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Case Report

Root repair and regeneration after miniscrew root damage

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ABSTRACT

Background: Root damage due to miniscrews can be a potentially serious complication. This case report describes a 21-year-old woman with bimaxillary protrusion and a congenitally missing mandibular left lateral tooth. Miniscrews were placed mesial to the maxillary second premolars.
Methods: After placement of the miniscrews, it was discovered on a periapical radiograph that a miniscrew perforated the root of the left maxillary second premolar. On discovery of the perforation, the miniscrew was immediately removed and a new miniscrew was placed mesial to the first maxillary molar. The patient did not complain of pain or discomfort, and there was no evidence of inflammation or a periapical lesion. Because the pulp vitality test initially showed the tooth to be nonvital, root canal treatment was originally considered. However, because the source of trauma was removed immediately and only part of the root was affected, the root was simply monitored and root canal treatment was not performed.
Results: At 10 months after perforation of the root, the tooth started showing vitality; there were positive readings during the third and fourth steps of electric pulp testing. At 2 years 6 months after the root damage, the tooth was completely vital, showing positive pulp tests during all four steps of the electric pulp testing. Additionally, the fractured part of the root embedded within the bone, reinstating a sound root form. Three years later, the root continued to demonstrate complete pulp vitality.
Conclusion: Despite root perforation extending into the pulp and causing root fracture, after immediate removal of the miniscrew, the damaged root repaired itself and regenerated without invasive treatment.

1. Introduction

A 21.6-year-old female patient presented with a chief complaint of lip protrusion. The treatment plan involved retraction of the anterior teeth after extraction of all first premolars except for the left mandibular first premolar (Fig. 1). Miniscrews were placed mesial to each maxillary second molar to preserve anchorage. Additional miniscrews were planned to be placed mesial and apical to the left maxillary second premolars for simultaneous retraction and intrusion of the maxillary anterior teeth (Fig. 2).

After placement of the miniscrews, it was discovered on a periapical radiograph that a miniscrew perforated the root of the left maxillary second premolar (Fig. 3). This occurred due to failure to observe the root's mesial inclination relative to the crown. On discovery of the perforation, the miniscrew was immediately removed and a new miniscrew was placed mesial to the first maxillary molar (Fig. 4). The patient was promptly referred to an endodontist, and nonvitality of the pulp was detected through use of an electric pulp test.

1.1. Treatment progress

Even after the faulty miniscrew placement, the patient did not complain of pain or discomfort, and there was no evidence of inflammation or a periapical lesion. Because the pulp vitality test initially showed the tooth to be nonvital, root canal treatment was originally considered. However, because the source of trauma was removed immediately and only part of the root was affected, the root was simply monitored without root canal treatment. The root was monitored every 4 weeks (Fig. 5). At the 10-month check, the pulp showed positive results. Thereafter, the tooth was monitored every 2 to 3 months (Fig. 6).

1.2. Treatment results

Orthodontic treatment was completed within 23 months. Fair occlusion was achieved. Molar and canine relationships were Class I

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Fig. 1. Despite the Class I molar relationship, there was anterior crowding in the mandibular and maxillary arch. The midline was shifted to the left due to a congenitally missing mandibular left premolar.

(Fig. 7). All roots showed good parallelism, and the left maxillary second premolar showed a fair shape (Fig. 8). After completion of orthodontic treatment, the left second premolar root continued to be observed (Figs. 9 and 10). At 2 years 6 months after the root damage, the pulp tissue of the tooth reacted positively to all four steps of the electric pulp test, confirming the pulp's complete recovery (Fig. 10). Three years after the root fracture, the root continued to maintain its form. The pulp tissue still responded positively to all steps of the electric pulp test (Fig. 11).

2. Discussion

A miniscrew's sharp drilling tip can cause root damage. Despite such damage, it has been shown that where a root is cut, the cementum has self-repairing properties, and the periodontal ligament reorganizes itself [1]. Roots damaged with miniscrews can generate reparative cementum [2]. Studies have shown that root damage limited to cementum and dentin can recover completely [3] and be regenerated without complications [4]. It is rare for root surface damage to cause irreversible pulp damage [5]. On the other hand, root damage involving the pulp usually results in loss of vitality and damage to the periodontal tissue [6]. Leaving the miniscrew in the site of damage delays or eliminates the likelihood of root repair [7]. Therefore, immediate miniscrew removal is recommended. Additionally, when miniscrews are removed immediately after root damage, symptoms of pain, discoloration, devitalization, or ankylosis can be avoided [8]. This case report shows an example of immediate miniscrew removal and the absence of inflammation, pain, or ankylosis. Despite damage extending into the pulp, complete root repair and regeneration occurred.

Precautionary measures must be taken with regard to miniscrew placement. Root damage can be prevented by examination of a periapical radiograph and cone beam computed tomography. It is important to accurately assess interradicular distance, as well as