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## Case Report

# Unraveling the canine using labial auxiliary spring and unilateral distalisation using infra zygomatic crestal implants

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### ABSTRACT

Impacted canines are a matter of concern in the treatment of malocclusion. After the third molars, maxillary canines are considered the most commonly impacted teeth with a frequency of 0.27% among Japanese and 2.4% among Italians. Unilateral impactions are more prevalent than bilateral impactions. The impacted canine can be detected with palpation, and radiographic techniques such as IOPA (Tube shift technique), panoramic radiographs, occlusal radiographs, and CT. The mesiodistal position and angulation of the canine crown on a panoramic radiograph can possibly predict treatment success. Various treatment approaches are considered depending on the mesiodistal angulation and position of the impacted canine. An auxiliary spring in the buccal region of the impacted canine designed by Kornhauser Et al has advantages such as avoidance of usage of palatal arches, and additional lab work such as soldering thereby incurring at least an extra clinical visit. This case report showcases the treatment of a 13-year-old growing male patient with a palatally impacted right maxillary canine using a Labial auxiliary spring and correction of molar relation using an Infra Zygomatic Crestal Implant.

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## 1. Introduction

After the third molars, maxillary canines are considered the most commonly impacted teeth with a frequency of 0.27% among Japanese and 2.4% among Italians. Unilateral impactions are more prevalent than bilateral impactions. The causes can be classified into 4 distinct groupings: local hard tissue obstruction, local pathology, a departure from or disturbance of the normal development of the incisors, and hereditary or genetic factors.<sup>1</sup> According to McConnell, transverse maxillary deficiency is considered one of the contributing factors to the impaction of canines.<sup>2</sup>

The impacted canine can be detected with palpation, and radiographic techniques such as IOPA (Tube shift

technique), panoramic radiographs, occlusal radiographs, and CT.<sup>3</sup> The mesiodistal position and angulation of the canine crown on a panoramic radiograph can possibly predict treatment success.<sup>4-6</sup> Ericson and Kuroi<sup>7</sup> reported less likelihood of eruption of a more mesially positioned canine crown following extraction of deciduous canine. Power and Short<sup>5</sup> reported a decreased chance of eruption of the maxillary canine with an angulation greater than 31 degrees to the midline. Lindauer et al.<sup>6</sup> determined the probability of impaction based on the location of the canine cusp tip in one of the four sectors, regarding its relationship to the adjacent lateral incisor. Jung et al.<sup>8</sup> in their study reported that canines in panoramic Sectors I, II, and III were more frequently in a labial position on the CBCT (cone beam computed tomography), however, canines in Sector IV were seen to be in the mid-alveolus position.

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Various treatment approaches are considered depending on the mesiodistal angulation and position of the impacted canine. The most common approach is to expose the impacted palatal canine, placing an orthodontic attachment and subjecting it to light forces to tip the tooth so that the periodontal integrity is maintained. An auxiliary spring in the buccal region of the impacted canine designed by Kornhauser et al.<sup>9</sup> has advantages such as avoidance of usage of palatal arches, and additional lab work such as soldering thereby incurring at least an extra clinical visit.

This case report showcases the treatment of a 13-year-old growing male patient with a palatally impacted right maxillary canine using a Labial auxiliary spring and correction of molar relation using an Infra Zygomatic Crestal Implant.

## 2. Diagnosis and Treatment Planning

A 13-year-old growing male patient came to the department with the chief complaint of forwardly placed upper front teeth with spacing. On examination, the patient had a convex profile, low mandibular plane angle with potentially incompetent lips. Intra-oral examination revealed end-on-molar relation on the left side and Class II molar relation on the right side with end-on-canine relation on the left side with an overjet of 10 mm and overbite of 5 mm with clinically missing permanent right maxillary canine and retained deciduous lower right and left second molars with an upper midline shift of 3 mm to the patient's left side (Figure 1).

Cephalometric analysis revealed that the mandible was retrognathic with respect to the cranial base with an average growth pattern. He had normally placed upper incisors with proclined and forwardly placed lower incisors and a lip strain of 6 mm.

An Orthopantomogram of the patient revealed an impacted permanent maxillary right canine in the palatal region. Modified Erikson and Kuroi sector analysis<sup>7</sup> was performed and the canine was in sector 3 with a 64 % prognosis.

A cone beam CT was taken with respect to the maxillary anterior region to assess the position of the canine with respect to the roots of the adjacent teeth and the amount of bone covering the canine and was shown the canine was not in proximity to the roots of lateral incisor and 0.8 millimeters of bone was covering the palatal side of the canine (Figure 2).

### 2.1. Treatment objectives

1. Correction of proclination and spacing in upper anterior teeth.
2. Correction of lower anterior crowding.
3. Extraction of deciduous right maxillary canine and alignment of permanent right maxillary canine.

4. Correction of overjet and overbite.
5. Correction of molar relation and canine relation.

### 2.2. Treatment progress

MBT prescription 0.022" slot passive self-ligating metal brackets were bonded on the upper and lower teeth. Leveling and alignment was carried out using copper nickel titanium arch wires. With 17x25" stainless steel wire as base arch wire, the deciduous maxillary right canine was extracted and the palatally impacted successor was exposed using a closed flap technique. A curved Begg bracket was bonded onto the exposed surface of the canine and a 0.012" stainless steel ligature was tied to the Begg bracket.

An auxiliary spring<sup>9</sup> described by Kornhauser Et al was fabricated using 0.014" stainless steel archwire and was used as a piggyback archwire through the entire maxillary arch keeping the 17x25" stainless steel wire as the base archwire. This auxiliary spring brought about vertical and buccal traction so as to prevent damage to the roots of the lateral incisor. In the passive position, the spring lay vertically onto the buccal surface with the helix facing towards the mandibular arch. The spring was activated periodically and in a 5-month period, the canine was near the line of occlusion after which it was bracketed and continued with the leveling and alignment (Figure 3).

An upper midline shift to the left side was observed with an end-on-molar relation on the right side with an end-on-canine relation which warranted unilateral distalisation of the maxillary arch on the right side. A 2x10 mm bone screw was placed on the infra zygomatic crest on the right side using Liou's technique<sup>10</sup> and distalisation was carried out using a power chain from the implant to the power arm placed on a 19x25" stainless steel archwire between the maxillary right lateral incisor and canine delivering a force of about 300 grams to correct the midline and overjet (FIGURE 4). The archwires were constantly checked for transverse coordination. The distalisation was completed in 6 months with a class I canine and molar relation on the right side.

### 2.3. Finishing and retention

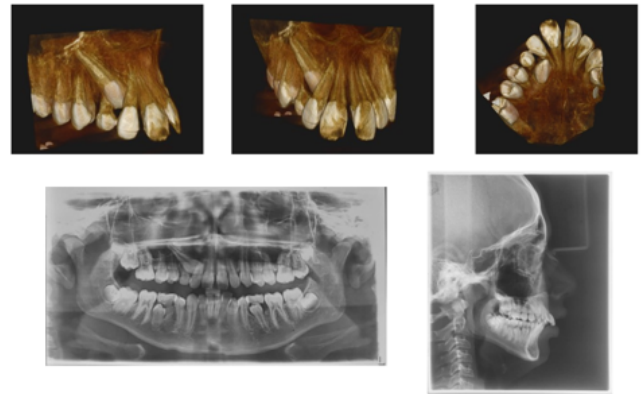
Finishing was carried out on a 19\*25 TMA and light settling elastics on 0.018 SS were used for settling following which the brackets were debonded. Begg wrap-around retainers were given in both upper and lower arches along with permanent lingual retainers bonded on the upper and lower anterior teeth.

### 2.4. Treatment outcome

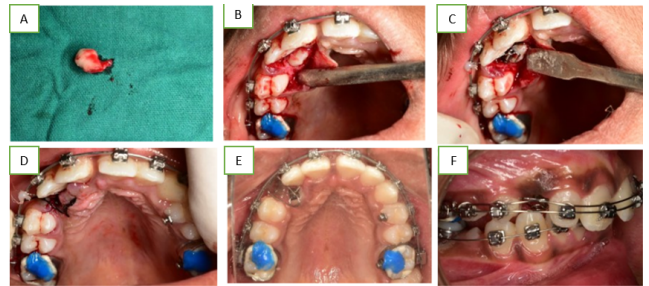
A balanced and pleasing profile with an esthetic and consonant smile was achieved along with harmony between the upper and lower lips, lip competence, and bilateral Class I canine relationships. The dental midlines were coinciding,

**Table 1:**

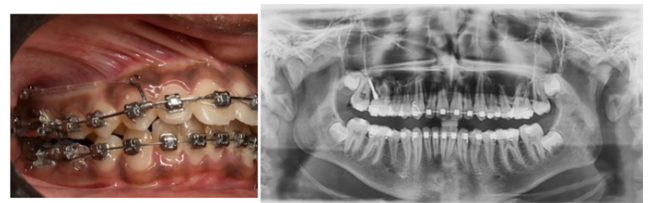
Landmarks assessed	Norms	Pre RX	Post RX
SNA	82 <sup>0</sup>	82 <sup>0</sup>	78 <sup>0</sup>
SNB	80 <sup>0</sup>	75 <sup>0</sup>	75 <sup>0</sup>
ANB	2 <sup>0</sup>	7 <sup>0</sup>	3 <sup>0</sup>
WITTS	0MM	9MM	7MM
A-N PERP	-1MM	3MM	4MM
SN-GOGN	32 <sup>0</sup>	26 <sup>0</sup>	31 <sup>0</sup>
FMA	25 <sup>0</sup>	22 <sup>0</sup>	30 <sup>0</sup>
U1-NA	22 <sup>0</sup> /4MM	35 <sup>0</sup> /4MM	26 <sup>0</sup> /6MM
L1-NB	25 <sup>0</sup> /4MM	30 <sup>0</sup> /5MM	25 <sup>0</sup> /4MM
U1-L1	131 <sup>0</sup>	110 <sup>0</sup>	124 <sup>0</sup>
IMPA	90 <sup>0</sup>	102 <sup>0</sup>	96 <sup>0</sup>
L1-APOG	2MM	4MM	1MM
U1-SN	104 <sup>0</sup>	112 <sup>0</sup>	104 <sup>0</sup>
Y Axis	66 <sup>0</sup>	60.5 <sup>0</sup>	64.5 <sup>0</sup>
Basal angle	25 <sup>0</sup>	28 <sup>0</sup>	28 <sup>0</sup>
Gonial angle	132 <sup>0</sup>	122 <sup>0</sup>	124 <sup>0</sup>
H line angle	8-15 <sup>0</sup>	22 <sup>0</sup>	22 <sup>0</sup>
Nasolabial angle	102 <sup>0</sup>	100 <sup>0</sup>	103 <sup>0</sup>
Lower lip-e line	-1MM	-2MM	-1MM



**Fig. 2:** Pre-treatment imaging



**Fig. 3:** A: Extraction of deciduous canine; B: Surgical exposure of maxillary right canine; C: Begg bracket bonded; D: Closure of flap; E: Auxiliary Spring Placed; F: Buccal view of the auxiliary spring



**Fig. 4:** A: IZC with power chain; B: OPG with IZC



**Fig. 1:** Pre treatment extra oral and intra oral photographs

and no muscle or joint problems developed during the treatment (Figure 5).

A panoramic radiograph was taken prior to debonding showing acceptable root angulations with little evidence of root or bone resorption.

The overjet was corrected, addressing the patient’s initial complaint of proclined teeth and protruding lips as shown in cephalograms and superimpositions (Figures 6 and 7).

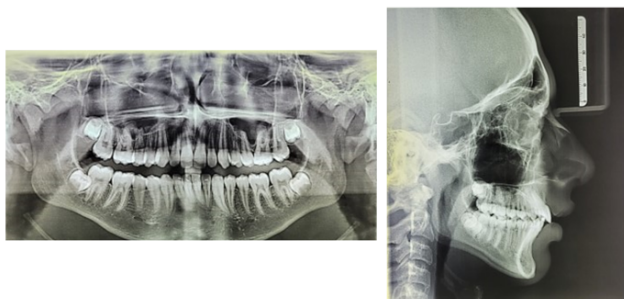
The cephalometric values showing the treatment outcome are mentioned in Table 1.

**3. Discussion**

The maxillary permanent canine has been considered to be an important tooth by virtue of its position, its place



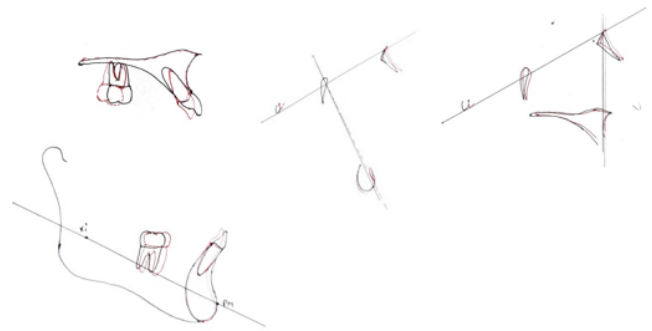
**Fig. 5:** Post treatment extra oral and intra oral photographs



**Fig. 6:** Post-treatment imaging

in the scheme of functional occlusion, and its role in establishing the arch form. This is one of the many reasons, Orthodontists have enthusiastically accepted the challenge of correcting the impacted canines.

In our case, after leveling and alignment, the deciduous right maxillary canine was extracted and the permanent successor was exposed using a closed flap technique. Auxiliary spring was preferred for the traction of the palatally impacted canine due to the ease of fabrication of



**Fig. 7:** Super imposition

the spring with the available inventory, increased range of action which required 2 activations, and ease of placement with a more predictable movement using optimum forces.<sup>9</sup>

The patient has a transverse arch deficiency with respect to the maxilla which prevented the mandible to slide anteriorly and resulted in crowding in the mandibular anterior teeth region. As the wire sequencing was done in the maxillary arch, the transverse dimensions were improved which according to the foot and shoe principle<sup>11</sup> allowed the mandible to translate anteriorly and the late mesial shift of permanent mandibular first molars contributed to the correction of molar relation to class I on the left side and class II to end on molar relation on right side.

The lower anterior crowding was relieved with the help of safety valve mechanism as the transverse maxillary deficiency was corrected.

Distalization using bone screws is superior compared to the inter radicular mini-implants because they are placed close to the center of resistance of the maxilla and they are safer and provide greater stability. In the maxillary arch – the limits of distalization follow Rickett's criteria (age-dependent and sagittal distance from the pterygoid vertical). Ideally fully erupted third molars are to be removed to create space and aid in the distalization process. For un-erupted third molars placed below the cement-enamel junction of the 2nd molars in young individuals, distalization is possible without their extraction if the criteria are fully filled, extractions are however indicated at a later date to prevent relapse.<sup>12</sup>

Extraction of the maxillary right third molar was planned for the later stage and the bone screw was placed followed by immediate loading to the power arm between the maxillary lateral incisor and canine whose length was close to the line of bone screw placement to prevent excessive canting of the arch and distalisation of 2.5 mm was achieved with the Infrazygomatic crestal implant.

#### 4. Conclusion

This case was effectively managed by efficient treatment planning and biomechanics.

#### 5. Conflict of Interest

None.

#### 6. Source of Funding

None.

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