



## Case Report

### Orthodontic Management of an Avulsed Maxillary Canine- A Case Report

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#### ABSTRACT

Avulsion of teeth is an uncommon condition which is usually associated with trauma. Management of an avulsed tooth often presents a challenge to the clinician and treatment planning differs with each situation. Key factor is the immediate management with appropriate protocol which usually results in good prognosis. A 15-year old female patient reported with avulsed 23 during therapeutic extraction of 24. The avulsed 23 was reimplanted in to the socket followed by splinting. Patient was treated with conventional fixed appliance and all the treatment objectives were achieved. This case report highlights the successful management of an avulsed maxillary canine during therapeutic extraction of maxillary first premolar with 3 years follow up after debonding.

**Keywords:** Avulsion, Maxillary canine, Replantation, orthodontic treatment, fixed appliance.

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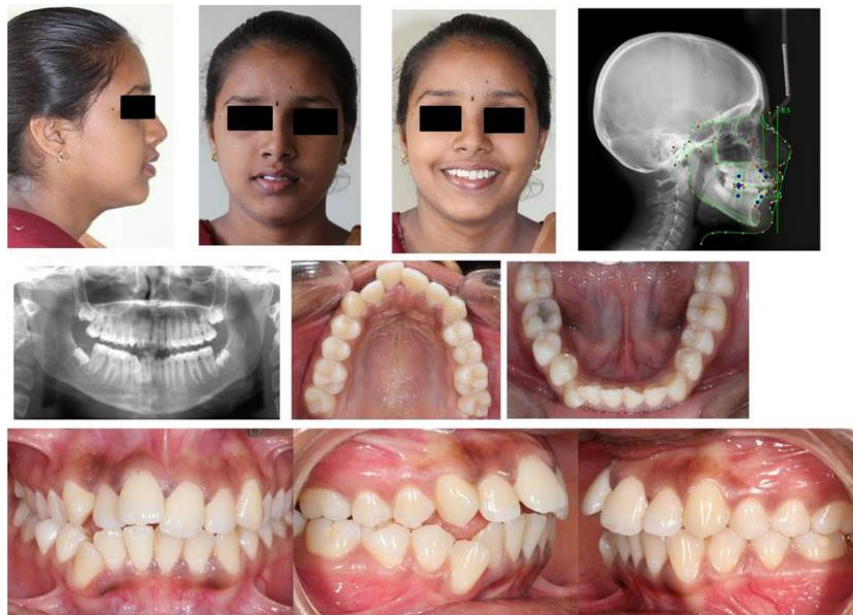
## INTRODUCTION

Tooth avulsion is defined as total displacement of the tooth out of its alveolar socket. Avulsion of permanent teeth occurs in children between seven to nine years of age due to the resiliency in the alveolar bone which provides minimal resistance to extrusive forces. Of all the traumatic injuries in the permanent dentition, avulsion accounts for 0.5% to 16%. The periodontal ligament (PL), alveolar bone, cementum, gingiva, and dental pulp are all damaged when a tooth is avulsed. This damage includes disruption of the gingival epithelium, severance of the PL, injury to the cementum and alveolar bone, and severance of the dental pulp neurovasculature.<sup>[1]</sup> Sometimes subluxation or avulsion of a tooth can occur during extraction of other teeth. This case report describes the orthodontic management of an avulsed maxillary canine during therapeutic extraction of a maxillary first premolar.

Management of dental trauma with conventional treatment protocols cannot be followed since each case presents with unique set of challenges. Most trauma cases require personalized treatment planning that involves a multidisciplinary approach, incorporating fields such as pediatric dentistry, endodontics, oral surgery, orthodontics, restorative dentistry, and prosthodontics. This planning should take into account biological, functional, aesthetic, and economic factors, along with the patient's preferences and level of compliance.<sup>[2]</sup>

## CASE REPORT

A 15 year old female patient presented to the Department of Orthodontics with problems of crowding and proclination. Extra oral examination revealed that the patient had convex profile with posterior divergence, acute nasolabial angle, protrusive upper and lower lips, increased interlabial gap and incompetent lips at rest. On Intraoral examination, crowding and proclination of maxillary and mandibular anteriors, crossbite in relation to 15, 16, 35, 36 and upper midline shift to right by 1mm with class I canine and molar relation bilaterally were present (Figure 1). Patient was diagnosed with Angle's class I malocclusion with proclination and crowding of maxillary and mandibular anteriors. Lateral cephalometric analyses (Figure 1) showed a class I skeletal base, proclined upper and lower anteriors with vertical growth pattern (Table I).



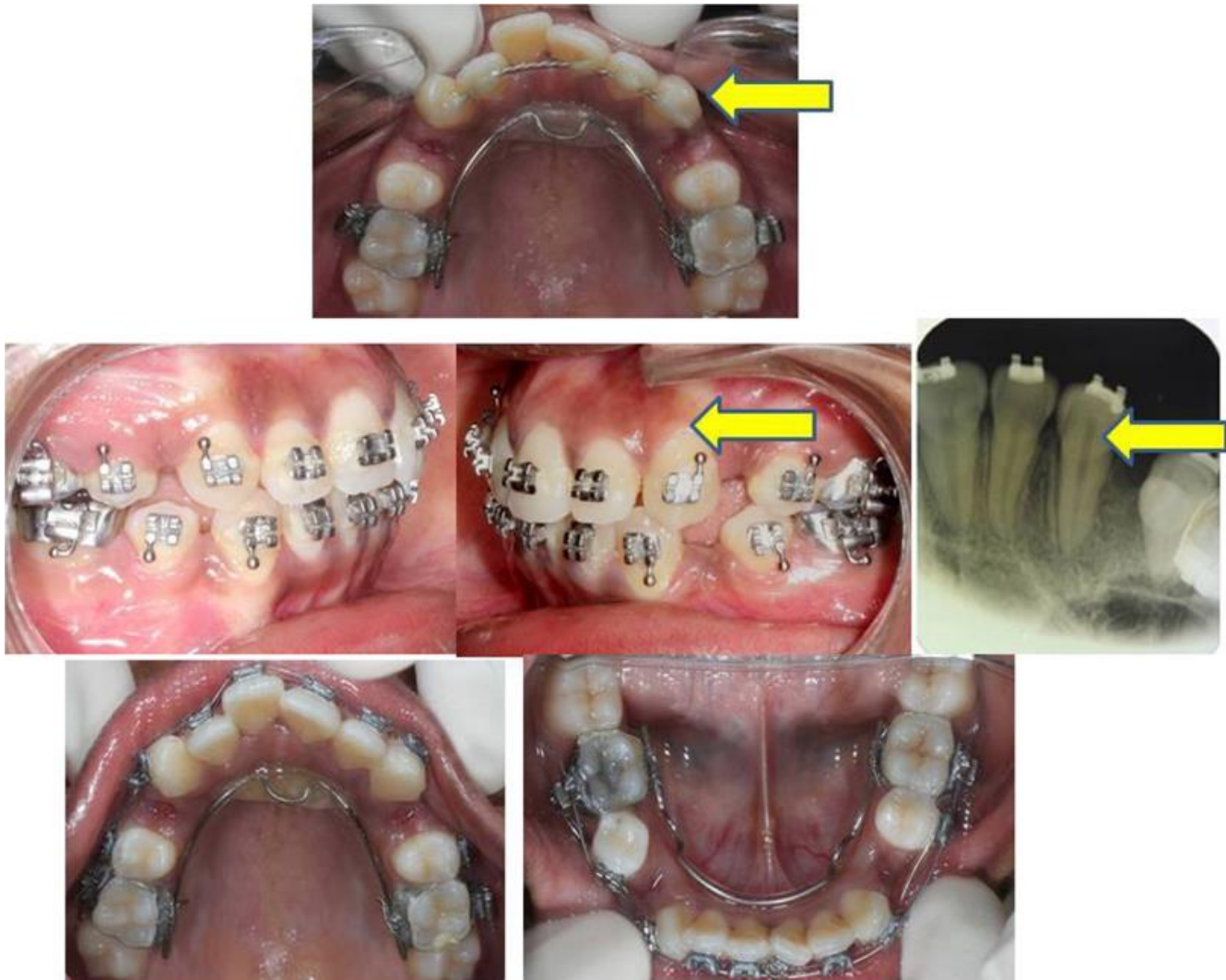
**Figure 1: Pretreatment photographs, OPG and Lateral cephalogram.**

**Table 1: Pre-Treatment and Post-Treatment Cephalometric Values**

<b>MEASUREMENT</b>	<b>PRE TREATMENT</b>	<b>POST TREATMENT</b>	<b>MEAN CHANGE</b>
<b>SNA</b>	<b>82°</b>	<b>80°</b>	<b>2°</b>
<b>SNB</b>	<b>78°</b>	<b>77°</b>	<b>1°</b>
<b>ANB</b>	<b>4°</b>	<b>3°</b>	<b>1°</b>
<b>Go Gn to SN plane Angle</b>	<b>36°</b>	<b>35°</b>	<b>1°</b>
<b>Upper 1 to NA (angle)</b>	<b>40°</b>	<b>22°</b>	<b>18°</b>
<b>Upper 1 to NA (mm)</b>	<b>9mm</b>	<b>3mm</b>	<b>6mm</b>
<b>Lower 1 to NB (angle)</b>	<b>41°</b>	<b>27°</b>	<b>14°</b>
<b>Lower 1 to NB (mm)</b>	<b>8mm</b>	<b>4mm</b>	<b>4mm</b>
<b>IMPA</b>	<b>104°</b>	<b>89°</b>	<b>15°</b>
<b>FMA</b>	<b>31°</b>	<b>32°</b>	<b>-1°</b>

**Diagnosis and Treatment plan**

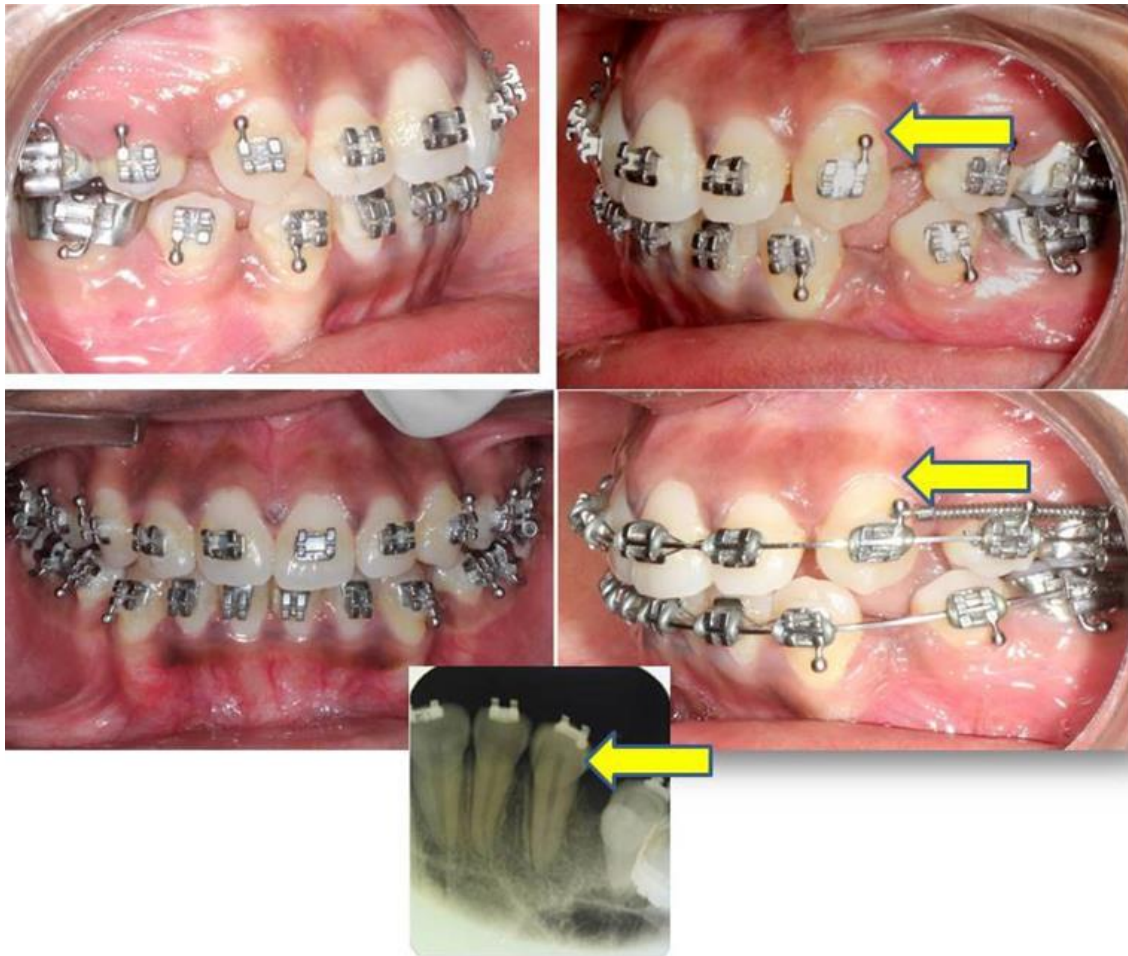
Based on the clinical findings, model analyses and cephalometric analyses, fixed appliance therapy with extraction of maxillary and mandibular first premolars, retraction of maxillary and mandibular anteriors under maximum anchorage was planned. Patient was referred to oral surgery for therapeutic extraction of maxillary and mandibular first premolars. When the maxillary left first premolar was being extracted, there was an accidental avulsion of the maxillary left canine. Parents were informed about the avulsion and its possible consequences. Immediately the tooth was replanted in to the socket with as minimal damage to the periodontal ligament as possible and semi rigid splinting was done (Figure 2). The splint was removed after four weeks and since vitality testing revealed a variable response, orthodontic treatment was initiated with 022 X 028 inch slot, MBT prescription (Ormco, Glendora, CA, USA) and leveling and aligning was carried out. After leveling and aligning, IOPA was taken to assess if there were any signs of ankylosis or root resorption of the avulsed tooth (Figure 2).



**Figure 2: Reimplantation with semi rigid splinting, Initial arch wire followed by leveling and aligning.**

### **Treatment progress**

Individual canine retraction (Figure 3) was done in the maxillary arch using active lace backs to keep the complications which may arise from replantation as minimal as possible. Retraction was initiated with sliding mechanics using active tiebacks in 19X25 stainless steel arch wires (Figure 3) and force level was monitored with a Dontrix gauge.



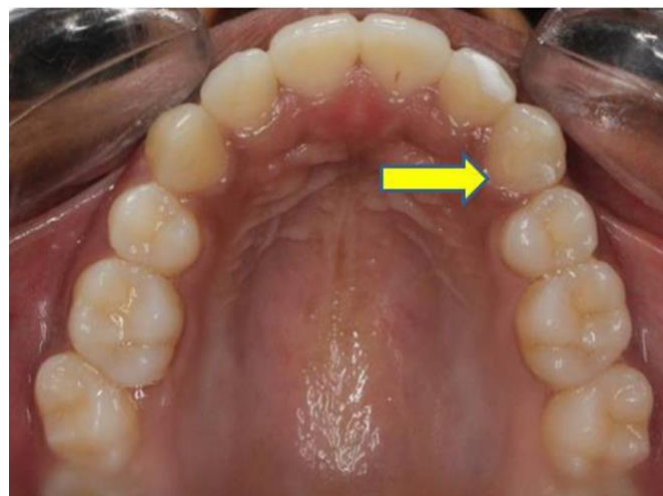
**Figure 3: Individual canine retraction and space closure.**

The avulsed and replanted tooth was checked for mobility and discoloration periodically. Space closure was achieved equally on both sides and settling elastics were used for achieving good intercuspation. Clinically the tooth did not show any signs of mobility or discoloration. Post treatment OPG and IOPA showed no evidence of resorption or ankylosis and cephalometric superimposition showed the retraction of maxillary and mandibular anteriors (Figure 4). Hawley's retainer in the upper arch and lingual bonded retainer in the lower arch was given (Figure 4). After debonding, the Vitality testing showed a delayed response in 23 after which test cavity was being prepared, the patient had sensitivity and it was restored with Type 9 GIC (GC International) (Figure 5). Follow up records taken at three years showed that the left maxillary canine had an intact periodontium without any signs of discoloration, ankylosis but mild external root resorption was seen (Figure 6).





**Figure 4:** Post treatment records with cephalometric superimposition, Hawley retainer in the upper arch and lingual bonded retainer in the lower arch.



**Figure 5:** Test cavity prepared in 23 and restored with type 9 GIC



**Figure 6: Follow up records after three years of debonding**

## DISCUSSION

Management of avulsed tooth especially in the permanent dentition often presents a challenge. Since the first premolar was already extracted in that quadrant, the primary objective in this case was to retain the avulsed canine and move it into the premolar extraction space. Root canal treatment was deferred initially because the tooth vitality showed a variable response. Studies have shown that avulsed tooth with open apex had high chances of revitalization of the pulp and continuation of root development is possible.<sup>[3]</sup> The avulsed tooth undergoes damage to the attachment apparatus and necrosis of the pulp. Tearing of the periodontal ligament and small areas of cemental damage also occurs. If the periodontal ligament on the root surface is not dry, then the consequences are minimal. There is a better chance for the cells to be viable and healing occurs with regenerated periodontal ligament cells and replacement cementum.

So, orthodontic treatment was initiated since the apex was still open in 23. Thus, light continuous force was applied to achieve tooth movement which might prevent ankylosis or root resorption. Animal studies suggested that the replantation of the avulsed tooth under optimal conditions results in better healing of the dental and supporting tissues. Chances of regeneration or healing with a normal periodontal ligament are possible if the innermost cell layers along the root surface are vital. One of the most important factors to ensure a favorable outcome is the speed with which the tooth is replanted<sup>[4]</sup>. When

the tooth is replanted within 5 minutes after avulsion, prognosis is good and high chance of complete healing of the periodontal ligament is possible.<sup>[5-8]</sup> In this case, the tooth was replanted within three minutes of avulsion which probably had contributed to the regeneration of the periodontal ligament leading to successful space closure.

Semi rigid splinting was done to allow physiological movement of teeth without any impingement on the gingiva thus not interfering with oral hygiene. It is recommended to immobilize the tooth with a semi rigid splint for a minimum of seven to ten days to create sufficient periodontal support to hold the tooth in position.<sup>[9]</sup> In this case, the avulsed tooth was replanted immediately, stabilized with semi rigid splint for 4 weeks to decrease the incidence of ankylosis and light forces were used to move the tooth.<sup>[2,10]</sup> Orthodontic force could have stimulated the process of migration and proliferation of periodontal ligament cells which had facilitated the repair of these tissues.<sup>[11]</sup> Kaneko et al also concluded that movement of luxated teeth may relieve the areas of compression in the pulp and periodontium and therefore facilitates the repair of these tissues.<sup>[12]</sup>

Although the vitality of the tooth was a questionable point, it was decided that a wait and watch approach could be followed before subjecting the tooth to endodontic treatment. Andreasen and Weine also strongly advised that an avulsed tooth should be reimplanted immediately without removing the attached periodontal ligament, and that no immediate pulpal treatment is required. The factors to be considered as to whether or not to treat a tooth pulpally after avulsion would be age of the patient, development of the tooth root, and the presence or absence of inflammation. As suggested by Kinirions et al, periodic intraoral periapical radiographs were taken to evaluate any signs of inflammatory root resorption.<sup>[2]</sup> As a result; treatment planning for this patient differed from the conventional avulsion management protocol. Immediately after avulsion, 23 responded to vitality testing although variable and there was no sign of discolouration.

On a follow up visit after one and half years of debonding, there was a delayed response to vitality test and Root canal treatment was initiated. Patient had sensitivity and hence the test cavity was restored with Glass Ionomer cement. Patient was also explained the need of pulpectomy later in life. At a three year follow up, the left maxillary canine had a slightly delayed response with mild widening of the periodontal ligament space in the apical third and mild external root resorption.

Ankylosis and inflammatory root resorption are common complications associated with the replantation of an avulsed maxillary incisor. Prognosis can be poor in cases when the tooth remains in the dry environment for longer period of time. In the case presented here, tooth was routinely monitored with IOPA during the fixed appliance therapy and retention. When an avulsed tooth is replanted, a follow- up period of at least one year is necessary since most root resorption occurs during the first year post- trauma and this patient was followed up for three years.

## **CONCLUSION**

Successful orthodontic management of an avulsed maxillary canine has been discussed in this case report. Extraction of teeth should be done with great caution so that subluxation or avulsion of adjacent teeth doesn't occur. The factors which are crucial for management of avulsed tooth especially in a patient during therapeutic extraction of premolar are the extra oral time, type of splinting, application of light continuous force and periodic monitoring for discoloration, ankylosis, and root resorption.



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