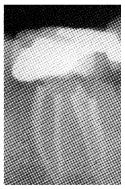
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CASE REPORT

Root canal treatment of a periradicular lesion caused by unintentional root damage after orthodontic miniscrew placement: a case report

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Abstract

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Aim To present the successful endodontic management of a maxillary lateral incisor tooth with a periradicular lesion caused by unintentional root damage after orthodontic miniscrew placement.

Summary A 22-year-old female was diagnosed with a skeletal Class II, Division 2 malocclusion with Class II molar and canine relationships on both sides. The treatment plan included distalization of the maxillary first molars bilaterally followed by full fixed appliance therapy. For the maxillary molar distalization, an appliance in conjunction with a miniscrew anchorage system was designed. Two months later, the patient came to the clinic with complaints of pain in the maxillary right lateral incisor region. On intraoral examination, intraoral sinus tracts were detected in the maxillary right buccal sulcus and palate. A large radiolucent lesion with a well-defined margin around the root of the maxillary right lateral incisor was seen. Root canal treatment was performed on the maxillary right lateral incisor tooth. The root canal was filled with gutta-percha and AH Plus sealer, using a lateral compaction technique. The final restoration of the tooth was completed using composite, and the tooth was reviewed after 10 months. The tooth was asymptomatic and radiographically showed repair of the lesion. Healing was achieved without any need for further endodontic or surgical intervention.

Key learning points

- This case illustrates the need to take care with miniscrews when performing orthodontic treatment, especially when the miniscrews are in close proximity to root apices.

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- The periradicular lesion as a result of miniscrew damage was successfully treated with root canal treatment.

Keywords: orthodontic miniscrew, periradicular lesion, root damage.

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Introduction

Anchorage refers to the resistance against displacement by anatomical structures; the control of anchorage is one of the main factors for determining the success of orthodontic treatment (Park *et al.* 2010). Obtaining proper anchorage has always been of interest to clinical orthodontists and researchers. To date, headgears and nance appliances are routinely used to establish anchorage during clinical treatment (Chen *et al.* 2006). Because of the disadvantages of these types of appliances, the concepts of skeletal anchorage systems have been introduced in clinical use as simpler alternatives to aid orthodontic mechanics.

In recent years, miniscrews have been used as skeletal anchorage systems, because they have advantages for orthodontic anchorage, and can be placed at various sites in the alveolar bone because of their small size and simple operative procedure (Kanomi 1997, Costa *et al.* 1998, Park *et al.* 2003). A limitation to the use of miniscrews might be the risk of damage to the roots of adjacent teeth (Deguchi *et al.* 2006), and their placement in the alveolar bone between roots is critical. This is one of the reasons why clinicians hesitate to use this device (Kravitz & Kusnoto 2007). Even if preventive measures are taken, such as a periapical radiograph before placing the screw, root damage can occur (Kadioglu *et al.* 2008).

The placement of miniscrews can produce immediate or delayed damage to tooth, periodontal tissues and bone. The damage can range from displacement of bone into the periodontal ligament space to pulpal damage and root fractures. Damage to the pulp by placement of a miniscrew can produce detrimental and irreversible effects (Hembree *et al.* 2009). This type of damage usually warrants either endodontic treatment or extraction of the damaged tooth (Mehlman 2000, Hembree *et al.* 2009).

The following case report describes the root canal treatment of a periradicular lesion in a maxillary right lateral incisor because of unintentional root damage after orthodontic miniscrew placement.

Case report

A 22-year-old female was referred to the Department of Orthodontics at the Faculty of Dentistry, Karadeniz Technical University with a chief complaint of retroclined and irregular upper front teeth, and a deep bite. She was diagnosed with a skeletal Class II, Division 2 malocclusion with Class II molar and canine relationships on both sides. The treatment plan included distalization of the maxillary first molars bilaterally followed by full fixed appliance therapy. For the maxillary molar distalization, an appliance in conjunction with miniscrew anchorage system was designed. Under local anaesthesia, the miniscrews (Aarhus Anchorage System; Medicon eG, Tuttlingen, Germany), 1.5 mm in diameter and 10 mm in length, were inserted bilaterally behind the incisive canal at a safe distance from the midpalatal suture in the palatal interradicular spaces between the lateral incisor and canine (Figs 1a,b and 2a).

An impression and a stone cast of the maxillary arch were obtained with the miniscrews in place. The appliance was constructed on the stone model and delivered to the patient

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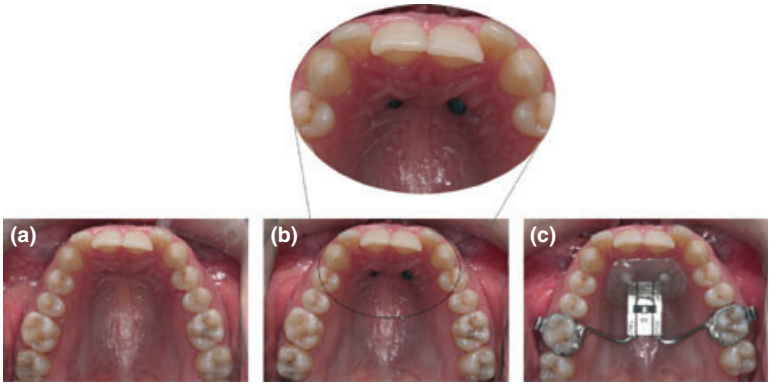


Figure 1 Occlusal views of the patient before orthodontic treatment (a), immediately after the placement of miniscrews (b) and after the cementation of the distalization appliance (c).

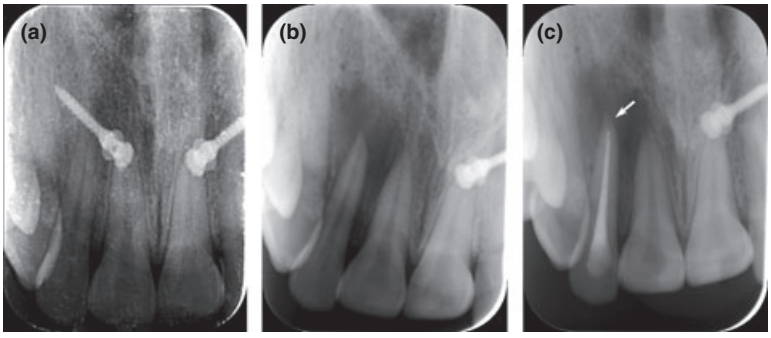


Figure 2 Radiograph after placement of miniscrews (a), maxillary right lateral incisor tooth with periapical radiolucency (b) and after root canal filling (c). Arrow showing the root damage.

2 weeks later (Fig. 1c). After the first activation of the appliance, the patient was monitored at 4-week intervals. Two months later, the patient complained of pain in the maxillary right lateral incisor region. On intraoral examination, intraoral sinus tracts were detected in the maxillary right buccal sulcus and palate. At this stage, it was decided to remove the appliance from the mouth. During the removal of the appliance, the miniscrew placed in the right was removed together with the appliance. Then, the patient was referred to the Department of Endodontics for detailed consideration to assess the pulp status and the need for root canal treatment.

Clinical and radiographic examinations were performed when the patient attended the endodontic clinic. On intraoral examination, intraoral sinus tracts were detected in the maxillary right buccal sulcus and palate. A large radiolucent lesion with a well-defined margin around the root of the maxillary right lateral incisor was seen on periapical radiographs (Fig. 2b). In addition, the mesial side of the root tip appeared to be damaged during the placement of miniscrew (Fig. 2b-arrow). The tooth was not tender to percussion and exhibited grade I mobility. Electronic pulp testing (Electric pulp tester; Parkell, Farmingdale, NY, USA) and cold application (ice stick) were negative. Based on these findings, the patient was diagnosed with a chronic apical abscess in the maxillary right lateral incisor and a decision was made to perform conventional root canal treatment.

At the same appointment, root canal treatment was initiated on the maxillary right lateral incisor. The access cavity was prepared and a rubber dam applied. Pulp remnants

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were extirpated, and the working length was estimated. The root canal was instrumented with size 15–40 K-files (Dentsply Maillefer, Ballaigues, Switzerland) using a step-back technique. During instrumentation, the canal was irrigated copiously with 2.5% sodium hypochlorite using a 27-gauge endodontic needle after each instrument. The final irrigation was accomplished with sodium hypochlorite and EDTA solutions. After drying the canal with sterile paper points, it was dressed with calcium hydroxide (Sultan, Englewood, NS, USA) using a lentulo spiral instrument. Sterile cotton pellets were placed into access cavities before sealing with a temporary filling (Cavit ESPE, Seefeld, Germany).

When the patient returned after 2 weeks, the tooth was asymptomatic and the sinus tracts were closed. The canal was irrigated with 2.5% NaOCl, and a CanalBrush (Coltene Whaledent Co. KG, Langenau, Germany) was used to remove the calcium hydroxide. After that, the root canal was dried with sterile paper points and filled with gutta-percha (Diadent, Chongchong, Korea) and AH Plus sealer (Dentsply DeTrey, Konstanz, Germany) using a lateral compaction technique. Glass ionomer cement (Ketac-Molar Easymix; 3M ESPE, Seefeld, Germany) was placed over the gutta-percha, and restoration of tooth was completed with a composite resin (Z250 3M ESPE, St. Paul, MN, USA). A post-operative radiograph was taken to ensure the quality of the filling (Fig. 2c). After three and 6-month follow-up, radiographs showed further bony healing (Fig. 3a,b). After 10-month follow-up, radiograph showed no pathosis and cementum deposits were seen on the damaged root tip (Fig. 3c). Clinical examination revealed no sensitivity to percussion or palpation, and the soft tissues were healthy. Subsequently, the patient was referred to the Department of Orthodontics to continue her interrupted orthodontic treatment. Because of the lack of suitable profile for tooth extraction and the patient's unwillingness about replacement of miniscrews, the treatment plan was changed. The orthodontic treatment of the patient has continued with conventional intraoral molar distalization methods (Distal Jet appliance) without skeletal anchorage devices.

Discussion

In recent years, miniscrews have been used increasingly either directly or indirectly for anchorage control in orthodontic treatment. Miniscrews are typically placed interradicularly and can be loaded immediately (Hembree *et al.* 2009). However, many orthodontists are apprehensive about miniscrew placement procedures. The space between the roots of teeth for miniscrew placement is often limited, making it inevitable for clinicians to place the miniscrews close to roots (Deguchi *et al.* 2006, Kadioglu *et al.* 2008). Moreover, miniscrews might not remain absolutely stationary and can move during orthodontic loading in some patients (Liou *et al.* 2004). Root damage can occur because of improper

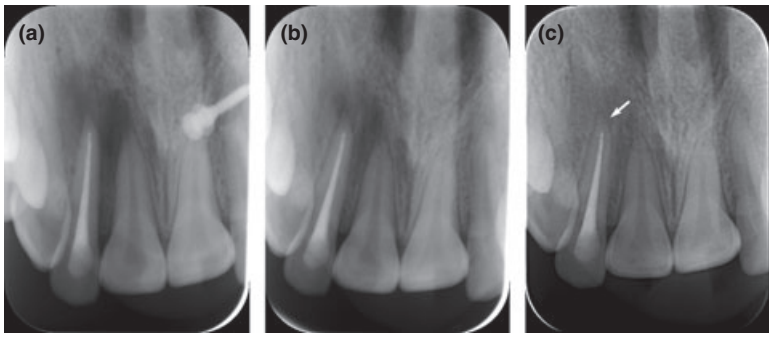


Figure 3 3 (a), 6 (b) and 10-month (c) follow-up radiographs. Arrow showing the cementum deposits.

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placement of the miniscrew, the miniscrew's movement after loading, and tooth movement causing contact with the miniscrew (Bae & Kyung 2006).

In orthodontics, intraoral maxillary molar distalization appliances supported with miniscrew implants have been used as an efficient treatment option for correcting Class II malocclusions (Kinzinger *et al.* 2006, Gelgör *et al.* 2007, Velo *et al.* 2007). In this case, the orthodontic treatment objectives, based on the clinical examination and the cephalometric analysis, were to distalize the maxillary first molars bilaterally followed by conventional full fixed orthodontic appliances. For the maxillary molar distalization, the appliance in conjunction with miniscrew anchorage system was designed and applied. However, the patient returned 2 months later with pain and discharge in the maxillary right lateral incisor region. Radiographic evaluation, after the removal of the appliance, revealed that a large radiolucent periradicular lesion with a well-defined margin had occurred around the root of maxillary right lateral incisor. The mesial side of the root tip was damaged. Particular attention should be paid when miniscrew placement is planned in the maxillary incisor area because more than 50% of the maxillary lateral incisor root apices deviate in the distal or palatal direction.

According to experimental studies (Kadioglu *et al.* 2008, Brisceno *et al.* 2009, Hembree *et al.* 2009), under favourable conditions, regeneration of the root surface and periodontal ligament is possible after immediate removal of the miniscrew. On the other hand, if inflammatory infiltration or invasion of the pulp chamber occurs, the normal healing process can be interrupted (Brisceno *et al.* 2009). Placement of the miniscrew within the pulp chamber produces a periodontal-endodontal bony lesion that can cause external inflammatory root resorption (Kawanami *et al.* 2001). Pulp invasion of the miniscrew allows access of the pathogens into the periodontal ligament space; this can result in devitalization of the pulp and bony destruction around roots (Brisceno *et al.* 2009). Although such a bony defect might heal after root canal treatment, endodontic surgery or extraction can be required if treatment fails (Kawanami *et al.* 2001, Hommez *et al.* 2006).

Because of the high probability of occurrence of root and pulpal damage, careful planning should be used when placing miniscrews. Various recommendations for miniscrew placement are provided in the literature. A 2-mm safety clearance between the miniscrew and roots was recommended in tooth-bearing areas to prevent the screws from causing injury to roots and pulps (Liou *et al.* 2004). Although there are general guidelines for safe zones during the placement of miniscrews, the risk of root and pulp damage remains (Poggio *et al.* 2006). Guidelines aid clinicians, but they do not take into account individual differences in root morphology. The use of 3D CT and an appliance to avoid damage to adjacent structures may be a useful guide for safe insertion of miniscrews. Even if all the necessary precautions have been taken, the patient should be informed about possible risks before placing miniscrews.

Conclusion

This case illustrates the need for care with miniscrews when performing orthodontic treatment, especially when the miniscrews are in close proximity to root apices. The periradicular lesion as a result of miniscrew damage was successfully treated with root canal treatment.

Acknowledgement

The authors deny any conflicts of interest.

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