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Case Report

Efficient management of eruptive abnormalities of canine: A case report

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Abstract

Impacted canines and buccally erupting canines are frequently dealt with in orthodontic practice. Traction of impacted canines is desirable as it provides functional occlusion along with being the cornerstone of the dentition. This case report shall elucidate various methods used during orthodontic traction of canines.

Keywords: Cuspids, computed tomography (CT), Computed tomography (CT)

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1. Introduction

Eruptive abnormalities complicate orthodontic treatment outcomes. It includes impactions, transpositions, ectopic eruptions etc. Failure of a tooth to erupt is attributable to the physical impedance of the eruptive path, displacement or even genetic predisposition. The incidence of impacted teeth in descending order of occurrence is as follows: third molars, maxillary cuspids, second premolars, mandibular cuspids, second molars, lateral incisors and the first premolars[1]. The ratio of maxillary to mandibular canine impaction is 20:1. Canine gets impacted labially either due to a retained deciduous tooth, deviation of canine tooth bud or iatrogenic failure of eruption[2]. Mandibular canine impactions have no single definitive aetiology.

Treatment options include surgical exposure and eruption into the dental arch, auto-transplantation and surgical extraction with premolar substitution[3]. The management of impacted teeth routinely necessitates a multidisciplinary approach. Extraction of canine is done only if it has an unfavourable predisposition which in turn inevitably compromises aesthetics and function[4]. The advent of cone beam computed tomography (CT) scanning has helped in the accuracy of treatment planning[5]. This case series describes simple and efficient mechanics for impacted canines.

2. Diagnosis and Etiology

A 17-year-old male patient reported with a chief complaint of missing teeth. Medical history was found to be irrelevant. The pre-treatment facial photographs showed a dolichocephalic symmetric face, straight profile and competent lips. The pre-treatment intra-oral photographs show the maxillary midline coinciding with the facial midline and mandibular midline deviated 5mm to the patient's right. Gingival exposure and buccal corridors were adequate upon smiling. There were no spaces present in the arches. The patient had normal overjet and overbite. Crowding and rotation were present in the mandibular arch and grossly decayed right mandibular 2nd premolar. The maxillary right canine was erupting high labially. The maxillary left canine and mandibular right canine were missing. The patient had Class I molar relation bilaterally and Angle's Class I Type 1 malocclusion. The periodontal tissues were healthy (**Figure 1**).

Initial panoramic radiograph (**Figure 2**) shows the maxillary left canine (Sector Class I), thus mandibular right canine impacted at the mid-root region of respective lateral incisors. The long axis of both was parallel with the midline

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on the panoramic radiograph but the crown of the maxillary impacted canine was located apical to mucogingival junction worsening the prognosis. It was well anticipated that 23 had to traverse a long path before erupting into the oral cavity. The crown of the maxillary left impacted canine could be digitally palpated very minutely high in the labial sulcus.

Intraoral periapical radiographs show no signs of root resorption (**Figure 2**).

The CBCT examination (**Figure 2**) confirmed the parallel orientation of the maxillary left canine as well as the mandibular right canine. Localisation of the maxillary left impacted canine in the transverse plane was found to be mid-alveolar. No contact of the canine with the lateral incisor. Localisation of cusp tip with respect to the lateral incisor root was apical 1/3rd. Both impacted canines had closed apex. 13 has a clear labial predisposition.

The pre-treatment cephalometric evaluation (**Figure 2**) (**Table 1**) revealed that the patient had a Class I skeletal pattern (ANB=5^0). The mandibular plane angle (32^0) and FMA (26^0) were in accordance with Steiner's and Tweed's norms respectively.

2.1. Treatment plan

First, an extraction treatment plan was devised for the patient. Second, to expose the canine surgically and bring them into the arch and to obtain well inter-cuspated Class I canine relation bilaterally along with corrected midlines. Finally to attain proper occlusion, a healthy zone of attached gingiva, ideal alveolar bone height and balanced soft tissue profile.

3. Treatment Progress

Orthodontic traction of maxillary/mandibular impacted canines and labially erupting canine requires a stable source of anchorage therefore 0.040 in round stainless-steel nance holding arch and lingual holding arch were cemented.

Standard Edgewise prescription was used. Extraction of 14 for orthodontic purpose was done without compressing the extraction socket. A cantilever spring[6] for traction of labially erupting 13 was fabricated. A closing loop was bent in .017*.025" TMA, for the first molar auxiliary tube with the loop positioned mesial to first molar at 1/3rd inter-bracket distance. The closing loop will provide distal retraction as well as extrusion of the canine as needed (**Figure 3**). Activate the lever arm for the required canine movement. Simultaneously initial alignment and levelling were being carried out. To maintain the 14 extraction space, the adjacent segments were tied into a figure of 8 ligatures (**Figure 3**). A cantilever spring is hereby statistically determinate[7].

Surgical exposure and double bonding[8] of 23 was done (**Figure 3** h-i), maxillary arch was ligated with 0.018 x 0.025" stainless steel wire. At this point 24 extraction space was being duly maintained.

Extraction of 45 was done and initial alignment wires were re-ligated in the lower arch. Over the next visit, 0.019*0.025" stainless steel wire was ligated with coil spring between 42 and 44 to distallize 44 into 45 extraction space thereby creating and maintaining space to anticipate spontaneous eruption of impacted mandibular canine. Elastic traction with the help of modules was given to both 13 and 23. A v-bend is placed distally to provide the distal force vector to 23 (**Figure 4**).

Upon the next visit, in the maxillary arch, using overlay mechanics (0.019*0.025" TMA and 0.012 NiTi), tracing of 13 was being done with a passive step bend (Fig 5). A buccolingual U loop was bent with a cervico-occlusal helix to give mid-alveolar traction to 23 into the line of arch which erupted into oral cavity[9] (**Figure 5**).

Extraction of 34 was done to derotate 33 and correct midline deviation. Over the next visit, two space opening loop (1*3mm) and closing loop (6*2 mm) with respect to 34 were bent on 17*25 TMA wire and ligated (**Figure 5, Figure 6**). The open loop shall do the required welcome preparation for 43 and the closing loop shall do the contralateral space closure thereby simultaneously correcting the midline shift. In **Figure 6** the anticipated spontaneous eruption of 43 did not take place.

Therefore diode laser assisted exposure of 43 was done to expose the superficially placed impacted canine and an attachment was bonded. Elastic traction was given to canine and further NiTi and SS wires were used for alignment (**Figure 7-10**). Vertical elastics were used for the infra occluded 13 and 43 thereby correcting the transient open-bite that occurred while tracing canines (**Figure 10**). Settling elastics were given over the last finishing wires followed by debonding (**Figure 11** and **Figure 12**). Retention was instituted with maxillary and mandibular Hawley's appliance with soldered Adam's clasp. Total active treatment time was 20 months. **Table 1** shows post treatment cephalometric values.

4. Treatment Results

The impacted canines and the buccally erupting canine were successfully brought into the arch with proper alignment, midline correction and an improved smile (**Figure 12** and **Figure 13**). Post-treatment cephalometric analysis (**Table 1**) shows the patient maintained a good skeletal relationship with bilateral Class I relation. All the roots were well aligned in post-treatment panoramic view (**Figure 12**) and in good periodontal health. The cephalometric evaluations (**Table 1**) as well as superimpositions (**Figure 14**) show the counter-clockwise movement of the mandible as both Sn-GoGn and FMA show a decrease. Proclination of lower incisors is evident with an increase in IMPA and decreased Interincisal angle. The accentuated positive lip step has normalised as the nasolabial angle decreased imparting fullness to upper lip

(**Figure 2** g vs 12m). The previously dished-in appearance at the region of upper lip has become more harmonious. Despite dental proclination taking place, ANB was controlled and balanced soft tissue profile.

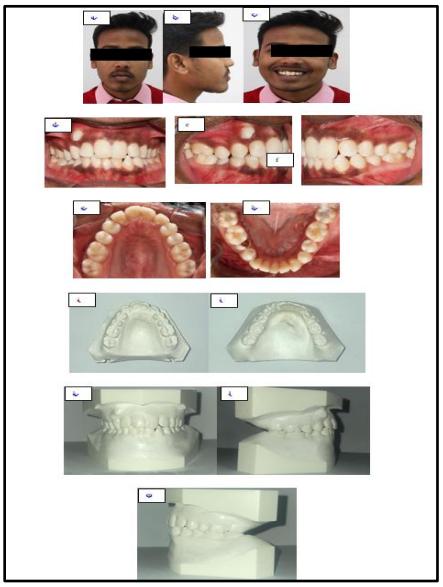

Figure 1: Pretreatment Extra-oral photographs (a-c), Intra-oral photographs (d-h) and study models (i-m)

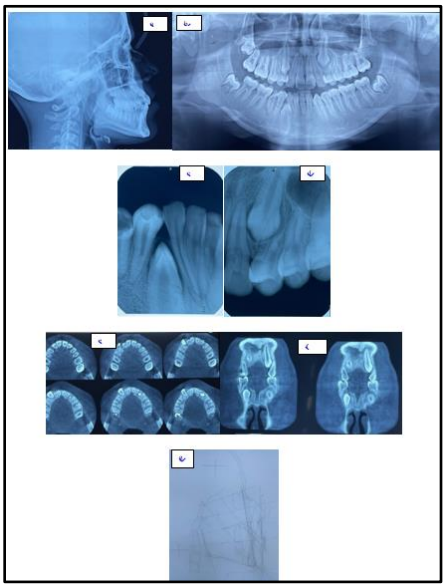

Figure 2: Pretreatment (a)Lateral cephalogram, (b)Panoramic radiograph, (c,d) IOPA wrt 23, 43 and (e,f) CBCT sections showing labial predisposition of 13 and mid-alveolar axial orientation of 23 in maxillary alveolar bone, cephalometric tracing (g).

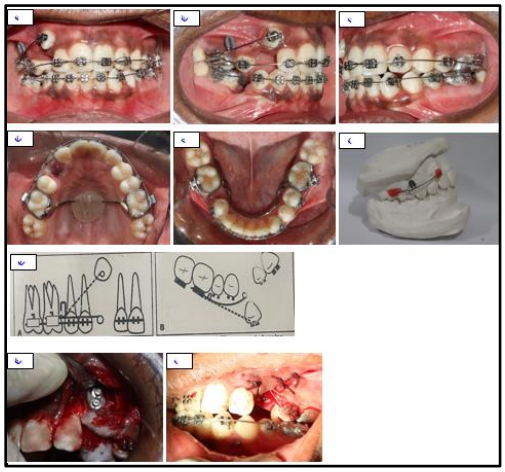

Figure 3: (a-f) Levelling of arches along with retraction of 13 using a simple cantilever spring, (g) cantilever spring-lever arm is activated vertically and the closing loop was activated by pulling the wire distally through the molar tube and cinching it back, (h,i) surgical exposure of 23, bonding attachment on 23 and suturing of the flap.

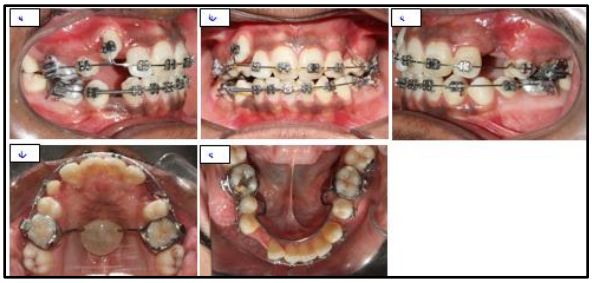

Figure 4: Extraction of 45, open coil spring pushing 44 into 45 extraction space. Elastic module traction given to 13 and distal force vector was given to 23.

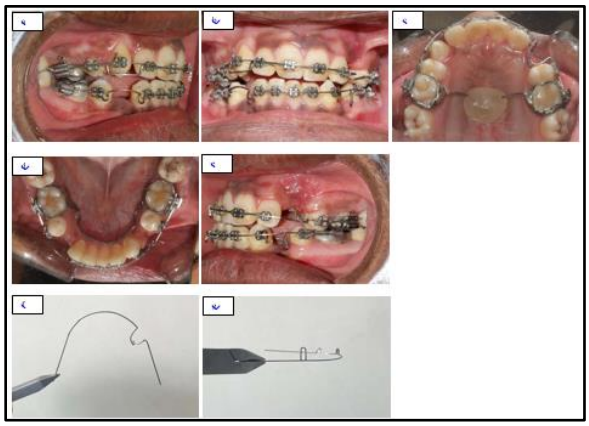

Figure 5: (a-f): Passive step bend with respect to 13 and creative wire bending based on Australian Helical archwire for traction of 23, (g) Double open loop and closing loop in the mandibular arch.

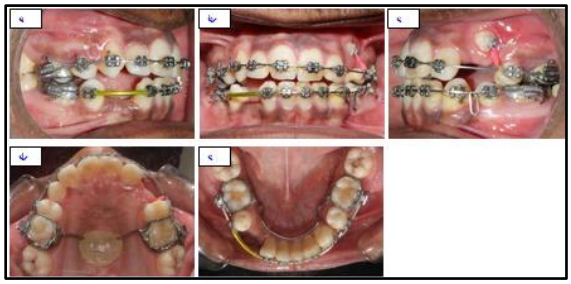

Figure 6: (a-e): Eruption of 23 into Oral cavity and space closure in the mandibular arch

Figure 7: Diode laser-assisted exposure of superficially placed impacted canine 4

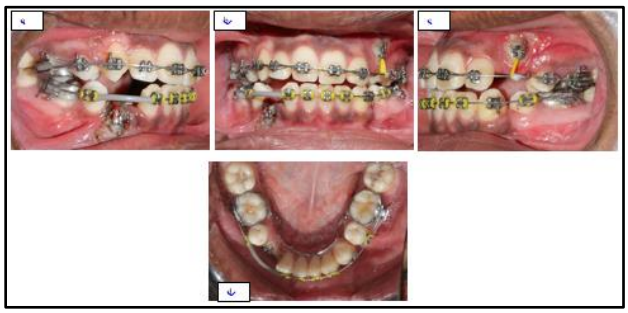

Figure 8: (a-d): Post laser-assisted exposure of 43

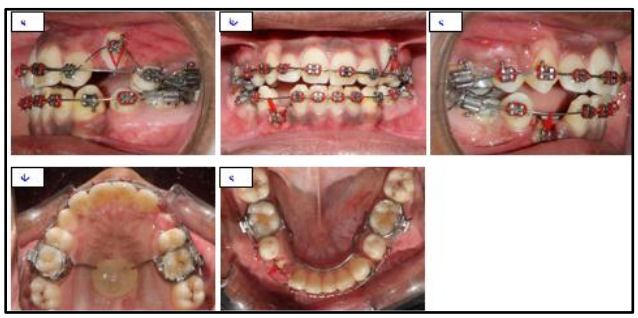

Figure 9: (a-e): Light elastic force given to 43

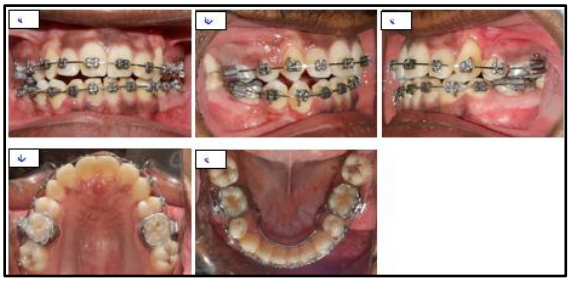

Figure 10: (a-e): All canines are present in the arches

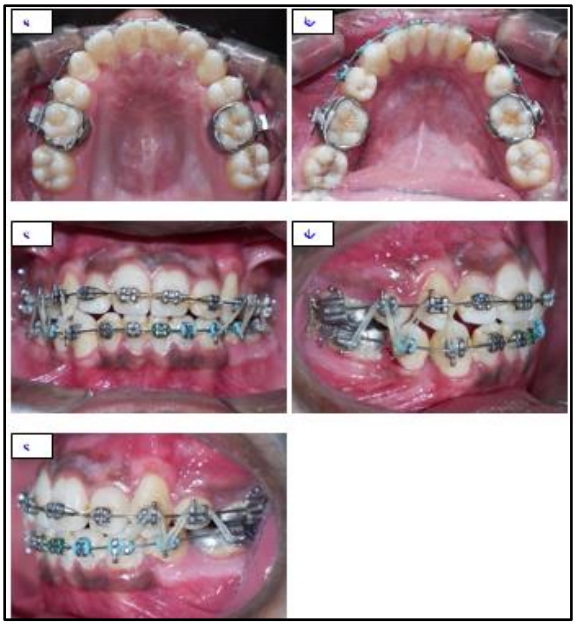

Figure 11: (a-e): Settling the occlusion.

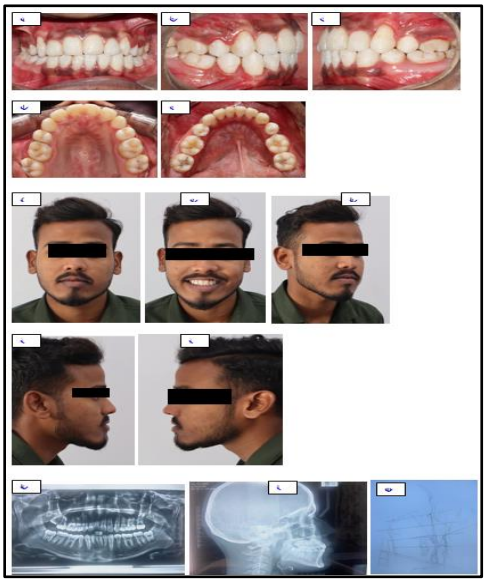

Figure 12: Post-treatment- intra-oral photos (a-e), extra-oral photos (f-j), panoramic radiograph (k), lateral cephalogram (l), cephalometric tracing(m)

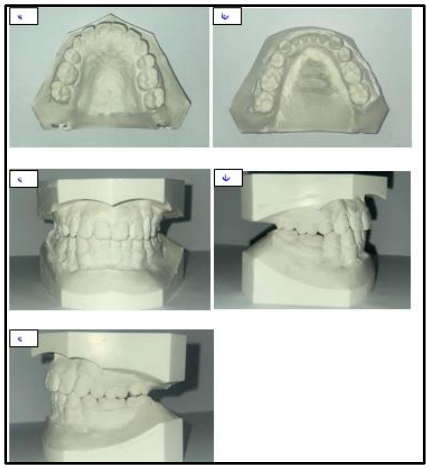

Figure 13: Post-treatment study models

Figure 14: Superimposition and changes observed on the SN plane

Table 1: Cephalometric analysis

Analysis	Norms	Pre	Post
Skeletal			
SNA	82	85	87
SNB	80	80	84
ANB	2	5	3
Sn-GoGn	32	32	30
FMA	25	26	25
IMPA	90	96	99
FMIA	65	62	56
Dental			
Inter-Incisal	131^0	123	120
Facial			
NLA	94-110	105	90

5. Discussion

The treatment plan was narrowed down to all four first premolar extractions. It is notable that even though labially erupting /crowded/ impacted canine might look unsightly yet it is not indicated for extraction as it shall only temporarily improve esthetic and rather compromise functional occlusion in the long run. Extraction of canine is rarely considered except in cases of ankylosis, internal root resorption, severely dilacerated root, impaction has crossed midline, acceptable occlusion, pathology like cyst and often in cases where patient cannot comply with extensive orthodontic treatment[4].

The usual predisposition of buccally impacted/ erupting canine is in vicinity of adjacent tooth and mesial to its normal position. It requires attention to 3 factors such as anchorage control, vertical and distal positioning of canine and adjacent root proximity which is duly taken care of by this cantilever spring along with required distal retraction. A simple way of activation is by pulling the wire distally through auxiliary tube and cinching it there along with the lever arm activated vertically(**Figure 3**g)[6]. One of the prime feature of cantilever spring is that it delivers statistically determinate force system in the correct direction of force delivery. It efficiently manages buccal segments without clinical adverse effects or intrusive side effects[7]

After a thorough clinical and radiographic examination, surgical canine exposure treatment was decided. The procedure was performed under infraorbital nerve block and nasopalatine nerve block local anaesthesia (lignocaine 1:80000 adr) under all aseptic precautions. The crevicular incision on the adjacent teeth and horizontal incision on the edentulous ridge was given with No 15 blade. The full-thickness mucoperiosteal flap was raised and the covering bone was removed to expose the underlying hard tissue. The area was clean and dried to attach the orthodontic button. The raised flap is closed by simple interrupted sutures with 3-0 silk sutures. Postoperative instructions were given and needful antibiotics were prescribed. Follow-up was done after 7-10 days and further treatment was carried out**.** In deeply buried infra-osseous labially impacted canine, the closed eruption technique is preferred as it provides healthy attached gingiva. In such cases, failure of bonded attachment is often encountered therefore bonding double attachments saves from re-exposure and further trauma. It further enhances the confidence of the orthodontist[8]. A module provides an elastic force system that is comfortable for the patient as well as convenient for the clinician.

One of the considerable aspects is the force vector that should be in the required direction to erupt the tooth into the line of arch. A simulation of Australian wire[9] has incorporated helices that serve various functions 1) as stops that maintain space to welcome the canine, 2) accentuate the resiliency of the system, 3) anchor the stainless steel wire coming from bonded attachment, 4) force vector can be given in desired direction by altering the transverse position of incisal helix (**Figure 5**) amount of force can be varied[9].

Laser surgical exposure holds various advantages over scalpel surgery. It keeps a clear dry field, seals off blood vessels and lymphatic drainage. Reduces pathogenic bacteria which are evaporated or denaturated by laser irradiation. HLLT and LLLT do not produce irreversible changes instead

promote desirable periodontal wound healing by the phenomenon of photobiomodulation (PBM). There are many soft tissue lasers but a diode laser is an excellent soft tissue laser for excising and coagulating mucosa as it is poorly absorbed by hydroxyapatite[10-16].

Very superficially located impacted teeth in the alveolar mucosa can be done via laser-assisted exposure. It helps in reducing treatment times. Any exposure must be performed conservatively and entirely in keratinised tissue to prevent loss of any attached gingiva during the eruption. Attachment is bonded and traction is given via elastomeric modules [17-21].

Often while applying force to an impacted canine which is a tooth with considerably high anchorage value, the arches tend to distort due to reciprocal forces. Therefore a transient open bite was created on the right side. Vertical elastics as well as settling elastics helped in the correction of transient open bite. Moreover instructing the patient upon clenching exercise regimen helps in settling the occlusion in the longer run[22].

There is a large variation in treatment times for eruptive abnormalities of canine owing to gender, age, severity of impaction, molar relation, amount of crowding, and unilateral or bilateral impaction. The duration of the traction needed to resolve the impaction was 20 months.

6. Conclusion

An orthodontist is well aware of the functional and aesthetic features of canine and therefore adopts most ideal ways of traction into the arch in the most favourable direction. At the same time avoiding further injuries to adjacent teeth. Management strategies such as cantilever spring, double bonding, laser-assisted exposure, creative wire bending and elastomeric module traction are convenient as well as expedite the treatment.

7. Source of Funding

None.

8. Conflict of Interest

None.

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