


Single visit root canal treatment of a third lower molar with curved canal and Class II disto-occlusal caries: Case report

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ABSTRACT

Introduction: Root canal treatment (RCT) of mandibular third molars is often considered challenging due to anatomical variability, limited accessibility, and difficulty achieving proper isolation. As a result, extraction is frequently chosen. This case report outlines a successful single-visit RCT on a right mandibular third molar with a curved canal and Class II disto-occlusal caries. **Case Report:** A 30-year-old female presented with a large cavity on her right lower molar and requested a restorative treatment. Three weeks earlier, devitalization and temporary restoration had been performed by another dentist. Clinical examination revealed no periapical lesion, and percussion testing was negative. Radiographic analysis showed a slight curvature in the distal canal. A pre-curved K-File and the One Curve System were used for instrumentation. The canal was obturated in a single visit, followed by restoration using direct composite and short fiber-reinforced composite. Matrix and PTFE tape were utilized for proper adaptation in the distal area. **Conclusion:** With accurate diagnosis, understanding of anatomical complexity, and appropriate technique, single-visit RCT on mandibular third molars is achievable. This case supports the viability of conservative treatment for necrotic third molars with asymptomatic apical periodontitis, avoiding unnecessary extraction.

Keywords

single visit, root canal treatment, third lower molar, curved canal, composite restoration.

Perawatan saluran akar sekali kunjungan pada molar ketiga dengan saluran akar melengkung: Laporan kasus

ABSTRAK

Pendahuluan: Perawatan saluran akar (RCT) pada molar ketiga mandibula menantang karena variasi konfigurasi saluran, kesulitan akses ke area posterior, dan tantangan dalam isolasi. Akibatnya, pencabutan sering menjadi pilihan. Laporan kasus ini mendeskripsikan protokol RCT kunjungan tunggal pada molar ketiga kanan mandibula dengan saluran melengkung dan karies disto-oklusal kelas II. **Laporan Kasus:** Seorang wanita 30 tahun datang dengan kavitas besar pada molar ketiga kanan bawah dan menginginkan perawatan tanpa pencabutan. Tiga minggu sebelumnya, dokter lain telah melakukan devitalisasi dan restorasi sementara. Pemeriksaan klinis menunjukkan tidak ada lesi periapikal dan uji perkusi negatif. Radiograf menunjukkan kelengkungan ringan pada saluran distal. RCT dilakukan menggunakan K-file pra-lengkung dengan sistem One Curve. Obturasi dilakukan dalam satu kunjungan, diikuti restorasi komposit langsung yang diperkuat dengan komposit serat pendek. Area distal direstorasi menggunakan matriks dan pita PTFE. **Simpulan:** RCT kunjungan tunggal pada molar ketiga mandibula dengan pulpa nekrotik dan periodontitis apikal asimtomatik dapat berhasil dilakukan dengan diagnosis akurat dan teknik yang tepat. Pendekatan konservatif ini menunjukkan bahwa pencabutan bukan satu-satunya pilihan.

Kata kunci

sekali kunjungan, perawatan saluran akar, molar ketiga, saluran melengkung, restorasi komposit.

INTRODUCTION

Single Visit Endodontics (SVE) involves completing the entire root canal treatment process—preparation, irrigation, and obturation of the root canal system—in a single appointment.¹ The efficiency and convenience of SVE make it an appealing option for both patients and practitioners.² However, SVE is not suitable for all cases. It is contraindicated for teeth with anomalies such as calcified canals, and situations where limited accessibility or the patient's inability to keep their mouth open for extended periods pose a challenge.³

The advantages of Single Visit Endodontics are numerous, from increased comfort as the entire treatment is completed in one visit.^{4,5} This approach is also cost-effective, as it uses fewer materials and reduces the potential for microleakages and infections that can occur between visits. The success of SVE largely depends on several critical factors, including the anatomy of the tooth, the skill and experience of the operator, the quality of the endodontic equipment used, and the overall condition of the patient, which must support the feasibility of completing the procedure in a single visit.^{6,7}

When considering root canal treatment (RCT) for third molars, several specific factors come into play. The indications for RCT in third molars include cases where the damages are restorable, the working area is accessible, antagonist teeth are present, and the tooth will serve as an abutment. Understanding the number of root canals, their morphology, and the complexity of the roots is crucial for successful treatment. One common and significant challenge in endodontics is the presence of curved canals.⁸ If the biomechanical preparation is not executed correctly, complications such as ledges, root canal transportation, perforation, and blockage can arise, complicating the treatment process.^{9,10}

Direct composite restoration offers an effective option for restoring endodontically treated teeth, especially when the damage to the tooth structure is minimal, not exceeding one-third of the tooth, and involving only one proximal area.^{11–13} The benefits of direct composite restoration include minimal tooth preparation, bonding to the tooth structure, aesthetic appeal, and the ability to be repaired if needed.^{14,15}

Recent studies have highlighted that incorporating fiber into composite resin significantly enhances its mechanical strength, thereby reducing the risk of fractures and increasing the longevity of the restoration.^{14,15} This case provides a detailed example of addressing the anatomical and technical challenges associated with a third molar featuring extreme canal curvature, employing advanced endodontic techniques and innovative restorative materials. It offers insights that may enhance the understanding and management of similar complex cases in clinical practice. This case report outlines a successful single-visit RCT on a right mandibular third molar with a curved canal and Class II disto-occlusal caries.

CASE REPORT

A 30 years-old female came to Dental Hospital Gajah Mada University complaining about her molar cavity. The tooth had been treated by the previous dentist 3 weeks ago. The pain emerged on the first day until the fourth day after the temporary filling. Recently, the tooth was painless. The patient wanted to save her tooth and wished to continue her RCT in one visit.

Objective examination revealed the caries reaching the pulp on the mandibular right third molar. The caries extend from mesial to distal proximal area. Vitality test was negative, percussion & palpation test was negative and mobility test was in normal range. Radiograph examination revealed radiolucency on pulp chamber also widening of periodontal ligament and radiolucency around apex of mesial root with diffuse border. Distal root curved on apical third area (Figure 1 A and B).

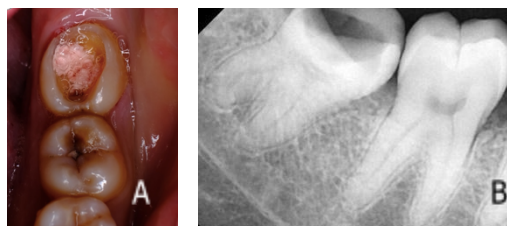


Figure 1. A. Initial condition showed temporary restoration and loss of distal wall; B. Initial radiograph showed slight curves on distal canal.

Diagnosis of lower right third molar mandible was necrosis of pulp, asymptomatic apical periodontitis. The differential diagnosis was pulpal necrosis with periapical granuloma. Prognosis was good, as rubber dam applicable, the remaining hard tissue restorable, and patient motivation to restore her tooth. Treatment planning was root canal treatment and direct composite restoration.

Patient screening followed covid-19 protocol by filling a screening form. Pandemic protocol was done in safety level 3 and preparation sterilization of the tools. Treatment was done in a negative chamber. Subjective and objective examination were done, including diagnosis, treatment planning and documentation. The patient was informed about diagnosis, treatment planning, procedures, cost, time of treatment and prognosis that could happen. Patient approved the treatment planning and signed the informed consent.

The patient rinsed her mouth with 1% povidone iodine (Betadine, Pyridam Farma Tbk, Indonesia). Intra-ligament anaesthesia, 2% lidocaine (Xylocaine, Phapros Tbk, Indonesia) was performed by citoject (Citoject, DC Dental, USA). A rubber dam (K-DAM, Klik Dental, Indonesia) was placed to isolate the working area on tooth no 48. Caries removal was performed by round diamond bur (Heico, Germany) and excavator endodontic (EXC31L, Osung, South Korea). Access opening was done by endo access bur (Dentsply-Maillefer, USA).

Pulp chamber opening by diamond bur (Dentsply-Maillefer, USA) after removal of old resin composite restoration. Orifice showed three root canals, mesio-buccal, mesio-lingual and distal. The canals were irrigated by 2,5% sodium hypochlorite (Hyposol, Prevest DenPro, Indonesia) and dried by sterilized paper point (Dentplus, Cobra Dental, Indonesia).



Figure 2. Pre-curved K-File for negotiating root canal.

The preparation of the curved canal began with initial coronal flaring using a One Flare rotary file (MicroMega) to create straight-line access to the apical third, ensuring reduced stress on the subsequent files. Following this, the canal was negotiated using a pre-curved K-File #10 (Dentsply-Maillefer). After gaining a straight access, then working length measurement was done by C-Plus file (M3-C plus, UDG dental, China) #10 and K-file #15 with confirmation of electronic apex locator (Tri Auto ZX2, Morita, Japan).¹⁶ The pre-curving of the file was done manually, allowing the operator to navigate the curvature effectively while identifying the canal's direction and minimizing the risk of ledge formation (Figure 2).

To facilitate smooth negotiation and reduce friction, the files were lubricated using 17% EDTA gel (i-Dental), and the canal was irrigated with 2.5% sodium hypochlorite (Niclor, PT. Super Tonic, Indonesia) after each file insertion. The irrigation helped dissolve organic debris and ensured a clear working field. After establishing the glide path, the canal preparation continued using the One Curve rotary system (MicroMega, France). This system, constructed from heat-treated nickel-titanium, provided excellent flexibility and allowed the operator to shape the curved canal effectively while minimizing procedural errors such as transportation.

The crown-down technique was employed during shaping, starting with larger-diameter files to prepare the coronal portion of the canal and progressively moving apically with smaller files. Each file was used with controlled apical pressure and short strokes to respect the canal's curvature and prevent instrument fracture. Regular recapitulation with the pre-curved K-File #10 ensured the glide path remained clear and free of blockages throughout the preparation.

Refinement of the apical third was carried out using a K-File #25, which was introduced with care to avoid disrupting the natural curvature. The canal was irrigated extensively with 2.5% sodium hypochlorite, activated by an ultrasonic device (Ultra-X, Eighteeth) for 60 seconds, followed by 17% EDTA for smear layer removal and 2% chlorhexidine gluconate (Gluco-Chex, Cerkamed, Poland) for antimicrobial action. Between irrigant applications, saline was used to flush the canal and prevent interactions between irrigants. The preparation of the curved canal was concluded by drying it thoroughly using sterilized paper points (Cobra Dental, Indonesia).

Gutta percha was sterilized by soaking in 2,5% sodium hypochlorite for 60 seconds, rinsed by 70% alcohol and dried. Apical cone fitting using #25/04 as the size of last file used. Gutta perchas were marked according to respective working length. (Figure 3).

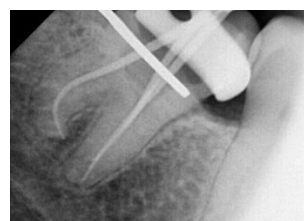


Figure 3. Gutta percha trial.

Obturation was done by single cone technique with resin-based sealer AH Plus (Dentsply-Maillefer, USA). Gutta percha was cut by Heat Carrier Plugger (Fast Pack, Eighteeth, China) on 90°C until orifices. Excess of sealer was cleaned by 70% alcohol and cavity disinfected by 2% Chlorhexidine as cavity cleanser.

Cavity was etched by 37% phosphoric acid (DenFil Etchant-37 syringe, Vericom, South Korea) for 15 seconds on the enamel and 10 seconds on the dentine. Cavity was then rinsed by air syringe and cotton pellet was placed in cavity surface to gain moist condition. Universal adhesive (Prime & Bond Universal, Dentsply-Maillefer, USA) was applied on tooth surface by micro-brush. Bottom of the cavity and all cavity were applied by bonding agent, leave them for 10 seconds and dried slightly by blowing the air syringe for 2 seconds, then light cured for 15 seconds.

Bulkfill composite (SDR, Dentsply-Maillefer, USA) was chosen as intraorifice barrier and light cured for 15 seconds. Short Fiber Reinforced Composite (Ever-X Posterior, GC, Japan) was applied to replace dentin structure in layering technique and light cured for 15 seconds (Figure 4).



Figure 4. GC EverX application.

The artificial wall was built on distal area by modification of Saddle Metal Matrices (TOR VM, Russia), Sectional Matrices (TOR VM, Russia), and Teflon Tape (PTFE Tape, Indonesia) to achieve good marginal adaptation. Building was done by resin composite (Palfique LX5, Tokuyama, Japan) shade OA2 (figure 5).



Figure 5. A. Teflon tape, B. Saddle Metal Matrix, C. Combination of double matrix with PTFE/teflon tape, D. Sectional matrices.

Dentin shade was placed until remaining 0,5 mm for enamel shade resin composite. Resin composite was placed on the occlusal incrementally cusp by cusp, then light-cured for 15 seconds (VRN VAFU curing light, VRN, China).

Finishing was done with a *superfine finishing bur* and polishing disc (Sof-Lex discs, 3M, USA) from coarse disc to fine disc to remove overfilling restoration. Interproximal check was done by dental floss. Polishing was done by *Twist Polisher* (Eve Diacom, Germany) and *Goat Brush Wheel* (Micerium, Italy). Occlusion check by articulating paper and radiograph examination to evaluate quality of the restoration (Figure 6 A and B).

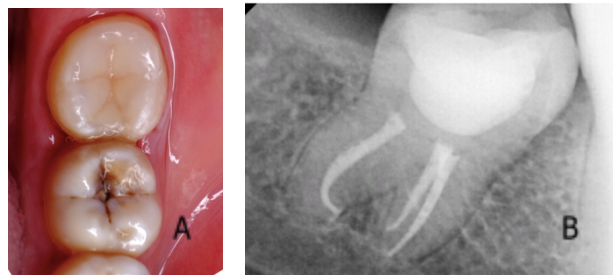


Figure 6. A. Final condition showed direct composite as final restoration; B. Final radiograph showed obturation of all root canals.

Dental Health Education was delivered to make the treatment success in long term, such as maintaining oral hygiene by brushing her teeth two times a day (after meal and before night sleep), flossing daily and mouth rinsing, Food diet such as more fruit and vegetable intake, limiting sugar foods and drinks, and avoiding hard consistency food, Routine dental check-up at least once per six months.

DISCUSSION

Curvature classification according to American Association of Endodontists (AAE) are classified into straight lines ($<10^\circ$), moderate curvature (10° - 30°), and extreme curvature ($>30^\circ$) or S-shaped curve.¹⁷ Determination of root canal curvature can be done by periapical radiograph, CBCT and Micro CT. Schneider method is widely used in endodontics due to practical use. Root canal curvature determination can be done digitally by measuring angle of intersection of two straight lines drawn from root canal orifice and periapical foramen.¹⁸ In this case, curvature angle was measured by imaginary line in Keynote application and Google Chrome screen protractor (Figure 7). The curvature angle was 60° (extreme curvature).

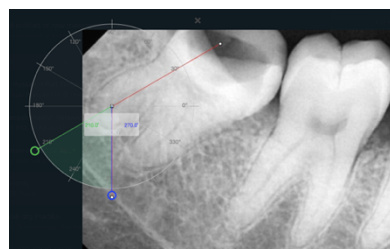


Figure 7. Schneider method to measure curvature digitally (green curvature).

Root canal treatment of curved roots presents an endodontic challenge. Coronal flaring to gain straight line access to apical foramen, preparation using smaller diameter K-file and pre-curved K-file, EDTA as chelating agent are strategies to enhance success rate of curved canals RCT.¹⁹ One Curve rotary system used in this case is a heat-treated nickel-titanium (NiTi) file designed for shaping curved canals. Its metallurgy, specifically the controlled memory (CM) wire technology, provides excellent flexibility and cyclic fatigue resistance.²⁰ One curve file used to shorten time of preparation significantly in in vitro study in teeth with curved canals.

Another study showed that a CM wire system has cyclic fatigue resistance compared to M-Wire in S-Shaped canals. One curve showed better cyclic

resistance than wave one gold and DiaX.^{21,22} Pre-curved K-file no.10 used to negotiate root canal with extreme curvature and determine direction of the curvatures. The pre-curved K-File, another critical tool used in this case, facilitated initial canal negotiation and glide path establishment. This file's stainless-steel construction, while less flexible than NiTi, allows manual pre-curving, enabling operators to navigate sharp curvatures effectively.²³ Sodium hypochlorite and EDTA used to lubricate scouting file and prevent debris accumulation to apical area.^{24 21,22}

The endomotor used in this case was the Tri Auto ZX2, a sophisticated system with integrated apex location capabilities. This device allowed precise working length determination, reducing the risk of over-preparation or under-preparation of the canal. The motor's torque and speed control features were particularly beneficial when using the One Curve file, as they minimized stress on the instrument and canal walls, enhancing safety and efficiency.²⁵

Composite resin was chosen to be the final restoration for its ability to preserve healthy tooth structure, provide a strong bond to enamel and dentin, and offer aesthetic and biocompatible advantages over amalgam or metal restorations. Short fiber-reinforced composite enhanced fracture resistance, making it suitable for large cavities in endodontically treated teeth. This approach ensured a durable, functional, and natural-looking restoration aligned with biomimetic principles.²⁶

Several crucial protocols of resin composite restoration, particularly class II restoration, such as rubber dam isolation, pre-wedging, space evaluation, interproximal clearance, matrix selection including placement and stabilization of the matrix. Matrix placement of distal area post rubber dam isolation is usually hard things to do, but sometimes can be done with loosening clamp and placing matrix in space between clamp and tooth.

Matrix adaptation and tight margin are mandatory before resin composite application.²⁷ Teflon tape can be used for matrix adaptation and stabilization to gain perfect anatomical contour.²⁸ Short fiber reinforced composite increased fracture resistance value on endodontically treated teeth.¹⁴

In a clinical study, short fiber reinforced composite showed no significant differences compared to G-aenial posterior. Both restorations showed acceptable clinical performance in 3-year follow-up. The presence of fiber in composite allows crack propagation toward the periphery.^{26,29} This case underscores the importance of utilizing advanced tools and techniques tailored to the anatomical complexities of curved canals.

The integration of heat-treated NiTi files, a precise endodontic motor, and innovative restorative materials demonstrates the potential for successful outcomes in challenging cases. The limitation of this report lies in the short follow-up period, which was influenced by pandemic-related constraints, thereby restricting the ability to assess long-term clinical outcomes and restoration durability. Further studies with longer observation periods and larger sample sizes are recommended to comprehensively evaluate the longevity and reliability of this treatment approach.

CONCLUSION

Treating a mandibular right third molar with a curved canal and disto-occlusal caries through single-visit endodontic therapy and direct restoration can be highly effective. Success hinges on several critical factors: preflaring, precise canal negotiation, choosing a flexible NiTi rotary file system, and strategic material selection for the resin composite restoration. These

elements collectively contribute to a favorable clinical outcome. The implication of this case is that, with the appropriate technique and material selection, conservative management of complex third molars is a viable alternative to extraction, even in anatomically challenging situations.

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Owing to ethical and privacy constraints, the information is not publicly accessible.

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