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Literature Review & Case Report

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Orthodontic Management of Impacted Mandibular Canine in a Patient with Class II Division 1 Malocclusion

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ABSTRACT

Impaction of the mandibular canine is an uncommon clinical finding and poses considerable challenges in orthodontic diagnosis and management due to its rarity and variable presentation. This case report describes the orthodontic management of a 13-year-old male patient presenting with an impacted permanent mandibular canine.

Clinical examination and radiographic assessment confirmed the unfavorable position of the impacted tooth within the mandibular alveolus.

A combined surgical–orthodontic treatment approach was planned to preserve the impacted canine and restore it to the dental arch. Surgical exposure of the canine was performed, followed by controlled orthodontic traction using fixed appliances to guide the tooth into its proper position within the arch while maintaining periodontal health and minimizing adverse effects on adjacent structures.

The impacted canine was successfully aligned into the occlusal plane with satisfactory functional occlusion, improved dental aesthetics, and healthy surrounding periodontal tissues. This case highlights the importance of early diagnosis, precise treatment planning, and interdisciplinary collaboration in managing impacted mandibular canines. It also demonstrates that conservative surgical–orthodontic intervention can be an effective and predictable treatment option in adolescent patients.

Keywords: Impacted Tooth, Lower Canines, Ortho-Surgical Treatment

Introduction

Impaction of the mandibular canine is an uncommon clinical finding and, consequently, most reported cases appear in the literature as isolated case reports rather than large epidemiological studies [1,2]. Due to the rarity of this condition, available prevalence data are largely derived from aggregated analyses of individual cases reported worldwide [3]. Mandibular canine impaction has been reported to occur approximately twenty times less frequently than its maxillary counterpart [4,5].

In most instances, impacted mandibular canines are asymptomatic and are often detected incidentally during routine clinical or radiographic examination [6]. Persistence of the deciduous canine with reduced mobility is frequently the earliest clinical indicator; however, this finding may remain unnoticed until the second decade of life or later [7]. Although some reports suggest a higher prevalence among females, this observation remains inconclusive due to the lack of large-scale epidemiological studies [8].

Mandibular impacted canines exhibit a wide range of ectopic positions. While migration across the mandibular symphysis is rare, such cases have been documented, with some canines reported to have reached the contralateral side of the dental arch [4,5,9]. More commonly, impacted mandibular canines are located buccally or within the line of the dental arch, a pattern attributed to the narrow dimensions of the mandibular alveolar ridge, which limit severe buccolingual displacement [10]. In certain cases, lingually displaced canines may present clinically as a palpable swelling beneath the lingual mucosa [11].

The etiology of mandibular canine impaction is considered multifactorial. Local factors such as supernumerary teeth,

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odontomas, enlarged dental follicles, and cystic lesions particularly those associated with non-vital deciduous teeth have been implicated [12-14]. Nevertheless, in many cases no identifiable local cause is present, suggesting that hereditary factors or primary displacement of the tooth germ may play a significant role [15]. The angulation of the impacted canine has been shown to influence its migratory behavior, with greater deviation from the vertical axis increasing the likelihood of extensive intraosseous movement or midline crossing [16].

Early diagnosis is critical to improving treatment prognosis and reducing the risk of complications [6,17]. Radiographic evaluation is mandatory once clinical suspicion is raised. Panoramic and periapical radiographs provide valuable information regarding tooth position and mesiodistal angulation, while occlusal and lateral cephalometric radiographs assist in assessing buccolingual displacement and spatial relationships [18,19]. In complex cases, three-dimensional imaging may be required to accurately determine tooth position and guide treatment planning [20].

Management of impacted mandibular canines depends on several factors, including patient age, tooth position, available space, and proximity to adjacent roots [21]. Interceptive measures, such as extraction of the retained deciduous canine-with or without removal of adjacent primary teeth-may favorably influence eruption in selected cases [22,23]. When spontaneous correction is unlikely, a combined surgical–orthodontic approach is generally recommended [24]. However, due to anatomical limitations and the three-dimensional complexity of mandibular canine displacement, orthodontic correction may be challenging, and extraction may represent the most practical treatment option in certain situations [25].

Since this abnormality is relatively less frequent in the lower jaw. Aydin et al. reviewed 4,500 OPGs patients from Turkey, and managed to identify twenty cases of canine impaction in the mandible (0.44%) [4]. Grover and Lortan confirmed only eleven cases of this anomaly in 5,000 examined patients (0.22%). Another study describes five cases of impacted mandibular canines in 7,486 patients (0.07%) [5,6].

There are few reports published concerning the incidence of canine impaction in relation to gender. Aydin and Ericson observed that this disorder more frequently affects women, with male to female ratio of 1: 1.22, whereas Ericson reported a twofold incidence in women [4,7].

The aim of this study was to describe the authors' clinical experience in aligning impacted mandibular canines into the occlusal plane using fixed orthodontic appliances. A case report is presented of a patient who sought treatment at the Orthodontic Clinics of the Dental School at Al-Quds University, where comprehensive orthodontic management was undertaken.

Case Presentation

A 13-year-old male presented at the Orthodontic Clinics of the Dental School at Al-Quds University for evaluation. He had no history of dental trauma. The pretreatment facial photographs showed a short facial pattern with reduced lower facial height, a slightly chin deviation, a slightly convex facial profile caused by maxillary prognathism (Figure 1).

Figure 1: Extraoral photographs

The pretreatment intraoral photographs and dental casts showed a square arch form in both the upper and lower arches, along with a Class II subdivision on the left molar and class II canine relationship on the left side. The patient had a reduced overbite and a large overjet, trapped lower lip, exhibited lip incompetence, and reported no functional problems. Oral hygiene was fair, with mild gingivitis. Additionally, upper midline is deviated 3mm to the left, unerupted mandibular right canine and third molars (Figure 2).

Figure 2: Intraoral photographs

The panoramic radiograph and CBCT revealed a horizontally impacted canine in a buccal position below the root apex of the inferior incisors, completely covered by bone (Figure 3). The vitality test was performed, and the lower left incisor was found to be vital. Computerized axial tomography was used to plan the surgical exposure of the canine for orthodontic engagement and traction.

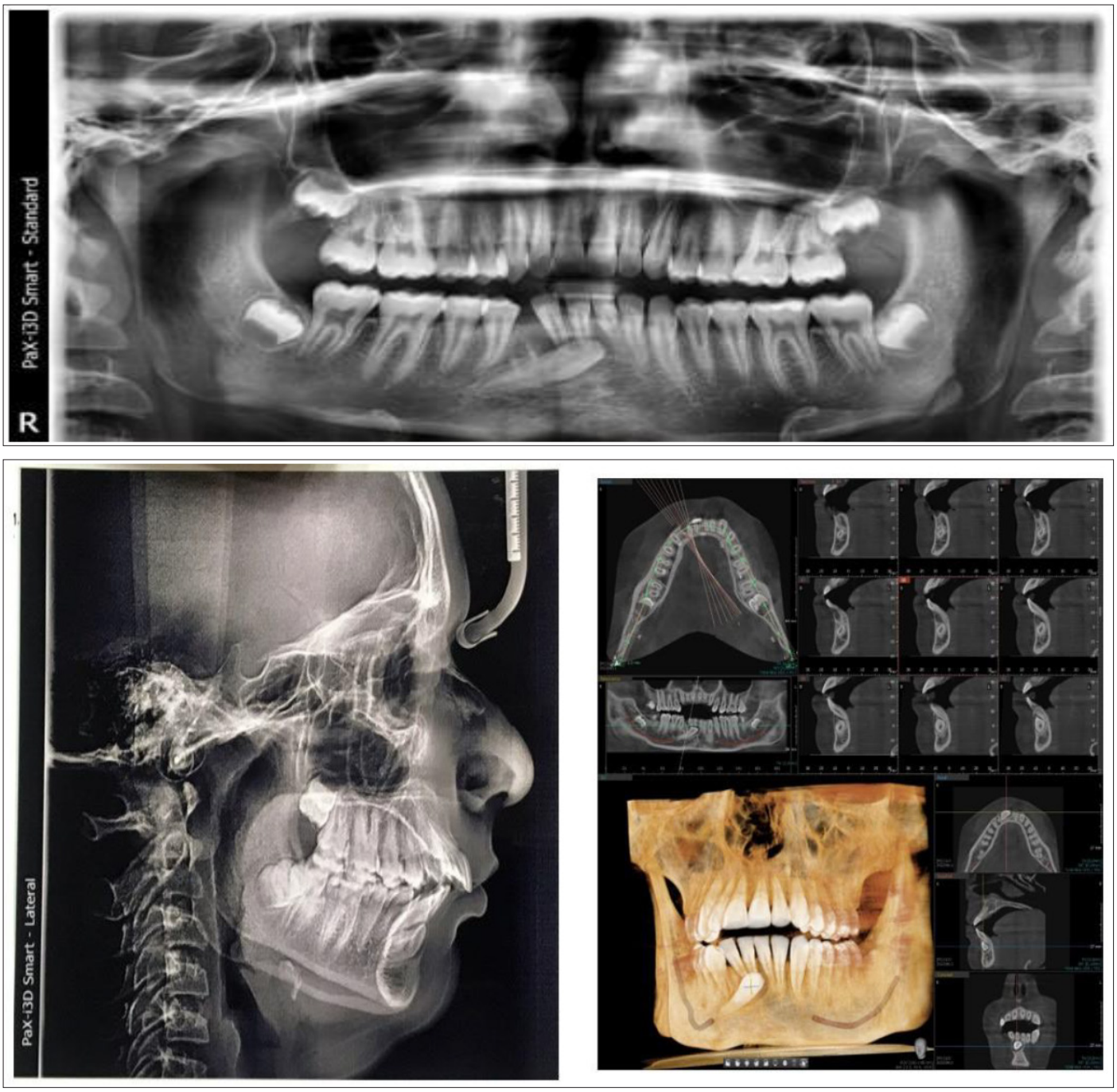

Figure 3: Pre-treatment panoramic X-ray(a), Lateral cephalometric(b) and CBCT(c)

Cephalometric tracings showed a skeletal Class II relationship (ANB angle 6◦) with reduced divergence angle (Sn-GoMe 26.2◦), maxillary prognathism (SNA angle 84◦), and a retrognathic mandible (SNB angle 76◦); the upper incisors (+1 to maxillary plane 123.8◦) and lower incisors are proclined (−1 to GoMe 109.72◦) with a reduced interincisal angle (98◦) (Figure 3).

Figure 4: Treatment Progress

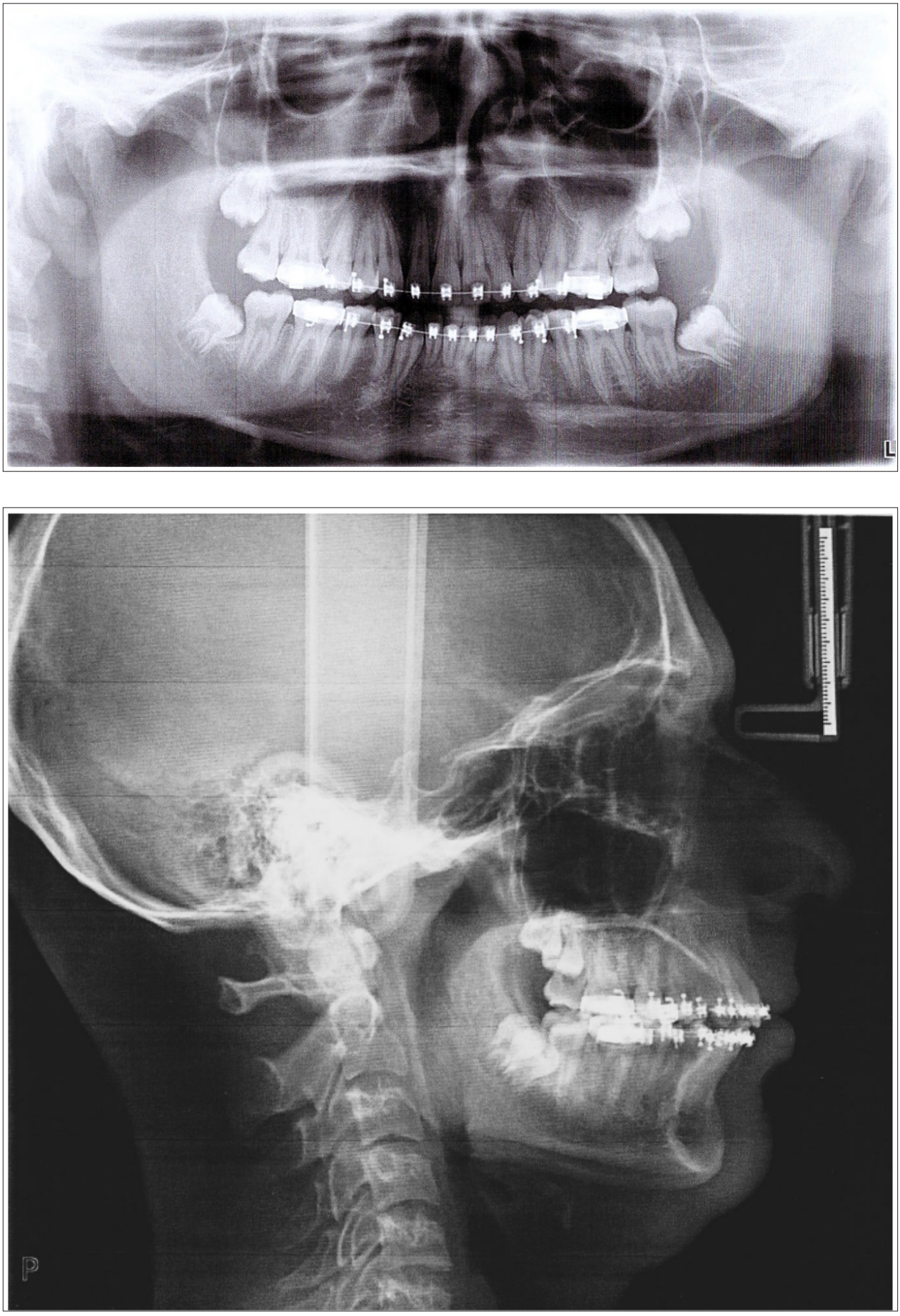

Figure 5: Final stage panoramic X-ray(a), Lateral cephalometric(b) and CBCT(c)

After clinical and radiological evaluations, the patient was diagnosed with a Class II Division 1 malocclusion, characterized by brachyfacial features, prognathic maxilla, retrognathic mandible, a reduced overbite, large overjet, proclined upper and lower incisors, impacted lower right canine, and developing wisdom teeth. The patient's request was to reduce the overjet and orthodontically correct the impacted mandibular canine.

Treatment Objectives

- Improve overjet and overbite;
- Achieve bilateral canine and molar class I occlusion;
- Increase facial esthetic balance;
- Level the arches and make both coordinate with each other;
- Orthodontic correction of the impacted lower right canine.

Treatment Alternatives

- Surgical removal of the impacted canine and close the space
- Surgical removal of the impacted canine and open space for future implant and faced crown.
- Auto-transplantation, possibly followed by endodontic treatment of mandibular left canine;

To treat the Class II malocclusion in this patient, the authors decided to use low pull headgear with longer inner bow on the left side to correct the molar relationahip [24]. An alternative treatment could involve extracting upper left 1st premolar and employing the traditional multibrackets technique for distalization [25].

In the present case, a non-extraction orthodontic treatment combined with low-pull headgear to correct the skeletal and molar relationships, but later on and due to lack of cooperation wearing the headgear, we decided to extract upper left 1st premolar to correct midline discrepancy and to achieve class I canine relationship.

Treatment Progress (Figure 4)

1. Low-pull headgear is inserted to with long inner bow to correct the molar relationship and we started with low force, so the patient can tolerate the appliance. later on, the force is increased to 500mg both sides for 16 hours per day.
2. Modified lingual arch with arm extended to the labial right side to use it for canine traction,
3. Sectional bonding of the brackets (Morelli, MBT prescription) on the posterior teeth and 0.014" NiTi wire was inserted.
4. Bonding of the upper arch with 0.016" NiTi
5. Several months later, 0.019"*0.025" SS wires were inserted in the upper and lower arches
6. Surgical exposure of the impacted canine was done gold chair was bonded and attached directly to the arm
7. Power chain was used from the arm and ligated to the chain
8. Bonding brackets on the lower incisors and placement of 0.014" NiTi wire, along with continue traction of the canine to the arm
9. 0.018 SS wire was inserted with open coil spring between lower right lateral incisor and 1st premolar to achieve the space required for the canine to be aligned in the arch.
10. Extraction of upper left 1st premolar
11. Step bend and lasso in a 0.018 SS wire to extrude the canine, along with short class II elastics on the left side to distalize the upper left canine.
12. 0.016" Niti wire was inserted in the lower arch engaging the brackets of all lower teeth
13. Several months later, after using power chains and appropriate elastics on both sides, we have achieved a good occlusion
14. Two years later, class I occlusion was achieved and the appliance was debonded and fixed retainers are bonded along with Essix retainers (Figure 8).

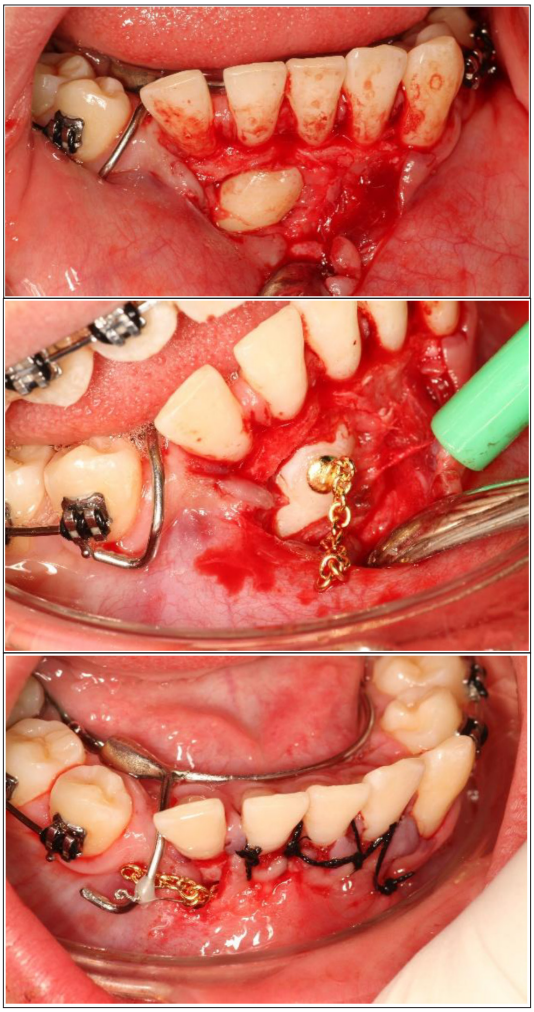

Figure 7: Surgical procedure to expose the impacted canine

Discussion

Impacted canines represent a relatively common clinical challenge in orthodontics and frequently require a multidisciplinary approach involving both orthodontic and surgical management. Among all teeth in the human dentition, canines are of particular importance due to their strategic position in the dental arch, their long and robust roots, and their key functional and aesthetic roles. They contribute significantly to arch stability, provide canine guidance during mandibular excursions, and support the overall harmony of the smile. Consequently, whenever feasible, treatment should aim to preserve impacted canines and guide them into their proper position within the dental arch. Extraction should therefore be considered only when other treatment modalities are not feasible.

The prognosis for orthodontic alignment of impacted canines depends on several factors, including the angulation of the impacted tooth, its vertical distance from the occlusal plane, and the patient's age. Favorable outcomes are generally associated

with younger patients because the surrounding bone is more responsive to orthodontic forces and the orientation of the impacted tooth tends to be more favorable. Previous studies have reported that treatment initiated after puberty may require a longer duration and may be associated with an increased risk of complications or treatment failure. In contrast, intervention during the pubertal growth phase often results in improved treatment predictability and more favorable biological response.

In the present cases, the impacted canines demonstrated mesioangular inclinations, with their cusps located at the level of the lateral incisor apices, corresponding to deep impaction levels described in the literature. Such positions typically require prolonged and carefully controlled orthodontic treatment. Nevertheless, successful alignment can be achieved when appropriate biomechanics and careful monitoring are employed. Several treatment options have been proposed for the management of impacted canines, including orthodontic traction following surgical exposure, autotransplantation, observation, and extraction. Among these modalities, orthodontic traction combined with surgical exposure remains the most conservative and widely accepted approach, as it preserves the natural tooth and allows restoration of a functional dentoalveolar relationship.

Two main surgical techniques have been described for exposing impacted canines: the open eruption technique and the closed eruption technique. The open technique provides direct visualization of the crown and facilitates bonding of orthodontic attachments; however, it may be associated with patient discomfort, gingival recession, and compromised aesthetics due to elongation of the clinical crown.

Conversely, the closed eruption technique has been shown to provide more favorable periodontal and aesthetic outcomes. By repositioning the mucoperiosteal flap after attachment placement, the impacted tooth erupts through the alveolar bone in a manner that mimics the natural eruption pathway, thereby preserving the width of attached gingiva and promoting a more favorable periodontal architecture.

Recent advances in orthodontic biomechanics have introduced skeletal anchorage systems, such as orthodontic mini-implants, which provide reliable anchorage during the traction of impacted teeth. These devices can reduce undesirable movement of adjacent teeth and improve force control during orthodontic treatment. However, successful outcomes can also be achieved using conventional anchorage systems when appropriate biomechanics and careful force application are employed.

Autotransplantation represents another potential treatment option in selected cases. The success of this procedure depends largely on the stage of root development and preservation of the periodontal ligament during transplantation. Although favorable survival rates have been reported in some studies, complications such as pulpal necrosis, root resorption, and ankylosis remain possible, particularly in teeth with complete root formation. Consequently, this technique is typically reserved for carefully selected clinical situations.

In certain circumstances, retaining the impacted canine within the alveolar bone may be considered, particularly when the tooth is asymptomatic, deeply positioned, or when surgical intervention may compromise adjacent structures. This approach may also be appropriate when a retained deciduous canine remains functional and aesthetically acceptable. However, impacted teeth left in situ require periodic clinical and radiographic monitoring, as long-term complications such as ankylosis or root resorption of adjacent teeth may occur.

Extraction of the impacted canine represents the final treatment option and is usually indicated when the tooth is severely displaced, morphologically abnormal, ankylosed, or associated with pathological lesions such as cysts or tumors. However, removal of the impacted tooth may lead to significant bone loss, potentially complicating future orthodontic, prosthetic, or implant-supported rehabilitation.

Although the principles of treatment are similar for both maxillary and mandibular impacted canines, important anatomical differences must be considered during treatment planning. The mandibular bone is generally denser than the maxillary bone, particularly in the anterior region, which may necessitate the application of greater orthodontic forces and may prolong treatment duration. Additionally, regaining sufficient space in the mandibular arch may be more challenging than in the maxilla, occasionally requiring extraction of adjacent teeth to facilitate alignment.

The treatment of impacted canines is also associated with potential complications, including gingival recession, root resorption of adjacent teeth, pulpal necrosis, and failure of orthodontic attachments. Gingival recession following orthodontic extrusion has been associated with the surgical technique used for exposure and the extent of soft tissue removal. Contemporary surgical approaches emphasize minimally invasive exposure and preservation of the periodontal tissues in order to optimize aesthetic outcomes.

Root resorption of adjacent teeth is another frequently reported complication, particularly when the impacted tooth is located in close proximity to the roots of neighboring teeth. Excessive orthodontic forces may further increase this risk. Therefore, accurate diagnosis and treatment planning are essential. Cone-beam computed tomography (CBCT) has become an invaluable diagnostic tool in such cases, as it allows precise three-dimensional evaluation of the impacted tooth position and its relationship with adjacent anatomical structures.

Ultimately, successful management of impacted canines depends on early diagnosis, comprehensive treatment planning, and the application of controlled orthodontic mechanics that respect the biological limits of the supporting tissues. When these principles are followed, orthodontic traction of impacted canines can effectively restore functional occlusion, maintain periodontal health, and significantly improve the aesthetic outcome of the dentition.

Conclusion

Impacted mandibular canines are relatively rare and often present significant therapeutic challenges. When feasible, surgical exposure followed by orthodontic traction represents an effective treatment approach for repositioning the impacted

canine into the dental arch, thereby improving both occlusion and aesthetics. In selected adult patient, the use of Headgear and Class II elastics facilitate the dentoalveolar correction while minimizing undesirable vertical side effects.

Although such treatment may be prolonged and requires a high level of patient compliance, the outcomes can demonstrate favorable efficacy, functional stability, and satisfactory aesthetic results. Early diagnosis and careful interdisciplinary collaboration between the orthodontist and oral surgeon are essential to minimize complications and ensure optimal treatment outcomes.

Figure 8: Post-treatment extraoral and intraoral photos

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