

Step Back Technique in Endodontic Treatment of a Mandibular Incisor with Normal Apical Tissue: A Case Report

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ABSTRACT

Introduction: Caries is a bacterial infection of the teeth that can attack the enamel, dentin, and pulp. Caries extending to the pulp can result in irreversible pulpitis, where root canal treatment is indicated so the tooth can return functionally and aesthetically. **Case report:** A 50-year-old woman came with chief complaints of cavities in her lower front teeth. From subjective, objective, and radiographic examination, tooth 31 was diagnosed with irreversible pulpitis with normal apical tissue, and a root canal treatment was planned. In the next visit, the root canal treatment was carried out using the step-back technique starting from IAF K-File #10 and MAF K-File #25 with a working length of 22.5 mm. The final K-File used was K-File #40, with a working length of 19.5 mm. Root canal treatment on tooth 31 was carried out in 10 visits. After radiographic evaluation subjective and objective examination, the root canal treatment was completed, and a post-crown restoration was planned as a follow-up. **Conclusion:** Root canal treatment in 10 visits on tooth 31, which was diagnosed with irreversible pulpitis with normal apical tissue, carried out using the step-back technique in this case, showed clinical and radiological success.

Keywords: Irreversible pulpitis, root canal treatment, anterior teeth, step back

ABSTRAK

Pendahuluan: Karies merupakan infeksi bakteri pada gigi yang dapat menyerang email, dentin, dan pulpa. Karies yang meluas hingga ke pulpa dapat mengakibatkan pulpitis ireversibel, sehingga diperlukan perawatan saluran akar agar gigi dapat kembali berfungsi dan estetik. **Laporan kasus:** Seorang perempuan berusia 50 tahun datang dengan keluhan utama gigi depan bawah berlubang. Dari pemeriksaan subjektif, objektif, dan radiografi, gigi 31 didiagnosis pulpitis ireversibel dengan jaringan apikal normal, dan direncanakan perawatan saluran akar. Pada kunjungan berikutnya dilakukan perawatan saluran akar dengan teknik step back dimulai dari K-File IAF #10 dan K-File MAF #25 dengan panjang kerja 22,5 mm. K-File terakhir yang digunakan adalah K-File #40 dengan panjang kerja 19,5 mm. Perawatan saluran akar pada gigi 31 dilakukan sebanyak 10 kali kunjungan. Setelah evaluasi radiografi, pemeriksaan subjektif dan objektif, perawatan saluran akar selesai, dan restorasi pasca-mahkota direncanakan sebagai tindak lanjut. **Kesimpulan:** Perawatan saluran akar dalam 10 kunjungan pada gigi 31, yang didiagnosis dengan pulpitis ireversibel dengan jaringan apikal normal, yang dilakukan menggunakan teknik step-back dalam kasus ini, menunjukkan keberhasilan klinis dan radiologis.

Kata Kunci: Pulpitis ireversibel, perawatan saluran akar, gigi anterior, step back

1. Introduction

Dental caries is a multifactorial disease strongly associated with microbiological biofilms and the availability of fermentable carbohydrates.¹ Sweet foods provide a nutrient source for cariogenic bacteria, which metabolize carbohydrates through fermentation, producing acids that lead to enamel demineralization.² If left untreated, this process continues, allowing the lesion to progress deeper into the dentin and ultimately reach the pulp. Beyond enamel demineralization, bacterial metabolic products can trigger physiological responses in the dentin and pulp, leading to increased intra-tubular dentinal pressure and inflammation.³ As caries advance and penetrate deeper into the tooth structure,

the risk of bacterial invasion into the pulp chamber increases.⁴ Once bacterial penetration occurs, an inflammatory response is triggered within the pulp tissue, and without timely intervention, this inflammation can become irreversible, necessitating endodontic treatment.⁵

A healthy pulp is symptom-free and usually responds to diagnostic tests such as thermal and electric pulp testing. However, once bacteria invade the pulp, an inflammatory response develops.⁶ If this inflammation becomes severe and irreversible, the condition is classified as irreversible pulpitis. According to the American Association of Endodontists (AAE), irreversible pulpitis is categorized into symptomatic and asymptomatic forms.⁷ Symptomatic irreversible pulpitis is characterized by sharp, lingering pain in response to thermal stimuli, which persists for 30 seconds or more after the stimulus is removed. Additionally, spontaneous pain may occur, often severe and difficult to manage.⁸ In contrast, asymptomatic irreversible pulpitis is often discovered incidentally during dental examinations, as patients do not report pain. However, deep caries are present, and pulp exposure may become evident upon the removal of carious dentin. Regardless of the presence or absence of symptoms, both conditions require root canal treatment to prevent further progression of infection and preserve the affected tooth.⁹

Root canal treatment (RCT) is a conservative dental procedure aimed at removing infected or inflamed pulp tissue, disinfecting the root canal system, and sealing the canals to prevent reinfection.¹⁰ The primary goal of RCT is to retain the tooth in the dental arch to continue to function effectively.¹¹ The decision to perform a single-visit or multiple-visit RCT depends on various factors, including the severity of the infection, the presence of periapical pathology, and patient-related considerations.¹² In symptomatic irreversible pulpitis without periapical involvement, multiple-visit RCT is often preferred to allow adequate disinfection of the root canal system and reduce the risk of postoperative complications.¹³ The Step Back Technique is a well-established method in endodontics that ensures effective shaping and cleaning of the root canals, particularly in narrow and curved canals.¹⁴ This technique involves sequential root canal preparation using increasing file sizes, creating a taper that facilitates optimal irrigation and obturation.

This case report aims to present the treatment process and outcomes of a 50-year-old female patient diagnosed with symptomatic irreversible pulpitis in a mandibular incisor, who underwent multiple-visit root canal treatment using the Step Back Technique. The report highlights the clinical approach, treatment challenges, and the effectiveness of this technique in managing the condition while preserving the affected tooth.

2. Case Report

A 50-year-old woman presented with complaints of cavities in both her upper and lower jaw, particularly affecting her front teeth, which significantly impacted her appearance. She reported experiencing pain when biting food or when her front teeth were touched. Additionally, she described a throbbing pain in her lower front teeth, which had been persistent. However, she had not taken any medication to alleviate the pain. Upon further inquiry, the patient reported a history of Bell's Palsy in 2010 but denied any family history of allergies or systemic diseases. She also admitted to having a habit of pushing her tongue against her front teeth, which may have contributed to her dental condition. Concerned about the condition of her teeth, the patient expressed a strong desire for treatment that would allow her to retain her natural teeth while ensuring their functionality and aesthetics (Fig 1).



Figure 1. Clinical pictures on the first visit

After conducting a comprehensive assessment, including subjective evaluation, objective examination, and radiographic analysis, tooth 31 was diagnosed with symptomatic irreversible

pulpitis with normal apical tissue (Fig. 2). Given this diagnosis, root canal treatment (RCT) was planned as the most appropriate course of action to alleviate the patient's symptoms and preserve the tooth. The patient was thoroughly informed about the root canal procedure, including its objectives, steps, potential risks, and expected outcomes. After a detailed discussion, the patient expressed understanding and consented to proceed with the treatment to restore both function and aesthetics while maintaining the natural tooth structure.

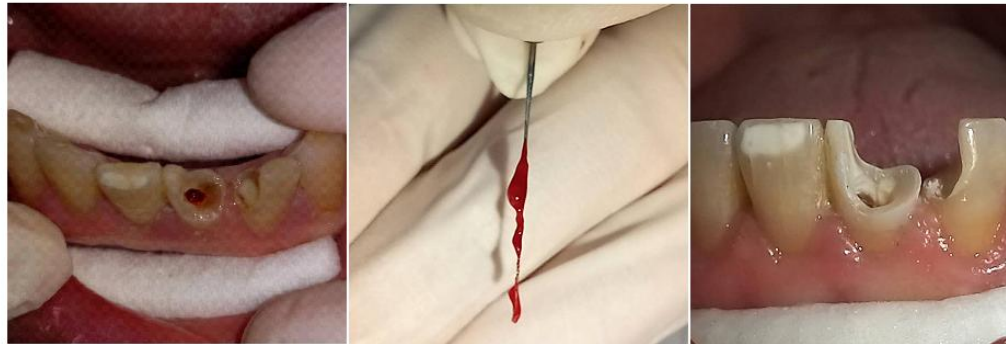


Figure 2. Caries excavation, pulp extirpation, and wall reconstruction.

Second Visit: The patient returned one week later to continue treatment, reporting the same complaints as during the first visit. After conducting a subjective and objective examination, the treatment proceeded with the access opening on tooth 31. Once the patient's vital signs were stable, pain management was administered through buccal infiltration anesthesia in the region of tooth 31. The working area was isolated using a cotton roll, where carious tissue was removed, and the access opening procedure was performed. Pulp extirpation was then performed using barbed broaches, and the root canal was irrigated with 5.25% NaOCl to ensure proper disinfection. To restore the tooth's structural integrity, rewalling of the dentofacial and disto-lingual walls was carried out using composite resin, employing the root canal projection technique. After irrigation, the root canal was thoroughly dried with paper points, and the cavity was sealed with a temporary filling to protect the treated area until the next visit (Fig. 3).

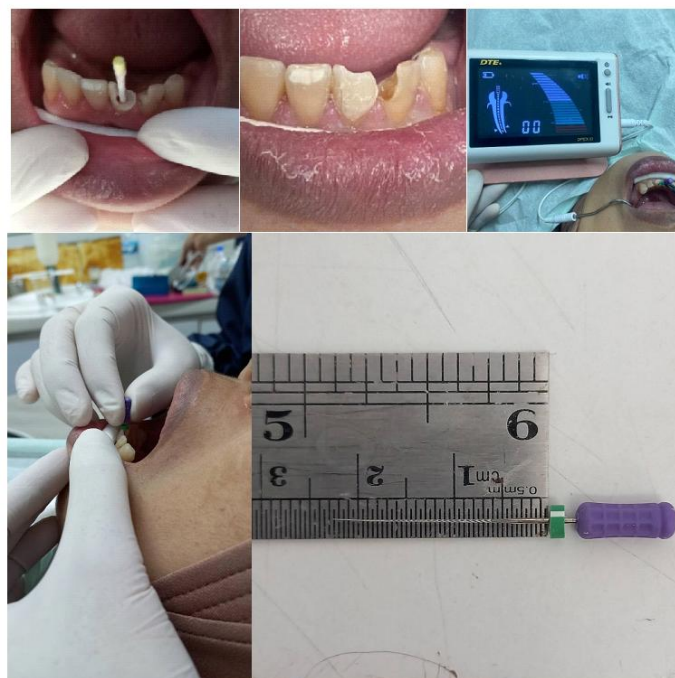


Figure 3. Wall reconstruction and root canal measurement for working length determination.

Third Visit: The patient returned for the continuation of treatment. Based on the anamnesis, there were no complaints following the previous visits. A thorough subjective and objective examination was conducted before proceeding with the next stage of treatment. During this visit, the rewalling of the tooth structure was reinforced using the root canal projection technique. The root canal's working length was then measured using an apex locator, which determined a length of 22.5 mm. Subsequently, the cleaning and shaping of the root canal of tooth 31 were performed using the step-back technique.

The procedure began with K-File #10 as the Initial Apical File (IAF) at a working length of 22.5 mm, gradually increasing in size. The process was completed with K-File #40 at a working length of 19.5 mm. The apical portion of the root canal was prepared up to the Master Apical File (MAF) using K-File #25. Throughout the procedure, irrigation was performed at each file change and after cleaning and shaping, using a combination of 5.25% NaOCl, EDTA, chlorhexidine, and saline solution to ensure effective disinfection. After cleaning and shaping, calcium hydroxide (CaOH) intracanal medicament was placed inside the root canal to aid in disinfection and healing. The cavity was then sealed with a temporary filling to protect the tooth until the next visit (Fig.4).

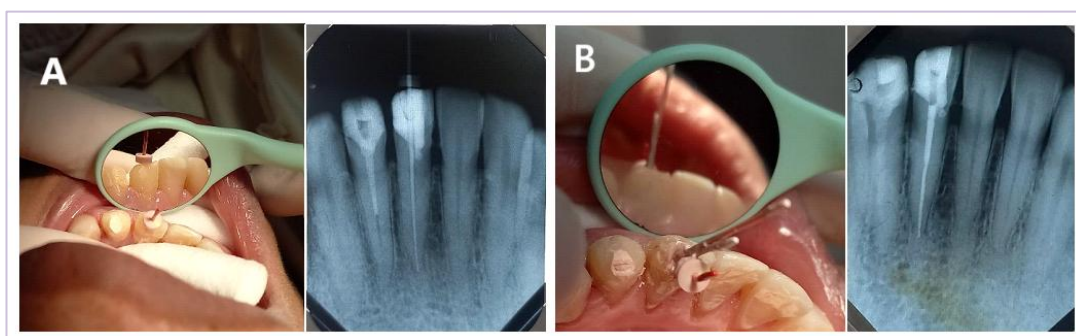


Figure 4. Master cone gutta-percha, trial obturation based on Master Apical File (A). Obturation on tooth 31 (B)

Rewalling repairs were performed on the distal wall of tooth 31 during the fourth and sixth visits. Based on the patient's history, it was noted that she had a habitual tendency to push her tongue forward, which may have contributed to the structural compromise of the tooth. Intracanal medicament was applied during the fifth and seventh visits to ensure continued disinfection and promote healing. At the seventh visit, a trial obturation was conducted to assess the fit of the master cone gutta-percha, followed by the final obturation at the eighth visit. The obturation procedure was performed using gutta-percha and an endodontic sealer.



Figure 5. First follow-up examination one week after obturation of tooth 31.

The master cone gutta-percha selected was size 25, with a length of 22 mm, as previously evaluated through radiographic examination during the trial obturation. Following the placement of the master cone, lateral condensation was performed, and accessory gutta-percha size 15 was inserted into the root canal. This process was repeated twice to ensure complete filling of the root canal. Upon

completion of the obturation, a periapical radiographic examination was conducted to evaluate the quality of the root canal filling. The radiographic results confirmed that the root canal was well obturated with gutta-percha, allowing treatment to proceed. To finalize the procedure, glass ionomer cement (GIC) was applied up to the level of the orifice, and the cavity was sealed with a temporary filling to protect the treated area (Fig. 5).

Post-obturation follow-up examinations were conducted twice, during the ninth and tenth visits. At the first follow-up, one week after the root canal filling, the patient reported pain in tooth 31. A radiographic examination confirmed the absence of periapical lesions and verified that the root canal filling was intact and well-sealed. Given the findings, the patient was scheduled for a second follow-up visit one week later to monitor progress and assess any changes in symptoms (Fig 6).



Figure 6. Second follow-up examination two weeks after obturation of tooth 31.

Tenth Visit. The patient returned for the second follow-up evaluation after root canal treatment. A comprehensive assessment was conducted, including subjective evaluation, objective examination, and radiographic analysis. The patient reported no complaints since the previous visit, indicating improved symptoms. A periapical radiographic examination was performed to assess the condition of the treated tooth. The results confirmed the absence of periapical lesions, and the root canal filling in tooth 31 remained intact and well-sealed. Given the stable clinical and radiographic findings, the treatment was deemed successful. With the root canal treatment completed, the next phase of the treatment plan involved a permanent restoration to ensure the long-term functionality and strength of the tooth. A post-crown restoration was recommended to provide structural reinforcement, enhance aesthetics, and protect the tooth from potential fractures or reinfection. The patient was advised to proceed with the final restorative phase to maintain the longevity of the treated tooth.

3. Discussion

Root canal treatment (RCT) is a crucial procedure for managing symptomatic irreversible pulpitis, particularly for patients who wish to retain their natural teeth while restoring function and aesthetics. In this case, tooth 31 was diagnosed with symptomatic irreversible pulpitis with normal apical tissue based on subjective complaints, objective examination, and radiographic findings. The patient initially presented with throbbing pain in the lower anterior teeth, indicating pulpal inflammation. A cold sensibility test confirmed the pulp's vitality, while a negative percussion test suggested the absence of periapical involvement. Radiographic evaluation revealed deep caries extending into the pulp, but no signs of periapical lesions were observed. Given these findings, root canal treatment was deemed the most appropriate.⁹

Caries in anterior teeth not only affect masticatory function but also have a significant impact on aesthetics.¹⁵ Endodontic treatment is necessary to remove infected pulp tissue, disinfect the root canal system, and restore the structural integrity of the affected tooth. In this case, the patient opted for a conservative approach rather than extraction, reinforcing the importance of preserving natural teeth whenever possible.¹¹ Root canal treatment is widely recognized as an effective method for maintaining teeth affected by pulp damage while ensuring they continue to function within the dental arch.¹¹

At the second visit, the treatment began with removing caries-infected tissue using rotary instruments, followed by access opening and pulp extirpation with a barbed broach. To facilitate effective irrigation and maintain a coronal seal, the distal wall was reconstructed with composite resin. Rewalling is essential in root canal treatment to prevent bacterial contamination and enhance

treatment success.¹⁶ Following these procedures, a temporary filling was placed to prevent bacterial infiltration and food debris from entering the root canal system.

Root Canal Preparation Using the Step-Back Technique

During the third visit, the working length was determined using an apex locator, confirming a measurement of 22.5 mm. The step-back technique was selected for root canal preparation, beginning with K-File #10 as the initial apical file (IAF). This technique is beneficial in creating a tapered root canal while minimizing the risk of procedural errors, such as perforation or ledging. The final apical preparation was completed with K-File #40 at 19.5 mm. While the step-back technique allows for better control of canal shaping, it also presents certain limitations, including the risk of instrument binding, difficulty achieving apical cleanliness, and requiring multiple instruments.¹⁷

To maintain effective disinfection, irrigation was performed at every file change using a combination of 5.25% sodium hypochlorite (NaOCl), EDTA, chlorhexidine, and saline solution. NaOCl is widely used for its ability to dissolve pulp debris and its bacteriostatic properties, while EDTA helps remove the smear layer.¹⁸ Additionally, chlorhexidine is effective against *Enterococcus faecalis*, a common bacterial species associated with persistent endodontic infections.¹⁹ After canal preparation, intracanal medication with calcium hydroxide (CaOH) paste was applied and sealed with a temporary filling to ensure continued disinfection.

During subsequent visits, it was observed that the rewalling restoration was damaged twice due to the patient's habitual tongue thrusting against the labial surface of tooth 31. This habit compromised the stability of the temporary restoration, potentially prolonging treatment time and affecting the overall success of the procedure. The patient was educated on the impact of this habit and advised to minimize tongue thrusting to facilitate a successful outcome. After repairing the rewalling restoration, the working length was reassessed, yielding a measurement of 22 mm. The slight difference from the initial measurement was attributed to changes in the reference point on the incisal surface following the rewalling procedure.²⁰ Sterile control and intracanal medicament replacement were performed twice, during the fifth and seventh visits, to maintain a bacteria-free environment within the root canal system.

The patient's condition had improved by the sixth visit, with negative percussion test results. A master cone gutta-percha trial was conducted using MAF #25, followed by a radiographic evaluation to confirm proper fit and adaptation. Based on the evaluation, the canal was refilled with CaOH intracanal medicament in preparation for final obturation. At the following visit, obturation was performed using the lateral condensation technique. A master cone gutta-percha size #25 with a length of 22 mm was inserted, followed by accessory gutta-percha application in two stages to ensure complete root canal filling. Lateral condensation is a widely used in endodontics due to its advantages, including precise control of the working length and a reduced risk of overextension. However, one drawback of this technique is that it may result in a non-homogeneous filling if not performed correctly.²¹ After completing the obturation, the orifice was sealed with glass ionomer cement (GIC), and a temporary filling was placed. A radiographic evaluation confirmed that the obturation was well-adapted with no voids or overextension.

Post-obturation follow-up examinations were conducted twice. During the first follow-up, one week after obturation, the patient reported pain in tooth 31, and a percussion test was positive, suggesting mild post-treatment discomfort. However, radiographic examination confirmed no periapical lesions, and the root canal filling remained intact. The patient was reassured and scheduled for another follow-up visit one week later. The patient reported no further discomfort at the final follow-up visit, and the percussion test was negative. A radiographic evaluation confirmed that the root canal filling and periapical tissue were in good condition, indicating successful treatment. Given the structural requirements of anterior teeth, a post-crown restoration was planned to reinforce the tooth and prevent future fractures.

The patient expressed satisfaction with the outcome, as the treatment successfully alleviated symptoms, preserved the tooth, and restored its aesthetics. This case highlights the importance of meticulous root canal procedures, effective irrigation protocols, and patient compliance in achieving long-term treatment success.¹¹

4. Conclusion

Root canal treatment on tooth 31, diagnosed with symptomatic irreversible pulpitis with normal apical tissue, was completed in 10 visits using the step-back technique. The treatment involved careful working length determination, thorough canal preparation, adequate irrigation, and proper

intracanal medication to ensure disinfection and healing. Despite challenges like the patient's habitual tongue thrusting, rewalling adjustments and patient education contributed to treatment success. The final obturation was performed using the lateral condensation technique, and radiographic evaluation confirmed a well-adapted root canal filling with no signs of periapical pathology. Follow-up visits showed no pain or discomfort, negative percussion test results, and healthy periapical tissue, indicating clinical and radiological success. A post-crown restoration was planned to reinforce the tooth, ensuring its long-term function and aesthetics.

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Authors Contribution

Contribution	Pratiwi AF,	Fatriadi F
Concepts or ideas	√	
Design		√
Definition of intellectual content	√	
Literature search		√
Experimental studies	√	
Data acquisition	√	√
Data analysis	√	
Statistical analysis	√	
Manuscript preparation	√	√
Manuscript editing	√	√
Manuscript review	√	√

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