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Case Report Article

Orthodontic treatment with extraction of ectopic canine replaced by premolar

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Abstract

Introduction: Ectopic mandibular canines are a rare condition that has been little documented in the literature, and their treatment can be challenging for clinicians. **Case report:** The present article reports on the treatment of an ectopic mandibular canine (43) located transversely to the midline in the chin region in an upright patient with Class II malocclusion with biprotrusion and severe crowding. It was decided to extract the ectopic canine in the lower arch, together with the removal of three premolars, to correct the crowding without prejudice to the inclination of the incisors. As well as correcting the negative discrepancy, extraction treatment can also improve facial balance and profile. **Results:** After two years' follow-up, the case is stable with satisfactory results. **Conclusion:** Clinicians must use their judgement to consider if orthodontic traction of a tooth in the lower arch is feasible or outweighs its cons. The replacement of a canine by the premolar in the lower arch can be achieved without aesthetic or functional compromise.

Introduction

Canine ectopia is a rare condition, observed in approximately 3% of the population, with a higher incidence in females [8]. The prevalence of impacted upper canines ranges from 0.9% to 5%. Ectopia of the lower canine is a less studied anomaly compared to the upper canine, as indicated by the scarcity of reports in the literature [7]. Furthermore, it has been noted that the occurrence of ectopic lower canines is considerably rarer than that of upper canines, and often this condition does not affect the contralateral tooth [3, 18]. The etiology of this condition may be associated with local pathologies, the presence of hard tissue at the eruption site, a history of trauma, limited space availability in the arch, rotation of permanent tooth germs, premature closure of root apices, and hereditary or genetic factors [2, 7].

The resorption of lateral incisors is a major concern in cases of canine impaction, as previous studies have shown an increased risk of root resorption ranging from 8.20% to 89.61%, with varying degrees of severity. Additionally, 30.9% of these cases may involve severe resorption [19]. Clinicians should consider this risk when planning the treatment of impacted canines, as there is not only the possibility of treatment failure but also the potential for damage to teeth that are already properly positioned in the dental arch [3, 7].

The treatment of impacted permanent canines in the upper arch has been extensively studied and includes options such as maxillary disjunction, extraction of the impacted canine, or orthodontic traction [11]. However, these treatment options are challenging or unfeasible in the lower arch, primarily due to anatomical limitations, such as a smaller vestibulolingual distance between the cortical plates and the availability of spongy bone, the proximity of the roots to the crown of the impacted tooth, and the difficulty in gaining space through expansion procedures and tooth projection. Furthermore, the choice of treatment should consider the risks that this approach may entail, as cases of impacted canines in the lower arch often present a risk of root resorption or periodontal problems, which may involve dehiscences or gingival recessions [7, 11, 14, 19, 21]. Such limitations often place the clinician in a situation where the decision regarding the space-gaining strategy for case correction involves invasive procedures, such as tooth wear or extractions.

The extraction of permanent teeth is a delicate decision that should be based on prior evidence, the clinician's experience, and the specificities of the case at hand [3]. This decision may lead to biomechanical difficulties in closing spaces left by extracted teeth, longer treatment times, increased risk of root resorption, and the potential for negative impacts on the aesthetics of the facial profile [7, 14, 21, 22].

The use of resources such as guidelines and clinical decision flowcharts can be helpful as guidance for making the best decision. Evidence-based dentistry divides this decision-making process into three pillars: professional experience/scientific evidence/patient's opinion [7]. Currently, the literature lacks high-quality evidence that can support clinical decisions in the treatment of lower canine ectopias and impactions. Successful treatment reports of this malocclusion serve as primary references for clinicians.

The objective of the present study is to discuss the approach to a patient with a lower ectopic canine treated with extraction and subsequent orthodontic correction.

Case report

Diagnosis and treatment planning

A 12-year-old female sought orthodontic treatment at a private practice. In the extraoral evaluation, a mesofacial pattern and a Class II profile, division 2, without asymmetries, were observed. The intraoral assessment revealed a Class II-2 malocclusion, left subdivision, with deep bite and 80% coverage of the lower incisors. A mild upper arch atresia was noted, along with severe anterior crowding (figures 1 and 2). The anterior teeth were biprotrusive (Interincisal angle: 105º), and the lower midline showed a deviation to the right Radiographic exams further disclosed infraocclusion of teeth 13 and 23, buccal impaction of tooth 43, and proximity of the crown to the roots of the lower incisors (figure 3).

Figure 1 – Initial patient presentation displaying a mildly vertical Class II profile characterized by mandibular retrusion, visible crowding, and midline deviation

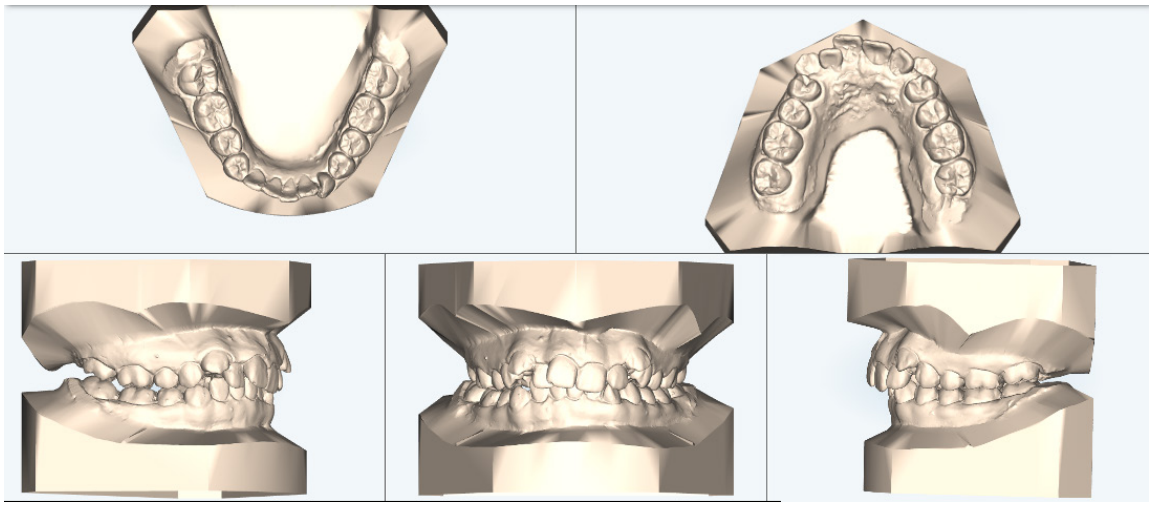

Figure 2 – A Class II left subdivision molar relationship was present with anterior crowding, and infraocclusion of upper canines. The lower right canine was not visible in the arch

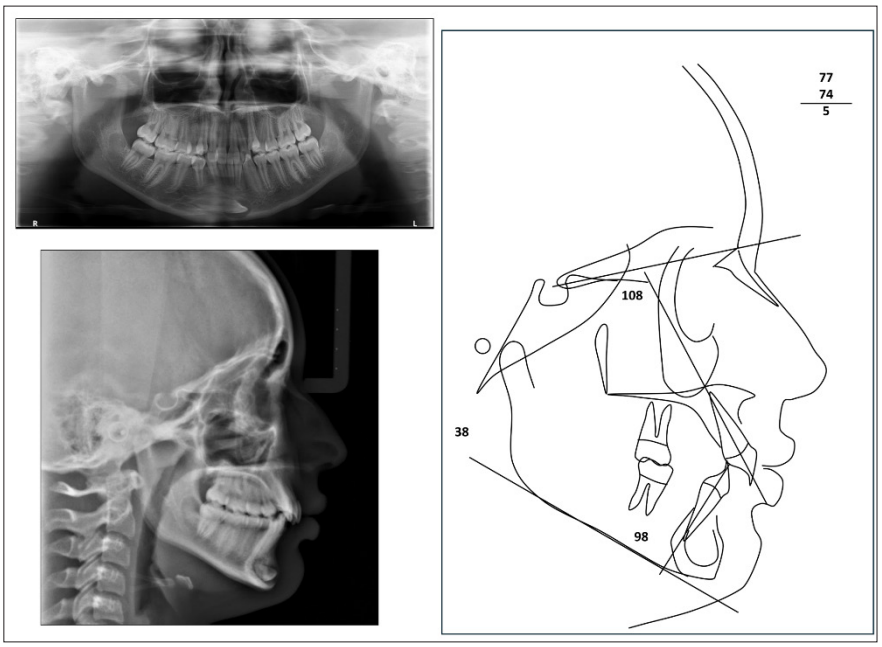

Figure 3 – Panoramic and teleradiographs reveal the lower right canine transverse to the lower midline and vestibular to the lower incisors. The tooth was positioned perpendicularly beneath the apexes of the lower incisors, with advanced root formation. The patient exhibits a slightly vertical growth pattern and a retrognathic mandible

Following the clinical decision tree proposed by Dalessandri *et al*. [7], the decision was made to extract the transposed canine (figure 4). The proposed treatment plan, accepted by the patient and her legal guardian, involved extractions to create space without the need for significant anterior inclination of incisors. The selected teeth for extraction were the upper and lower left first premolars, along with the lower right canine (14, 24, 34, and 43). The choice of extracting the upper premolars was due to crowding, the extraction of lower right first premolar aimed at correcting the lower midline, and the extraction of the lower right canine was necessary due to its impaction.

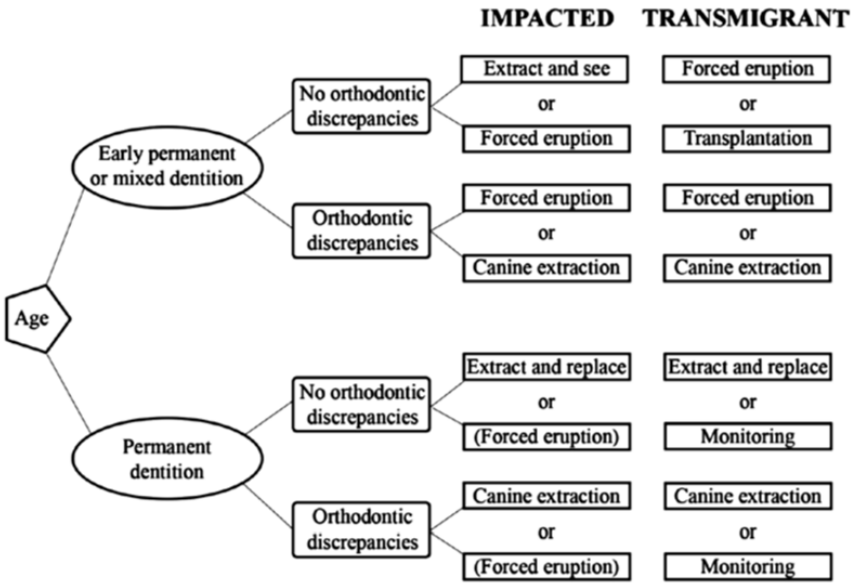

Figure 4 – The clinical decision tree proposed by Dalessandri *et al*. [7] supports the extraction of the lower right canine. Despite the potential for monitoring, orthodontic movement of the lower incisors could pose a risk of root contact with the canine crown and subsequent resorption

Another treatment options were presented: a more conservative approach involving upper arch distalization and incisor proclination could be employed, utilizing skeletal anchorage to create space for the upper canines. Nevertheless, this approach would lead to a clockwise rotation of the mandible, accentuating the vertical component in the patient. Given the patient's existing deep bite, pursuing posterior intrusion for vertical control would have complicated the correction of the deep bite.

The decision to protrude incisors in this treatment plan would be unfavorable, especially considering the initial proclination of these teeth. Additionally, opting for a non-extraction treatment would necessitate the traction of the lower right canine. This, in turn, would extend the treatment time and increase complexity, posing a risk of unsuccessful outcomes.

Treatment progress

A fixed metallic orthodontic appliance with Roth Max prescription and a 0.018" slot was bonded to both the upper and lower arches. After the extraction of upper first premolars, upper canines were tractioned to correct infraocclusion, utilizing a 0.012" nickel-titanium arch overlying a segmented stainless-steel arch of 0.016x0.022" (figure 5A). The lower left canine was distalized to facilitate the correction of the lower midline, and the lower right first premolar was mesialized to replace the canine in the same quadrant.

To address the deep bite, lower incisors were intruded, maintaining the favorable exposure of upper incisors for a young female patient. Additionally, the correction involved the intrusion of lower incisors, with manual compensatory torques applied during the finalization to achieve functional guides. The brackets on the upper lateral incisors were subsequently upside-down to purposefully apply vestibular root torque, addressing the observed flaring of these teeth during the finalization process (figure 5B).

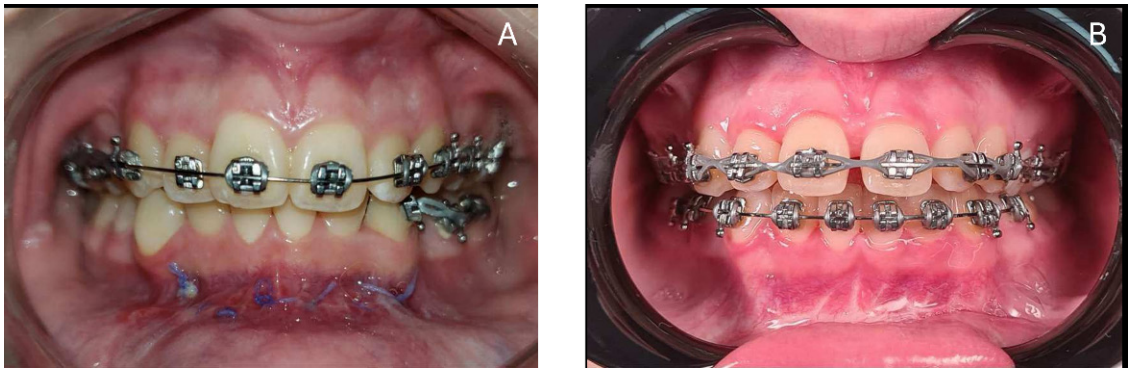

Figure 5 – A) Patient after the lower canine extraction, employing segmented mechanics in the lower arch to prevent undesirable root movement of the lower incisors; B) retraction of upper incisors with resistant torque, highlighting the inverted bonding of the lateral for root verticalization

The patient's challenging socioeconomic circumstances significantly influenced her healthcare journey. Raised by her aunt amidst financial struggles, accessing treatment in her hometown proved arduous, necessitating care in the capital city. Complicating matters, she learned of her pregnancy during treatment, prompting a postponement of surgery to mitigate fetal exposure to radiation per her obstetrician's counsel. This unexpected event temporarily disrupted her adherence to treatment, amplifying the economic burdens already weighing heavily upon her. This unexpected event temporarily disrupted her adherence to treatment, amplifying the economic burdens already weighing heavily upon her.

After childbirth, our team managed to bring her to our clinic after several attempts to contact her, and a commitment was made to expedite the finalization process with the aim of removing the device as soon as possible.

Treatment results

The treatment yielded coincident midlines and Class I molars. Notably, there was no increase in the proclination of incisors, as confirmed by the teleradiograph. Upon removal of the appliance, the patient demonstrated functional anterior and lateral guides, with unimpeded right lateral movement on tooth 44 (figures 6, 7 and 8). Cephalometric

changes observed during the treatment included a slightly more protruded mandible with clockwise rotation, likely attributed to growth and some molar extrusion. The profile exhibited harmony, featuring a reduced initial overjet and improved lip relationship (figure 9 and table I).

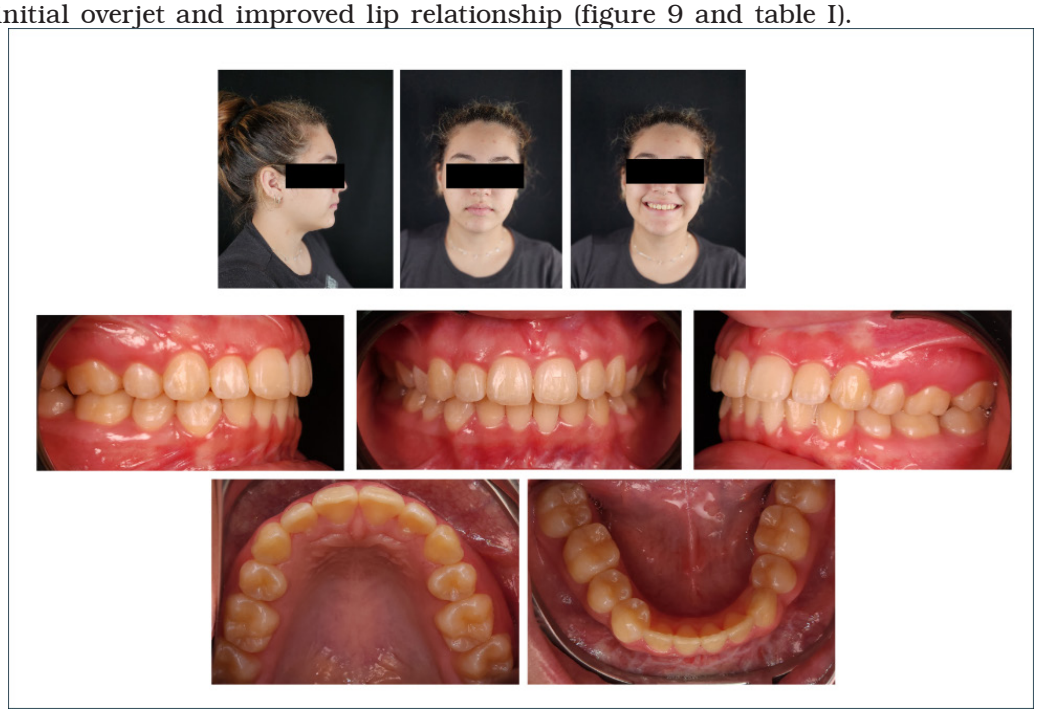

Figure 6 – Final photographs of the patient, showcasing a favorable profile with good lip relation and an aesthetic smile

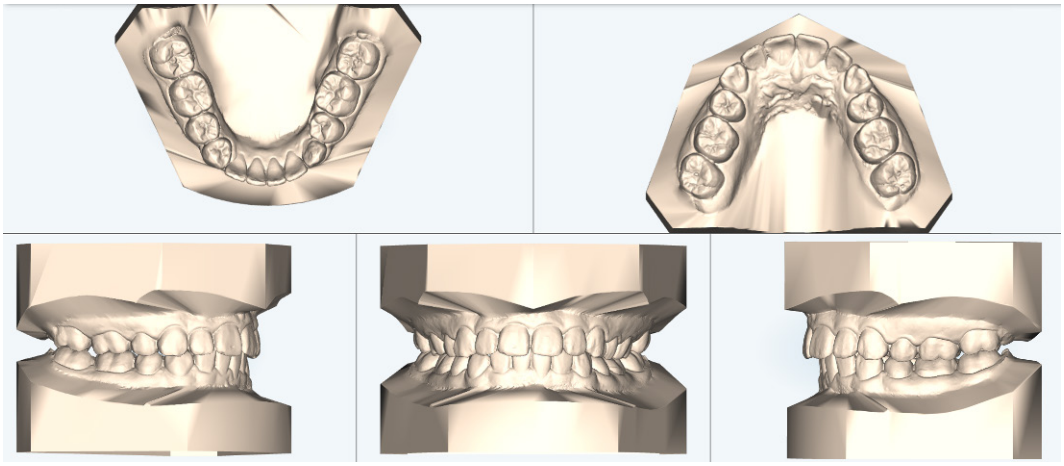

Figure 7 – Final occlusion of the patient reveals coincident midlines, a good incisor relationship, and Class I occlusion of molars and left canines. The right side shows a Class I relationship with the lower premolar in place of the canine and functional disocclusion guides

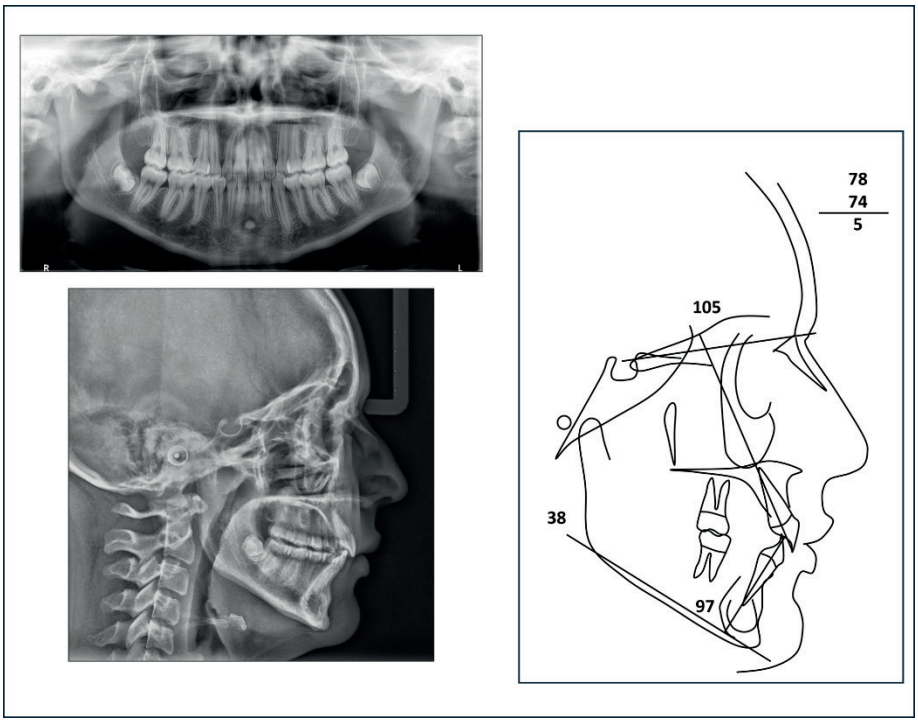

Figure 8 – Following the lower canine extraction, a bone callus is present but does not impact the patient's overall occlusion and oral health (A). The teleradiograph shows a shallow bone callus anterior to the lower incisor apexes, with no proximity issues. The patient's vertical pattern is maintained, with no increase in lower facial height, and a favorable lip posture is achieved

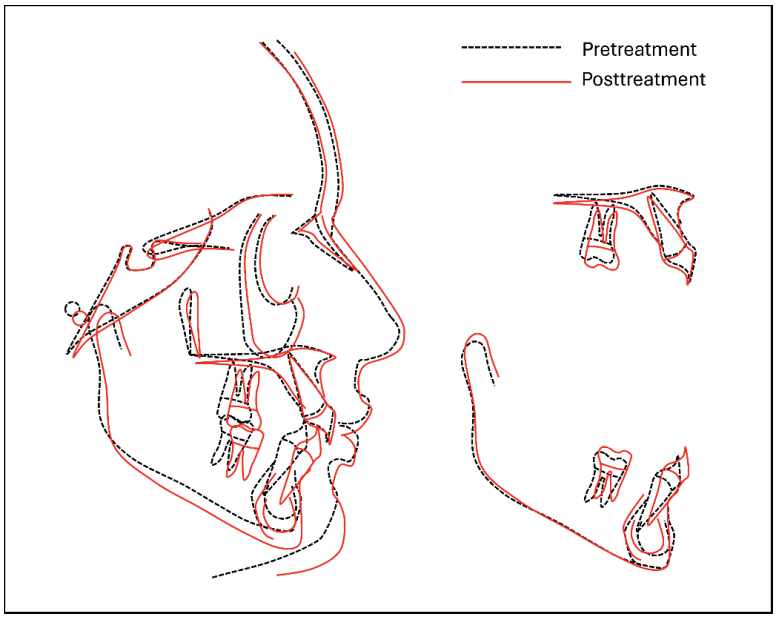

Figure 9 – Cephalometric superimposition reveal a slightly clockwise rotation of the mandible due to extrusion of upper and lower molar teeth. Due to this, there was an extrusion of the lower incisors despite the initial overbite to achieve functional anterior disocclusion guides. The profile improved with mandibular growth and torque control of incisors during treatment

Table I – Cephalometric measurements before and after treatment. It was possible to correct the dental crowding without compromising the patient profile as observed on the dental and facial analysis

Measurement	Norm	Initial	Final
Skeletal analysis			
SNA (º)	82±3.5	77	78
SNB (º)	80±3.2	70	74
ANB (º)	2±1.8	5	5
Sn-MP (º)	33±1.8	38	41
Dental analysis			
U1-NA (mm)	3.9±2.1	0.5	0.3
U1.Sn (º)	108.2±5.5	108	105
L1-NB (mm)	6.6±2.8	0.5	0.7
L1-MP (º)	96.8±6.4	98	97
Facial analysis			
E-Line/UL (mm)	-1.1±2.2	0.2	0.5
E-Line/LL (mm)	0.5±2.5	0	0.5

During a 2-year follow-up, the patient demonstrated stability and satisfactory results, with no changes in incisor inclination or the development of diastemas.

Discussion and Conclusion

In the presented clinical condition, the extraction of the impacted tooth and its replacement with a premolar was deemed necessary. Upper arch extractions were also performed to address dental biprotrusion, resulting in a case concluded with functional disocclusion guides and an aesthetically pleasing smile and profile.

The lower right canine presented a challenging diagonal position in the mentum region, crossing the midline, with 2/3 of the root formed, making its traction challenging. Instead of pursuing the conventional approach of extracting the lower right first premolar (tooth 44), an atypical extraction of the lower right canine was chosen [6].

Discrepancies exceeding 4 mm may warrant premolar extractions, as obtaining the necessary space for correcting crowding through dental expansion and projection could lead to increased instability, higher risks of dehiscence and gingival retractions, and a deterioration of the patient's profile [7, 14, 21]. In this specific case, the dental discrepancy was considerable, exceeding 6 mm, and the patient already presented pronounced incisor proclination initially.

Previous reports support the choice of premolar extraction for correcting Class II subdivision malocclusions, proving to be significantly more effective [9, 14, 17]. However, the prolonged treatment time and biomechanical challenges inherent in closing spaces after extractions should be considered when opting for extractions to correct severe crowding [21].

Although previously reported, distalization of the upper segment and mesialization of the lower segment for Class II correction [10, 12, 13, 17] would not be a favorable approach for the present case. The patient's lower dental projection made mesialization of this arch impractical. Additionally, the vertical growth pattern rendered upper distalization undesirable due to the resulting clockwise rotation of the mandible [5]. Moreover, the alternative of tractioning the impacted tooth could pose risks such as incisor resorption, gingival dehiscence, and a considerable possibility of failure [15].

Following the extraction of the impacted canine, the decision was made to replace it with a premolar, serving both aesthetic and functional purposes. The replacement of a lower canine with a premolar has minimal aesthetic impact due to their anatomical similarity. Furthermore, maintaining right lateral disocclusion on the premolar did not compromise group guidance. Previous reports suggest that this approach does not lead to periodontal issues for the involved premolar, making it a clinically interesting treatment option [15, 20].

The choice of extractions in orthodontic treatment does not inherently result in a compromised patient profile. Torque control played a pivotal role

during retraction and finalization, ensuring the establishment of a harmonious relationship between upper and lower incisors [1]. In this case this was achieved with differential bonding of lateral incisors and manual torque. This meticulous torque control positively influenced the patient's profile during the finalization phase. Previous reports emphasize the significance of torque control in extraction cases for preserving aesthetic outcomes [22]. In this specific case, the combined factors of mandibular growth improvement and careful management of incisor inclination were essential for sustaining an aesthetically pleasing profile post-treatment. Applying manually resistant torque is an important measure to avoid loss of incisor inclination which could lead to closing the overjet gap without bodily movement of teeth. Despite all its advantages, the straight-wire system has flaws pertaining the materials employed in this technique, since brackets and wires have imperfections in their manufacturing that can lead to slot shape and dimensions that deviate from the prescriptions [4, 16].

Ultimately, the outcomes in cases involving extractions are more significantly influenced by factors such as meticulous planning, the skill of the operator, and the employed mechanics, rather than simply attributing the potential for a compromised profile to extractions alone. The success of the treatment hinges on the careful consideration of these elements, emphasizing the importance of a comprehensive approach beyond the decision for extractions.

The traction of impacted teeth can involve considerable biological and time costs. In the current clinical scenario, the proximity of the lower right canine to the roots of the lower incisors was a significant factor that influenced the patient's decision to opt for extraction. The replacement of the extracted tooth with the first lower right premolar proved to be functionally satisfactory without compromising aesthetics for the patient. Throughout a 2-year follow-up, the case exhibited stability, maintaining disocclusion guides, a molar key, and the alignment and leveling achieved during the treatment.

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