

PREMOLAR SUBSTITUTION OF IMPACTED CANINE ASSOCIATED WITH DENTIGEROUS CYST. A CASE REPORT OF AN INTERDISCIPLINARY APPROACH

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Abstract

Impacted canines are commonly associated with the development of dentigerous cysts, which can be extensive if they are identified late. The surgical management of such cysts by enucleation and extraction can result in significant bony defects that can complicate patient's comprehensive management. This case report presents the conservative interdisciplinary management of an impacted canine associated with an extensive dentigerous cyst. The treatment involved enucleation and extraction of the impacted canine, an initial period of passive eruption of an impacted tooth into the resulting bony defect, followed by an active orthodontic movement and conservative restoration of the substituted premolar. This technique allowed the resolution of the bony defect without resorting to bone grafting.

Keywords: *impacted canine, dentigerous cyst, premolar substitution.*

1. INTRODUCTION

Canine impaction is the second most common condition after third molars [1], its prevalence ranging from 0.27 to 5.2%, based on the population investigated [2-4]. It is more common in females, with a ratio of 3:1 [3], and mostly present palatally [5]. Several etiological factors have been involved in canine impaction, Becker and Chaushu classifying the causes into four groups: local hard tissue obstruction, local pathology, abnormal incisors development and genetic factors [1].

If left untreated, impacted canines can lead to early morbidity of the deciduous canine, root resorption of the adjacent teeth, crown resorption of the impacted tooth and cystic changes [6-8]. Dentigerous cysts (DC) are the second most common type of odontogenic cysts, and the most common developmental cyst of the jaws [9]. They develop from proliferation of the enamel organ remnant or reduced enamel epithelium associated with the crown of the impacted tooth. Expansion of the cyst

results from the increase in cystic fluid osmolality and release of bone resorbing factors [9].

DCs have the potential to extend, considering they are asymptomatic, resulting in potentially damaging neighboring teeth and causing significant disruption in the eruption pattern, which makes the surgical and interdisciplinary management more challenging. The most common surgical management is enucleation, with removal of the affected teeth, most frequently in the unerupted third molars and canines [9,10].

The maxillary permanent canines have an essential role in both function and dentofacial aesthetics [11,12]. Thus, great efforts have been implemented in successfully aligning impacted canines with combined orthodontic and surgical approaches [13]. However, several adverse effects are reported as to the orthodontic management of an impacted canine, namely prolonged treatment duration [14], differences in tooth color, periodontal outcomes and alignment differences with the contralateral tooth [15].

Certain clinical scenarios require considering extraction of the permanent canines and subsequent premolar substitution orthodontically, such as: ankylosis, severe impaction, congenital defects or congenitally missing canines. Substitution of the maxillary canines by the maxillary first premolar is a valid alternative with no perceived compromise on aesthetics [16], however the evidence on functional occlusion comparison is limited [17,18].

The present report describes the successful conservative interdisciplinary management of a patient treated with unilateral premolar substitution of an impacted maxillary canine, associated with an extensive dentigerous cyst.

2. DIAGNOSIS AND ETIOLOGY

A 17 year-old female came with the chief complaint of retained baby teeth and dental protrusion (Figs. 1, 2A and 3).

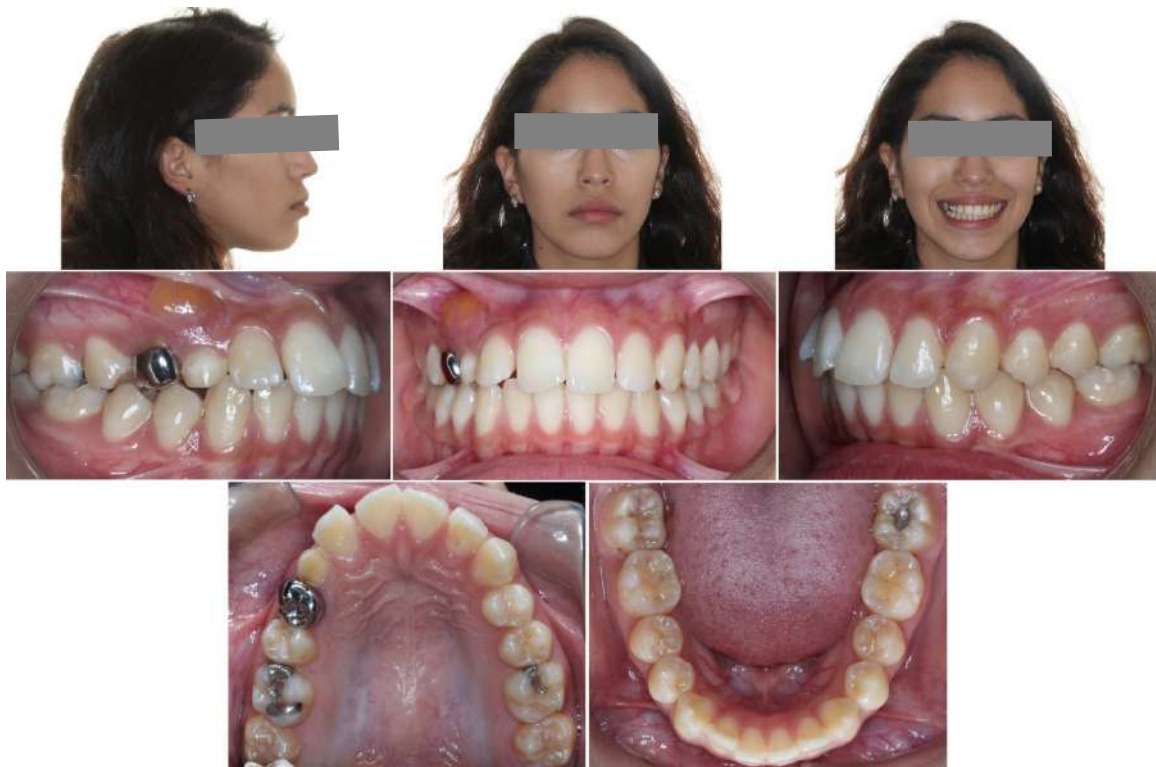


Fig. 1. Pre-treatment photographs

Facial analysis showed a convex profile with protrusive and competent lips with deep labiomental fold. Intraoral examination showed a healthy periodontium with normal overbite and overjet, mild lower anterior crowding, and minimum spacing in the upper arch. A Class I

molar and canine relationship was present, and all teeth were erupted, except for the maxillary right canine, first premolar and all third molars. An asymptomatic palpable cyst was present labially and apically to the retained primary upper right canine and primary first molar.

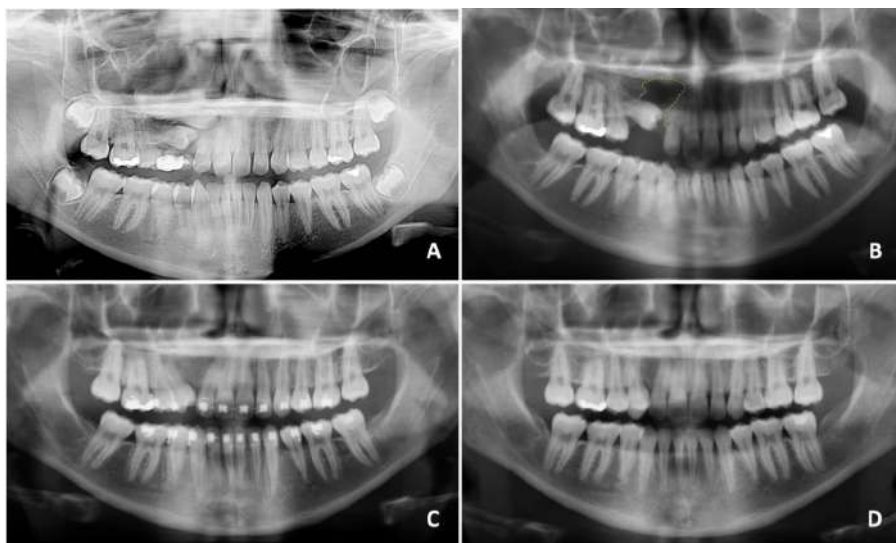


Fig. 2. Panoramic radiographs at pre-treatment (A), 4 months after enucleation and extraction of impacted maxillary right canine (B) 14 months treatment progress (C) Post treatment (D)



Fig. 3. Pre-treatment cephalogram

The panoramic radiograph showed impaction of the permanent maxillary right canine and first premolar. The canine was high with respect to the occlusal plane and horizontally oriented, with noticeable dilaceration of the apical third of the root. The impacted first premolar was also horizontally oriented and mesially migrated

into the permanent canine space. The root health status of the maxillary right lateral incisors and second premolar were not clearly visible. Cephalometric analysis showed a hyperdivergent tendency, normal anteroposterior skeletal relationship, with bimaxillary dentoalveolar protrusion (Table 1).

Table 1. Pre- and post-treatment cephalometri measurements

Measurement	Pre-treatment	Post-treatment
Horizontal skeletal		
SNA (°)	81.4	81.0
SNB (°)	78.4	78.0
ANB (°)	3.0	3.0
Maxillary skeletal		
(A-Na perp) (mm)	2.1	1.5
Mandibular skeletal		
(Pg-Na perp) (mm)	-1.5	-1.6
Wits (mm)	-1.6	-1.8
Vertical skeletal		
FMA (MP-FH) (°)	30.3	30.5
MP-SN (°)	37.9	38.0
Anterior dental		
U1-NA (mm)	8.2	1.4
U1-SN (°)	113.2	100.3
L1-NB (mm)	8.9	3.0

L1-MP (°)	96.8	85.6
Soft tissue		
Upper lip to E-plane (mm)	-1.7	-3.9
Lower lip to E-plane (mm)	4.3	-2.2
Nasolabial angle (°)	87.2	92.5

Due to the limited information obtained from the panoramic radiograph, a Cone Beam Computed Tomography (CBCT) was indicated for accurate assessment of the impacted teeth and their surrounding structures (Fig. 4). Unilocular radiolucency was related to the crown of the impacted canine, extending buccolingually, fenestrating the buccal and

palatal cortical plates. Vertically, the cyst extends from the alveolar crest to the cortical plate of the nasal floor. Based on the radiographic features, the differential diagnosis considered were dentigerous cyst, keratocystic odontogenic tumor and unicystic ameloblastoma. No damage was observed to the roots of the neighboring teeth.

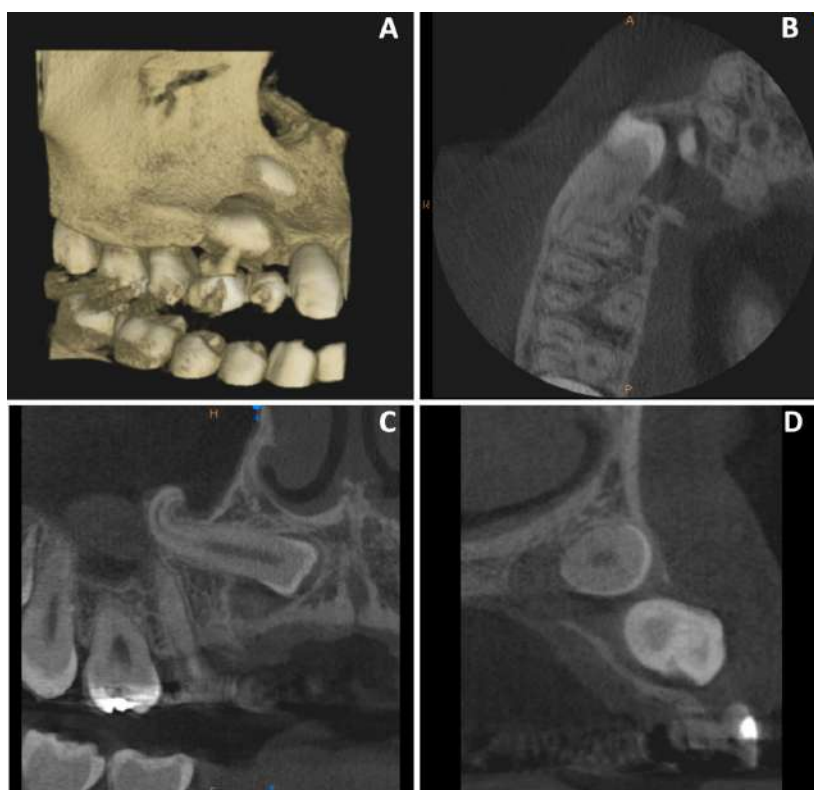


Fig. 4. Pre-treatment reconstructed CBCT of the impacted permanent upper right canine and first premolar (A). Axial view showing the bucco-lingual extension of the DC perforating both buccal and lingual cortical plates (B). Sagittal view showing the dilacerated root and a well defined unilocular radiolucency surrounding the crown of the impacted permanent upper right canine (C). Coronal view showing the vertical extension of the DC (D)

A familial history of maxillary impacted canines suggested that the etiology of this malocclusion could be genetic.

reduce dentoalveolar and lip protrusion, provide adequate space and bony support for the impacted tooth.

3. TREATMENT OBJECTIVES

4. TREATMENT ALTERNATIVES

To maintain a Class I dental relationship, align the maxillary and mandibular dental arches,

Non-extraction and extraction plans were considered. The maxillary and mandibular

dentition could have been levelled and aligned orthodontically without extraction of the permanent teeth. However, this option does not address patient's chief complaint of dentoalveolar biprotrusion. In this respect, two extraction options were discussed.

First, cyst enucleation and extraction of all first premolars and retained primary teeth were performed, combined with orthodontic and surgical approach to extrude the impacted canine, followed by closing of the extraction spaces reciprocally, with equal amount of incisors retraction and posterior teeth protraction. Although this option does address patient's chief complaints, it has its own limitation. The severity of the vertical and antero-posterior position of the impacted canine, combined with its dilacerated root (and surrounding bone resorption) would make the treatment duration significantly longer and the prognosis less favorable.

Secondly, extraction (and cyst enucleation) of the impacted maxillary right canine, extraction of the first premolars in quadrants 2, 3 and 4, which allow for spontaneous eruption of the impacted maxillary right first premolar, and then complete levelling and aligning orthodontically with closing spaces reciprocally. The maxillary right first premolars would replace the canine and be restored with a direct composite veneer, to match its contralateral canine. This option would reduce dentoalveolar biprotrusion, improve facial profile

and minimize the overall treatment duration. The second extraction plan was selected for our patient.

5. TREATMENT PROGRESS

Enucleation of the maxillary right canine and associated cyst was performed, the pathology report confirming a dentigerous cyst. Then, extraction of the first premolars in quadrant 2, 3 and 4 and all-third molars was performed.

A period of observation was allowed, with no active treatment to monitor the bone healing response after the surgical procedure. At 4 month post enucleation and removal of the impacted canine, a panoramic radiograph exam showed spontaneous correction of the maxillary right first premolar's position, and a noticeable bony defect in the operation site that was palpated clinically (Fig. 2B). At 7 month follow-up post surgery, the first premolar's crown was completely visible intraorally, and an active orthodontic treatment with preadjusted fixed appliances was initiated. After levelling the maxillary and mandibular arches with a 0.016-inch nickel-titanium wire, piggyback mechanics were applied to extrude the maxillary right first premolar, and a 0.020 stainless-steel base archwire with an overlay 0.014-inch nickel-titanium was used (Fig. 5). Space closure started with lacebacks, and finalized by utilizing Class I elastics and power chains on maxillary and mandibular 0.019 x 0.025 stainless-steel wires.

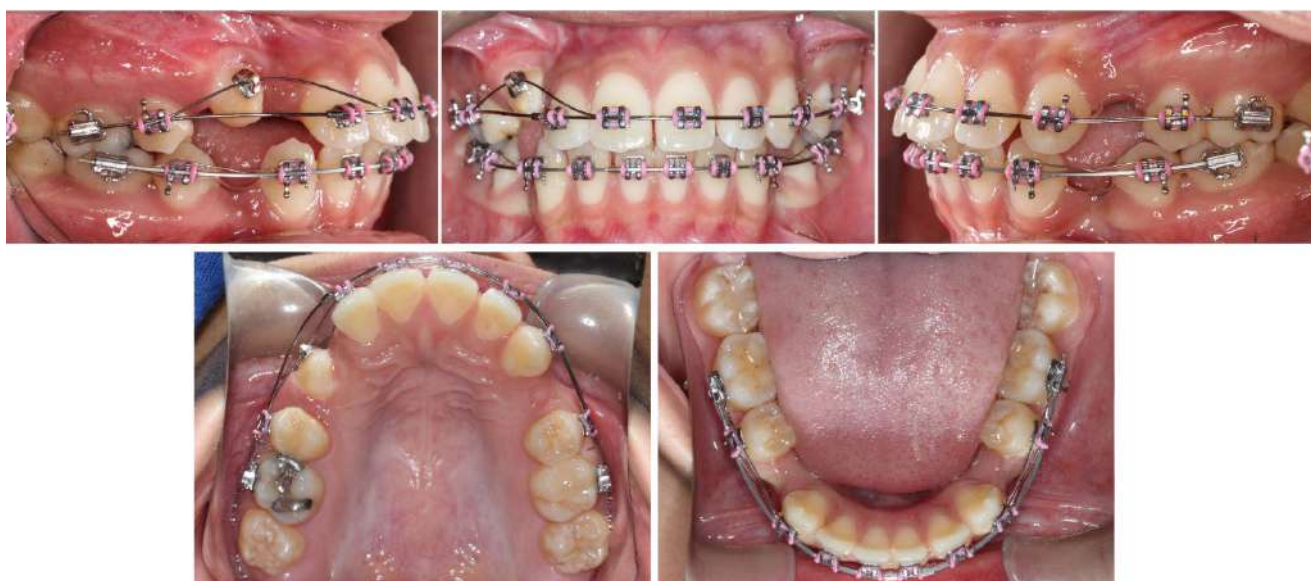


Fig. 5. Three months of active treatment progress

14 months within the active orthodontic treatment, a progress panoramic radiograph was taken, to assess the root parallelism and health, in addition to the status of the bony defect left at the surgical site (Fig. 2C). Noticeable improvement of the bone fill associated with the eruption and active extrusion of the previously impacted first premolar were observed.

In the finishing stages, the restorative plan was visualized (Fig. 6), with placement of a direct composite veneer on the maxillary first premolar to match its contralateral canine, on increasing the mesio-distal dimension and incisal edge height by 1.5 mm. The remaining space distally to the maxillary right lateral incisor was closed by retraction of the anterior teeth posteriorly by 2 mm.

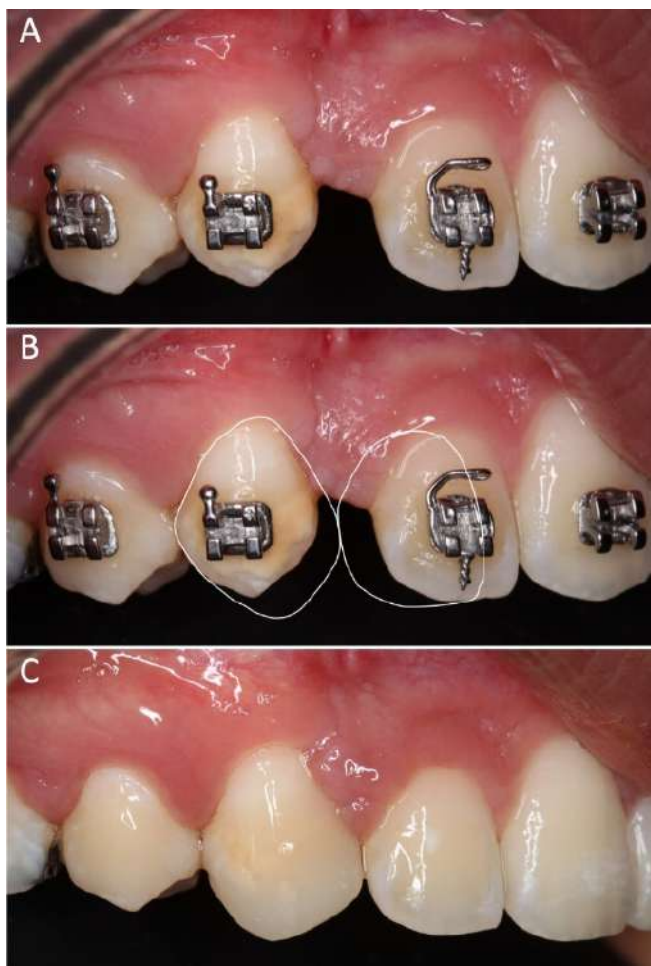


Fig. 6. The gingival margins of the upper right central incisor, lateral incisor and substituted first premolar were set at high-low-high respectively (A) Visualization of the planned restorative/orthodontic management of the remaining space, increasing the mesio-distal dimension and incisal edge height of the

substituted premolar by a direct composite veneer. The remaining space distal the maxillary right lateral incisor was planned for retraction of the anterior teeth posteriorly (B) One month post treatment (C)

6. TREATMENT RESULTS

After 23 months of active treatment, the patient had a Class I molar relationship and ideal overbite and overjet. The profile has improved, the lips were retracted, and cephalometric evaluation showed acceptable maxillary and mandibular incisor inclinations. The final panoramic radiograph (Fig. 2D) showed that an overall good root parallelism was achieved, expected in the area of upper right lateral incisor and new canine (area of previous bony defect) at which the clinical aesthetics were favoured on ideal root parallelism. A significant improvement in the bony fill was observed during the treatment, even if an angular bony defect was seen in the mesial aspect of the substituted first premolar. Periodontal examination showed overall normal probing measurements even around the substituted tooth.

The gingival levels were acceptable, but in a slightly higher position of the substituted first premolar, compared to its contralateral tooth. However, that was not a concern, as the patient does not show the gingival margin upon smiling. Functional occlusion achieved was bilateral canine rise with no reduction of the palatal cusp of the substituted premolar.

Tracing superimposition showed a mild mesial movement of the maxillary and mandibular first molars, and significant distal movement and retroclination of the maxillary and mandibular incisors accompanied by reduction in lips protrusion. (Figs. 7, 8, Table 1).

Maxillary and mandibular clear essix retainers were delivered. Clinical examination performed 6 months after the end of the treatment showed stable aesthetic and functional results. The periodontal measurements were stable and healthy. The direct composite veneer was maintained adequately, no deteriorating aesthetics or function being observed at 6 month follow-up.



Fig. 7. Post-treatment photographs

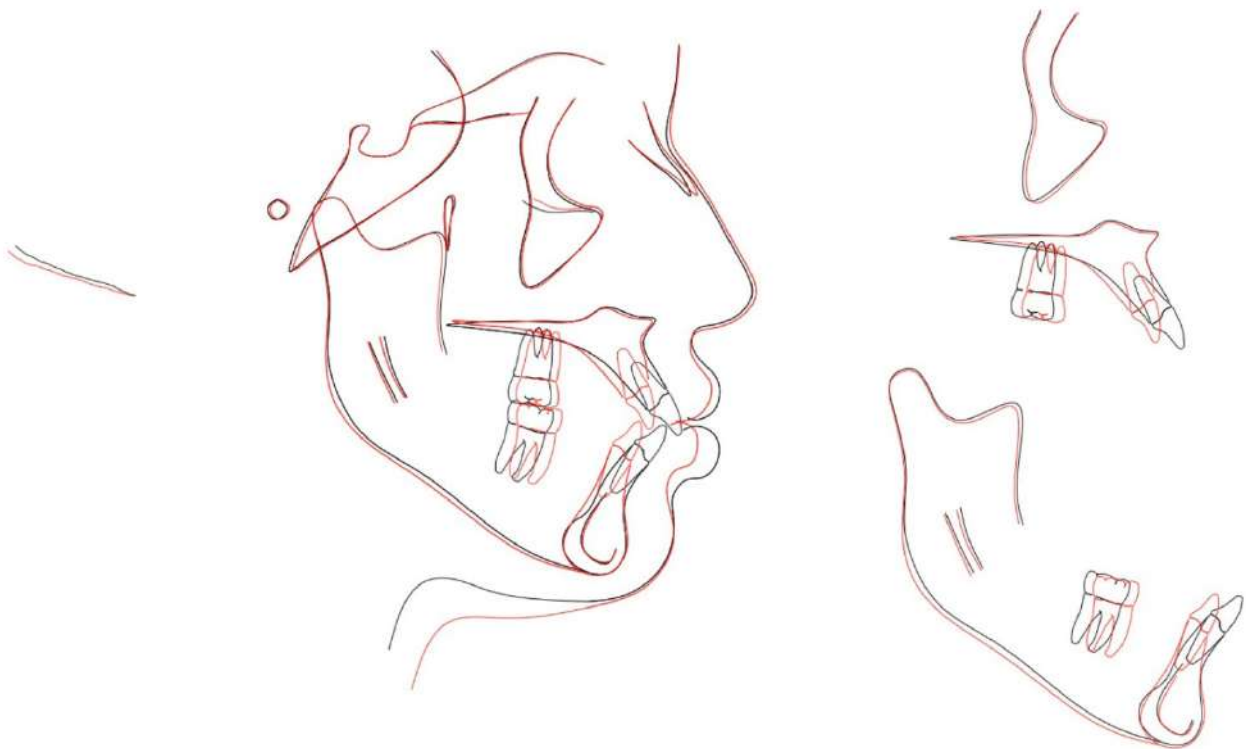


Fig. 8. Pre and post treatment superimposed tracings.

7. DISCUSSION

The conventional treatment of severely impacted canines represents a clinical challenge, as it involves a combination of surgical exposure and orthodontic extrusion. Ideally, the results of the treatment should show a healthy periodontium and no compromise in the stability or aesthetics of the canine.

However, the surgical-orthodontic combination can result in many complications, such as prolonged active treatment duration [14], ankylosis, loss of vitality of the canine and adjacent incisors, loss of periodontal support and external root resorption [15]. Therefore, considering these risks, the option to extract an impacted canine can eliminate all risks associated with its orthodontic extrusion.

In the present case, extraction of all first premolars was indicated to reduce the bimaxillary dentoalveolar protrusion. However, due to the severity of canine impaction, dilacerated root and associated cyst, we extracted the impacted canine and enucleated the cyst, followed by premolar substitution.

There are aesthetic concerns related to premolar substitution. The maxillary first premolar is shorter than the maxillary canine, thus leading to possible vertical gingival level discrepancies. In a relatively different clinical scenario of canine substitution in cases of congenitally missing lateral incisors, Rosa and Zachrisson [19] recommended intruding the first premolars to achieve natural marginal gingival contours (high-low-high) and restoring the premolars with composite resin build-ups or porcelain veneers to resemble natural canines. There are no apparent aesthetic compromises in premolar substitution, Thiruvengkatachari *et al.* [16], who compared the aesthetic perception of patient's smiles treated by extraction of either maxillary canines or first premolars, found no difference in smile attractiveness, as assessed by general dentists, laypersons, and orthodontists. However, the evidence on functional occlusion comparison is limited [17,18].

Several methods have been discussed in literature to eliminate dentigerous cysts, including decompression, marsupialisation and

enucleation [9,20]. A minimum period of 6 months is required for healing of the bony defect [10,21]. In the present case, enucleation of the cyst and extraction of the impacted canine resulted in a significant bony defect. However, knowing that the erupting tooth brings bone with it [1,22], allowing a period of healing and passive eruption of the impacted first premolar resulted in spontaneous bone filling, without resorting to bone grafting.

Patient's choice of a direct composite veneer was driven by the lower cost, compared with a porcelain veneer. This choice comes with its own limitation, for example, the survival rate of direct composite veneers are reported from 80-89% over 5 years [23,24], while porcelain veneers show higher survival rates [25].

8. CONCLUSIONS

Significant bony defects, resulting from enucleation of a DC can be resolved by allowing a period of monitoring and passive eruption, followed by an active orthodontic treatment without bone grafting. Extraction of a severely impacted canine and subsequent premolar substitution provides an alternative to the conventional orthodontic treatment where premolar extraction is indicated. Adequate function and aesthetics can be achieved with interdisciplinary management.

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