*International Journal Of Health, Engineering And Technology (IJHET)* *E-ISSN 2829 - 8683*
Volume 5, Number 3, September 2026, *Page. 3035 - 3043*
Email : editorijhess@gmail.com

# Management Of Single Root Canal Treatment With Fiber Post And Jacket Crown Restoration In Tooth 22 With Pulp Necrosis

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***Abstract***

*Single root canal treatment is an endodontic treatment of dental conservation. The procedure involves removing necrotic or vital pulp and replacing the root canal filling material to prevent recurrent infection. Dental restorations are necessary after root canal treatment, considering retention and resistance. The selection of a jacket crown restoration with a post core intended to increase strength to withstand chewing loads and create additional retention, especially in this case, which concerns anterior teeth. This treatment useful in determining the success of single root canal treatment with a jacket crown restoration and fiber post core. This descriptive case report study was conducted based on a patient treated directly at Soelastri Dental and Oral Hospital. The results of single root canal treatment with a jacket crown restoration and post core were obtained from objective examination results of percussion (-), palpation (-), USPHS (United States Public Health Service) anatomy: alpha, color matching: alpha, margin adaptation: alpha, color change: alpha, surface roughness: alpha, secondary caries: alpha. Conclusion: Single root canal treatment with a jacket crown restoration and fiber post core provides optimal, aesthetically pleasing anterior tooth restoration results with minimal risk of failure.*

**Keywords:** ***Jacket Crown Restoration; Fiber Post Core; Pulp Necrosis, Single Root Canal Treatment***

## INTRODUCTION

Oral and dental diseases are pathological problems that affect the health of the teeth, gums, and other structures in the oral cavity. This problem is a crucial aspect of overall health because the condition of the oral cavity can directly impact the body's health. According to the 2023 Indonesian Health Survey (SKI), 56.9% of the population aged three and over in Indonesia experienced oral and dental health problems, and according to the 2018 Basic Health Research (RISKESDAS), the prevalence of cavities (caries) remains quite high at 82.8% (RISKESDAS, 2025). Untreated caries can lead pulp disease, which can involve to pulp death (pulp necrosis) and even periapical tissue disease (Widyastuti et al., 2021).

Pulp necrosis is the final stage of pulp inflammation (pulpitis) and can be caused by a lack of blood circulation to the pulp, rendering the tooth unviable (Widyastuti et al., 2021). Pulp and periapical disease can be treated with curative treatment, namely endodontic treatment, which can be performed conventionally through root canal treatment. Root canal treatment involves removing necrotic or still-viable pulp tissue and replacing it with a filling material to prevent recurrent infection (Sutowijoyo et al., 2023). Post placement in the root canal after endodontic treatment is a good option because it can improve retention and stabilization, as well as strengthen the tooth (Riska et al., 2024).

Tooth after root canal treatment become weak against masticatory pressure, requiring additional retention in the form of post core. The function of post core increase strength to the restoration and distribute the pressure received by the tooth evenly along the tooth root. Based on their manufacture, post core can be divided into two types: metal and non-metallic. Non-metallic post core consist of composite resin, ceramic, and fiber-reinforced polymers. Fiber-reinforced polymers are made of carbon or silica fibers coated with a resin polymer (epoxy resin) and called fiber reinforced composites (FRC). The purpose of FRC post core to fill the entire root canal space following the anatomical shape with minimal preparation. Fiber reinforced composite (FRC) post core were chosen because they have

the advantages of being aesthetically pleasing, able to bond with tooth structure, and have an elastic modulus similar to dentin (Kusumawati et al., 2019).

Following root canal treatment, the remaining tooth structure plays an important role in determining the prognosis of the tooth. Extensive loss of coronal structure may reduce the ability of the tooth to withstand functional forces and increase the risk of fracture. Therefore, restoration of endodontically treated teeth should not only restore the morphology and function of the tooth but also provide adequate resistance and retention while preserving as much sound tooth structure as possible. The selection of an appropriate post and core system is consequently an important consideration, particularly in anterior teeth with substantial loss of tooth structure.

Fiber posts have become widely used as an alternative to conventional metallic posts because of their biomechanical and aesthetic properties. The elastic modulus of fiber-reinforced composite posts is relatively close to that of dentin, allowing functional stresses to be distributed more evenly within the remaining tooth structure. This property may reduce stress concentration at the post–dentin interface and potentially decrease the risk of catastrophic root fracture. In addition, the tooth-colored appearance of fiber posts provides an aesthetic advantage, especially when they are used in anterior teeth where the final restoration is expected to have a natural appearance.

The success of a fiber post-supported restoration also depends on adequate adaptation of the post within the root canal, preservation of the apical seal, and proper bonding between the post, luting material, and dentin. Excessive preparation of the root canal should be avoided because it may further reduce the thickness of the remaining root dentin. Therefore, the use of a fiber post with minimal canal preparation can provide retention while maintaining the structural integrity of the root. Proper treatment planning and consideration of the remaining tooth structure are essential to achieve a predictable long-term outcome.

For anterior teeth with extensive coronal destruction, a jacket crown can provide full-coverage protection while restoring aesthetics, shape, and function. The combination of a fiber post and core with a jacket crown can therefore be considered a conservative restorative approach for endodontically treated anterior teeth with insufficient remaining coronal structure. This combination is expected to provide adequate retention and stabilization while maintaining favourable aesthetic and biomechanical characteristics. Accordingly, documenting the clinical management and restorative outcome of such cases may provide useful information for clinicians when selecting an appropriate restorative treatment for endodontically treated anterior teeth.

Final restoration after root canal treatment is adjusted to the condition of the tooth, such as the amount of remaining tooth structure, horizontal pressure, and chewing load (Kusumawati et al., 2019). Anterior teeth after root canal treatment with incomplete marginal edges, indirect restoration with a porcelain fused to metal (PFM) jacket crown can be performed (Riska et al., 2024). Jacket crown treatment with a fiber reinforced composite post core is carried out because in cases of anterior teeth sustain significant tooth structure loss, efforts are needed to increase retention and stabilization, which is the use of a jacket crown with a post core. We hope this case report can be a reference for operators or dentists facing similar situations. The purpose of this report is to explain the success of a single root canal treatment procedure with a jacket crown restoration and fiber post core.

## RESEARCH METHODS

### Study Design and Subject

Uses a case report design that aims to comprehensively describe the diagnostic process, surgical management, and histopathological confirmation in a 22-year-old female patient diagnosed with pulp necrosis of tooth 22.

### Examination and Treatment Procedure

Examinations included medical history, clinical examination, pulp vitality testing using chlor ethyl and the Electric Pulp Test (EPT), and periapical radiography. Treatment began with access

opening and pulp extirpation, followed by working length determination and root canal preparation using the step-back technique. Irrigation was performed using sodium hypochlorite (NaOCl), and calcium hydroxide [$Ca(OH)_2$] was used as intracanal medication. Following evaluation, root canal obturation was performed using the lateral condensation technique with gutta-percha and sealer.

**Restoration and Evaluation**

After completion of root canal treatment, post-space preparation, fiber post placement, and core build-up were performed. The tooth was subsequently prepared for a porcelain-fused-to-metal (PFM) crown. The crown was tried in to evaluate marginal adaptation, shade matching, and occlusion before cementation using glass ionomer cement (GIC).

Treatment outcomes were evaluated through subjective and objective examinations, including patient complaints, percussion, palpation, tooth mobility, crown marginal adaptation, and occlusion. The restoration was also evaluated using the United States Public Health Service (USPHS) criteria, including anatomical form, color matching, marginal adaptation, color change, surface roughness, and secondary caries.

## RESULTS AND DISCUSSION

### CASE REPORT

A 22-year-old female patient came to the Soelastri Dental and Oral Hospital complaining of feeling less confident due to cavity and discoloration in her upper left front tooth. Based on the history, the tooth had been decayed for the past 12 months, had experienced spontaneous pain but was no longer painful, and previously undergone dental filling treatment. There was no history of systemic disease or allergies to food, drugs, or environmental factors. The patient was in general good physical condition, and showed a cooperative and communicative during the examination.

Objective examination showed that tooth 22 had cavity and discoloration in the mesio-incisal. Probing, percussion, and palpation examinations showed negative results. Pulp vitality testing with chlor ethyl (CE) also showed negative results. Meanwhile, examination using the Electric Pulp Test (EPT) score is 44. Periapical radiography showed a radiolucent image on the crown of tooth 22 in the mesio-incisal extending to pulp chamber of the tooth. There was also a periapical lesion in the form of a diffuse or unclearly defined radiolucent image at the apical of tooth 22. Based on clinical and radiographic findings, a diagnosis of pulp necrosis was made in tooth 22. ICDAS (International Caries Detection and Assessment System) category D6, site 2, size 3. The treatment plan in this case includes communication, information, and education regarding the patient's dental condition, and the patient was planned to root canal treatment and final restoration with porcelain fused to metal jacket crown and fiber post core.

**Figure 1. Clinical and Radiographic Images of Tooth 22 Before Treatment.**

The clinical procedure began with communication, information, and education (IEC) regarding the diagnosis and treatment plan, followed by a signed informed consent form. The initial treatment phase involves initial therapy, including calculus and plaque removal through a scaling procedure. On the second visit, the filling material was removed using round diamond bur and followed by opening the pulp chamber with an endo access bur. After that, the cavity wall was prepared with a diamendo bur until divergent towards the incisal. Preparation considered complete when the pulp roof was completely lifted, the orifice and root canal were clearly visible, and the cavity shape provided good retention. Afterward, the work area was isolated with a rubber dam and necrotic pulp tissue was

removed from the pulp chamber using an endo excavator to the orifice. Root canal exploration was performed using a smooth broach and the smallest file, #10 k-file smeared with EDTA gel. Then, pulp extirpation was performed with a barbed broach, until the pulp canal was clean and no pulp tissue was visible during irrigation.

**Figure 2. Open Access and Extirpation Tooth 22**

Determination of working length was carried out by direct observation method using k-file #15 with estimated working length and fixation stopper then evaluated with periapical radiography. The measurement results obtained working length is obtained at 21 mm. After that, a dressing application with Chlorophenol Camphormenthol (CHKM) material is carried out, then a temporary restoration using cavit.

**Figure 3. Determination Working Length Tooth 22**

On the third visit, root canal preparation was performed using the step-back technique. Preparation was carried out by determining the Initial Apical File (IAF), which in this case was file #30 to file #45 Master Apical File (MAF) with a fixed working length of 21 mm. Preparation root canal body using pull stroke movement consisting of #50 k-file at 20 mm, #55 k-file at 19 mm, #60 k-file at 18 mm. Each file change recapitulation using MAF file and working length 21 mm.

Finishing preparation using circumferential filling technique, preparation was performed with H-files #65 to #75 with a working length reduced by 1 mm for each file increment. Recapitulation with the actual working length and irrigation using NaOCl. Preparation finished until white dentin was created, then intrakanal medication was carried out using calcium hydroxide ($Ca(OH)_2$) powder mixed with saline applied into the root canal using lentulo. Then a temporary filling was performed using cavit until the next visit for 7 days.

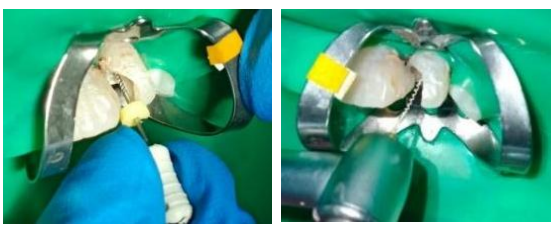

**Figure 3. Preparation and Medication Root Canal Tooth 22**

On the fourth visit, evaluation using hydrogen peroxide showed test was negative, patient was asymptomatic, indicating absence of active infection. Obturation root canal was performed using lateral condensation technique with gutta percha and endomethasone sealer. Master Apical Cone (MAC) #45 gutta-percha was inserted to the established working length until tugback was achieved. The excess gutta-percha was cut with a guttap cutter to the orifice. The obturation results were evaluated using periapical radiographs to determine whether the obturation was hermetic afterwards cavity was lined with a thin layer of type 3 GIC and a temporary restoration was placed. Evaluation was performed after 7 days.

**Figure 5. Obturation and Post-Obturation Radiography Tooth 22**

On the fifth visit, a root canal treatment evaluated with a subjective and objective examination, included evaluation retention, marginal integrity, surface texture, anatomical shape, caries recurrence, surface stains, and soft tissue health. The result of examination was found negative. Patient had no complaints so that the final restoration of the root canal treatment could be continued with a jacket crown with a fiber post core. The first stage involved root canal preparation and post core fabrication.

Before preparation of post core, work plan for the fiber post core was calculated, result were obtained removing 8.6 mm of gutta-percha using a peaso reamer followed preparation with precision drill and try-in of the appropriate fiber post core size. Radiographs were used to confirm whether the post core was the correct size and length for the root canal. If it was, cementation with resin cement using a lentulo was performed. The excess post core in the coronal area was used to core build up.

**Figure 6. Try-In and Radiograph Try-In Post Core Fiber Reinforced Composite Tooth 22**

Jacket crown restoration begins with preparation labial surface with a depth marker bur and create a guiding line depth of approximately 1 mm, then using a round end fissure bur to create chamfered end of the preparation. Palatal preparation using round end fissure bur with depth approximately 0.5-1 mm, while maintaining the concave anatomical contour of the palatal surface. Proximal preparation using tappered diamond bur create converging towards the incisal.

The reduction is stopped when sufficient proximal space has been created with the adjacent teeth. Axial angle reduction with a diamond round end fissure bur is performed by rounding all sharp corners. Finishing and polishing the entire preparation with finishing bur and sandpaper disc. Then, double impression was made using putty (catalyst base) and elastomer with a one step technique to create an indirect restoration of the jacket crown.

**Figure 7. Jacket Crown Preparation and One Step Impression Tooth 22**

At the subsequent visit, jacket crown porcelain fused to metal try-in was performed. Try in the jacket crown by observing the edge adaptation, whether or not the crown jacket injures soft tissue, the presence or absence of gaps, checking color compatibility, checking occlusion using articulating paper, asking the patient if there is anything stuck or not. The restoration demonstrated satisfactory marginal fit, appropriate shade matching, and absence of discomfort.

The jacket crown insertion using glass ionomer cement (GIC), applied to tooth surface and the internal surface of the crown. The crown was seated with cervical pressure, clean excess in the

proximal area with dental floss and lightcure by pressing the jacket crown towards the cervical then checking the patient's occlusion with articulating paper. Postoperative instructions included maintaining oral hygiene by brushing twice daily, avoiding eating or drinking for one hour after cementation, and returning for follow-up evaluation.

Clinical after one week showed subjective examination that the patient does not feel any complaints or discomfort and the results of the objective examination such as percussion, palpation, mobility, adaptation of the crown edge to the gingiva, and occlusion are known to be negative or no complaints reported by the patient, indicating satisfactory functional and esthetic outcomes

**Figure 8. Try In and Post Dental Treatment Check Up Tooth 22**

## Discussion

In this case, pulp necrosis is caused by improper brushing, resulting in less than optimal tooth hygiene, leading to the accumulation of food debris and plaque, creating a favorable environment for bacteria to thrive. Bacterial activity lowers the pH of the oral cavity, leading to mineral loss in the enamel and dentin that protect the teeth. If bacteria are allowed to enter, they can reach the pulp, causing inflammation of the vital tooth pulp, which then leads to pulp death or necrosis. Pulp necrosis is the partial or complete death of the pulp, which can occur due to inflammation or traumatic stimuli. Necrosis can be caused by bacteria, trauma, irritation from restorative materials, or ongoing inflammation of the pulp (Manei et al., 2023).

Pulp necrosis begins with bacterial penetration through the enamel and dentin, causing healthy pulp tissue to produce inflammatory mediators to fight the bacteria. This reaction leads to swelling and pain, which then creates excessive pressure on the nerves in the tooth root, reducing blood flow to the traumatized tooth and causing nutritional deficiencies, leading to ischemic necrosis, followed by pulp death or necrosis. Necrotic pulp is susceptible to inflammation due to bacterial infection in the periapical tissue (Abdulwahab et al., 2022).

Root canal treatment can be performed to prevent the spread of disease from the pulp to the periapical tissue or, in this case to restore the periapical tissue to health. Root canal treatment involves several stages, including access opening, measuring the working length, preparation, irrigation, disinfection, and root canal filling. Several stages require preparation to ensure success, including adherence to the principles of asepsis, which ensures the elimination of bacteria and other microorganisms within the root canal, and pain management, as pulp disease typically produces pain, necessitating appropriate pain management. Furthermore, other stages, such as mechanical preparation, intracanal medication, and obturation with appropriate techniques are essential (Widyastuti et al., 2017).

The primary objective of root canal treatment is to eliminate microorganisms and infected or necrotic tissue from the root canal system while preserving the remaining tooth structure. The complex anatomy of the root canal system, including irregularities, lateral canals, and dentinal tubules, can make complete elimination of microorganisms difficult. Therefore, successful endodontic treatment depends on the interaction between mechanical instrumentation and chemical disinfection. Mechanical preparation helps remove infected dentin and shape the canal, while irrigation facilitates the removal of tissue remnants, microorganisms, and debris that cannot be adequately eliminated by instrumentation alone.

The condition of the periapical tissue is also an important consideration in determining the prognosis of endodontic treatment. When necrotic pulp tissue remains infected for an extended period, microorganisms and their by-products may migrate through the apical foramen and trigger inflammation in the periapical tissues. Consequently, adequate cleaning, shaping, and disinfection of

the root canal are essential to reduce the microbial load and provide favorable conditions for periapical healing. In this case, appropriate root canal treatment was performed to eliminate the source of infection and support the restoration of healthy periapical tissues.

The root canal preparation technique used in this case was the step back technique. The advantages of this technique include more effective root canal cleaning, easier obturation, and a denser root canal filling because the spreader can reach close to the apex, thus reducing apical leakage. Each preparation file change in this case was irrigated with 2.5% Sodium Hypochlorite (NaOCl), an oxidizing agent considered the most effective because it acts as a lubricant, dissolves pulp tissue, acts as a bleaching agent, and is a strong antiseptic.

The step-back technique also allows the operator to establish a controlled taper of the root canal while maintaining the original canal anatomy. Proper canal shaping is important because it facilitates the penetration and circulation of irrigating solutions and creates sufficient space for subsequent obturation. However, instrumentation should be performed carefully to avoid excessive removal of dentin, transportation of the canal, ledge formation, or other procedural complications. In this case, the use of the step-back technique combined with irrigation after each file change was intended to achieve adequate canal preparation while maintaining the integrity of the remaining root structure.

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Ethylene Diamine Tetra Acetic Acid (EDTA) 15%, which was also used in this case, is an effective chelating agent that softens dentin, moderate irritation, removes the smear layer, and its combination with 2.5% Sodium Hypochlorite (NaOCl) will help enhance antimicrobial properties. The use of irrigants must be appropriate to enhance canal disinfection and thus improve treatment outcomes. Successful root canal treatment requires a combination of mechanical preparation, irrigation, intracanal medication, and obturation with the correct technique (Hutami et al., 2020).

The combination of NaOCl and EDTA provides complementary effects during root canal preparation. Sodium hypochlorite is primarily used to dissolve organic tissue and reduce the microbial load, whereas EDTA facilitates the removal of the inorganic component of the smear layer. The removal of the smear layer can improve the cleanliness of the dentinal surface and facilitate interaction between the root canal wall and the subsequent filling materials. Therefore, the sequential use of these irrigants in this case was intended to optimize root canal cleanliness and support effective obturation.

In this case, intracanal medication uses Calcium Hydroxide ($Ca(OH)_2$) because it is antibacterial, soluble in tissue, prevents tooth resorption, controls exudate in teeth with persistent periapical inflammation, and stimulates tissue repair with hard tissue formation. Post root canal teeth have a fragile structure due to reduced moisture. In this case, the tooth requires a post as intra radicular retention in an effort to form a core to replace damaged or lost dentin and support tooth restoration. Based on this, a passive post is preferred to prevent pressure in the root canal, thereby reducing the risk of fracture. The use of calcium hydroxide as an intracanal medicament is particularly relevant in cases involving pulp necrosis because the root canal may contain residual microorganisms after mechanical preparation and irrigation. Its antimicrobial activity and high alkalinity can help reduce the remaining bacterial population and create a more favorable environment for periapical healing. The intracanal medicament therefore serves as an additional disinfection step before obturation, particularly when complete microbial elimination cannot be achieved through instrumentation and irrigation alone.

Post core used in this case is a fiber reinforced composite (FRC) post. The purpose of an individual FRC post is to be able to fill the entire space of the root canal following the anatomical shape with minimal preparation. FRC posts are chosen because they have a modulus of elasticity

similar to dentin so that pressure will be distributed along the post and throughout the root (Kusumawati et al., 2019). The final restoration, a porcelain fused-to-metal (PFM) crown, was chosen for this case because the anterior teeth required aesthetic value and mechanical strength. The use of a metal structure in the inner layer provides greater strength against masticatory forces, and the porcelain structure coating provides an aesthetic appearance resembling natural teeth, making it suitable for use in cases such as anterior teeth. The choice of final restoration depends on the remaining tooth structure, horizontal pressure, and masticatory load. The use of a fiber-reinforced composite (FRC) post with resin cementation forms the post canal wall with the post, which is integral to the monoblock system. The combination of a fiber reinforced composite (FRC) post with a porcelain fused to metal (PFM) crown was chosen because the anterior teeth had lost significant tooth structure, thus enhancing aesthetic value and providing greater strength.

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## CONCLUSION

Root canal treatment for maxillary lateral incisors with pulp necrosis aims to remove the necrotic pulp tissue and help maintain the tooth so it can function optimally and prevent recurrent infection. Post root canal treatment requires a sufficiently strong restoration for retention and stabilization, especially if the remaining tooth is inadequate. Therefore, a post can be used to help increase the strength of the restoration and distribute the pressure received by the tooth. The use of an indirect jacket crown as the final restoration also helps provide stronger and more aesthetic restoration durability. Single root canal treatment with a Porcelain Fused to Metal (PFM) jacket crown and a Fiber Reinforced Composite (FRC) post core in teeth with pulp necrosis provides better treatment in terms of retention, resistance, aesthetics, and long term stabilization, and contributes to improving the patient's quality of life.

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