Case Report

Management of Impacted Central Incisor with Surgical and Orthodontic Approach: A Case Series

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Abstract

The case series comprises multiple instances of impacted maxillary central incisors, each originating from different etiological factors, including extra teeth and odontomas-patients presented with various complaints, such as pain, esthetic concerns, and functional occlusion issues. The case series underscores the effectiveness of the combined surgical (closed eruption) technique and orthodontic approach in managing impacted maxillary central incisors, irrespective of their etiology. Not only did this method restore functional occlusion, but it also significantly improved gingival esthetics. This case series holds substantial clinical significance by showcasing the success of a multidisciplinary strategy for treating impacted maxillary central incisors. A comprehensive diagnosis was conducted, involving a detailed assessment of the impaction's cause and its impact on patients' oral health. Sciagrams and imaging were employed to assess the extent and nature of impaction.A tailored treatment plan was formulated for each patient, involving a combined surgical and orthodontic approach. This approach included surgical removal of obstructions, guided eruption, and orthodontic alignment. Patients were closely monitored during and after treatment to track progress and address any complications that arose. The follow-up phase involved orthodontic adjustments and maintenance to ensure optimal outcomes.

Keywords: Impacted maxillary central incisors, Odontoma, Orthodontic traction, Supernumerary teeth, Surgical and orthodontic approach.

Introduction

Managing impacted maxillary central incisors is a complex and diverse task in dentistry. The etiologies of these cases are diverse, with odontoma being one of the contributing causes that result in impactions. Congenital absence of a permanent central incisor (with the presence of a lateral incisor) is a rare situation, thus indicating the impaction of the prior. An impacted maxillary permanent central incisor is rarely diagnosed during the mixed dentition period owing to delayed eruption. Some of the reasons for such an impaction include: Obstruction due to supernumerary tooth, obstruction due to odontoma, ectopic tooth bud, obstruction due to soft tissue repair, dilaceration, arrested root development, and intrusive luxation. A surgical intervention successfully addressed an impacted canine in conjunction with a compound odontoma in one such case report by Smitha *et al*.,[1] restoring dental harmony. Shi *et al*.[2] also described a case of a compound odontoma-induced impacted maxillary right central incisor. This case series serves as an excellent illustration of the value of a surgical and orthodontic approach that is well-synchronized. The orthodontic eruption was followed by surgical excision.

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The orthodontic-surgical therapy of horizontally impacted maxillary incisors has also been covered in case reports by Chan *et al*.[3] and Agarwal *et al*.[4] These cases highlight the complex issues that impacted the central incisors present and the successful resolution obtained by combining several treatment techniques. Additionally, Tanaka *et al*.[5] and Chew and Ong.[6] have critically reviewed clinical instances involving the orthodontic traction of impacted maxillary central incisors.

By presenting a collection of cases illustrating the efficiency of a joint surgical and orthodontic strategy in managing impacted maxillary central incisors, this case series aims to add to the body of current knowledge. Each case was thoroughly examined, with special attention paid to any unusual difficulties encountered, the treatment modalities used, and the outcomes in terms of functional occlusion and cosmetic improvement.

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These exemplary cases have been examined and reported to provide researchers and professionals with insightful information.

Case Description

Case report-1

Unaffected by trauma or extraction, a 10-year-old girl appeared with a missing upper right central incisor, the deciduous predecessor being exfoliated 3 years ago. A balanced facial profile, Angle's class I molar relationship, and a mixed dentition phase were all present during the clinical examination, and there was no evident deficiency in arch length (Figure 1a). On the right side of the maxillary arch, a supernumerary tooth and an impacted permanent central incisor were found radiographically (Figure 1b). With informed parental permission, the treatment strategy included a synchronized surgical and orthodontic approach. Oral prophylaxis and a thorough physical examination were the first steps in treatment. Crevicular and vertical incisions were made during the procedure, which was done under local anesthesia. After that, the closed eruption technique was used, in which a full-thickness mucoperiosteal flap was raised to reveal the supernumerary tooth and impacted central incisor. A surgical extraction was performed to remove the supernumerary tooth, and the extraction socket was painstakingly curetted (Figure 1c). The maxillary first permanent molars received orthodontic bands with molar tubes, and Beggs (Libral) brackets were cemented on all maxillary anterior and premolar teeth. A ligature wire of gauge 0.010" was attached from the slot of the Bracket of tooth 11 and the other end was held with an artery forceps and twisted to a braid form and kept dangling in the oral cavity within the comfort zone of the patient (Figure 1d). The mucoperiosteal flap was sutured back. Sutures were taken out a week later, and 0.016" AJ Wilcock orthodontic wire was attached in the bracket slots from 16 to 26. The Ligature wire was twisted around the AJ Wilcock wire and extrusion forces were generated. The power chain was used from 21 to 26 and 12 to 16 to maintain the space of 11 in the arch (Figure 2a). To extrude 11 up to the occlusal plane, light continuous orthodontic traction force (60–90 g) was used throughout several appointments.

An intraoral periapical radiograph taken after 1 month showed that the impacted tooth had moved mesially and incisally. At 3 months, further radiographs showed that the impacted tooth 11, had made satisfactory movement toward the occlusal plane. The activation of the ligature archwire to impart continuous orthodontic extrusion force was made possible by monthly visits. After 9 months of therapy, tooth 11 had fully emerged into the mouth. To level the tooth, now a 0.016" NiTi round archwire replaced the earlier AJ Wilcock wire and the Ligature wire (Figure 2b). The tooth 21 was effectively aligned in the dental arch after 12 months, displaying a suitable gingival shape and a healthy pulp. For closure of diastema between 11 and 21, Power chain was used from 16 to 26 (Figure 2c). After 1 month, the closure of diastema was achieved. Then, the fixed retainer was cemented palatally from 13 to 23. The patient continued to receive routine follow-up care, till the right permanent maxillary incisor had fully erupted to the occlusal plane (Figure 2d). This case exemplifies effective treatment

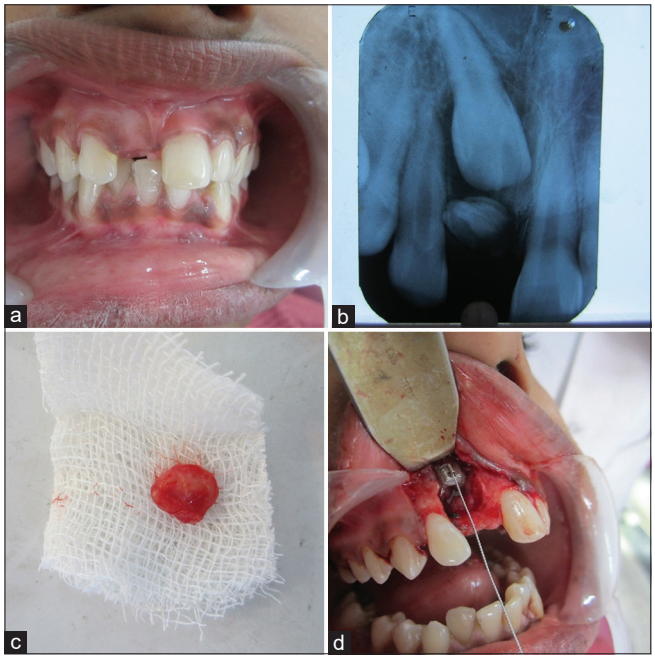

Figure 1: (a) Pre-treatment photograph showing missing right maxillary central incisor, (b) IOPA showing a supernumerary tooth and an impacted permanent central incisor, (c) orthodontic ligature wire attached to Beggs bracket cemented on 11, and (d) extracted supernumerary

Figure 2: (a) Orthodontic ligature wire tied to base arch AJ Wilcock wire 0.016" after molar tubes were bonded to 16,26 and Beggs bracket bonded from 15 to 25, (b) after 9 months of treatment, 0.016" round NiTi archwire replaced the earlier AJ Wilcock wire and the Ligature wire, (c) A powerchain was given to close the diastema, and (d) follow-up photograph showing fully erupted permanent maxillary fight incisor in the occlusal plane

using a surgical and orthodontic technique coupled to provide functional and cosmetic restoration of both tooth and gingiva.

Case report-2

An 11-year-old girl, despite having lost her deciduous tooth 4 years prior, presented with a non-eruption of her right maxillary central incisor (Figure 3a). A panoramic radiograph verified the existence of overlapping radiopaque structures, indicative of an odontoma close to the impacted incisor which was horizontally impacted, and clinical examination revealed an orthodontic problem with dental malalignment (Figure 3b).

The treatment aimed to obtain symmetric gingival margins, establish appropriately attached gingiva, maintain space for the impacted incisor, and align the anterior teeth. This all-encompassing strategy included traction of the impacted incisor, surgical odontoma excision, and orthodontic space restoration. Similarly, a closed eruption technique was utilized, where a full-thickness mucoperiosteal flap was raised to expose the supernumerary tooth and odontoma (Figure 3c). Odontoma extracted resembled a compound odontoma as it resembled rudimentary teeth-like structures (Figure 3d).

The maxillary first permanent molars received orthodontic bands with molar tubes. Except for 13, Beggs (Libral) brackets were cemented on all maxillary anterior and premolar teeth. Beggs bracket was bonded to a palatal surface of 11 and Orthodontic ligature wire 0.010" was tied to the bracket slot. The ligature wire was tied to the main archwire, which was 0.016" NiTi (Figure 4a and b).

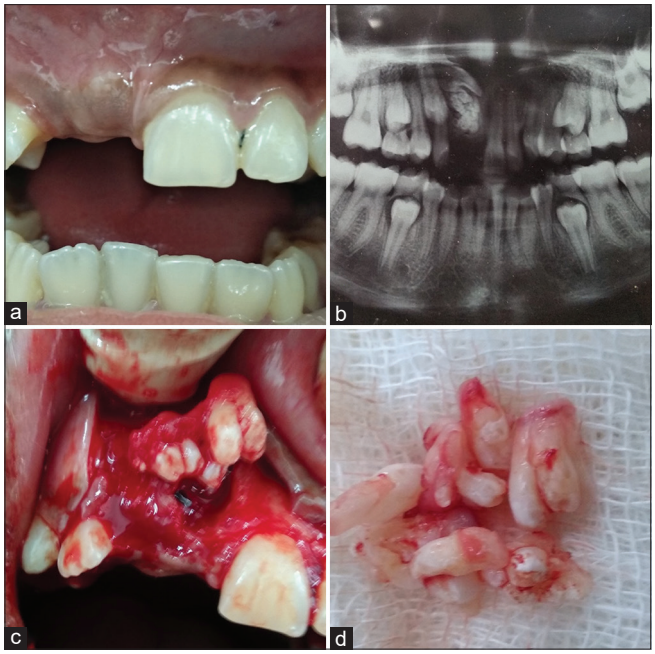

Figure 3: (a) Clinical photograph showing non-erupted right maxillary central incisor at the age of 11, (b) orthopantomograph showing the existence of overlapping radiopaque structures, indicative of a compound odontome adjacent to the horizontally impacted incisor, (c) full thickness mucoperiosteal flap was raised to expose the supernumerary tooth and odontome, and (d) extracted compound odontome

A panoramic radiograph 3 months later showed progress. A labial Beggs bracket was applied when the tooth appeared in the oral cavity, ensuring a more precise force direction. The affected incisor emerged but distally rotated, after another 6 months of activation. Lingual button was bonded for derotation. Power chain was attached from the lingual button of 11 to 14 and labially from 11 to 23. Thirteen was later extracted due to lack of space in the maxillary arch.

Tooth 11 erupted to the occlusal plane with proper alignment and leveling at the end of 20 months of treatment (Figure 4c). A balanced occlusion, improved overbite and overjet, and a unified smile were attained after 35 months of active treatment (Figure 4d). After the procedure, radiographs revealed intact roots, and good bone growth around 11. Improved skeletal relationships and beneficial modifications to the facial profile were found by cephalometric analysis. In conclusion, this case shows how an 11-year-old girl's impacted odontoma was successfully managed by surgery and orthodontics. The interdisciplinary strategy produced a pleasing grin and enhanced occlusion, highlighting the significance of cooperation and patient compliance in getting the best results. The stability and health of the gingiva would be observed throughout time.

Discussion

Effective management of impacted maxillary central incisors necessitates collaboration between oral surgeons and orthodontists.[7,8] Impactions may stem from various

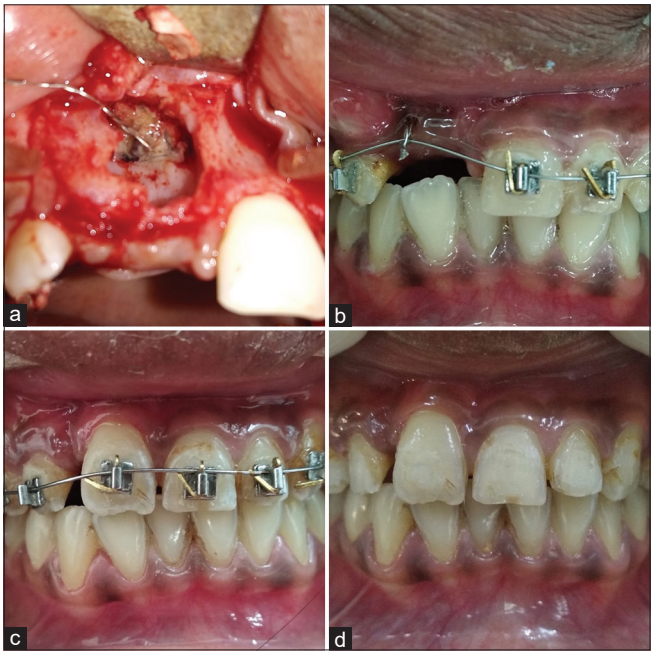

Figure 4: (a) Beggs bracket was bonded to palatal surface of 11 and orthodontic ligature wire 0.010" tied to the bracket slot, (b) the ligature wire was tied to the main arch wire, which was 0.016' round NiTi (c) after 20 months of treatment, (d) a balanced occlusion, improved overbite and overjet, and a unified smile were attained after 35 months of active treatment

causes, including supernumerary teeth,[8] odontomas,[1,2] and dilacerations.[7] The present case series was found to be in concordance with several other similar cases presented earlier by various other authors.[5,9-12] Supernumerary teeth are frequently linked to impacted central incisors.[8] Achieving optimal results hinges on a combined surgical and orthodontic strategy.[9,13] Typically, treatment initiates with the surgical extraction of supernumerary teeth,[13,14] followed by orthodontic interventions employing brackets and archwires to apply extrusive forces to the impacted tooth.[5,6,15]

A ligature wire was used in the first case reported here to provide constant orthodontic extrusion force, ensuring precise and progressive eruption control that was in concordance with the case done by Vanarsdall and Corn.[16] Extrusion was aided by light continuous traction forces of 60–90 g and routine follow-ups allowed for any necessary orthodontic adjustments that were similar to previous case reports presented by Becker *et al*.[11] and Kohavi *et al*.[17] The impacted central incisor was successfully placed within the dental arch, achieving both a functional restoration and esthetic improvement as was seen in other cases reported by Kocadereli and Turgut,[10] Becker *et al*.,[11] Becker.[12]

Due to the existence of a complicated odontoma, a less frequent cause of impacted incisors, the second case presented here was a special challenge. Similar cases were reported by Smitha *et al*.,[1] Shi *et al*.[2] Odontomas can block the natural eruption processes as hamartomatous lesions.[2] To treat the impaction caused by the odontoma on the maxillary central incisor in this case, a combined surgical and orthodontic approach was necessary.[11,12]

The closed-eruption approach, that was used to treat impacted maxillary incisors in this case series, entails a surgical procedure in which a tiny attachment is bonded to the impacted tooth, followed by the complete replacement of a flap with attached gingiva in its original location. The affected tooth is subsequently guided into the right position inside the dental arch by the use of gentle orthodontic traction provided by a ligature wire. According to research, this method seeks to reduce harm done to the teeth and their supporting tissues during the eruption process. The long-term esthetic and periodontal effects of the closed-eruption approach appear positive, despite some studies suggesting modest detrimental alterations, such as a tiny reduction in bone support and gingival abnormalities. However, it is essential to consider each patient's unique situation and seek the advice of a certified dental expert for a thorough assessment and a treatment plan customized to the patient's needs.[11]

The first step in removing the physical barrier preventing incisor eruption was surgical excision of the odontoma as was done by Foley,[18] McDonald and Yap[19] After the odontoma was removed, orthodontic therapy started to make room and straighten the front teeth.

To promote derotation and exact alignment, orthodontic traction was used to guide the impacted incisor occlusally. The maxillary first premolar had to be removed to make room in the maxillary arch. This was similar to previous cases done by Chew and Ong[6] Hou *et al*.[20] and Smitha *et al*.[1] This case series highlights the need for a flexible treatment strategy that may be tailored to the specific traits and state of each patient's therapy.

In both situations, interdisciplinary cooperation between pedodontists and oral surgeons is crucial.[11,12] Treatment of impacted central incisors requires effective coordination and communication among these professionals.[4] Some authors used a variety of orthodontic instruments, such as ligature wires, archwires, and powerchains to demonstrate the adaptability of orthodontic treatment for different impaction reasons.[21,22] The prolonged course of therapy emphasizes the necessity of perseverance and ongoing observation while treating impacted incisors.[11,15] For tracking eruption development, assessing root growth, and assuring treatment stability, routine monitoring is crucial.[4,18]

Both cases emphasize the importance of the use of various orthodontic tools such as ligature wires, archwires, and power chains demonstrating the adaptability of orthodontic therapy for diverse impaction causes.[21,22] The extended treatment duration underscores the need for patience and continuous monitoring when dealing with impacted incisors.[12,15] Regular monitoring is vital for tracking eruption progress, assessing root growth, and ensuring treatment stability.[4,18]

Conclusion

The case series demonstrates the importance of a comprehensive approach, encompassing various etiologies for impacted maxillary central incisors. It underscores the critical need for thorough examination, meticulous treatment planning, and seamless collaboration between pedodontists and oral surgeons. The inclusion of light extrusive forces by ligature wire prevents further complications, such as undermining resorption and mobility of tooth undergoing extrusion, often rendering it non-vital. The closed eruption technique also establishes its superiority over open eruption technique in establishing greater width of attached gingiva, thus contributing to gingival aesthetics.

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