Case Report

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ORTHODONTIC TREATMENT OF AN IMPACTED MAXILLARY CENTRAL INCISOR COMBINED WITH SURGICAL EXPOSURE

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ABSTRACT:

Impaction of maxillary permanent incisors is not a frequent case in dental practice, but its treatment is challenging because of these teeth importance to facial esthetics Management by a combination of orthodontics and surgery produces a satisfactory result. The surgical exposure and orthodontic traction of impacted central incisor after surgical exposure of impacted maxillary central incisor teeth is presented in this case report.

Key words: Impacted tooth, Maxillary incisors orthodontics, tooth movement

INTRODUCTION:

The impact of maxillary permanent incisor development may possess important problems in terms of esthetics and occlusion in the early mixed dentition [1]. Children with a marked delayed eruption of permanent incisors are usually at the age of 8-10 years old. The maxillary incisor can be considered impacted if the following conditions exist:

1.) No historical record of previous extraction,

2.) Eruption of contra-lateral incisor which occur 6 months earlier,

3.) Both incisors are un-erupted and the lower incisors have erupted one year previously or deviate from the normal sequence of eruption e.g., lateral incisors erupt before the central incisor,

4.) Maxillary incisors have delayed eruption 6 months after the normal eruption date [2,3] .

The prevalence of unerupted maxillary incisors in the 5-12 year age group has been reported as 0.13%. In a referred population to regional hospitals the prevalence has been estimated at 2.6%. Unerupted incisors are more common in males than females with a ratio of 2.7:1. Almost half (47%) of all unerupted maxillary incisors are due to supernumeraries. The mesiodont variety has more eruptive disturbances compared to the palatodont [4].

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The occurrence of erupted lateral incisors associated with the non-appearance of one or both of the central incisors should always be deemed abnormal when a child is between 8 and 10 years of age [5]. Although impaction of a permanent tooth is rarely diagnosed during the mixed dentition period, an impacted central incisor is usually diagnosed accurately when there is delay in the eruption of the tooth. However, the abnormality in the appearance can also be due to other clinical features and malformation of other elements of the craniofacial complex. Tooth impaction may result from a number of local causes. The principal local factors involved in this anomaly are supernumerary teeth, odontomas, and trauma.[6] Table.1

The following radiographs need to be taken to assist in the diagnosis and management [7,8]:

- An anterior occlusal radiograph for general assessment purposes.

- Two periapical radiographs should be taken using the parallax technique for detailed assessment of the position, root and crown morphology. It has been shown that the use of horizontal parallax technique is better than vertical parallax.

- If an anterior occlusal and a panoramic radiograph are already available, the vertical tube shift (VTS) technique can also be used for assessment

In recent years CBCT has been introduced as a technique for imaging of dental and maxillofacial structures. CBCT is a medical image acquisition technique based on a cone-shaped X-ray beam centred on a two-dimensional (2D) detector. The source-detector system performs one rotation around the object producing a series of 2D images. The images are reconstructed in a three-dimensional (3D) data set using a modification of the original cone-beam algorithm [9].

CBCT imaging provides orthodontists with an excellent tool to improve diagnosis, treatment planning and outcome assessment in appropriate malocclusion .Studies have shown that CBCT is more sensitive than conventional radiography for both impacted teeth localization and identification of root resorption of adjacent teeth.

The comprehensive images in 3 planes provided by CBCT can assist surgeons in choosing the appropriate surgical approach, identifying the tooth that should be extracted, and reducing the amount of surgical trauma on the adjacent hard and soft tissues [10,11].

Adequate space (9mm for central incisor and 7mm for lateral incisor) should be created prior to any surgical intervention to enhance spontaneous eruption. Almost half of the impacted incisors erupt spontaneously following the removal of obstruction and creation of space [12].

Maintenance of space throughout the treatment is crucial to prevent the loss of space which can lead to secondary inhibition of spontaneous eruption of the impacted tooth [13].

The impacted tooth is left open to the oral environment following the surgery and surrounded by the incised palatal or labial mucosa [1,2]. An attachment may be placed during or after the procedure. This technique is termed open eruption technique or exposure and can be performed in two ways [14-17]:

a) The window technique

This direct technique involved removal of overlying mucosa and the finally erupted tooth will have a non-keratinized labial gingival mucosa.

b) The apically repositioned flap

The procedure involves apically repositioning the raised flap that incorporates attached gingiva overlying the impacted tooth and is expected to provide adequate width of attached gingiva.

The closed eruption technique has been favored by many clinicians who claimed that the aesthetic and periodontal outcome is far more superior when compared with the apically positioned flap. With this method, a labial or palatal flap is raised and an attachment with gold chain or a bracket/eyelet with ligature wire is bonded to the enamel surface of the tooth using acid-etch technique, preferably with a light cured adhesive, before the flap is replaced. Orthodontic traction is then applied [1].

There are a few criteria to evaluate when considering the best method for uncovering unerupted tooth.

-Labio-lingual position of the unerupted tooth

For labially positioned tooth any technique is possible. However, if the unerupted tooth is in centre of the alveolus, it may be difficult to approach by the two open eruption technique. A simple window technique may be preferred if the impacted tooth is low down in the alveolus and bucco lingually close to its place in the arch.

For palatally positioned tooth where there is presence of thick palatal mucosa tissue the window technique usually requires placement of a periodontal pack to prevent regrowth of tissue over the exposed tooth.

-Vertical position of the unerupted tooth relative to the mucogingival junction

If the crown of the unerupted tooth is positioned coronal to mucogingival junction any one of the three techniques can be used to uncover the tooth. If it is positioned apical to the mucogingival junction the window technique may not be appropriate and the apically position technique is appropriate. To uncover the tooth that is significantly apical to the mucogingival junction a close eruption technique is preferred.

- The amount of gingiva in the area of the unerupted tooth

In the presence of insufficient gingiva in the area of the unerupted tooth, an apically positioned flap is preferred. A 2 - 3 mm of attached gingiva over the crown

of the tooth allows any of the three technique to be used.

- The mesio-distal position of the crown of the tooth

If it is positioned over the root of the lateral incisor it would be difficult to move the tooth through the alveolus unless completely exposed with apically positioned flap. The close eruption or excisional uncovering generally is not recommended [18].

The objectives of orthodontic therapy are to establish a good occlusion, enhance the health of the periodontium, and most importantly to improve dental and facial esthetics. One of the most common orthodontic problems requiring surgical intervention is the non-eruption of a permanent tooth. The non-eruption of a permanent tooth is a frequently occurring situation which, provided the permanent tooth is not congenitally absent, may be caused by a variety of clinical abnormalities such as dense overlying bone, or excessive soft tissue prevents their eruption. Other origins include various local causes such as odontoma, arch [19].

The surgical exposure and orthodontic traction of impacted central incisor after surgical exposure of impacted maxillary central incisor teeth is presented in this case report.

CASE DETAIL:

The 20-year-old female patient reported with chief complaint of an unerupted upper front tooth. The patient was made aware of the existence of an impacted maxillary incisor during a recent dental X-ray examination. Patient was in good health and gave no history of medical concerns or dental trauma.

Intraoral examination revealed a generally satisfactory dentition with the exception of dental caries in # 36 and # 46 and a grossly decayed # 26. The patient had normal overjet and overbite, class I molar relationship on the right side and a class I canine relationship bilaterally. Fig.1a-b

Orthopantomogram examination showed an impacted no. 21 and a mesiodens in the same region. The impacted incisor was positioned horizontally with its crown close to the middle third of the root of the maxillary right central incisor, and its root in close relation to the root of the maxillary left lateral incisor. Fig.2

Treatment options were explained to the patient and her parents, and it was decided that the impacted tooth be salvaged and brought into occlusion with orthodontic movement. Taking into consideration the position of the impacted central incisor and its vicinity to the root of the lateral incisor, treatment was decided to be conducted in two phases.

Phase I included extraction of the mesiodens in relation to 11 and 21, leveling and aligning of maxillary and mandibular arches with fixed orthodontic appliance and space regain for the impacted maxillary incisor. Fig.3a

Phase II included surgical exposure of the crown of an impacted tooth, uprighting it from a horizontal to a vertical position, followed by subsequent orthodontic traction to bring it into occlusion.

An MBT prescription, 0.022 slot bracket system was placed with bands on teeth nos. 17, 26, 37, 46 and initial leveling was completed with a 0.016" NiTi wire. With a relatively rigid stabilizing wire (0.017 × 0.025" stainless steel) on the maxillary arch, a NiTi Open Coil Spring was used between 11 and 22 to create adequate space for the impacted incisor. Fig.3b

Exposure of the impacted central incisor was performed, and the exposure site was allowed a short healing period before further treatment was carried out.

A maxillary central incisor bracket was bonded onto the available labial surface of the crown of the incisor with its horizontal slot as parallel as possible with the incisal edge of the tooth. Fig.3c

Initial traction on the impacted tooth was applied with a 0.016" NiTi wire riding piggyback on a 0.017 × 0.025" SS mainarchwire. The auxiliary wire was ligated loosely to the impacted tooth. This initial procedure made adequate surface of the crown available for application of uprighting spring. Fig.4a

The impacted tooth needed to be uprighted to a vertical orientation to allow for further orthodontic traction. This was done by the use of an auxiliary spring constructed from a 0.016 × 0.022" TMA archwire. Fig.4b-c. The spring was designed in a manner so as to upright the impacted incisor while simultaneously continuing application of orthodontic traction to bring the tooth into occlusion. One end of the spring was ligated to the main archwire through all teeth in the first quadrant while the free end was engaged as possible to the horizontal slot of the bracket bonded on the impacted incisor. The design of the spring allowed for application of force to bring the tooth downward and provide a labial root torque to upright it. .

The versatile spring was used in this case for management of impacted maxillary central incisor, though the uniplaner design of its active component permits operation in labial vestibule in both maxillary and mandibular anterior arches. It is constructed using commonly available TMA wire of 0.016 × 0.022" or 0.017 × 0.025" dimensions. It can be easily activated at various bends to direct force in the desirable direction or to impart root torque. Fig.5. The passive and retentive component of the spring is the archform segment that rides piggyback to main archwire or can be ligated with main archwire or under tie-wings. The final wire was round 0.018 straight. Treatment period was six month. . Fig.6

DISCUSSION:

The treatment of an unerupted tooth will depend on its state, position and if there is enough space in the dental arch to accommodate. If eruption has been delayed, the permanent tooth should be exposed, because it is important to allow

the tooth to erupt into correct position as soon as possible [1,2,7,8].

Proffit has considered problems in treating impacted teeth in three distinct areas: Surgical exposure for access, placement of a utilitarian attachment and orthodontic force application [2]. The first two areas have common solutions.

Exposure can be performed in 3 accepted ways: 1. Circular excision of the oral mucosa immediately overlying the impacted tooth; 2. Apically repositioning the raised flap that incorporates attached gingiva overlying the impacted tooth and 3. The closed-eruption technique in which the raised flap that incorporates attached gingiva is fully replaced in its former position, after the attachment has been bonded to the impacted tooth.[20]

While orthodontic traction for treatment of impacted teeth that are vertically oriented in the alveolar bone requires only time and patience, challenges are different when the tooth is impacted horizontally. In the present case, a new design for an auxiliary spring was used that was capable of exerting force in variable directions with suitable activations. The spring was successfully used to meet treatment objectives [20,21,22].

"Window" approach indicates statistically significant loss of attachment, recision and gingival inflammation occur on maxillary canines after surgical exposure. Therefore a part of keratinized gingiva must be preserved or an apically flap should be used. This approach aims at obtaining keratinized gingiva around the entire erupting tooth. It is important for a tooth to erupt through attached gingiva not through alveolar mucosa. Attached gingiva has to be transferred to the region where the crown is exposed [21,22].

Various surgical techniques have been described for exposing impacted teeth before orthodontic tooth movement. Two of the most commonly used surgical exposure techniques for labial impacted teeth are: (1) exposure of the entire labial aspect to the anatomic crown with total excision of all keratinized tissue (the window approach) and (2) a technique which exposes only 4-5 mm of the most superficial portion of the labial aspect of the cusp tip while maintaining 2-3 mm of keratinized tissues.[23,24]

In this case, the available space for tooth alignment was sufficient and tooth was brought into right anatomical position in the dental arch. It has been suggested and shown that the "window" approach causes statistically significant loss of attachment, recession and gingival inflammation occur on maxillary canines after surgical exposure. Therefore, a part of keratinized gingiva must be preserved or an apical flap should be used. This approach aims at obtaining keratinized gingiva around the entire erupting tooth. It is important for a tooth to erupt through attached gingival, and not through alveolar mucosa. If the impacted tooth is diagnosed with its root completely formed or if present in an unfavorable position, combination of

surgical and orthodontic treatment has to be carried out.

Recently, Cone Beam Computed Tomography (CBCT) has become available for high effective localization of unerupted teeth. However, CBCT still has a higher effective radiation dose and cost to the patient than conventional radiography, and arguably, is not needed in determining the position and condition of most unerupted teeth.[25]

CONCLUSION:

Impaction of maxillary anterior teeth can be a challenging orthodontic problem. The treatment of an unerupted tooth will depend on its state, position, and presence of enough space in the dental arch to accommodate. If eruption is delayed, the permanent tooth should be exposed because it is important to allow the tooth to erupt into correct position as soon as possible. Impaction of maxillary permanent incisors is not a frequent case in dental practice, but its treatment is challenging because of the importance of these teeth in facial esthetics.

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FIGURES:

Fig.1a-b Intra-oral photographs

Fig.2 Panoramic radiograph showing impacted maxillary central incisor and mesiodens in region of 21

Fig.3a Maxillary arch with adequate space for impacted incisor before its surgical exposure

Fig.3b Bracket bonded on labial surface of tooth no. 21 after surgical exposure and healing period

Fig.3c Orthodontic traction applied with 0.016” NiTi wire over

0.017 × 0.025″ stainless steel main archwire

Fig.4a Auxiliary spring design-constructed with 0.016 × 0.022″ TMA wire to upright horizontally impacted maxillary central incisor

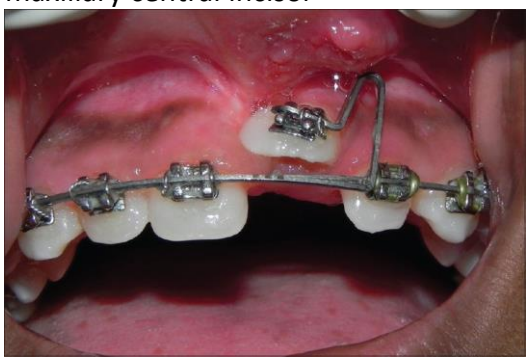

Fig.4b Partial uprighting of impacted maxillary central incisor

Fig.4c Bracket engaged to main archwire with elastomeric chain Bracket position correction and continued alignment

Fig.5 0.016″ NiTi wire engaged in bracket

Fig.6 0.019 × 0.025″ NiTi wire engaged in bracket