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ENDODONTIC MANAGEMENT OF IRREVERSIBLE PULPITIS IN MANDIBULAR SECOND MOLAR: CASE REPORT

(MANAJEMEN ENDODONTIK PULPITIS IREVERSIBEL GIGI GERAHAM KEDUA MANDIBULA: LAPORAN KASUS)

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ABSTRACT

Irreversible pulpitis is a permanent inflammatory condition of the dental pulp, generally caused by bacterial invasion from deep caries, and is characterized by spontaneous pain that cannot be reversed even after the removal of etiologic factors. Permanent mandibular molars, such as tooth 37, often present complex root canal anatomies, including C-shaped canals, two distal canals, or a middle mesial canal, which may directly affect the success of endodontic treatment. This case report aims to describe the management of multiple root canal treatments in a permanent mandibular molar diagnosed with irreversible pulpitis due to deep caries, and to evaluate clinical and radiographic outcomes after therapy. A 35-year-old male patient presented to the Dental Hospital of Jenderal Achmad Yani University with a chief complaint of spontaneous pain in tooth 37 that interfered with daily activities. Clinical examination revealed extensive coronal destruction, a positive painful response to pulp vitality testing, and radiographic findings of deep caries approximating the pulp with periodontal ligament widening but without signs of abscess. A diagnosis of irreversible pulpitis was established, and root canal therapy was performed, including rewalling restoration, biomechanical preparation with hand K-files up to master apical file #25, irrigation with 2.5% sodium hypochlorite and saline, followed by obturation using the lateral condensation technique with resin-based sealer. Final restoration was achieved with an indirect composite to restore masticatory function and prevent reinfection. At follow-

up, the patient reported no symptoms, with normal clinical and radiographic findings, indicating successful treatment and functional tooth preservation. In conclusion, irreversible pulpitis in mandibular molars with complex canal morphology can be effectively managed with conventional root canal therapy, where accurate preparation and proper coronal restoration play a more significant role in long-term success than the obturation technique employed.

Keywords : endodontics; irreversible pulpitis; root canal treatment

ABSTRAK

Pulpitis ireversibel merupakan kondisi inflamasi permanen pada pulpa gigi yang umumnya disebabkan oleh invasi bakteri akibat karies dalam, ditandai oleh nyeri spontan dan tidak dapat dipulihkan meskipun faktor penyebab dihilangkan. Pada gigi molar mandibula permanen, seperti gigi 37, kompleksitas anatomi saluran akar—misalnya saluran berbentuk C, dua saluran distal, atau saluran mesial tengah—menjadi tantangan dalam keberhasilan terapi endodontik. Laporan kasus ini bertujuan mendeskripsikan penatalaksanaan perawatan saluran akar multipel pada molar mandibula dengan diagnosis pulpitis ireversibel akibat karies dalam, sekaligus mengevaluasi hasil klinis dan radiografis setelah terapi. Seorang pasien laki-laki berusia 35 tahun datang ke RSGM Unjani dengan keluhan nyeri spontan pada gigi 37 yang mengganggu aktivitas sehari-hari. Pemeriksaan klinis menunjukkan kerusakan mahkota ekstensif, respon vitalitas positif dengan nyeri, dan radiografi memperlihatkan karies mendekati pulpa serta pelebaran ligamen periodontal tanpa tanda abses. Diagnosis pulpitis ireversibel ditegakkan dan dilakukan perawatan saluran akar dengan tahapan rewalling restorasi, preparasi biomekanis manual menggunakan K-file hingga master apical file #25, irigasi menggunakan NaOCl 2,5% dan saline, serta obturasi teknik kondensasi lateral dengan sealer resin. Restorasi akhir berupa komposit indirek dipasang untuk mengembalikan fungsi mastikasi dan mencegah reinfeksi. Pada kunjungan tindak lanjut, pasien tidak melaporkan keluhan, pemeriksaan klinis dan radiografis menunjukkan hasil normal, serta gigi berfungsi

baik, menandakan keberhasilan terapi. Kesimpulannya, pulpitis ireversibel pada molar mandibula dengan saluran akar kompleks dapat ditangani efektif menggunakan terapi saluran akar konvensional, di mana ketepatan preparasi dan restorasi koronal lebih berperan terhadap keberhasilan jangka panjang dibandingkan teknik obturasi yang dipilih.

Kata kunci: *endodontik; pulpitis ireversibel; perawatan saluran akar*

INTRODUCTION

Irreversible pulpitis is a pathological condition of the pulp tissue characterized by severe inflammation and prolonged spontaneous pain, and cannot be cured without endodontic intervention. This condition is usually caused by bacterial invasion from deep caries that reaches the pulp, causing progressive tissue damage. If left untreated, this condition can progress to pulp necrosis and periapical abscess. [1]

Mandibular second molars (teeth 37 and 47) have complex root canal anatomy, with a common configuration of three canals: mesiobuccal, mesiolingual, and distal. This complexity can pose challenges in root canal treatment, particularly in terms of accessibility, identification of additional canals, and the ability to perform thorough preparation and irrigation. [4] Failure to address these anatomical variations can lead to endodontic failure. [2,3]

Root canal treatment aims to eliminate infected pulp tissue, clean and shape the root canal, and hermetically fill the root canal system to prevent reinfection. The long-term success of this procedure is greatly influenced by the accuracy of the diagnosis, aseptic control, preparation technique, irrigation effectiveness, and obturation method used.[9] The lateral condensation technique is a root canal filling technique that shows quite good results and shows hermetic results.[4]

In addition to adequate root canal treatment, the choice of final restorative material and method also plays a crucial role in the success of therapy. [6,7] Teeth that have experienced significant structural loss due to caries and access preparation should be restored with materials capable of withstanding occlusal loads and preventing fracture. [3] Composite-based indirect restorations can be an appropriate choice in such cases because they offer good strength, retention, and marginal adaptation. [5]

This case report discusses the endodontic treatment of tooth 37 in a male patient with irreversible pulpitis due to deep caries. The treatment consisted of several

stages, including diagnosis, preparation and obturation of multiple root canals, and final restoration. This report aims to illustrate the importance of a structured and comprehensive approach in managing endodontic cases in mandibular posterior teeth with complex root canals and to evaluate the success of the treatment at the Universitas Achmad Yani Cimahi Indonesia Dental Hospital.

CASE REPORT

A 35-year-old man presented to Unjani Dental Hospital (RSGM) complaining of a cavity and pain in the back of his lower left jaw tooth for the past two months. The pain was spontaneous and disrupted his daily activities, particularly during meals and at night. The patient had not previously received treatment and stated he wanted to retain the tooth. There was no history of systemic disease or drug allergies.

Objective examination showed that tooth 37 had extensive crown damage due to deep caries. Vitality test was positive, with spontaneous pain response and positive percussion response. Periapical radiography showed caries approaching the pulp and widening of the periodontal ligament in the apical area without any abnormalities in the periapical image indicating an abscess infection. Based on clinical and radiographic findings, a diagnosis of irreversible pulpitis was made in tooth 37 with deep caries etiology. The patient was planned to undergo multiple root canal treatments.

Figure 1. Clinical and Radiographic Images of Tooth 37 before Treatment.

The clinical procedure began with a rewalling restoration of the distal wall using composite resin to restore the lost wall contour and ensure adequate isolation during treatment. This was followed by a cavity access procedure to open the pulp chamber and explore the root canal orifices. Tooth 37 has three root canals: mesiolingual, mesiobuccal, and distal.

then determined using an apex locator and confirmed by radiography. The working

length of the distal root was 18 mm, mesiolingual 19.5 mm, and mesiobuccal 17.5 mm. Root canal preparation was performed manually using conventional techniques using K-files, starting with a #10 K-file as the initial file for canal exploration and ending with a #25 master apical file (MAF) for each canal. Irrigation was performed using 2.5% NaOCl during the procedure to eliminate necrotic tissue and debris, and saline as the final irrigation. The canals were dried with sterile paper points, and the teeth were temporarily sealed with temporary filling.

Figure 2 . Bimechanical Preparation.

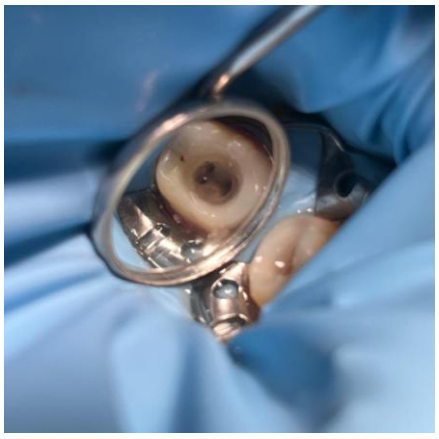

Figure 3. After Rewalling and Biomechanical Preparation.

After no complaints were reported at the follow-up visit, the obturation procedure was performed. A guttap-percha trial was performed beforehand to ensure appropriate length and cone adaptation. The master apical cone used was a #25 guttap-percha cone, adjusted to the previously achieved MAF. The obturation procedure was performed using a lateral condensation technique using a resin-based sealer to fill the space between the guttap and the root canal dentin, ensuring a hermetic seal.

Figure 3 . Guttap Percha Trial.

After obturation is complete, a post-obturation radiograph is performed to ensure adequate root canal filling to the apical end. A final restoration, an *indirect restoration* with composite resin, is then performed to restore masticatory function and prevent re-contamination of the root canal.

At the follow-up visit, subjective and objective examinations were performed. The patient did not complain of pain, and no signs of inflammation or periapical reaction were found. Percussion and palpation examinations were negative, and there were

no new pathological radiological signs. The tooth functioned well clinically and esthetically, indicating a successful treatment outcome. The patient is recommended to have regular check-ups every six months for long-term evaluation.

DISCUSSION

Irreversible pulpitis is a condition in which pulp inflammation reaches a stage that cannot be reversed even after elimination of the causative stimulus, such as bacteria or restorative trauma. In mandibular posterior teeth especially molars the risk of irreversible pulpitis is increased due to the complex fissure and fissure anatomy that facilitates deep caries invasion. Histological studies have shown a significant increase in proinflammatory mediators such as interleukin -1β and TNFα in the pulp of these teeth, which triggers a rapid inflammatory response, increased intrapulpal pressure, and pulp hypoxia and necrosis. [1] Furthermore, the curved root canals of mandibular molars contribute to difficult cleaning, allowing infection and inflammation to persist and progress to irreversible conditions. [2]

The primary goal of root canal treatment in multi-rooted teeth is to achieve ideal access to all canals, mechanically and chemically clean the canal system, and completely seal the canal space to prevent reinfection. [6] Manual biomechanical strategies such as step- -back and manual crowndown provide optimal working length control and reduce the risk of perforation in curved or obscured canals. The combination of NaOCl (2.5–5.25%) and 17% EDTA irrigation has been shown to effectively remove the smear layer and dead tissue, increase sealer penetration into the dentinal tubules, and reduce the residual bacterial population by >99%. [3-5]

Once the canal shape is optimized, obturation is performed by lateral condensation, using *a Master Apical Cone (MAC)* and resin sealer. This technique allows for uniform lateral pressure, ensuring that the gutta-percha is compressed against the canal walls and minimizing *voids.* Although this technique *induces voids compared to thermoplastic* methods, -modern in vitro meta-analyses have shown that the clinical success between lateral condensation and other modern techniques (such as *warm vertical condensation/wave, single-cone*) is minimal (<5%) and that errors in filling technique are not a primary indicator of long-term clinical outcomes . [6,8] This technique has advantages in molar canals with curved or complex morphologies, as it is easily accessible and manually adjusted. [6,8]

In this case, the treatment procedure was structured with four visits. The first visit included a complete diagnostic and periapical X-ray to confirm irreversible pulpitis. The second visit included rewalling of the cavity construction, open access, and canal preparation using K -files #10 to Master Apical File #25, with specific working lengths (distal 18 mm, mesiolingual 19.5 mm, mesiobuccal 17.5 mm). Progressive irrigation of NaOCl, and saline solution. The third visit included a trial cone gutta-percha size 25, obturation technique *lateral condensation* with *resin-based sealer* , and restoration of full filler *indirect composite* . The fourth visit showed positive results without subjective complaints and clinical-radiographic signs of failure, indicating the clinical success of this protocol and the appropriate conservative approach.

Several retrospective studies have shown that the success of PSA therapy in posterior teeth is more influenced by the pretreatment periapical condition, preparation accuracy, and coronal restoration, than by the specific obturation technique. Another study showed no significant difference ($p>0.05$) in success rates between lateral condensation and the warm vertical technique over a 4–6-year period, provided the sealer and preparation form were applied correctly. [10] These data support the choice of the multiple PSA protocol applied in this case, namely the conventional technique, which is reliable when performed correctly, complete with adequate observation and final restoration. [11]

CONCLUSION

Irreversible pulpitis is a pathological condition of the pulp tissue characterized by severe inflammation that cannot heal spontaneously, requiring intervention in the form of root canal treatment to maintain the tooth in the oral cavity. In lower posterior teeth such as tooth 37, the complex anatomy of multiple root canals requires a careful and systematic approach in every stage of treatment, from diagnosis and biomechanical preparation to obturation. This case report demonstrates that multiple root canal treatment with a conventional approach, manual biomechanical preparation technique, and lateral condensation obturation technique can be an effective option in managing irreversible pulpitis and preventing further complications. The satisfactory clinical outcome in this case emphasizes the importance of thorough evaluation and appropriate technique to ensure the long-term success of endodontic treatment, especially in molar teeth with complex root morphology. [5]

Composite resin is one of the most used materials in dental restorations (dental

fillings) due to its good aesthetic properties, sufficient mechanical strength, and ability to bond with tooth structure.[12] Composite resin consists of several main components and comes in various types, depending on its composition and use. The constituent materials of composite resin consist of three main components: the Resin Matrix (Resin Matrix), usually a resin monomer such as Bis-GMA (Bisphenol A-Glycidyl Methacrylate), UDMA (Urethane Dimethacrylate), TEGDMA (Triethylene Glycol Dimethacrylate), which serves to provide the basic form of the composite material, becoming the organic phase that binds the filler particles. There is also an inorganic filler made of silica (silicon dioxide) which functions to provide mechanical strength, reduce polymerization shrinkage, provide radiopacity (so it can be seen on x-rays).[13] The size and shape of the filler determine the type of composite resin. There is also a binding agent in the form of a silane (silane coupling agent) that functions to bind the inorganic filler to the organic resin matrix so that it is chemically united. In addition, composite resins also contain initiators and activators, such as camphorquinone, to initiate the polymerization (hardening) process, especially in light-cure composites. Based on the hardening method, composite resins are divided into three types: Self-cure (autopolymerized): hardens by mixing two components. Light-cure (photo-polymerized): hardens by exposure to blue light (470 nm). Dual-cure: a combination of self- and light-cure; used for areas where light is difficult to reach.[14,15]

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

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