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Orthodontic management of a dilacerated central incisor and partially impacted canine with unilateral extraction – A case report

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KEYWORDS

Partially impacted canine;
Dilacerated maxillary central incisor;
Lower incisor extraction;
Canine disimpaction spring

Abstract *Aim:* To align a dilacerated maxillary central incisor and partially impacted canine with unilateral extraction in a young patient with skeletal deep bite.

Materials and methods: A 14 year old male patient reported to the hospital with skeletal deep bite (basal plane angle-17°), severe horizontal pattern of growth (Go-Gn to Sn -22°), upright maxillary incisors (U1 to NA -26°) and retroclined lower incisors (L1 to NB -11°). The maxillary left central incisor was dilacerated, and the maxillary left canine was partially impacted. Unilateral extraction of the left maxillary premolar and left mandibular central incisor was done. A canine disimpaction spring was used to align the impacted canine. An anterior bite plane was given to open the bite.

Results: Superimposition of lateral cephalogram (T1, T2) revealed bite opening, normal overjet and overbite. There was backward rotation of the mandible and increase in lower anterior facial height. There was no evidence of root resorption or loss of vitality in the dilacerated tooth. Clinically the canine was well aligned in the arch.

Conclusion: Orthodontic management of a dilacerated incisor can be done without root resorption or loss of vitality. The partially impacted canine was well aligned in the arch. Unilateral extraction can produce good treatment results.

Clinical relevance

Orthodontic movement of a dilacerated tooth is a very challenging situation. Such a clinical situation along with a partially erupted canine and skeletal deep bite requires proper treatment planning to produce a favourable prognosis. Malocclusions with a skeletal deep bite require precise extraction protocol to avoid excessive space and difficulty during closure of extraction space. The patient was treated with extraction of

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a single tooth in each arch, the left maxillary premolar and left mandibular central incisor. The occlusion was finished in group function as canine guidance is not possible due to lower incisor extraction. This paper deals with optimal orthodontic management of a clinical situation which is not encountered routinely in everyday practice but do occur from time to time.

1. Introduction

A dilacerated tooth is one which has an angulation of the crown or root. Orthodontic movement of such a tooth is a challenge to any orthodontist. Successful orthodontic management of a dilacerated tooth depends on the degree and level of dilaceration, the tooth's vertical position, and the maturity of the tooth apex (Chew and Ong, 2004). A dilacerated tooth with a more occlusal position in the alveolus, an obtuse crown-root angulation and incomplete root formation would have a better prognosis for orthodontic traction. Alignment of a tooth with a severely dilacerated root has chances of failure due to ankylosis, external root resorption and root exposure after orthodontic tooth movement.

A partially impacted canine is one which has not completely erupted into the oral cavity due to lack of space in the arch and lies deep into the buccal vestibule. This can occur due to ectopic migration of the canine or shifting of the midline of the maxillary dentition causing insufficient space for the canine to erupt (Kokich, 2004). A canine placed high in the vestibule requires a substantial amount of tooth movement to be brought into alignment. Since the canine root in such a situation lies close to the cortical bone of the maxilla the vascularization is compromised. This results in delayed bone remodelling during tooth movement. Hence, very light orthodontic force should be applied.

The following paper deals with the successful management of a dilacerated maxillary central incisor and also a partially impacted canine in a patient with skeletal deep bite.

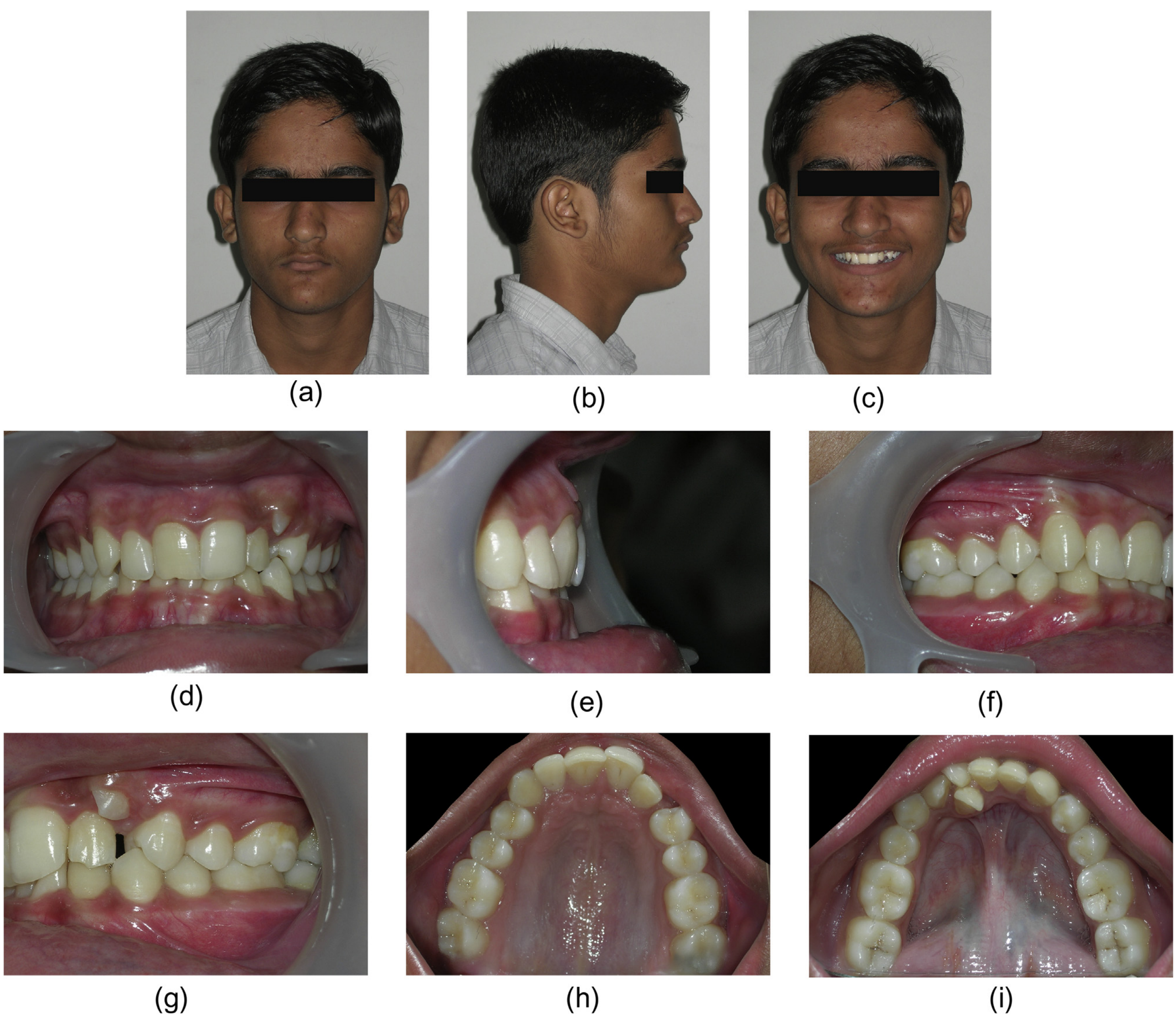

Fig. 1 (a-c) Pre-treatment extraoral photographs. (d–i) Pre-treatment intraoral photographs showing the partially impacted canine.

2. Case report

2.1. Extraoral examination

A male patient aged 14 years came to the dental hospital with a chief complaint of irregular arrangement of teeth. Extraoral examination (Fig. 1a-c) revealed a mesocephalic shape of head, mesoprosopic facial form, deep mentolabial sulcus, hyperactive lower lip, prominent chin, horizontal growth pattern and decreased lower facial height. The patient had competent lips.

2.2. Intraoral examination

Intraoral examination (Fig. 1d-i) revealed a class I molar relation bilaterally. He had a class I canine relation on the right side. The canine relation could not be ascertained on the left side as the maxillary canine was not present in the arch. Only the incisal tip of the left maxillary canine was visible in the left upper buccal vestibule. In the mandibular arch, the left central incisor was totally blocked out on the lingual side. The patient had a closed bite with the maxillary incisors completely overlapping the mandibular incisors. The curve of Spee was exaggerated.

2.3. Radiographic examination

OPG (Fig. 2) revealed a partially impacted canine in the left side of the maxilla. However, it was in a favourable position and could be brought into alignment in the arch. The OPG (Fig. 2) also revealed a blunting of the apex of the maxillary right central incisor. Further investigation with an intraoral periapical radiograph (Fig. 3) of the maxillary right central incisor revealed a severe dilaceration of the apex of the root. Mandibular occlusal radiograph (Fig. 4) showed that the mandibular left central incisor was completely blocked out with the apex very close to the lingual cortex and was unfavourable for alignment.

Evaluation of lateral cephalogram (Fig. 5, Table 1) showed a skeletal deep bite with a basal plane angle of 17°. Sagittally, the patient had a class I skeletal relationship with an ANB of 2° and Witt's appraisal of 1 mm. The maxillary and mandibular skeletal bases were within normal limits (SNA-82° and SNB-80°). Patient had a severe horizontal pattern of growth (Go-Gn to Sn - 22°). The maxillary incisors were upright (U1 to NA - 26°), and the mandibular incisors were retroclined (L1 to NB -11°). The nasolabial angle was normal (105°), and the lower anterior facial height was decreased.

Fig. 3 Pre-treatment intra-oral periapical radiograph showing dilaceration of right maxillary central incisor.

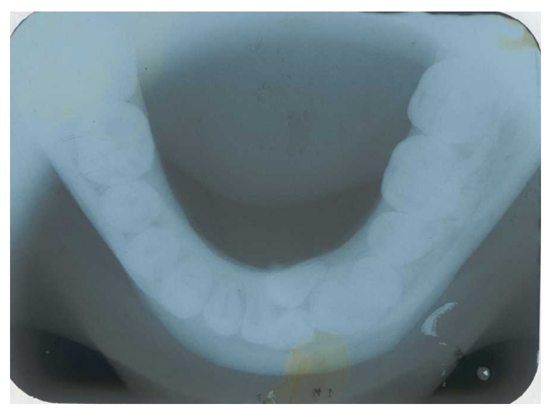

Fig. 4 Mandibular occlusal radiograph showing a lingually blocked left central incisor.

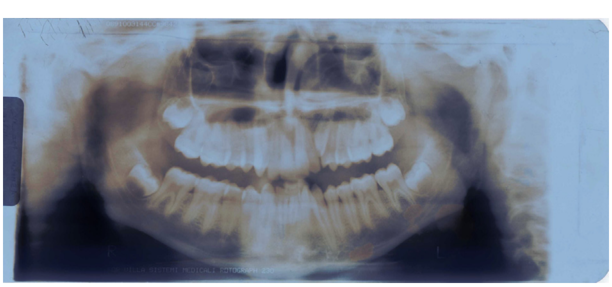

Fig. 2 Pre-treatment OPG showing dilaceration of right maxillary central incisor and partially impacted canine.

2.4. Aetiology

The patient had a severe deep bite which was of skeletal origin. The upright upper incisors and retroclined lower incisors could be attributed to the hyperactive lower lip.

The unerupted canine and the blocked out lower incisor can be attributed to a severe arch length tooth size discrepancy. No definitive cause could be elicited for the dilaceration of the maxillary right central incisor although it could be due to various reasons such as traumatic injury of the deciduous tooth, ectopic development of the tooth germ or trauma to the decid-

Fig. 5 Pre-treatment Lateral Cephalogram.

uous tooth causing a change in the axial inclination of the unerupted tooth (Smith and Winter, 1981; Kolokithas and Kawakasis, 1979; Stewart, 1978; Felicita, 2011).

2.5. Aim of treatment

To bring the left upper canine into alignment
Level and align the upper and lower arch
Open the bite and achieve normal overjet and overbite
Maintain class I molar relation
Improve soft tissue profile

2.6. Treatment plan

Unilateral extraction of left maxillary first premolar and lingually blocked lower central incisor.

Canine retraction spring to bring the partially impacted tooth into alignment.

Anterior bite plane to open the bite.

2.7. Rationale for treatment

The case was diagnosed as skeletal deep bite with Angle's class I malocclusion with upper and lower anterior crowding. Extraction of all four premolars to correct the malocclusion was not contemplated as it would result in further deepening of the bite with difficulty in closing the extraction spaces. Extraction of the left maxillary canine cannot be done for aesthetic reasons. Hence, unilateral extraction only on the left side of the arch was considered. As the mesiodistal width of the canine is almost that of the first premolar in the maxillary arch it will occupy the entire extraction space. Hence, collapse of the arch on the left side would be minimal. In the lower arch

Table 1 Showing pre-treatment and post-treatment cephalometric values.

Parameter	Mean	Pre-treatment (T1)	Post-treatment (T2)
Skeletal			
SNA	82°	82°	82°
SNB	80°	80°	79°
ANB	2°	2	3°
Witt's appraisal		AO ahead of BO by 1 mm	AO ahead of BO by 1 mm
Lower anterior facial height (mm)		66	69
Y-axis	66°	61°	62°
Facial angle	0°	96°	95°
Sum of posterior angles	396° ± 6°	388°	397°
Jarabak ratio	60–65%	73%	69%
Basal plane angle	25°	17°	20°
Angle of inclination	85°	85°	85°
Dental			
U1 to NA (angular)	22°	26°	25°
U1 to NA (linear) mm	4	3	2
U1 to SN	102° ± 2°	105°	105°
L1 to NB (angular)	25°	11°	14°
L1 to NB (linear) mm	4	−2	0
L1 to Mandibular plane	90°	85°	87°
Interincisal angle	130°	146°	136°
Soft tissue			
S line to U lip (mm)	−2	0	1
S line to L lip (mm)	0	−2	0
Nasolabial angle	90° ± 110°	105°	104°

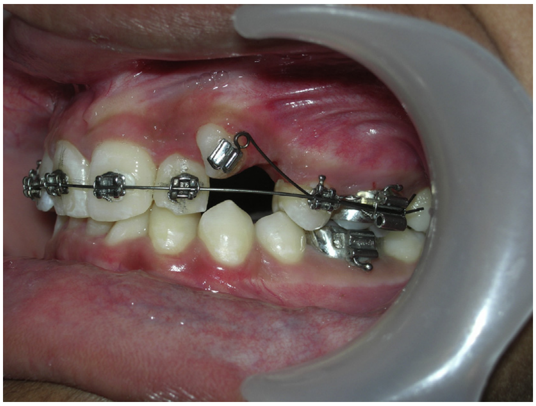

Fig. 6 Simple canine disimpaction spring placed to bring the partially impacted canine into the arch.

Fig. 7 Canine retraction in progress. The base arch wire has been stepped up to a stiff 0.018″ round stainless steel wire with an occlusal offset in the left maxillary canine region.

Fig. 8 The highly placed canine brought into the alignment of the arch.

bringing the blocked out incisor into alignment will be time-consuming with risk of root resorption and non vitality due to proximity to the lingual cortex. Since the patient had a severe horizontal pattern of growth, extrusion of the posterior segment for correction of deep bite was contemplated. This was done by means of an anterior bite plane.

2.8. Treatment progress

The maxillary arch was bonded with 0.022 Roth brackets except for the partially impacted canine (Fig. 6) where a Begg bracket was placed. An anterior bite plane was given to open the bite and level the lower curve of Spee. A 0.016″ round stainless steel base arch wire was placed in all the brackets except the left maxillary canine. A canine disimpaction spring made of 0.014″ round stainless steel wire with a helix 3 mm in diameter in the anterior end was fabricated. The anterior end of the spring was placed in the Begg bracket on the canine while the posterior end of the spring was ligated as piggyback into the second premolar and first molar bracket (Fig. 6). A horizontal activation was placed on the spring by pulling the distal end of the wire and cinching it over the distal end of the molar tube. As treatment continued, the base arch wire was stepped up to a stiffer 0.018″ round stainless steel wire with an offset bend in the left maxillary canine region to avoid interference to the emerging canine (Fig. 7) and bonding was done in the lower arch. The spring was periodically activated each appointment by pulling it distally and cinching it. Once, the canine was brought into alignment in the maxillary arch a standard 0.022 Roth canine bracket was bonded, and the residual space was closed (Fig. 8). The teeth were settled with 0.014 inch stainless steel wire and triangular red elastics. The occlusion was finished with group function on both sides.

The brackets were debonded and an upper wraparound retainer and lower lingual bonded retainer were given as part of retention protocol. Intraoral periapical radiographs were taken at frequent intervals to assess the status of the dilacerated central incisor.

2.9. Case assessment

Clinical evaluation of pre-treatment-T1 (Fig. 1a-i) and post-treatment-T2 (Fig. 9a-i) photographs revealed an increase in lower anterior facial height and an improvement in the depth of the mentolabial sulcus. The upper midline was coincident with the facial midline. The lower midline did not coincide with the upper midline and the facial midline due to the lower incisor extraction. Lip competency was maintained. Intraoral examination revealed a class I molar relation bilaterally. The patient had a class I canine relation on the right side whereas on the left side the maxillary canine came into occlusion between the mandibular premolars. The mandibular teeth were well aligned. Bite opening was achieved and there was normal overjet and overbite between the maxillary and mandibular anterior teeth. The curve of Spee was flat.

Comparison of pre-treatment and post-treatment results (Table 1, Figs. 5 and 10) showed no change in the maxillary skeletal base (SNA-82° at T1 and T2) whereas mandibular skeletal base showed a marginal decrease (SNB-80° and 79° at T1 and T2). The maxillomandibular skeletal relation was class I with ANB being 2° at T1 and 3° at T2. The marginal increase in ANB can be attributed to a mild backward rotation of the mandible due to extrusion of the posterior teeth. There was a mild increase in the mandibular plane angle (Go-Gn to Sn at T1-22°, T2 - 24°) due to mandibular molar extrusion although the growth pattern remained horizontal. There was no change in the inclination of the maxilla. Looking into the dental component the maxillary teeth were upright at T1

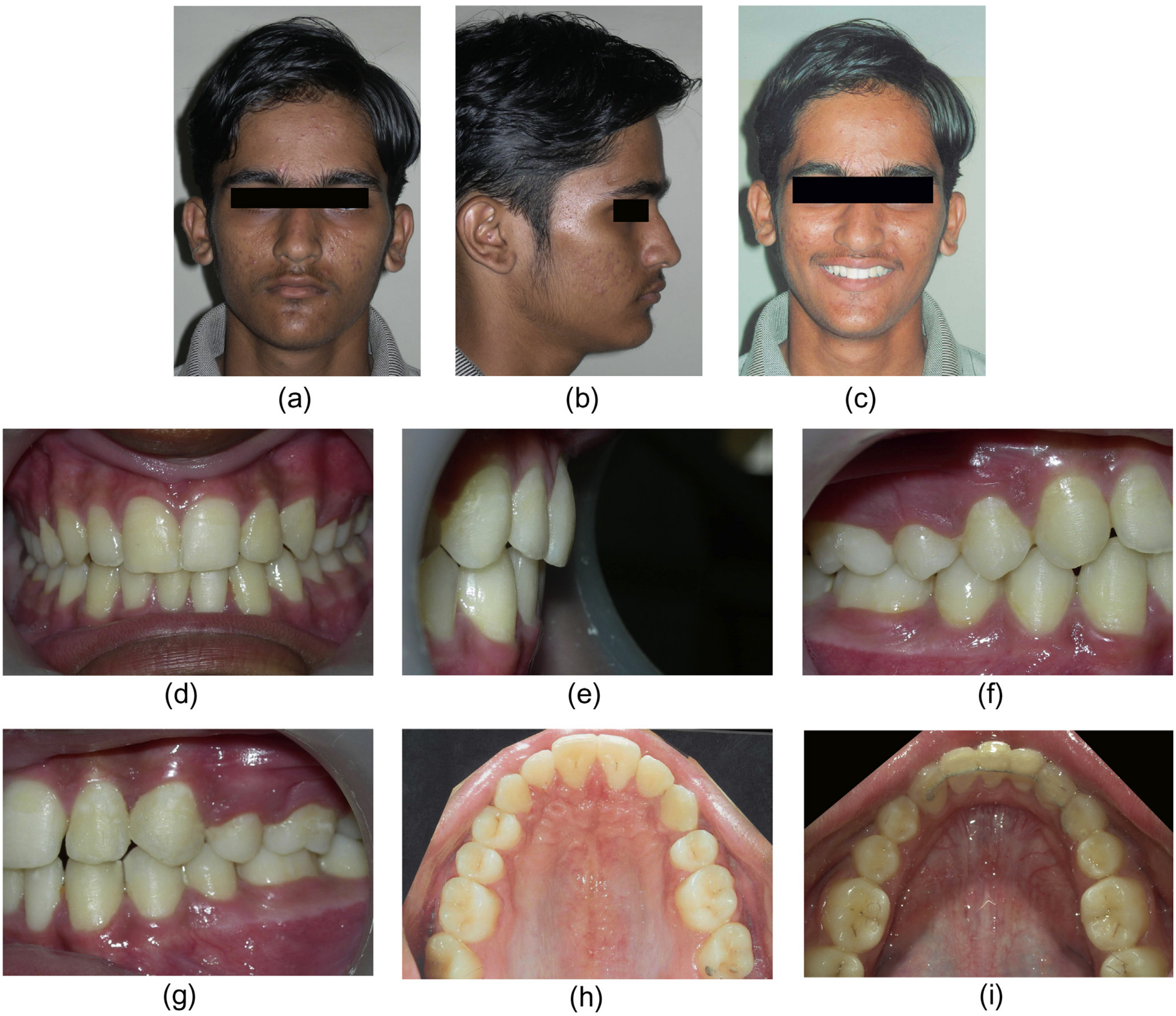

Fig. 9 (a-c) Post-treatment extraoral photographs. (d-i) Post-treatment intraoral photographs.

(U1 to NA -26°) with very minimal decrease at T2 (U1 to NA -25°). The lower incisors were retroclined at T1 (L1 to NB -11°) with mild improvement at the end of treatment (L1 to NB -14°) due to levelling of the curve of Spee. There was an increase in lower anterior facial height (LAFH-66 mm at T1 and 69 mm at T2). The nasolabial angle was within normal limits at the start of treatment with no change at the end of treatment. The patient's facial balance improved towards the completion of treatment.

Superimposition of lateral cephalogram taken at T1 and T2 (Fig. 11) revealed mild extrusion of the mandibular posterior teeth. Bite opening was achieved with attainment of normal overjet and overbite. There was a backward rotation of the mandible and no change in the maxillary skeletal base. Increase in lower anterior facial height was noted.

Intraoral periapical radiographs showed no evidence of root resorption in the dilacerated right upper central incisor (Figs. 12 and 13) on debonding. Vitality tests done at the end of treatment revealed that the tooth was vital. There was a slight mesial tipping of the left maxillary canine although it was well aligned in the arch.

The patient was given a fixed lingual bonded retainer in the lower arch and a wraparound retainer in the upper arch. A Hawley appliance with an anterior bite plane could have been another option in maintaining the corrected overbite. Since the patient was an adolescent greater stability can be expected (Bock and Ruf, 2008). Studies also suggest that adolescents have some reduction in overbite as they mature (Franchi et al., 2011; Bergersen, 1988; Sinclair and Little, 1983).

3. Discussion

There are several methods of disimpacting an impacted canine (Becker, 2007a, 2007b, 2007c). It may be a simple eyelet (Becker, 2007a, 2007b, 2007c), lasso wires (Shapira and Kuftinec, 1981), elastic thread (Lu et al., 1993), e-chain, class II elastics (Storie et al., 1994; Becker, 2007a, 2007b, 2007c) or a simple ligature wire (Becker, 2007a, 2007b, 2007c). The

Fig. 10 Post-treatment Cephalogram.

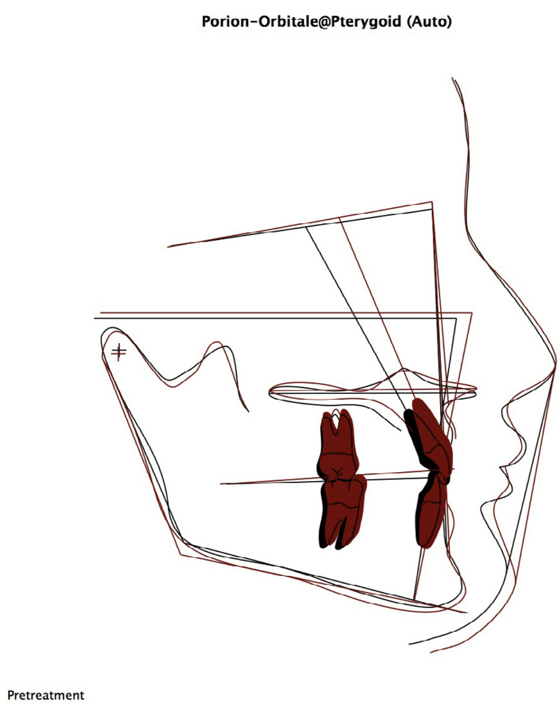

Fig. 11 Superimposition of pre-treatment and post-treatment cephalogram.

active arch (Sinha and Nanda, 1999), Australian helical arch wire (Hauser et al., 2000), the Monkey Hook (Bowman et al., 2002), magnets (Darendelier and Friedli, 1994; Vardimon, 1993; Vardimon et al., 1991), the Ballista Spring (Jacoby, 1979) and the K-9 spring (Kalra, 2000) are some of the more recent techniques for disimpacting the canine. A continuous Niti wire placed on all the teeth including the canine

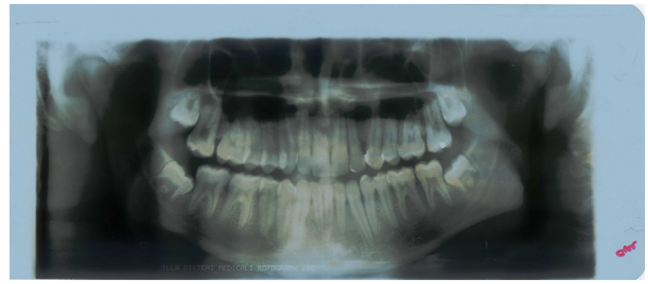

Fig. 12 Post-treatment OPG.

Fig. 13 Intraoral periapical radiograph of maxillary right central incisor just prior to debonding.

Fig. 14 Undesirable side effects produced by a continuous wire placed through all the brackets.

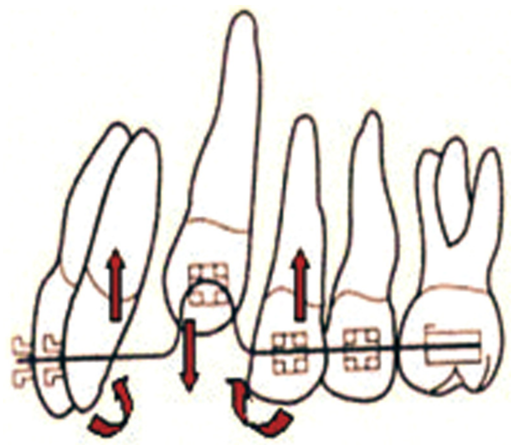

Fig. 15 Schematic representation of the forces generated upon placement of a continuous arch wire in a dentition with partially impacted canine.

(Fig. 14) would result in incisor intrusion, anterior open bite tendency with dumping of the anterior and posterior segment towards each other, loss of arch length, reduced space in the canine region and undesirable rotation of the impacted canine (Fig. 15).

Thus, it is prudent to align the canine by segmental mechanics. The canine disimpaction spring produced a very light force with a low load deflection rate as it was made with a 0.014 round stainless steel wire. To prevent distortion of the spring by masticatory forces, it was inserted as a piggyback on the 0.016″ stainless steel wire base arch wire (Fig. 6). The helix incorporated in the anterior region increased the length of the wire and reduced the load deflection rate. Thus, this design had a low load deflection rate, increased range of action and generated a more constant and light force.

Lower incisor extraction is commonly indicated in anomalies in the number of anterior teeth, tooth size anomalies, ectopic eruption of incisors and moderate Class III malocclusions (Canut, 1996). Extraction of ectopic tooth is done to protect the long-term survival of the dentition (Bahreman, 1977). Extensive periodontal destruction of the lower incisor attributed to decreased width of attached gingiva is also an indication for lower incisor extraction. Incisor extraction can help minimize arch expansion, decrease the amount of tooth movement required, minimize facial change and reduce treatment time. When a lower incisor is extracted the canine will lie mesially beneath the upper lateral incisor and the canine tip will contact the distolingual marginal ridge of the lateral incisor rather than the mesial fossa of the canine. This interference can be compensated by equilibrating the non-functioning portion of the lower canine cusps or extruding the lower incisors to maintain occlusal contact in centric relation and an attempt can be made to achieve a canine guided occlusion (Kokich and Shapiro, 1984). Otherwise group function can be established by orthodontic means and equilibration can be done to eliminate cross arch balancing interferences like in the present case.

According to Riedel, mandibular anterior incisor extraction has greater stability especially in cases with greater pretreatment crowding (Riedel et al., 1992).

4. Conclusion

Orthodontic management of dilaceration can be successfully performed with proper application of force. Extraction of lower incisor could be favourable to the overall prognosis of the case. Unilateral extraction proved to be a better treatment plan in the present case.

Conflict of interest

The author has no conflict of interest to declare.

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