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Case Report

Loops of logic: Segmental solution for ectopic canines -A case report

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Abstract

Ectopic eruption and impaction of the permanent maxillary canines present as a common clinical challenge in orthodontics, with a prevalence ranging from 0.8% to 2.8%. The majority of these impactions occur palatally, although labial impactions or ectopic eruptions are also encountered, particularly in cases associated with arch length deficiency. Multiple systemic and local factors have been implicated in the etiology of this condition. The complex anatomical location of maxillary canines, surrounded by critical structures and adjacent teeth, further complicates their eruption pathway. When arch space is inadequate, orthodontic extraction of premolars is a frequent intervention. However, closing the resulting spaces requires precise biomechanical planning. Segmental mechanics, a frictionless technique, offers improved control during space closure, particularly in cases with ectopic canines and proclined incisors. This case report illustrates the management of bilateral ectopic maxillary canines using first premolar extractions followed by segmental mechanics to achieve optimal alignment and occlusion.

Keywords: Ectopic eruption, Maxillary canines, Canine impaction, Palatal impaction

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1. Introduction

Ectopic eruption and impaction of permanent maxillary canines present significant challenges in orthodontic practice, due to their crucial role in arch form and smile esthetics. The reported prevalence ranges from 0.8% to 2.8%, with 85% of impactions occurring palatally and 15% labially.[1] Fournier et al. documented a palatal-to-buccal impaction ratio of 3:1.[2] Various systemic and local factors contribute to this condition[3] (**Table 1**). Surrounded by the nasal cavity, orbit, and sinus wall, the maxillary canine lies near adjacent tooth structures. Labial ectopic eruption/ impaction of canine occurs when arch length is insufficient, the developmental labial position of the tooth limits its eruption to the labial side.[4]

To manage arch length deficiency, tooth extraction is a routine orthodontic procedure, but space closure remains one of the most complex tasks. Mastery of space closure, especially after extraction, is essential for achieving ideal occlusion.[5] Two primary techniques—sliding (friction) and segmental (frictionless) mechanics—are employed. This report presents a case of ectopic maxillary canines managed with first premolar extractions and segmental mechanics for canine and incisor retraction.

2. Case Report

A 14-year-old female reported to the Department of Orthodontics & Dentofacial Orthopaedics, King George's Medical University, Lucknow, with a chief complaint of irregularly positioned upper canines and lower teeth. Her medical history was non-contributory. Dental history revealed trauma to the upper front teeth approximately 10 years ago, with no subsequent dental consultation.

2.1. Clinical examination

1. Extraoral examination revealed a mesomorphic build and leptoprosopic face, with no gross asymmetry. The patient had a convex profile, potentially competent lips, everted lower lip, and a slightly reduced nasolabial angle [**Figure 1**].
2. Intraoral findings included symmetric maxillary and asymmetric mandibular arches, crowding in both arches,

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ectopically erupted maxillary canines, and retained deciduous canines. The lower dental midline was shifted 3 mm to the right. The patient had a 5 mm overbite, 3 mm overjet, and Angle's Class I molar relationship bilaterally. Brown discoloration of the central incisors was diagnosed as Turner's hypoplasia, linked to prior trauma to the deciduous incisors [**Figure 1**].

3. Functional examination showed normal swallowing, upward and forward mandibular movement on closure, 4 mm incisor exposure at rest, and full incisor display during smiling.

2.2. Investigations

1. Extraoral and intraoral photographs, a panoramic radiograph, a lateral cephalometric radiograph and study models were obtained for diagnostic purposes. [**Figure 2**]
2. Study model analysis confirmed the clinical findings, and Carey's analysis and Arch perimeter analysis revealed discrepancies of 8 mm and 9 mm, respectively.
3. Cephalometric analysis revealed Class I skeletal relationship (ANB= 4˚, BO ahead of AO by 1.5mm, Beta angle-34), orthognathic maxilla (SNA= 83˚) and orthognathic mandible (SNB= 79˚) with reference to the anterior cranial base. Maxillary incisors and mandibular incisors were labially inclined (Mx.1 to NA 7mm/31^0 and Md.1 to NB 8mm/34^0).

2.3. Diagnosis

The case was diagnosed as Angle's Class I Type 1 malocclusion over a Class I skeletal base with ectopically erupted maxillary canines and retained deciduous canines in 1st and 2nd quadrant.

2.4. Treatment progress

1. Fixed orthodontic treatment was initiated using 0.022 × 0.028 MBT brackets.
2. Maximum anchorage was established with banding of all first molars, a Nance palatal button in the maxilla, and a lingual holding arch in the mandible.
3. To relieve crowding, all four first premolars and the retained deciduous canines in the 1st and 2nd quadrants were extracted in two visits.
4. Posterior units were stabilized with 0.019 × 0.025 stainless steel wires. Canine retraction was done using T-loops made of 0.017 × 0.025 TMA wire[6] over 5 months, activated initially by 6 mm and then 3 mm at subsequent visits [**Figure 3**, **Figure 4**].
5. After canine retraction, spontaneous improvement in crowding was seen which allowed bracket bonding on 42.
6. Alignment and levelling were carried out with progressive NiTi wires: 0.014, 0.016, 0.018, 0.017 × 0.025, and 0.019 × 0.025 SS wires [**Figure 5**].
7. Mandibular midline correction was done using an open coil spring between 42 and 43 [**Figure 6**].
8. Simultaneous retraction and intrusion of maxillary incisors were achieved using a three-piece intrusion arch,[7] while mandibular incisors were retracted with mushroom loop made from 0.017 × 0.025 TMA wire, activated by 5mm.[8] [**Figure 7**].
9. Final detailing was performed with 0.017 × 0.025 and 0.019 × 0.025 TMA wires using artistic bends and torque adjustments.

Table 1: Etiologic factors of impacted canines

Genetics	Local Environmental	Systemic Environmental
Heredity	Prolonged retention of primary teeth	Endocrine deficiency
Malposed tooth germ	Reduced root length of adjacent lateral incisor	Febrile diseases
Shortened arch length	Ankylosis of permanent canine	
Alveolar cleft	Degree of dental crowding and spacing	
	Failure of primary canine root to resorb	
	Small or congenitally missing lateral incisors	

Table 2: Cephalometric changes observed pre and post-treatment.

Variables	Pre-treatment values	Post treatment values
SNA	83^0	82^0
SNB	79^0	79^0
ANB	04^0	03^0
Mx.1 to Md.1	110^0	127^0
FMA	31^0	28^0
U1 to SN	114^0	107^0
IMPA	100^0	94
Mx.1 to NA	$7/31^0$	$5/25^0$
Md.1 to NB	$8/34^0$	$5/26^0$
Rickett's "E" line to Upper Lip	0	-2
Rickett's "E" line to Lower Lip	4	0

2.5. Treatment results

Post-treatment documentation confirmed the successful achievement of treatment objectives. Facial photographs indicated Enhanced lip competency an improved facial profile. Class I canine relationship was attained, accompanied by a canine-guided occlusion. The crowding in both maxillary and mandibular arches were resolved, and the dental midlines were aligned with the facial midline. Optimal overbite and overjet relationships were also established. [**Figure 8**]. The post treatment radiographs are shown in

[**Figure 9**] and the cephalometric changes are listed in **Table 2**, with soft and hard tissue superimposition shown in [**Figure 10**]. The patient achieved optimal aesthetic and balanced occlusal function, ensuring long-term stability.

Figure 1: Pre- treatment extra oral and intra oral photographs

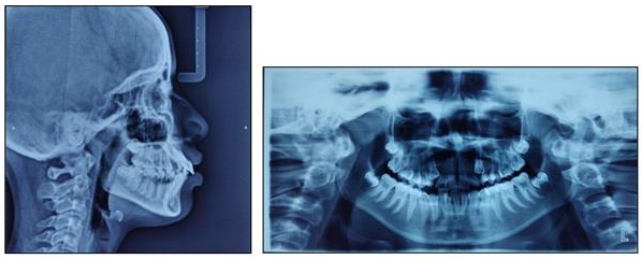

Figure 2: Pre- treatment lateral cephalometric radiograph and panoramic radiograph

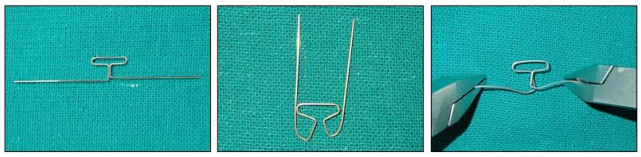

Figure 3: T-loops made of 0.017 × 0.025 TMA wire

Figure 4: Posterior units stabilized with 0.019 × 0.025 stainless steel wires and canine retraction done using T-loops

Figure 5: Alignment and leveling carried out with progressive NiTi wires (0.014 NiTi)

Figure 6: Mandibular midline correction done using an open coil spring between 42 and 43

Figure 7: Simultaneous retraction and intrusion of maxillary incisors using a three-piece intrusion arch while mandibular incisors were retracted with mushroom loops made from 0.017 × 0.025 TMA wire

Figure 8: Post treatment extraoral and intraoral photographs

Figure 9: Post treatment lateral cephalometric and panoramic radiographs

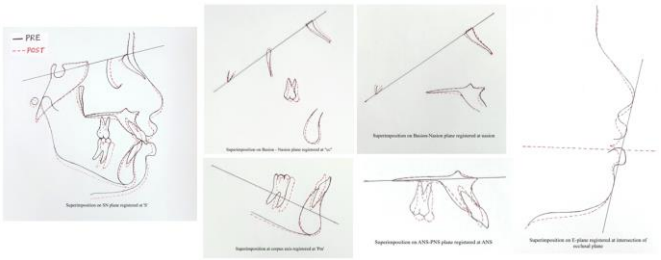

Figure 10: Cephalometric changes with soft and hard tissue superimposition

3. Discussion

To evaluate an impacted or ectopic canine, a thorough assessment of the malocclusion is necessary, considering arch space, adjacent tooth position, bone contours, tooth mobility, and radiographic analysis of the canine's position, apex, crown, and axis.[9] A key consideration in treatment planning is ensuring sufficient attached gingival support, as inadequate attached gingiva can lead to bone dehiscence and tooth mobility from uncontrolled force application.[10] In addition to being unappealing, untreated ectopic canines most frequently result in root resorption of the teeth next to it. In comparison to other invasive methods, early intervention and vigilance about canine malposition throughout development are the most economically viable options.[11]

An effective treatment should minimize time and tissue damage. While continuous arch-wire sliding is the most common approach, it may not be suitable for complex dental cases or cases with poor periodontal health.[12,13] The T-loop is ideal for retraction in crowded arches, as it moves teeth efficiently without undue anchorage load. Unlike continuous archwires, it avoids undesirable intrusion and tipping of adjacent teeth while correcting the malpositioned tooth.[12,14] T-Loops, with their differential moments and pre-activated bends, provide better anchorage control.[14] A three-piece intrusion/retraction arch helps to reduce gummy smile and deep bite.[7] The mushroom loop, a variation of the T-loop, is more patient-friendly due to its smaller horizontal portion and better fit in shallow mandibular vestibules. The required moment/force ratio is attained by preactivating the archwire. The first step in this preactivation is to carefully separate the two mushroom loops' legs by around 3 mm. If necessary, further gable bends can be positioned distal to the mushroom loop to enhance anchoring moment and mesially to increase anterior moment (torque).[8,15] TMA wire is particularly effective for creating loops due to its springiness, low stiffness, and good formability.[15]

4. Conclusion

The successful management of ectopically erupted maxillary canines requires a solid understanding of diagnosis, biomechanics, and precise treatment execution. In this case, a combination of first premolar extractions and segmental mechanics (T-loops and three-piece intrusion arches) allowed controlled retraction of the ectopic canines and proclined incisors, while maintaining anchorage and minimizing undesirable movements. The use of TMA wire provided flexibility, optimal force and greater range of activation for effective space closure. The treatment resulted in improved dental alignment, occlusion, facial aesthetics, and long-term stability. This case demonstrates the value of individualized approaches for complex malocclusions and highlights the predictability and control segmental mechanics offer when planned carefully. Early diagnosis, strategic planning, and biomechanical techniques are key to achieving optimal outcomes.

5. Source of Funding

None.

6. Conflict of Interest

None.

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