Bilateral transposed and impacted upper canines: case report

Transposición bilateral e impacto de los caninos superiores: reporte de caso

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ABSTRACT
The aim of the study was to report, through a clinical case, the treatment of bilaterally impacted upper canines. A 9-year-old patient presented with prolonged retention of deciduous canines. Radiographic analysis revealed bilateral and
horizontally impacted canines. After extraction of the deciduous teeth and access to the impacted canines, a transpalatal bar associated with a cantilever was used for traction without compromising neighboring teeth. Due to the location and complexity of the case, the upper canines underwent transposition with the first premolars. The lower arch was aligned and exhibited diastemas, which were treated with elastomeric chains and bull loops for space closure. The treatment goals were achieved with excellence in aesthetics, function, and healthy periodontal conditions.

Keywords: Impacted canine teeth, upper canine, orthodontics.

RESUMO
O objetivo do estudo foi relatar, por meio de um caso clínico, o tratamento de caninos superiores impactados bilateralmente. Paciente de 9 anos apresentou retenção prolongada de caninos deciduos. A análise radiográfica revelou caninos bilaterais e horizontalmente impactados. Após a extração dos dentes deciduous e o acesso aos caninos afetados, uma barra transpalatal associada a um cantilever foi usada para tração sem comprometer os dentes vizinhos. Devido à localização e complexidade do caso, os caninos superiores passaram por transposição com os primeiros pré-molares. O arco inferior foi alinhado e exibiu diastemas, que foram tratados com cadeias de elastômeros e laços de touro para o fechamento do espaço. Os objetivos do tratamento foram alcançados com excelência em estética, função e condições periodontais saudáveis.

Keywords: Dentes caninos impactados, caninos superiores, ortodontia.

RESUMEN
El objetivo del estudio fue reportar, a través de un caso clínico, el tratamiento de los caninos superiores impactados bilateralmente. Paciente de 9 años con retención prolongada de caninos caducos. El análisis radiográfico reveló caninos impactados bilaterales y horizontalmente. Después de la extracción de los dientes caducífolios y el acceso a los caninos impactados, se utilizó una barra transpalatal asociada con un voladizo para la tracción sin comprometer los dientes vecinos. Debido a la ubicación y complejidad del caso, los caninos superiores se transpusieron con los primeros premolares. El arco inferior estaba alineado y presentaba diastemas, que se trataban con cadenas elastoméricas y bucles alcistas para el cierre del espacio. Los objetivos del tratamiento se lograron con excelencia en estética, función y condiciones periodontales saludables.

Palabras clave: Dientes caninos impactados, caninos superiores, ortodoncia.
1 INTRODUCTION

In dental development, anomalies are commonly influenced by genetic, epigenetic, and environmental factors (BROOK, 2009). In upper canine impactions, genetic factors play a significant role in development (CHUNG; WEISBERG; PAGALA, 2011). They are very prevalent in orthodontic patients and can range from a delay in tooth formation and eruption to the complete absence of permanent teeth (PECK, 2009). Eruption, canines may present some anomalies, such as ectopic eruption, transposition, agenesis, and impaction (JAIN; DEBBARMA, 2019).

Tooth impaction is a condition in which a tooth remains embedded in the alveolar bone and is unable to erupt into the oral cavity at the expected time (LITSAS, 2011). An impacted tooth can be positioned correctly or displaced, while an ectopic tooth is always displaced. It is possible to predict that severely ectopic teeth will become impacted, even if the expected developmental window has not yet passed (LÖVGREN et al., 2019).

Dental transposition is defined as a change in the normal position of a tooth during its development, erupting in place of another permanent tooth (SHAPIRA; KUFTINEC, 1989). Considering that transposition in the maxilla, it is always the result of displacement and ectopic eruption of the upper canine and it can occur in two ways: either complete transposition, where the crown and root completely change position in the arch, or incomplete, partial, or pseudo transposition, where the crown changes position but the apex remains in the normal position (SHAPIRA; KUFTINEC; STOM, 2001).

The upper canine is the most commonly impacted tooth, followed by the lower canines, excluding third molars (ZOUBI et al., 2019), often unilateral and in female patients, affecting 1.7–4.7% of the population (LÖVGREN et al., 2019), and have a prevalence of 8.0% to 10.0% bilaterally (BISHARA; ORTHO., 1992; QUIRYNEN et al., 2000). Impaction compromises aesthetics, phonetics, loss of arch length, and causes referred pain (BISHARA; ORTHO., 1992). It is of great importance for an ideal and mutually protected occlusion, in addition to the continuous aesthetics of the dental arch (POKORNY; WIENS; LITVAK, 2008).
Treatment time may increase due to the mechanics used for impacted canines to reach the oral cavity, also increasing treatment costs (ZUCCATI et al., 2006). Therefore, early diagnosis is essential for a better treatment approach, especially in cases where canines are palatinized, and spontaneous correction occurs in two-thirds if interceptive treatment is initiated, and the deciduous tooth is extracted in time (NAOUMOVA; KUROL; KJELLBERG, 2014). In a meta-analysis, it is concluded that the location and angle, i.e., the initial mesial and horizontal inclination, are useful in predicting spontaneous eruption in the palatal position of permanent maxillary canines (SHARMA et al., 2021).

Orthodontic traction of impacted canines continues to be a challenge as it requires surgical exposure, followed by orthodontic traction to guide and align it in the dental arch. Complications can occur along this path, such as bone loss, root resorption, and gingival recession around the treated teeth (MANNE et al., 2012). When properly aligned and with good shape and size, very beautiful proportions of the front teeth and correct smile lines are obtained. As for functional aspects, the canines are equally important to support the general dentition and contribute to posterior disocclusion during lateral movements (CRUZ, 2019).

The objective of this case report was to present the treatment plan and advance the management of orthodontic treatment for ectopically positioned and bilaterally impacted upper canines.

2 ETIOLOGY AND DIAGNOSIS

A 9-year-old patient presented with prolonged retention of a deciduous canine. Detailed radiographic evaluation was necessary to assess the impacted tooth regarding its location, angulation, and orientation for orthodontic treatment planning. Thus, intraoral and radiographic clinical examinations were used to evaluate the impacted canines (Fig.1, Fig.2). Cephalometric radiography and analysis discovered a skeletal pattern with a tendency to Class III, presenting balanced horizontal and vertical growth, buccalized upper incisors and lingualized lower incisors (Table 1).
Figure 1: 9-year-old patient, presenting a Class II molar relationship and retained upper and lower deciduous canines

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Figure 2: Pretreatment lateral cephalograms and panoramic radiographs

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Table 1. Cephalometric measurements

<table>
<thead>
<tr>
<th>Variables</th>
<th>Norm</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (°)</td>
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<td>78.90</td>
<td>80.14</td>
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<tr>
<td>SNB (°)</td>
<td>80.0</td>
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<td>82.06</td>
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<tr>
<td>ANB (°)</td>
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<td>SN.GnMe (°)</td>
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<td>34.78</td>
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<td>S-N.Gn (°)</td>
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<td>IMPA (°)</td>
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<td>13.25</td>
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<tr>
<td>L1-NB (mm)</td>
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<tr>
<td>U1/L1 (°)</td>
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<td>128.69</td>
<td>136.36</td>
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In the CBCT images, we can observe the axial and sagittal views of the maxillary canines. The right canine was retained in a horizontal position at the center of the alveolar ridge of the maxilla, with its crown oriented buccally, juxtaposed to the root of the first premolar in formation and the floor of the nasal fossa. The left canine appeared to be retained in a horizontal position at the center of the alveolar ridge. The crown was oriented towards the center, in contact with the floor of the nasal fossa and with the incompletely formed root of the first premolar (Fig.3).
Figure 3. CBCT images of the maxillary canines

According to Zoubi et al. (2019), canines can be classified into seven subtypes of impaction, and this classification is useful for planning. The majority of impacted upper canines (51%) are type II, meaning the crown is tilted mesially and pressing and tilting distally the lateral incisors. Type IV and V impactions were the rarest, where the orientation is horizontal along the axis of the canines.

Some factors influence orthodontic traction treatment, including the horizontal position of the canine, the patient's age, the buccal or lingual position, and the vertical height of the ectopic tooth (PITT; HAMDAN; ROCK, 2006). The prognosis is unfavorable if the canine is close to the midline and at an angle greater than 45°. Palatally impacted canines are generally closer to the midline horizontally and higher vertically relative to the occlusion (KUCUKKARACA, 2023).

Horizontal position of the canine occurs when the long axis of the impacted canine meets the median sagittal plane at an angle greater than 70 degrees. The horizontal displacement of the upper canine overlapping the lateral incisor root towards the midline appears to present a higher risk of impaction than the angular displacement of the canine (WARFORD; GRANDHI; TIRA, 2003). Typically, horizontally impacted or ankylosed canines are the most challenging to manage and have the poorest prognosis (BISHARA; ORTHO., 1992).
3 TREATMENT

3.1 OBJECTIVES

The objectives of the treatment were to traction the canines in the dental arch, position them between the premolars, achieve a Class I molar relationship, closure of the lower space with ideal overjet and overbite and maintain periodontal stability.

3.2 PLAN

The treatment plan involved extraction of the upper primary canines, followed by surgical exposure of the permanent canines and bonding a button. A transpalatal bar was installed to allow the use of the cantilever, which was made with TMA (titanium-molybdenum) 0.17x 0.25 for traction purposes. In the second stage, after the eruption of the upper premolars, a fixed appliance was installed. A NiTi (Nickel-titanium) spring was used to mesialize the first premolar and distalize the second premolar, thus the canine erupted between the premolars, since its location was far from its original position. The Class II relationship was correct by cervical pull headgear.

3.3 PROGRESS

The treatment commenced with a referral for surgery to attach the button to the impacted canines. Subsequently, orthodontic bands were applied to the upper molars, and a transpalatal bar and cantilevers by buccal side, were used to started the movement of pulling down the canines (Fig. 4).
After the eruption of the maxillary premolars, the fixed appliance was installed, and an open coil spring was applied to create additional space for the canines. This was done as the optimal orthodontic outcome dictated that the best position for the canines was between the premolars (Fig. 5).

When the left canine reached the oral cavity, a rectangular TMA loop was used to root correction and finished the vertical movement (Fig. 6). Fixed appliance was placed on the lower arch too, in order to reach finishing and detailing the inter arch occlusion (Fig. 7).
Figure 6: TMA rectangular loop utilized for left canine uprighting.

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Figure 7: Bonding of the lower appliance and positioning of the upper canines in occlusion.

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The lower arch was aligned and exhibited diastemas, so elastomeric chains and bull loops were applied to close the spaces (Fig. 8).
Figure 8: Bull loops and power chain used to closing spaces.

After class II correction, alignment and leveling of the arches, and positioning of the canines and premolars in occlusion, the upper and lower retainers were installed (Fig. 9).

Figure 9: Treatment completed with canines in occlusion.
4 TREATMENT RESULTS

The treatment objectives were successfully reached, achieving excellent aesthetics and functionality. The patient's primary concern was addressed using a fixed appliance and open springs, correcting the class II issue using headgear. The lower space was closed using elastomeric elastics and a bull loop. Additionally, a good overjet and overbite were achieved, along with maintaining healthy periodontal conditions.

5 CASE RETENTION

Upper removable wraparound appliance was used to retain the upper arch and 3 to 3 fixed retainer was addressed on the lower arch.

6 DISCUSSION

The first step in choosing a treatment strategy is early diagnosis. During the initial investigation phase, radiographic examinations play a crucial role, including those that are not so common, such as 3D Cone Beam Computed Tomography (CBCT). CBCT is a more accurate examination method compared to conventional radiography for locating impacted teeth, such as accurate 3D location of impacted maxillary canines and root resorption of adjacent teeth (TSOLAKIS et al., 2018). This is because 2D panoramic radiography, in some situations, does not provide enough details (MITSEA et al., 2022; WRIEDT et al., 2012). Considering the complexities, impacted canines can present a wide range of variations in their long axis and must be carefully evaluated during treatment planning (ZOUBI et al., 2019).

Therefore, 3D exams are essential for the initial assessment and precise localization of canines, as indicated by a comparative literature review between CBCT and conventional radiography for locating impacted maxillary canines (WRIEDT et al., 2012).

In this case, the diagnosis was concluded following the guidelines described in the literature regarding the indication of CBCT and panoramic radiography. CBCT is preferred among professionals for diagnosing and planning
impacted canines and provides relevant clinical information about the position of the canines, damage to adjacent teeth and severity index, with an impact on dentists’ decisions regarding biomechanics, patient education and estimation of the treatment time (KEENER et al., 2023).

As reported by Naoumova et al. (2014) in cases where a severe palatal displacement occurs (alpha angle >30 degrees, sector 4), interceptive treatment has shown a tendency towards failure. In these scenarios, a combined treatment is recommended, involving interceptive techniques, surgical exposure, and traction, aiming to reduce the risk of worsening canine impaction and minimize the possibility of root resorption in adjacent teeth. On the other hand, in situations where canines are buccally located, they are usually associated with discrepancies in arch length, and interceptive procedures can contribute to increasing this length. This is relevant to avoid, or at least reduce, the decrease in arch length during occlusal development, as highlighted by (BARROS et al., 2018)

The horizontal position, as emphasized (GRISAR et al., 2021), presents a less favorable prognosis for a successful outcome after interceptive treatment. Even after the extraction of deciduous canines, the permanent maxillary canines often assume unfavorable positions, leading us to opt for the initial surgical approach. And it still important considering the canines were placed between the premolars, mainly considering the canine apex, and it explain the alternative of switch the canines with the first premolars. The use of a cantilever was adopted in this context, and only after the eruption of premolars, we associate the fixed appliance. Cantilevers are more predictable with regard to force magnitude and direction control. Using cantilevers, the reaction was transferred to the molar areas and increased the anchorage unit and preserved any side effects on the lateral incisors, as well as the possibility of anterosuperior occlusal tilt (BURSTONE; CHOY, 2018).

As described Grisar et al. (2021), surgical techniques prove to be favorable for orthodontic treatment, allowing for the traction of canines through direct button attachment. The application of this traction can be achieved using removable or
fixed appliances, aiming to position the canines appropriately in the oral cavity. This integrated approach proves to be effective in overcoming challenges associated with the horizontal position of canines, ensuring more satisfactory results in orthodontic treatment.

Various methods are used to bring the impacted canine into the desired position. However, there is no consensus among orthodontists on how to approach impacted maxillary canines regarding diagnostic methods, surgical management, materials, and mechanics (ALQAHTANI, 2021). Thus, this case suggests an approach for complex treatment of impacted maxillary canines that may serve as guidance for orthodontists.

7 CONCLUSION

This case has shown that the orthodontic treatment of impacted upper canines is complex and requires proper orthosurgical planning to restore both aesthetics and function. Biomechanics with the initial use of cantilever and transpalatal bar is an effective combination. Each impacted canine should be carefully evaluated in terms of angulation and position for the best treatment choice.
REFERENCES


BURSTONE, J. C.; CHOY, K. Fundamentos Biomecânicos da Clínica Ortodôntica. [s.l: s.n.].


