Interdisciplinary approach for the management of bilaterally impacted maxillary canines

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Abstract
Interdisciplinary approach for the management of malocclusion provides a holistic approach of patient management. Prudent treatment planning is necessary to achieve the various treatment goals. This case report describes the orthodontic management of a 16-year-old adolescent female patient with bilateral labially impacted maxillary canines. The problems associated with impacted maxillary canines and the biomechanical interventions used for this patient are discussed. The treatment protocol involved surgical intervention, followed by sequential traction of the impacted teeth. An interdisciplinary approach to treatment with different mechanical strategies led to the achievement of the desired esthetic, functional, and occlusal treatment goals.

Keywords: Flap designs, impacted canine, interdisciplinary, orthodontic intervention, sequential traction

Introduction
Eruptive disturbances are alterations of normal tooth eruption, including accelerated, delayed, failed, or deviated in the direction of tooth eruption.[1] Impaction is the total or partial lack of eruption of a tooth well after the normal age of eruption.[2] Between 25% and 50% of the general population are affected by impacted teeth, with the incidence of upper canine impaction reportedly ranging from 0.92% to 4.3%, respectively.[3,4] Maxillary canine impactions are twice more common in females (1.17%) than in males (0.51%).[3] Eight percent of patients with impacted maxillary canines have bilateral impactions.[5] Impaction of a maxillary canine is a common problem because it has the longest period of development, the deepest area of development, and the long eruption path of all the teeth.[3] They are also the teeth that frequently require surgical and orthodontic intervention for their eruption. According to Kokich and Mathews the cause of labial impaction of the canines probably is related to either a retained deciduous tooth, diversion of the canine tooth bud, or idiopathic failure of eruption of unknown origin.[6]

This case report describes the sequential management of bilateral labial canine impaction in the maxillary arch. The treatment success was the result of the combined efforts of the orthodontist, a periodontist, and the patient.

Case Report
A 16-year-old female presented for orthodontic treatment with the chief complaint of impaired facial esthetics due to irregular upper front teeth. She had a grossly symmetric, mildly brachycephalic, euryprosopic face with interlabial gape of 3 mm [Figure 1a]. Intraoral examination [Figure 2a] showed bilaterally rotated and labially displaced lateral incisors and retained deciduous canine with unerupted permanent canines and a mildly crowded lower arch. In the occlusion, she had a 50% overbite and a 3 mm overjet. The molar relationship was Class I. The dental midlines were concordant with each other and with the face, and no mandibular shift was detected on closure. There was no relevant history of any medical problem.

Cephalometrically, the patient had a mild Class II skeletal relationship with slight retrognathism of the mandible (ANB angle, 5°). The maxillary and mandibular incisors were mildly proclined, resulting in decreased interincisal angle [Figure 3a and Table 1]. The panoramic radiograph showed all permanent teeth, including the maxillary and mandibular third molar. Both maxillary canines had well-developed roots, were impacted at the level of the roof of the palate, and were mesially angulated and crossed the roots of the maxillary lateral incisors. The maxillary right canine was positioned higher and was more severely mesioangulated than the left [Figure 4a]. A horizontal tube shift technique with periapical radiographs confirmed that both impacted maxillary canines were in the labial position [Figure 5a].
Treatment objectives and plan
The objectives of orthodontic treatment for the patient were to erupt the labially impacted maxillary canines, level, and align the arches, obtain normal overjet, and overbite, and achieve a well-intercuspated bilateral Class I canine occlusion. Based on the patient’s overall analysis and soft tissue profile, it was determined that a nonextraction orthodontic treatment plan would be the best approach. It was decided to expose the canines surgically and bond attachments to aid their eruption with light forces. Toward the end of finalizing the upper arch, the lower arch would be bonded and interarch finishing achieved with minimal impact on the soft tissue profile.

Treatment progress
After completing the oral prophylaxis, preadjusted edgewise appliance attachments (0.022 inch slot, Roth prescription) were placed on the maxillary premolars and first molars. Sectional arches were used to start aligning the buccal segments. After alignment, both labially impacted maxillary canines were surgically exposed with a wide mucoperiosteal flap, similar to that described in the closed-eruption technique. Bondable buttons were bonded to them, and 0.010 inch stainless steel ligature wires were braided from these buttons [Figure 6a]. The surgical flap closure was carefully done to avoid a poor periodontal mucosal attachment. After 1 week traction was started. A sectional spring was made with 0.017 × 0.025 inch TMA for distal movement of the crown of the canine away from the root of lateral incisor. The braided ligature strands from the maxillary canines were lightly tied with elastic module to free end of spring [Figure 6b]. The force level for the distal traction of canines was kept around 2 oz. Preformed transpalatal arch was used to augment the anchorage. After repeated activation with light forces, periapical radiographs were taken to monitor progress.

After the crowns of canines moved away from root of lateral incisor, vertical eruption of canines was planned. The cantilever spring were made from 0.017 × 0.025 inch TMA for vertical eruption [Figure 6c]. The cantilever spring was activated with force level of 60–80 g. When the both canines sufficiently moved vertically then deciduous canines were extracted. The maxillary incisors and canines were then bonded (0.022 inch slot), and continuous 0.014 inch nickel-titanium archwire was placed for alignment, which was later replaced by 0.018 inch and 0.017 × 0.025 inch nickel-titanium archwire [Figure 6d]. In the mandibular arch, the primary alignment and leveling were achieved with a sequence of 0.014 and 0.018 inch

![Figure 1: Facial photographs: (a) Pretreatment; (b) Posttreatment](image-url)
nickel-titanium archwires, which were later replaced by rectangular nickel-titanium archwires (0.016 × 0.022 and 0.019 × 0.025 inch). After proper alignment and leveling, finishing, and detailing was done with 0.019 × 0.025 inch stainless steel archwire with artistic positioning band and individualized torqueing for maxillary lateral incisors and canines [Figures 2b, 4b, and 5b]. After finishing archwires were sectionalized, and the occlusion was allowed to settle; then the patient was debonded. Retention was instituted with maxillary and mandibular 3–3 lingual bonded retainers. Total active treatment time was 22 months.

Treatment results

The impacted teeth were positioned into proper alignment with the assistance of direct traction, producing a complete anterior dentition with good alignment of the gingival margins and the improved smile [Figure 1b]. Bilateral Class I canine relationships and ideal overjet and overbite were obtained [Figure 2c]. The cephalometric analysis at the end of the treatment and comparison of the pretreatment and the posttreatment cephalograms [Figures 3b and 7, Table 1] showed that the patient maintained a good skeletal relationship and improvements in the overjet and overbite relationships from the treatment. The posttreatment panoramic view and IOPA radiographs showed the roots of the teeth in both arches to be well angulated and aligned [Figures 4c, 5c and 8]. Periodontal health was not compromised.

Discussion

Maxillary permanent canines are important for an attractive smile and are also essential for a functional occlusion. Therefore, extraction of the labially impacted canine is
generally contraindicated because it can complicate and compromise the orthodontic result and limit the possibility of providing the patient with a functional occlusion. Impacted maxillary canines most commonly require surgical exposure and orthodontic guidance during eruption.\cite{3} However, bringing an unerupted or impacted maxillary canine into the occlusion should not be the only goal in managing these teeth. The aim should be to attain proper occlusion, a healthy zone of attached gingiva, and ideal alveolar bone height.\cite{7}

**Figure 4:** Panoramic radiographs: (a) Pretreatment; (b) During treatment; (c) Posttreatment

**Figure 5:** IOPA radiographs: (a) Pretreatment; (b) During treatment; (c) Posttreatment

**Figure 6:** Intraoral photographs: (a) Surgical exposure of impacted canines and placement of bondable button on them; (b) 0.017 × 0.025 TMA spring for distal traction of crown of canines; (c) 0.017 × 0.025 TMA cantilever spring for occlusal movement of crown of canines; (d) After eruption of canines alignment with continuous archwire
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In the surgical management of the impacted maxillary canine, the choice of flap was either closed-eruption or an apically positioned flap to expose the tooth. Closed-eruption is the surgical method of choice for very high, labially placed maxillary canines. Labially impacted maxillary teeth uncovered with an apically positioned flap technique have more unesthetic sequelae, such as increased clinical crown length, decreased width of attached tissue, gingival scarring, and intrusive relapse than those uncovered with the closed-eruption technique. The closed-eruption technique used in this patient seemed to be a good surgical choice.

Many methods to erupt impacted canines into proper alignment have been discussed in the literature. In the present case report, the successful treatment of a buccally impacted maxillary canine using the different type of spring was presented. In our patient initially, it is necessary to move the crown of canine away from lateral incisors to minimize any damage to root of lateral incisors. For this purpose, we have designed a sectional spring from 0.017 × 0.025 TMA, which is shown to be effective. Light force is delivered from both the preactivation of spring and elastic module effectively. When the distal traction of crown of canine is accomplished, we have planned for occlusal movement of canine by the use of cantilever spring. The cantilever spring was easy to fabricate and biomechanically efficient for occlusal movement of buccally placed canine. When tied to the braided ligature strands, the stored energy in the spring generated optimum eruptive force in the occlusal direction. The segmental beta-titanium alloy cantilever spring was used to provide a point force application to the canine, a low load-deflection rate, and a large range of activation. In this statically determinate force system, the buccal segments were more efficiently managed, and intrusive side-effects were distributed over a wider area to minimize the clinical side effects. When the canines show the occlusal movement, the deciduous canines were extracted because up to that time they were an act as natural space maintainer.

The duration of the traction needed to resolve the impaction was 10 months, and the total treatment time was 22 months in this case. The duration of the treatment for the impacted canines was reported to change due to age, gender, molar relation, severity of impaction, amount of crowding, unilateral, and bilateral impactions. Thus, individual treatment times for the impacted canine teeth showed a large range.

**Conclusion**

Understanding the biologic principles and proper application of the biomechanics enable us to carry out challenging tooth movements. The treatment of bilaterally impacted maxillary canines presented a clinical challenge. A closed-eruption technique and the sequential traction of the impacted teeth with light orthodontic forces were effective approaches to successfully bring the teeth into occlusion.
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