nerve. Posterior to the canine the incision was kept 8-10 mm away from the attached gingiva, staying superior to the mental nerve. Fibrotic bands present at this point were incised to aid in retraction of soft tissues. The branches of the mental nerve located just underneath the mucosal flap were skeletonised by spreading scissors parallel to nerve. This was done to aid in retraction and to access the fracture line distal to the mental foramen.

men.

Fracture reduction and fixation: Fracture reduction and fixation was done with 2.0 mm titanium system, Synthes Corporation Pvt. Ltd., West Chester, PA, USA. Two screws of 8 mm length were placed on each side of the fracture line.

Combination with the transbuccal technique: To place posterior screws minimizing mental nerve retraction, the transbuccal trocar was used to drill holes and keep the screws perpendicular to the plate.

Wound closure: The incision was closed after thoroughly irrigating the wound and checking for hemostasis. Anteriorly, the mentalis muscle was reapproximated to prevent drooping of the chin tissues. The mucosa was closed with interrupted 3-0 vicryl resorbable sutures. An elastic pressure dressing on the chin region was given to help support the soft tissues and prevent hematoma formation (Figures 2, 3 and 4).

Figure 1: Restricted Oral Opening.



Figure 2: Maxillo-Mandibular Fixation with Lingual Insertion of Wires.



Figure 3: Open Reduction and Internal Fixation.

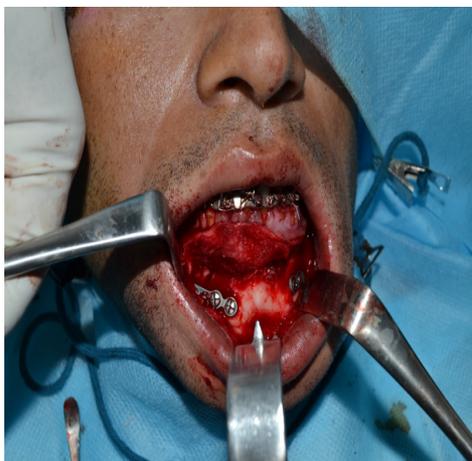


Figure 4: Post-Operative Radiograph Showing Miniplates Osteosynthesis.



Oral submucous fibrosis (OSMF) is a chronic, irreversible, highly potent pre-cancerous condition characterized by juxta-epithelial inflammatory reaction and progressive fibrosis of the submucosal tissues. It is thought to be an oral pre-cancerous condition with about 7.6% malignant transformation rates. The histopathological hallmark of the disease is fibrosis that affects most parts of the oral cavity, pharynx and upper aero digestive tract. Intolerance to spicy food, rigidity of lip, tongue and palate leading to varying degrees of limitation of opening of the mouth and tongue movement.³ In severe cases the oral opening is less than 15 mm and presents difficulty in oral hygiene care and dental care. Trismus and decreased laxity of buccal soft tissues make these patients poor candidates for any dental treatment and often present with multiple decayed teeth and periodontal problems. Fracture management in these patients is often challenging. Conservative management by closed reduction and maxillo-mandibular fixation is also difficult due to fibrous bands and inelastic buccal tissues with limited cheek retraction. Placement of wires from palatal/lingual to buccal/labial interspaces need to be done with smaller head wire twisters.

The intraoral vestibular incisions are the usual access for simple fractures of the symphysis, parasymphysis and body region. The approach can be extended posteriorly for better access to the body and angle region. Between the canines the incision was made 20-25 mm (normally 10-15 mm) away from the attached gingiva in a curvilinear fashion. Friability and ease at tearing of fibrosed, avascular mucosal and submucosal tissue meant that an increased bulk was required to aid in wound closure later on. In the body region the incision was kept superior to the mental nerve. Particularly in the extended intraoral approach such as this, care must be taken to protect the mental nerve in the anterior body region. Posterior to the canine the incision was kept 8-10 mm away from the attached gingiva, staying superior to the mental nerve. Fibrotic bands present at this point were incised to aid in retraction of soft tissues. The branches of the mental nerve located just underneath the mucosal flap were skeletonised by spreading scissors parallel to nerve. This was done to aid in retraction and to access the fracture line distal to the mental foramen.

Mandibular fracture fixation in the symphysis and body region often can be done intraoral approach but fractures distal to the foramen area often require a transoral approach.^{4,5} Placement of screws which are distal to mental foramen may require a transbuccal trocar in order to keep the screws perpendicular to

the plate.

Wound closure has to be done in layers with greater importance to reattachment of muscular tissue. Decreased vascularity of the mucosal and submucosal connective tissues can present with problem in healing especially at wound edges which mandates that the wound edges to be kept everted during suturing.

CONCLUSION

Fracture management in an oral submucous fibrosis patient even though challenging but can be done with certain modifications as elaborated in this case.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONSENT

An informed consent was taken from the patient prior to surgery and also prior to submission.

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Case Report

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Bilateral Fusion in Mandibular Primary Anterior Teeth: Report of a Rare Case With a Brief Review of Literature

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ABSTRACT

Fusion is a developmental anomaly of teeth. It is defined as the dentinal union of two embryologically developing teeth. It is more commonly seen in primary dentition and more frequently in incisor region. This paper reports a rare case which had the presence of bilaterally fused primary central incisor and lateral incisor in the mandibular region.

KEY WORDS: Fusion; Developmental anomaly; Primary incisors.

INTRODUCTION

Fusion is defined as the dentinal union of two embryologically developing teeth leading to one less tooth than normal in the affected arch. It is a dental twinning anomaly and has been described by many terms like double teeth, conjoined teeth, twinned teeth. Clinically, it may appear as normal sized or large, depending upon the stage at which embryological union occurs during development. It is commonly confused with gemination which is an incomplete attempt of one tooth bud to divide into two. Fused teeth are more commonly found in primary dentition as compared to permanent dentition. The occurrence is 0.5% in primary dentition, 0.1% in the permanent dentition and 0.02% for bilateral involvement in primary dentition.¹ It is more frequently seen in mandibular primary incisors.^{2,3} Males and females are equally affected. Genetics may be an important factor when there is an increased incidence.⁴ The presence of fused teeth can cause a lot of clinical problems like unacceptable appearance and periodontal conditions.⁵ A frequent finding in fusion of primary teeth is the congenital absence of corresponding permanent teeth. A multidisciplinary approach may be indicated in the clinical management of problems associated with fused teeth.⁶

CASE REPORT

A 4-year-old boy reported to the Department of Pediatric and Preventive Dentistry, Jamia Millia Islamia, New Delhi, India with the chief complaint of decayed tooth in the lower arch. The family and medical history of the child patient were insignificant. Thorough intraoral examination revealed a primary dentition with carious involvement of mandibular right primary second molar.

The mandibular arch also revealed an asymmetry in the tooth number. There were four teeth each present on the left and right side. There was bilateral presence of enlarged bifid crowns i.e., 71 and 72, and 81 and 82 and deep labio-lingual groove in relation to 81 and 82 (Figures 1 and 3). Intraoral periapical radiograph revealed that the enlarged bifid crowns were due to fused 71 and 72 (mandibular left primary central incisor and primary lateral incisor), and fused 81 and 82 (mandibular right primary central incisor and primary lateral incisor). The affected teeth i.e., 71 and 72 showed complete fusion of crown and roots resulting in joined pulp canal through pulp chambers, whereas 81 and 82 exhibited complete union of pulp chambers but incomplete union of pulp canals (Figure 2). OPG confirmed the presence of bilaterally fused

Figure 1: Clinical Image Showing Bilateral Fusion of Primary Mandibular Central Incisor and Lateral Incisor.



Figure 2: Intraoral Periapical Radiograph Showing Complete Fusion of 71-72 and Incomplete Fusion of 81-82.



Figure 3: Clinical Image Showing Occlusal View of Bilateral Fusion of Primary Mandibular Incisors after Restoration of 85.



Figure 4: OPG Showing Bilaterally Fused Mandibular Incisors.



primary mandibular incisors and the presence of permanent successor teeth (Figure 4).

The primary mandibular lateral incisors were missing, thereby confirming that it was a case of fusion. The parents of the child patient gave no history of trauma, dental anomalies and consanguineous marriage. A thorough general examination was carried out to rule out the presence of any associated syndrome.

DISCUSSION

Fused teeth arise through union of two normally separated tooth germs and they can be found in almost any region of the dental arch, both in primary and permanent dentitions. According to the most accepted theory, some physical force or pressure is responsible for contact between developing teeth and their subsequent fusion.⁷ Genetic predisposition and racial differences are other predisposing factors. Fusion can be classified into complete and incomplete types. In case of complete fusion the union begins before calcification and crown of the fused tooth incorporates features of both teeth, but in incomplete fusion union of teeth occur at a much later stage and tooth might exhibit separate crown and fusion may be limited to roots with pulp canals fused or sep-

arate.⁸ Fusion may affect two normal teeth or it may also occur between a normal tooth and a supernumerary tooth which may be a mesiodens or a distomolar.^{7,9} Although, case of bilaterally fused mandibular lateral incisors and canines in the primary dentition have been reported in the literature, but interesting finding of bilaterally fused central and lateral incisors in the mandibular region makes the present case more extraordinary and worthy to report. Most of the fused teeth are associated with occlusal disturbances, space problems and delayed eruption of the permanent successors. The fissure present at the union between fused teeth predisposes it to dental caries and in some cases periodontal disease.⁹ Fused primary teeth may result in delayed resorption of roots due to its big root mass thereby leading to ectopic resorption of the permanent teeth.¹⁰ The presence of fused teeth in primary dentition has been associated with absence of permanent dentition and the prevalence depends on the combination of fused primary teeth.¹¹ Cases of fusion of primary mandibular anterior teeth associated with partial anodontia of both primary and permanent dentition¹² or with anodontia of permanent dentition alone have also been reported.¹³ The presence of fused teeth can also cause aesthetic problems, especially in the anterior region.

The treatment of fused teeth depends on the clinical sit-

uation, patient's expectations and degree of compliance.¹⁴ Proper instructions regarding maintenance of oral hygiene should be given to the patient to avoid caries. Fissure sealants can be used as they reduce the risk of caries. A multidisciplinary approach can also be used to ensure functional occlusion and aesthetics.

In the present case restoration of 85 was done with glass ionomer cement and fused primary teeth were retained as such as they were free from caries (Figure 3). Preventive approach was planned that included application of topical fluoride, oral hygiene instructions and periodic follow-ups.

Why this Paper is Important to Pediatric Dentists

- A thorough clinical and radiographic evaluation is compulsory as early diagnosis results in enhanced prognosis.
- Early detection and intervention of fused teeth is essential part of preventive dentistry as it is one of the rare anomalies of shape of tooth.
- Hypodontia of permanent dentition is a complication associated with fused primary teeth and the prevalence depends on the combination of fused teeth.
- Fusion of primary teeth may be associated with pulp exposure due to presence of deep grooves.
- Careful monitoring is required in most of the cases as regular and long-term follow-up is required to manage fusion.

SOURCES OF SUPPORT: None.

PATIENT'S CONSENT

Written informed consent was obtained from the patient for publication of this case report.

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