

A Combined Endodontic Management Approach in immature Permanent Molar tooth with Periapical Lesion: Case Report

Periapikal Lezyonlu İmmatür Daimi Molar Dişte Kombine Endodontik Tedavi Yaklaşımı: Vaka Raporu

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ABSTRACT

Immature dental pulp, which has a highly cellular structure and a rich vascular nutrition system, is highly resistant to inflammation. In these teeth, determining the treatment option based on clinical and radiographic findings alone may result in the removal of diseased pulp tissue as well as vital pulp tissue. In order to increase the prognosis of these teeth, vital pulp treatments are highly recommended to preserve pulp vitality. By evaluating the condition of the root pulps of young permanent molars separately, it is possible to increase the prognosis of the tooth by combining regenerative endodontic treatment and pulpotomy treatment according to the condition of the pulps. In this case report, regenerative endodontic treatment and pulpotomy treatment were applied to different root canals of the first molar, which became necrotic before completing its maturation due to caries and had an apical lesion, and excellent healing was demonstrated.

Keywords: Biodentine, immature permanent teeth, periapical lesions, pulpotomy, regenerative endodontic treatment.

ÖZ

Son derece hücresel bir yapıya ve zengin bir damarsal beslenme sistemine sahip olan immatür dişlerin pulpaları, inflamasyona karşı oldukça dirençlidir. Bu dişlerde tedavi seçeneğinin sadece klinik ve radyografik bulgulara göre belirlenmesi, hastalıklı pulpa dokusunun yanı sıra vital pulpa dokusunun da çıkarılmasıyla sonuçlanabilir. Vital pulpa tedavileri, bu dişlerin prognozunu iyileştirmek ve pulpa canlılığını korumak için şiddetle tavsiye edilir. Genç daimi azı dişlerinin kök pulpalarının durumunu ayrı ayrı değerlendirerek ve pulpaların durumuna göre rejeneratif endodontik tedavi ile pulpotomi tedavisini kombine ederek dişin prognozunu artırmak mümkündür. Bu olgu sunumunda çürüğe bağlı olarak olgunlaşması tamamlanmadan nekrotik hale gelen ve apikal lezyonu olan birinci azı dişinin farklı kök kanallarına rejeneratif endodontik tedavi ve pulpotomi tedavisi uygulanmış ve mükemmel iyileşme gösterdiği görülmüştür.

Anahtar Kelimeler: Biodentine, immatür daimi dişler, periapikal lezyon, pulpotomi, rejeneratif endodontik tedavi.

Introduction

Dental caries is one of the most common diseases worldwide and this situation also includes the majority of children.¹ Carious lesions in young permanent dentition that has not completed the maturation process can lead children to experience severe pulpal inflammation treatment processes are highly difficult. The patient's complaint, the result of pulp test, clinical and radiographic findings play important roles in determining the inflammation status of the pulp and the treatment. However, these findings may not always be compatible with the histopathological findings of the pulp.² In particular, immature dental pulp, which has a highly cellular structure and a rich vascular nutrition system, is highly resistant to inflammation,³ and in these teeth, determining the treatment option based on clinical and radiographic findings alone may result in the removal of diseased pulp tissue and vital pulp tissue.⁴ In order to increase the prognosis of these teeth, vital pulp treatments are highly recommended to preserve pulp vitality.⁵

Pulpotomy is a vital pulp therapy in which the degenerated and inflamed pulp part is removed and root development continues via the remaining healthy pulp.^{5,6} Today, bioactive cement materials are used to increase the chance of success in pulpotomy treatment, to heal the remaining pulp tissue and to maintain its vitality.^{5,7} Mineral trioxide aggregate (MTA) is the gold standard material for clinical procedures of vital pulp therapy. However, the use of Biodentine was preferred in this case because MTA has disadvantages such as longer hardening time, difficult use, high cost and tooth discoloration.⁸

Pulp necrosis of immature permanent teeth represents a significant challenge for clinical management as root development ceases and open apices remain.⁹ The cessation of root development leads chemo mechanical debridement and apical occlusion to be difficult,¹⁰ therefore, specification methods or regenerative endodontic applications that enable continued root development are recommended in order to create a barrier in the apical region in teeth with open apex.^{11,12} Reported case reports of regenerative endodontic treatment indicate that immature permanent teeth with apical periodontitis or

abscess, as well as pulp necrosis, may undergo revascularization.¹³⁻¹⁵

Immature molar teeth, which have lost their vitality completely or partially due to caries, are clinical cases that are frequently encountered and require difficult treatment processes. It is possible to combine different treatment approaches that can be applied to these teeth by evaluating the condition of the pulp in the roots of the same tooth separately. This case report presents regenerative endodontic treatment and pulpotomy treatment that were applied to different root canals of tooth 46, which became necrotic before completing its maturation due to caries and had an apical lesion, and the purpose of this report is to contribute to the literature by resulting in complete healing.

Case Report:

The patient was a 9-year-old male who applied to Ataturk University Faculty of Dentistry Department of Pedodontics in order to have root canal treatment of his right lower first molar (#46) tooth. The patient had a mesio-occlusal composite filling in his tooth two years ago and experienced severe spontaneous pain and chewing difficulties caused by this tooth about 1 month ago, and after these symptoms, an extra-oral swelling developed in the same area. It was revealed that the patient applied to another center and the swelling was treated through the use of prescribed antibiotics, but the pain continued with less intensity. When the patient applied to our clinic, it was observed that he had no extra-oral swelling, but redness and swelling existed in the buccal gingival area of first right mandibular molar. (Fig 1A) There was a mild response to palpation and percussion. There was no chronic disease or allergy in the patient's medical history.

On the radiograph, it was seen that the root development of the tooth continued and there was a large radiolucency area starting from the apical of the distal and mesial roots, including the furcal area. (Fig 1B) Endodontic treatment was considered to be ideal to perform. The parents of the patient were informed about the treatment and their consent was obtained. Finally, treatment was performed.

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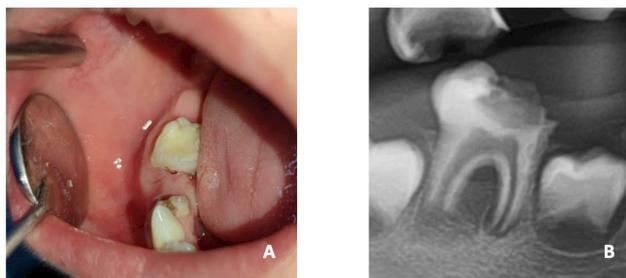


Figure 1A-B: intraoral and radiographic image of the right mandibular first molar before treatment.

After the placement of a rubber dam (Royal Shield Dental Dams, MALAYSIA) on the tooth, no anesthesia was administered in the treatment, since the tooth appeared to be necrotic. However, after reaching the pulp cavity, the patient was observed to feel pain and mandibular block anesthesia was administered with Ultracain DS® (Sanofi-Aventis, Frankfurt Main, Germany). Bleeding without dark color was observed in the pulp cavity and it was determined that this bleeding originated from the pulp in the mesial canals. Based on this finding, it is possible to assume that the pulp tissue in the mesial canals may still be vital. Bleeding was controlled within 3-5 minutes through 2.5% NaOCl after removal of the pulp, which was thought to be inflamed, in the coronal of the mesial canals. (Fig. 2A) The vital pulp tissue left in the mesial roots was covered with Biodentine® (Septodont, France) and glass ionomer cement (EQUIA Forte Fil, GC America) was applied on it. (Fig. 2B-C)



Figure 2A-B-C: pulpotomy treatment applied to the mesial canals

No indication of the presence of vital pulp was observed in the distal root. The root was considered to be treated through regenerative endodontic treatment. The distal root length was measured using the Apex locator (Dentsply Propex Pixi Apex Locator, Israel) and minimal instrumentation was performed to remove the remaining necrotic pulp using hand files of this size. The canal was irrigated using 20 ml of 2.5% NaOCl followed by 20 ml of saline. CaOH₂ was administered through the canal to ensure intra-canal disinfection and a temporary filling was placed and the patient had another appointment 2 weeks later.

In the following 2 weeks, the patient's symptoms disappeared and the red and swollen gingiva in the buccal region healed. After the tooth was anesthetized with 2% mepivacaine (Citanest; AstraZeneca, London, UK) without vasoconstrictor, the procedure was initiated under a rubber dam. In this session, the distal root was irrigated with 20 ml of saline followed by 20 ml of EDTA. After the canal was dried, intra-bleeding was provoked by extending 2-3 mm beyond the apical region using a 15 Hfile. After it was observed that the bleeding reached the coronal part of the root, it was covered with Biodentine. In order to prevent fractures and post-restoration microleakage, the tooth with significant material loss was restored with a stainless steel crown (3M ESPE) (Fig. 3).



Figure 3: Radiograph taken after completion of treatment

The patient's radiograph taken in the 9th month showed that the furcal and periapical lesion had completely disappeared. In addition, it was noticed that mesial and distal root development continued and dentin thickness increased (Fig 4A). In the periapical radiograph taken 1.5 years later, it was seen that the mesial roots had completed their development and calcified tissue had formed in the apical part of the distal root (Fig 4B).

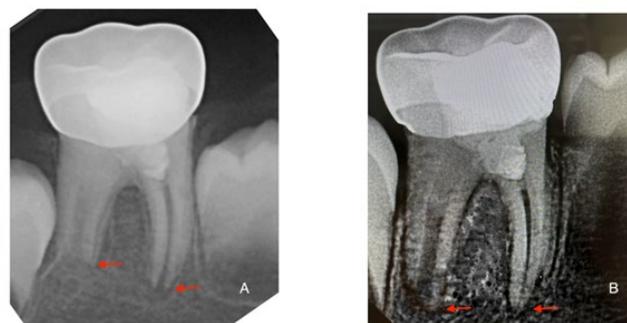


Figure 4: Radiographic images taken 9 months (A) and (B) 1.5 years after treatment

Although the patient did not respond to the cold test and electric pulp test applied to tooth number 46 in the follow-ups at the 9th months and 1,5th years, no clinical and radiographic symptoms were observed.

Discussion:

The vitality of the pulp is important regarding root development in young permanent teeth that have not completed the maturation process. When the pulp loses its vitality, root development ceases and the long-term prognosis of the tooth decreases. It is very important to choose the appropriate treatment for these teeth that are required to stay in the mouth for a long time and to apply them with the right procedures in order to increase the prognosis of the teeth. Root canal treatment or extraction is mainly preferred to treat mature permanent teeth with pulp necrosis and periapical pathology. However, since the root development of young permanent teeth still continues, apexification to create a calcified barrier in the apical or regenerative endodontic treatment, which is more preferred today, is applied because it enables continued root development.¹² However, there are also studies that suggest immature teeth with periapical lesions are treated through pulpotomy.^{16, 17}

The pulp of young permanent teeth with an immature structure, unlike mature teeth, has a highly cellular structure and a rich vascular nutrition system, and is more resistant to becoming necrotic. Therefore, clinical and radiographic pathologies obtained in the early period, especially in multi-rooted immature teeth occasionally fail to assume that the entire pulp is necrotic.³ Before choosing the treatment option, the pulp is required be opened directly and evaluated in terms of vitality,^{17, 18} and the purpose of treatments is to preserve the vitality of the pulp.^{17, 18} In our case, the large periapical lesion involving both roots of tooth number 46 and the clinical findings in the patient suggested that the tooth might be necrotic. After the pulp was opened,

the bleeding appearance of the pulp tissue, which are common criteria to determine vitality, the color and volume of bleeding, and the time to control bleeding¹⁷ were evaluated, and it was determined that the pulp in the mesial roots was vital, and pulpotomy was performed on both roots in the mesial and the remaining pulp tissue was covered with Biodentine. Since adequate drainage is provided through the pulpotomy procedure, healing can be achieved in chronic pulpitis by reducing the intra-pulpal pressure and thus delaying tissue destruction.³ The current studies have demonstrated the ideal healing after pulpotomy treatment, even in immature and even mature teeth with irreversible pulpitis and periapical pathology.¹⁶⁻¹⁸ The current case and previously reported cases indicate that despite the presence of periapical radiolucency, pulpotomy likely has more indications than previously suggested.

The use of bioactive endodontic cement in vital pulp treatments increases the chances of success.^{17, 19} Biodentine has been reported to exhibit high micro-hardness, flexural strength, compressive strength, sealing and calcium ion release compared to other bioactive endodontic cements.¹⁹ The studies conducted on animals indicate that Biodentine promotes hard tissue regeneration, has bioactive properties, and fails to cause moderate or severe pulp response.²⁰ When mineral trioxide aggregate (MTA), another bioactive endodontic cement, is compared with Biodentine, which is frequently preferred in vital pulp treatments, the latter is considered to be a new agent that is more suitable alternative to MTA, as it has superior physical and mechanical properties, offers easier use, and is difficult to color.^{17, 19} Due to all these superior properties, Biodentine was applied to the mesial canals of the tooth number 46 and complete healing was achieved after pulpotomy.

Although the study regarded the pulp in the mesial canals of tooth number 46 as vital, no such finding was detected in the distal canal and regenerative endodontic treatment was considered to be appropriate to treat this canal. Regenerative endodontic procedures (REP) are defined biologically based procedures that replace damaged structures in tooth structures, including the dentin and root structure with pulp and dentin cells.^{21, 22} A significant number of studies reveal healing of periapical tissues, root thickness and continued root development with this treatment method.^{12, 14, 21, 22} In the cases reported by Chueh et al., it was argued that periapical tissue healing was completed in 3 to 21 months and root development was completed in 10 to 29 months after regenerative endodontic treatment.¹⁵ In the current case report, it was observed that the periapical tissues healed significantly in 9 months and distal root development continued. After 1.5 years, it was determined that distal root development was approaching completion.

In regenerative endodontic treatment, the extent of apical opening, patient age and the amount of infection in the root canal system are considered to have a key role in the treatment outcome. In immature teeth where the apical opening is more than 1-2 mm, the easier application of the apical bleeding process and the ability to reach more stem cells from the canal to the coronal region with the bleeding process increase the chances of success. However, especially in younger patients (8-13 years), the high healing potential and regeneration abilities of stem cells are also important factors in the treatment prognosis.⁹ Therefore, in our study, the continuation of root development with an increase in the amount of dentin at the end of 9 months and the almost completion of root development at the end of 1.5 years indicate that the success of the treatment may be related to the lower age of the patient and the larger apical width.

Currently, apexification methods have been replaced by regenerative endodontic treatment, which allows root development in open apical teeth and results in pulp-like tissue formation. The related literature review suggests that regenerative endodontic treatment offers a high success in periapical tissue healing and root development.^{12-14, 21-23} However, another issue discussed in regenerative endodontic treatment is the response of regenerated root pulp to pulp susceptibility tests. In the study in which Çehreli et al. reported a 1-year follow-up after regenerative treatment applied to molar teeth, it was observed that only 2 teeth out of 6 teeth responded only to the cold test after 9 months.¹⁴ There was no positive response to the cold test and electric pulp test applied to tooth 46 in our case report at the 9rd months and 1.5 years of follow-up.

The related literature review suggests that there are few cases of combined treatment in the form of regeneration and pulpotomy applied to the teeth.^{4, 18} Similar to the current case, it was reported that in the right mandibular first molar tooth, in which Lee et al. applied combined treatment, a positive response to the cold test was obtained in the 1st month of the follow-up, the periapical tissues were healed in the 6th month, and the root development was completed in the 18th month.¹⁸ In the study by Terauchi et al. in which they reported the combined treatment applied to the left mandibular first molar tooth with complete root development, it was reported that the bone lesion completely healed in this process after a 2-year follow-up, and a positive response to pulp sensitivity tests was obtained.⁴

Conclusion

Although pathology is clinically and radiographically detected in multi-rooted immature teeth, it is not always possible to suggest that the pulp tissue in all root canals is simultaneously necrosis. By separately evaluating the condition of root pulps of young permanent molars, it is possible to combine regenerative endodontic treatment and pulpotomy treatment in line with the condition of the pulps. Regenerative endodontic treatment enables new pulp-like tissue formation and root development continues, periapical tissue healing is achieved and the prognosis of the tooth increases through the vital pulp remaining after pulpotomy.

Değerlendirme / Peer-Review

İki Dış Hakem / Çift Taraflı Körleme

Etik Beyan / Ethical statement

This article was not produced by improving or partially changing the content of a paper presented at a symposium or congress.

This study was not prepared on the basis of a master's or doctoral thesis.

It is declared that scientific and ethical principles were followed during the preparation of this study and that all studies used are stated in the bibliography.

Bu makale herhangi bir sempozyum veya kongrede sunulan bir bildirinin içeriğinin iyileştirilmesi veya kısmen değiştirilmesi yoluyla üretilmemiştir.

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Çıkar Çatışması / Conflict of Interest

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Yazar Katkıları / Author Contributions

Çalışmanın Tasarlanması | Design of Study: AB(%40), CMT(%40), SD(%20)
Veri Toplanması | Data Acquisition: AB (%50), CMT (%50)
Veri Analizi | Data Analysis: AB (%60),CMT(%30),SD(%10)
Makalenin Yazımı | Writing up: AB(%70), SD (%30)
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