

ENDODONTIC TREATMENT ON FRACTURED MANDIBULAR ANTERIOR TOOTH WITH CROWN DOWN TECHNIQUE

Raisya Aurellia Putri Lesmana¹⁾, Fajar Fatriadi²⁾

¹⁾ Dentistry Professional Program, Universitas Padjadjaran, Bandung, Indonesia

²⁾ Conservative Dentistry Department, Universitas Padjadjaran, Bandung, Indonesia

ABSTRACT

Background: Trauma involving the dento-alveolar area often occurs and tends to cause tooth fractures. Fractured teeth can be at risk of infection which can lead to pain and tooth necrosis. In necrotic tooth cases, root canal treatment is one of the most common procedures to be performed to preserve the tooth. **Case:** A 36-year-old female patient came to RSGM Unpad with chief complaint of a broken mandibular anterior tooth. This complaint occurred 3 months ago. The patient did not complain of any pain. Previously, the tooth that the patient complained about had been restored but fell out again a month ago. History of systemic disease, family disease, and allergies was denied. Patients want their complaints to be resolved. **Case Management:** The treatment carried out in this case is root canal treatment. Root canal treatment consists of three main stages, namely biomechanical preparation of the root canal, root sterilization with calcium hydroxide, and obturation. The preparation technique used is crown down. The main aim of the crown down root canal preparation technique is to minimize or eliminate the amount of extruded necrotic tissue towards the apical foramen during preparation. **Conclusion:** Establishing a good diagnosis, as well as the use of good instrumentation in root canal treatment with a crown down preparation technique followed by single cone obturation can be an option for treating crown fracture teeth. Further follow-up is required in this case.

Keywords: crown down, fracture, nonvital, root canal treatment

Correspondence: Raisya Aurellia Putri Lesmana; Dentistry Professional Program, Universitas Padjadjaran, Bandung, Indonesia; E-mail corresponding author: raisya17003@mail.unpad.ac.id

INTRODUCTION

Trauma incidents in the dento-alveolar region can occur among children, adolescents, and adults. Trauma involving the dento-alveolar region often leads to tooth fractures.¹ The prevalence of tooth fractures worldwide is estimated to be between 9.4% and 41.6%. The etiology of fractured teeth is predominantly accidental events and occurs most often on the anterior teeth. Tooth fractures can result in tissue injuries and tooth displacement from their sockets.²

Tooth that has experienced fractures may be at risk of infection, which can cause pain and tooth necrosis.³ Tooth with pulp inflammation and necrosis root canal treatment is necessary to eliminate irritants such as bacteria and clean the infected root canal of necrotic tissue, thus establishing conditions that promotes healing, and arrests the progression of periapical pathology.⁴ The three main stages of root canal treatment, often referred to as the endodontic triad, which includes biomechanical preparation, sterilization, and hermetic root canal filling, are important to achieve successful root canal treatment.⁵

Various methods of root canal preparation have been proposed. Ingle introduced the standard

technique and then step-back technique. This technique focused on root canal preparation in an apico-coronal direction. The step-back technique has a high risk of preparation errors especially at the apex, such as ledge, zipping, pushing the debris into the periapical, and the risk of working length loss. Therefore, the crown-down preparation technique was developed to improve the shortcomings of the step-back technique.⁶

CASE REPORT

CASE

A 36-year-old female patient came to RSGM Unpad with chief complaints of a fractured mandibular anterior tooth 3 months ago. The patient did not complain of any pain. Previously, the fractured tooth had been restored but fell out again a month ago. Patient wanted her complaints to be resolved.

Physical, extra-oral, and intra-oral examinations were performed in this case. Upon examination, the patient was in good overall health, conscious, and had normal vital signs, including blood pressure, respiration, pulse, and temperature. No abnormalities were observed during the

extraoral examination. Intraoral examination of the buccal mucosa, labial, palate durum, palate mole, uvula, tonsils, frenulum, tongue, and gingiva showed no abnormalities.

Intraoral examination revealed the presence of a fracture of tooth 43 from the distal part of the enamel to the pulp, media caries on 11 and 12, media caries on occlusal aspect of tooth 14, superficial caries on occlusal aspect of of teeth 15, 16, 24, 25, 34, 35. Teeth 44, 36, 37 are also missing (Figure 1).

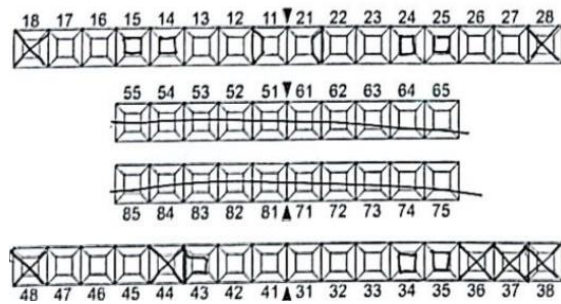


Figure 1. Odontogram

Additionally, local examination of tooth 43, which included sensitivity tests, showed a negative result, indicating that the tooth was non-vital. The percussion test on tooth 43 was negative. Biting and palpation tests were also negative. Tooth 43 also showed no signs of mobility (Figure 2).

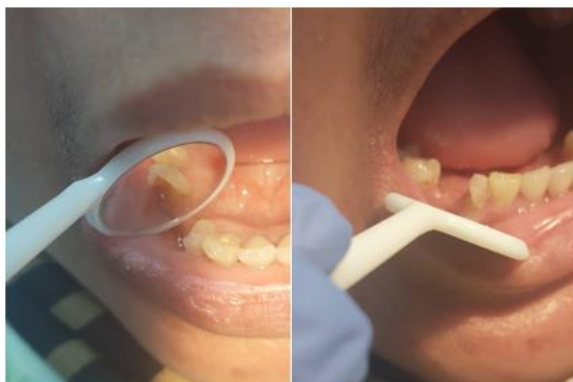


Figure 2. Clinical Appearance of Tooth 43

Radiological examination showed radiolucency extending from the distal aspect of tooth 43, reaching from the enamel to the pulp. The tooth had a single root with periodontal membrane around tooth 43 appeared widened along the entire root surface, and the lamina dura surrounding the root was thickened. However, alveolar bone and periapical regions appeared normal. Based on these findings, the initial diagnosis of tooth 43 was necrotic pulp with asymptomatic apical periodontitis (Figure 3).

CASE MANAGEMENT

On the first visit, after the patient agreed and signed the informed consent, the working area of tooth 43 was isolated using a cotton roll. The caries

removal procedure was carried out using a 1.0 mm diameter round carbide bur (SS White, USA) until all caries tissue and unsupported enamel was removed, then an access opening was done using a 1.0 mm diameter endo access opening bur (Dentsply Sirona, USA) until the orifice was visible and reaches straight line access (Figure 4).



Figure 4. Access Opening on Tooth 43

The following extirpation procedure was carried out using a barbed broach instrument (Dentsply Sirona, USA) by rotating the instrument and then the barbed broach was pulled out until the pulp tissue was removed entirely (Figure 5). After the pulp tissue had been completely removed, root canal irrigation was done using 2.5% NaOCl liquid (OneMed, Indonesia) and sterile aquadest. The root canal was dried using a sterile paper point (Dentsply Sirona, USA).

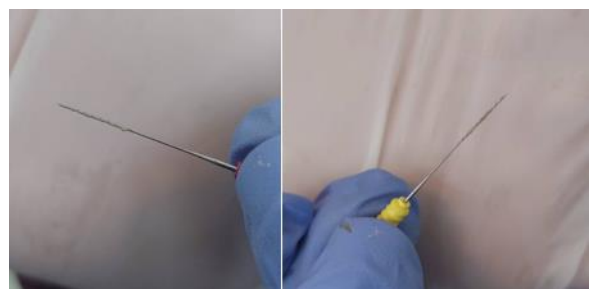


Figure 5. Pulp Extirpation of Tooth 43

The following procedure was rewalling the tooth by maintaining straight-line access. In this case, the canal projection technique was used by inserting gutta percha into the root canal to maintain the straight-line access structure. Next, 37% phosphoric acid etchant (Any-Com, Korea) was applied, and then a bonding agent was applied to

the cavities and cured for 20 seconds. Rewalling was performed using nano hybrid universal restorative composite adhesive (3M, Germany) and the restoration was done following tooth anatomy and subsequent curing (Figure 6).



Figure 6. Rewalling of Tooth 43

After the rewalling was complete, working length measurements were taken with the help of the apex locator tool. The steps taken were to insert K-file #10 (Dentsply Sirona, USA) and using the apex locator until zero reading was achieved. In this case, the UPK obtained was 20 mm (Figure 7).



Figure 7. Working Length Measurement Using Apex Locator

The cleaning and shaping technique used in this case was the crown-down technique using ProTaper hand use (Dentsply Sirona, USA). The initial stage was coronal scouting with K-file #10 (Dentsply Sirona, USA) and K-file #15 (Dentsply Sirona, USA) to a depth of 10 mm. This process was carried out to check the curvature and whether there were any calcifications that could potentially hinder access before doing the next root canal preparation step. Each sequence was irrigated using 2.5% NaOCl (OneMed, Indonesia) and rinsed with sterile aquadest and dried with a sterile paperpoint (Dentsply Sirona, USA). Next, coronal flaring was performed using ProTaper S1 (Dentsply Sirona, USA) and SX (Dentsply Sirona, USA) at 2/3 of the working length of 10 mm.

K-files 10 and 15 (Dentsply Sirona, USA) with 20 mm working length were inserted passively into the canal, then watch winding movement was performed. In each sequence the root canal was irrigated using 2.5% NaOCl (OneMed, Indonesia)

and rinsed with aquades and dried with a paper point (Dentsply Sirona, USA). The next procedure was shaping the apical part using Protaper files S1 and S2 (Dentsply Sirona, USA) and finishing with Protaper files F1, F2, F3 (Dentsply Sirona, USA) with the working length of 20 mm. Irrigation and recapitulation was performed (Figure 8).

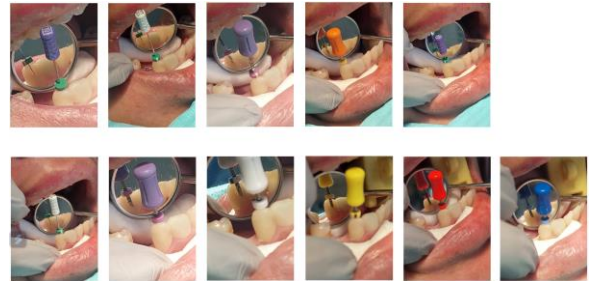


Figure 8. Cleaning and Shaping Sequences

After using the MAF and final irrigation was done, the root canal was filled with Ca(OH)₂ medicament (Calcipex) up to the orifice border (Figure 9). Tooth then sealed with sterile cotton pellets and sealed with a temporary filling (Reco-Dent, Taiwan) (Figure 10).



Figure 9. Intracanal Medicament Application



Figure 10. Temporary Filling

At the second visit, the patient was subjectively examined and objectively examined. On subjective examination, the patient claimed no spontaneous pain. On objective examination, no abnormalities were found. A localized intra oral examination was also performed. The results of vitality, percussion, palpation, and pressure tests on the tooth were negative. The temporary filling was removed, operator irrigated the root canal with 2.5% NaOCl (OneMed, Indonesia) and aquades (Figure 11). After the canal had been irrigated, it

was dried with paper points. Trial obturation with gutta-percha MAF F3 was performed according to the working length of 20 mm, and periapical radiographs were taken (Figure 13).



Figure 11. Removal of Temporary Filling and Intracanal Medicament

After the results of the obturation trial was appropriate, obturation was performed with a single cone technique using gutta-percha F3 (Dentsply Sirona, USA) and ZOE based sealer (PREVEST DenPro, India). The sealer was manipulated on a paper pad. Then, the sealer was inserted into the root canal and was pumped to distribute the results evenly. Afterward, gutta-percha that had been coated with the sealer was inserted into the root canal along the working length. The gutta percha was cut 1-2 mm below the orifice using a warmed excavator and then compacted using a plugger. Next, Glass ionomer cement (GC, Japan) was applied above the orifice, and the cavities were closed with temporary fillings (Reco-Dent, Taiwan). A periapical radiographic examination was performed and showed hermetic obturation. The patient was instructed to return one week later.



Figure 12. Obturation on tooth 43

On the third visit, the patient underwent subjective, objective, and radiographic examinations. On subjective examination, the patient claimed to have no complaints about the previous treatment. On objective examination, no abnormalities were found. A radiographic examination was also performed for evaluation, and no abnormalities were found. Furthermore, the patient was referred to continue the follow-up of post and indirect restorations to the prosthodontics

department.



Figure 13. One Week Post Obturation

DISCUSSION

On subjective examination, the patient complained of a fractured right mandibular anterior tooth. The complaint had occurred for three months, and the patient did not complain of any aches or pains. A vitality test was performed using ethyl chloride on the cervical part of the tooth 43, and the response was negative. Percussion, palpation, and pressure tests showed negative results. On radiographic examination, a radiolucent picture was found from the enamel to the pulp in the medial part of the tooth, and no periapical lesions were found. Based on subjective, objective, and radiologic examinations, the diagnosis of American Association of Endodontists (AAE), necrotic pulp with asymptomatic apical periodontitis in this case was established.⁷

Based on the Ellis fracture classification, this case belonged to class 4 Ellis fracture, which was a condition when tooth was nonvital caused by a fracture.⁸ A necrotized tooth needs to be treated to prevent infection. Root canal treatment is one of the treatments to maintain a tooth that has been damaged so that it can be biologically accepted and function in the oral cavity. The purpose of root canal treatment is to reduce microorganisms contained in the root canal. The principle of root canal treatment consists of root canal preparation, root canal sterilization, and root canal obturation.⁴

The root canal preparation technique used in this case was the crown-down technique. The main purpose of the crown down root canal preparation technique is to minimize or eliminate the amount of necrotic tissue extruded towards the apical foramen during preparation. The crown down technique requires the preparation of one-third of the coronal working length first to prepare a space for debris in the apical part to be lifted towards the coronal. Therefore, there is no debris buildup in the apical part. This is supported by research conducted by Giovanni et al. (2022), who concluded that the crown-down technique has better effectiveness than conventional techniques because it produces a minimal value of apical extrusion debris.⁹ This technique can also reduce discomfort due to less clean instrumentation and debridement due to debris in the direction of the apical foramen and cause biocompatible narrowing. In addition, the advantage of this technique is that it is free from the

constraint or problem of apical widening due to proper instrumentation.

Furthermore, this case used the single cone technique for root canal filling. The single-cone technique usually uses the master cone from the MAF value obtained from the root canal preparation process. Over the years, this technique has become popular among endodontists due to its high adaptability to the characteristics of the nickel-titanium (NiTi) rotary system without the need for additional cones, thus reducing working time and allowing faster and easier filling. In terms of obturation quality, apical microleakage, and bacterial penetration, this technique provides results similar to those achieved using other techniques. The single-cone technique also helps to save time during root canal filling and is more comfortable for both the patient and the dentist.¹⁰ In addition, this technique does not require any compaction effort that generates hydraulic pressure.¹¹

The success of root canal treatment is the combination of clinical and radiographic success. General success criteria include no symptoms (pain, sensitivity to percussion or chewing, etc.) or clinical signs (sinus tract, swelling, etc.), and the tooth can return to physiological function, as well as radiographic images of periapical area.¹²

Establishing a good diagnosis, as well as the use of good instrumentation in root canal treatment with a crown down preparation technique followed by single cone obturation can be an option for treating crown fractured teeth. Further follow-up is required in this case.

REFERENCES

1. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF, Tsiligkaridis G, Abbott PV, Fouad AF, Hicks L, Andreasen JO, Cehreli ZC, Harlamb S, Kahler B, Oginni A, Semper M, Levin L. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. *Dent Traumatol.* 2020;36(4):314–330.
2. Sidiartha IFN, Wiswananta P P. Penatalaksanaan Fraktur Ellis Kelas Iii 11 Dengan Pulpektomi Dan Restorasi Mahkota Pasak. *Interdental J Kedokt Gigi.* 2020;16(2):28–33.
3. Bhandari S. Facts About Cracks in Teeth. *Prim Dent J.* 2021;10(1):20–7.
4. Makanjuola JO, Oderinu OH, Umesi DC. Treatment Outcome and Root Canal Preparation Techniques: 5-Year Follow-Up. *International Dental Journal.* 2022;72(6):811-818.
5. Kartinawanti AT, Khoiruza Asy'ari A. Penyakit Pulpa dan Perawatan Saluran Akar Satu Kali Kunjungan: Literature Review. *J Ilmu Kedokt Gigi.* 2021;4(2):64–72.
6. Bolourchi I, Pourmousavi L. A Novel Hybrid Hand Instrumentation Technique for Root Canal Preparation. *Iranian Endodontic Journal.* 2018;13(4):461–468.
7. Baig HA. Clinical Diagnostic Procedures in Endodontics. *Adv Dent & Oral Health.* 2016;1(3):60–67.
8. Imtiaz T, Adimulapu HS, Pandiyan I, Bhandari S. Dentist perspective on knowledge and practice toward Ellis class 3 tooth fracture: A survey. *J Adv Pharm Technol Res.* 2022;13(6):387–391.
9. Giovanni A, Nahzi MYI, Adhani R. Perbandingan Efektivitas Penggunaan Teknik Preparasi Saluran Akar Konvensional dan Crown Down Terhadap Ekstrusi Debris Apikal. *Dentin J Kedokt Gigi.* 2022;4(2):59–64.
10. Preethi G, Khandelwal A. Evaluation of obturation techniques used for single visit root canal treatment and Multi visit root canal treatment of anterior teeth - a retrospective study. *Nat. Volatiles & Essent. Oils.* 2021;8(5):6311–6320.
11. Cho YS, Kwak Y, Shin SJ. Comparison of root filling quality of two types of single cone-based canal filling methods in complex root canal anatomies: The ultrasonic vibration and thermo-hydrodynamic obturation versus single-cone technique. *Materials (Basel).* 2021;14(20):1–10.
12. Nieuwenhuysen, JV, D'Hoore W, Leprince J. What ultimately matters in root canal treatment success and tooth preservation: A 25-year cohort study. *International Endodontic Journal.* 2023;56(5):544-557.