Case Report

Management of ledge and overprepared access cavity in mandibular second molar

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ABSTRACT

Background: *Endodontic success depends on precise execution. Iatrogenic complications such as ledge formation and excessive access cavity preparation can obstruct canal negotiation, impair disinfection, weaken tooth structure, and increase treatment failure.* ***Purpose:*** *This case report describes the management of a ledge and an overprepared access cavity in a mandibular second molar.* ***Case:*** *A 33-year-old female was referred with tooth 37 restored using a subgingival temporary filling. Radiographs revealed mesial radiolucency, an excessively extended access cavity, and a ledge in the mesial root canal.* ***Case Management:*** *Treatment was performed under rubber dam isolation. Temporary restoration and caries were removed, followed by artificial wall construction with resin composite. Pre-curved K-files (#10, #15) were used to bypass the ledge and establish a glide path and determine the working length. Rotary glide path instruments and heat-treated NiTi files were used to shape up to size #25/.04, with irrigation using 5.25% NaOCl and 17% EDTA. After intracanal calcium hydroxide medication, obturation was completed using bioceramic sealer, warm vertical compaction in the mesial root, and a single-cone technique in the distal root. A flowable bulk-fill composite was placed as the intracanal barrier, and final restoration was completed with packable composite.* ***Conclusion:*** *Ledges obstruct instrumentation and disinfection, requiring flexible pre-curved files and careful negotiation to re-establish canal patency. Excessive access cavity preparation compromises peri-cervical dentin, increasing susceptibility to structural failure. Bulk-fill flowable composite offers good marginal adaptation and may improve restoration durability. Thorough planning, controlled instrumentation, and appropriate restorative materials are essential to manage such complications effectively.*

Keywords: *ledge, access cavity design, excessive preparation, procedure errors, root canal retreatment*

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INTRODUCTION

Effective endodontic treatment is paramount for ensuring the long-term health and functionality of teeth.[1] The process requires meticulous access cavity preparation, careful canal negotiation, biomechanical debridement, obturation, and restoration to achieve optimal outcomes.[2] However, practitioners often encounter significant challenges, challenges, leading to ledge formation and overpreparation of access cavities. These complications can impede the cleaning, shaping, and obturation of the root canal system and reduce the remaining tooth structure, ultimately affecting the prognosis of the tooth.[3,4]

Ledge is a common occurrence and is formed when an instrument strays from the original path of the canal, causing an artificial irregularity within the canal.[4–6] This irregularity hinders the access of instruments and irrigants to the apex, leading to inadequate cleaning, shaping, and obturation of the root canal, apical to the ledge.[7,8] This deviation is often caused by insufficient understanding by the operator regarding the internal and external anatomy of the tooth, poor access cavity that may lead to improper guiding of the instruments by the walls of the cavity, inadequate canal scouting, inaccurate working length determination, improper instrumentation techniques, inappropriate instrument selection, or excessive force.[7,9] Canals with a ledge can be formed either within the original path of the canal or by establishing a new artificial canal. The presence of a ledge makes it challenging to negotiate the canal properly, hindering the complete removal of pulp tissue, debris, and microorganisms and complicating the subsequent filling of the canal, and may lead to persistent endodontic pathosis and endodontic treatment failure.[7,10]

Excessive access cavity preparation, on the other hand, is a critical issue in endodontic treatment, posing significant risks to the structural integrity of the tooth.[11] The peri-cervical dentin (PCD), which is the dentin surrounding the cervical area of the tooth, plays a crucial role in maintaining tooth strength and resistance to fracture.[12] Excessive removal of PCD dentin during access cavity preparation can

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compromise the tooth's ability to withstand functional stress, making the tooth more susceptible to cracks and fractures.[13] Preservation of PCD is essential to ensure the long-term prognosis of the tooth.[13,14] In addition, maintaining 3D soffit helps minimize the potential damage caused by excessive removal of PCD. Clark and Khademi define a 3D soffit as a small portion of the roof chamber surrounding the pulp chamber, resulting in a banked tooth structure.[14] Efforts to eliminate the soffit could damage the surrounding PCD.[15] The major purpose of maintaining the soffit is to prevent the lateral walls from being gouged.[14,15] Preserving this banking tooth structure enhances the tooth's long-term prognosis and fracture resistance.[14] Moreover, the concept of a 3D ferrule, which involves creating a circumferential collar of dentin extending above the gingival margin, is essential for distributing functional stresses and improving the fracture resistance of endodontically treated teeth.[16]

Significant complications and failures can arise if teeth with iatrogenic errors like ledges and overprepared access cavities are not properly managed. A ledge can hinder the complete cleaning and shaping of the root canal, leading to persistent infection, treatment failure, and potentially the development of periapical pathology.[7,10] Several alternative techniques are available for managing ledge formation, including bypassing the obstruction with pre-curved stainless-steel or flexible NiTi files, the use of chelating agents to soften dentin during negotiation, ultrasonic refinement of canal entry, or creating a controlled artificial pathway when the original canal cannot be regained.[7–9] In cases where canal negotiation is unsuccessful, surgical endodontic treatment may also be considered.[3,17] Tooth with overprepared access cavity weakens the tooth structure, making it more susceptible to fractures under functional stress.[11] This can result in tooth loss or the need for complex restorative procedures. Additionally, these errors can lead to patient discomfort, prolonged treatment times, and increased costs. Management options for a tooth with overprepared access cavity includes reinforcement using fiber posts, bulk-fill of short-fiber reinforced composites, cuspal coverage restorations, or full-crown restorations to improve structural resistance.[18–24] Proper management, including the use of advanced techniques and materials, is essential to mitigate these risks and ensure long-term success of the endodontic treatment.[17] In situations where the remaining tooth structure is inadequate, extraction followed by prosthetic rehabilitation may be indicated.[25–28]

CASE

A 33-year-old female patient was referred by her previous dentist to continue her dental treatment. The patient is currently asymptomatic, although she previously experienced difficulty eating and throbbing pain. An intraoral examination revealed tooth 37 with a temporary filling extending subgingivally. Tooth 37 exhibited mesial tipping due to the absence of tooth 36, while tooth 27 remained intact. Radiographic examination revealed a temporary filling on the occlusal surface of tooth 37, a radiolucent area on its mesial aspect, excessive access cavity access preparation from the pulp chamber extending distally, and ledge formation in the mesial root canal. The diagnosis was previously initiated therapy with normal apical tissue [Figure 1]. The patient provided written informed consent for the treatment and for the use of clinical information and images for publication.

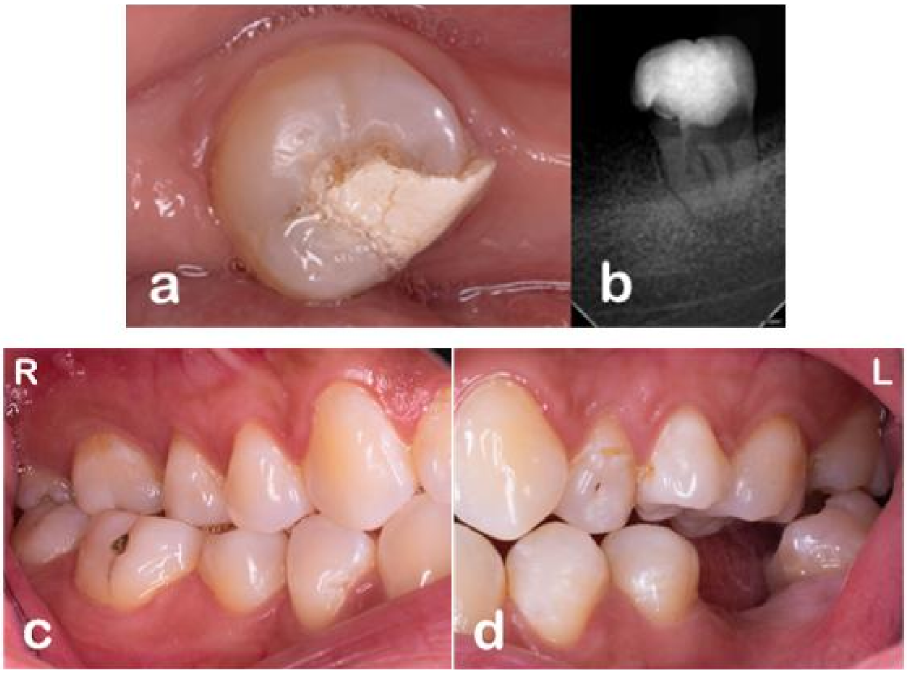

Figure 1. Pre-operative evaluation: (a) Clinical condition of tooth 37; (b) Pre-operative periapical radiograph; (c) Right side occlusion; (d) Left side occlusion demonstrating the absence of tooth 36 and mesial tipping of tooth 37.

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CASE MANAGEMENT

Root canal treatment was performed under rubber dam isolation. Temporary restoration and carious tissue were removed using an ultrasonic scaler (Satelec) and a carbide round bur #2 (SS White). An artificial wall was constructed using the doughnut and snowplow techniques with a packable resin composite [Figure 2]. Biomechanical preparation was initiated using pre-curved stainless-steel K-files #10 and #15 to explore, negotiate, and establish a glide path past the ledge. A rubber stopper indicator on each file was used to determine the orientation of root canal curvature in both roots. After the endodontic files had navigated past the ledge, the working length was established with an electronic apex locator and verified using a periapical radiograph. To preserve the canal shape and minimize the risk of iatrogenic error, all rotary files were pre-curved before use. Glide path preparation (C-Path Rotary Files, Fanta) was performed using #13/.02, #16/.02, and #19/.02 with a pecking motion to the working length. Heat-treated files (AF Rotary Files, Fanta) were used for biomechanical preparation up to size #25/.04. Each consecutive file was accompanied by irrigation with 5.25% sodium hypochlorite (NaOCl) and apical patency was maintained with a K-file #10. Biomechanical preparation continued until one-third of the file flutes filled with white dentin. Apical gauging was performed with a K-file #25, followed by the application of calcium hydroxide as an intracanal medicament and temporary restoration [Figure 3].

The patient returned after seven days for the second visit of root canal treatment. She reported no complaints, and the examination did not reveal any abnormalities. The procedure involved using rubber dam isolation, followed by the removal of the temporary restoration and intracanal

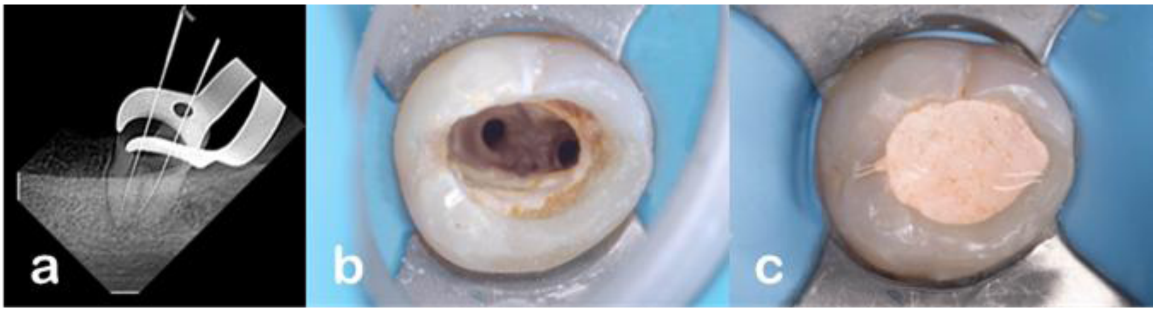

Figure 2. First visit of root canal treatment: (a) Removal of temporary restoration and carious tissue; (b) Placement of teflon tape and posterior sectional matrix; (c) Artificial wall build-up with doughnut and snowplow technique.

Figure 3. First visit root canal treatment: (a) Working length determination; (b) Biomechanical preparation; (c) Placement of intracanal medicament and temporary restoration.

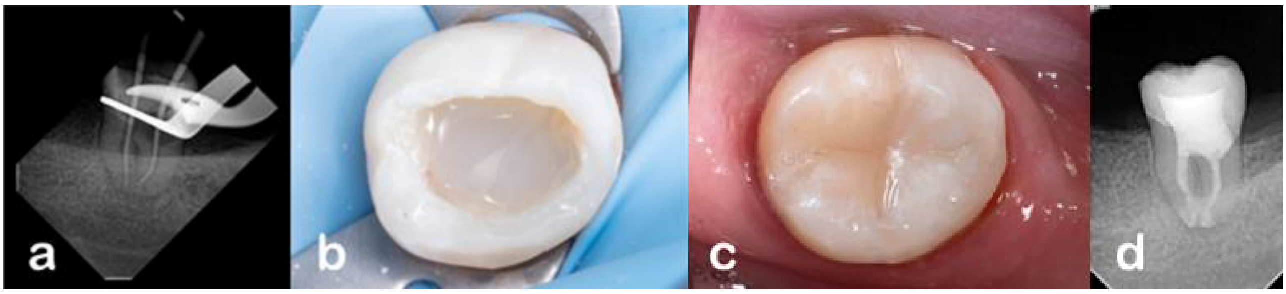

Figure 4. Second visit of root canal treatment: (a) Master gutta-percha cones verification and obturation; (b) Intracanal barrier with flowable bulk-fill resin composite; (c) Restoration with packable composite; (d) Post-operative radiograph.

medicament calcium hydroxide. This was achieved by irrigating with 5.25% sodium hypochlorite until the root canal was thoroughly cleaned. Master gutta-percha cones #25 were then carried to the working length and verified using a periapical radiograph. Final irrigation was performed using 5.25% NaOCl and 17% EDTA (ethylenediamine tetra-acetic acid), activated with an endoactivator (Eddy, VDW). Each successive irrigation solution was followed by rinsing with distilled water. The root canal was then dried until slight moisture remained, as indicated by the remaining 3-4 mm of moisture on the paper point. Obturation was completed with bioceramic sealer, warm vertical compaction in the mesial root, and a single-cone obturation technique in the distal root. A flowable bulk-fill resin composite (SDR flow+, Dentsply) was chosen for the intracanal barrier, and the final restoration was completed using packable resin composite (Micerium UD3 and Palfique LX5 A2) [Figure 4].

DISCUSSION

Iatrogenic errors are unintended complications that occur due to the actions of the dental practitioner, which can significantly impact the prognosis of root canal treatment. Two common iatrogenic errors include the formation of a ledge and the overprepared access cavity.

Ledges can occur during endodontic procedures when an instrument deviates from the original canal path, creating an artificial shelf-like structure within the root canal. In mandibular molars, ledges are often encountered in the mesial canals due to their complex anatomy. According to a study, ledges were mainly associated with the use of hand file instruments, particularly in posterior teeth with curved root canals.[29] Ledge formation can also arise due to the utilization of rigid instruments with sharp, inflexible cutting edges during root canal treatment.[7] Ledge formation usually occurs in the direction opposite to the curvature of the root canal and is affected by the degree of the curvature.[30] Canals with a curve of less than 10 degrees were infrequently ledged, while canals with a curvature exceeding 20 degrees were ledged over 56% of the time.[7] Based on studies, ledges typically develop on molars rather than anterior teeth, primarily on the mesiobuccal root.[7] The average curvature of the mesiobuccal root is 24.34 degrees in the buccal-lingual projection and 16.60 degrees in the mesio-distal projection. This phenomenon is due to the significant anatomical variability of the lower mesial root, including isthmuses and curvature. These characteristics are typically not visible on periapical radiographs. Consequently, the mesial root canal of lower molars is predominantly impacted by canal irregularities during the scouting, gliding, and shaping procedures.[30] If a ledge does occur, the first step is to acknowledge the existence of a ledge; there will be a loss of tactile sensation as the the instrument's tip binds against the canal wall, creating the sensation of hitting a solid obstruction. The second step is to use pre-curved small K-files or flexible nickel-titanium (NiTi) files have been recommended for navigating and bypass the ledge, as their flexibility allows them to follow the original canal path and does not straighten like stainless steel files.[8,9] Additionally, techniques such as the creation of a glide path with smaller instruments and the use of chelating agents can facilitate negotiation of ledged canals. However, it is important to exercise caution while using chelating agents, such as ethylenediamine tetra-acetic acid (EDTA), as their excessive use (applied more than one minute) might lead to dentin softening and erosion, increasing the incidence of tooth crack and fracture.[9,31]

Overprepared access cavities involve excessive removal of tooth structure, compromising the tooth's integrity and potentially leading to fractures or weakening the remaining tooth structure. While gaining visibility and straight-line access is crucial, excessive enlargement weakens the tooth and may lead to complications. Preservation of peri-cervical dentin (PCD), 3D soffit, and 3D ferrule has been recommended in endodontics due to its ability to enhance the structural integrity of the tooth.[12,15] Excessive removal of PCD during access cavity preparation can compromise the tooth's ability to withstand functional stress, making the tooth more susceptible to cracks and fractures. This is particularly concerning for posterior teeth, such as molars, which are subjected to higher vertical masticatory forces.[12,13] In order to prevent structural flexure and subsequential collapse, the access and coronal aspect of root canal must be protected from gouging. Dentin conservation and protection above and below the pulp chamber are achieved by implementation of a highly effective technique and materials for reinforcing an endodontically treated tooth.[12] Employing a flowable bulk-fill resin composite base to restore the cavity, such as Smart Dentin Replacement (SDR), can enhance the tooth's structural integrity, with self-levelling characteristics, minimal cuspal deflection, and excellent marginal adaptation.[18–20,32,33] Based on a study, the implementation of SDR demonstrated a higher pushout bond strength in flared canals compared to the group that utilized a fiber post with composite flowable and biological post for intraradicular restoration. This could be related to a reduced number of interphases, as it utilizes as a single material, forming a "monoblock" restoration that possess mechanical properties similar to natural tooth structure. Another reasons is because SDR employing SDR (Stress Decreasing Resin) technology, which is specifically designed to slow the polymerization rate, and effectively reduce polymerization shrinkage by 60-70%.[33] A study demonstrated that the utilization of Stress Decreasing Resin in SDR as an intermediate layer can enhance the fracture resistance of class II restoration.[34] Another study showed that SDR exhibited fracture toughness comparable to sound teeth, which may serve as a viable alternative for full-crown coverage restoration in endodontically treated molars.[21] Another approach, although not yet implemented in this case, is to use restorations that provide cuspal coverage and superior mechanical properties to enhance fracture resistance, thereby further strengthening the restoration and improving the overall prognosis of the affected tooth while providing adequate support for occlusal forces.[22–24]

The relationship of tooth 37 with its antagonist and adjacent teeth must also be clarified within this context. As tooth 37 remains present while teeth 36 and 38 are absent, it plays a pivotal role in occlusion with opposing dentition. Although the load on tooth 37 may be significantly increased due to the loss of support from adjacent teeth, the presence of its antagonist still provides stability and better masticatory function.[25–27] In this regard, restoring tooth 37 with a tooth-supported partial denture is more advantageous option compared to tissue-supported partial denture. This is due to several factors: first, tooth-supported restorations can help distribute occlusal forces more evenly across all dental structures and supporting tissues.[26] Second, using tooth-supported dentures tends to preserve alveolar bone integrity better than tissue-supported because occlusal forces transmitted to alveolar bone through periodontal ligament stimulate bone formation, thus preserving alveolar bone structure.[28,35,36] Third, dentists are obligated to avoid tooth loss wherever feasible and must implement every necessary precaution to prevent patients from becoming edentulous, since preventive prosthodontics emphasizes the significance of procedures that can postpone or resolve future complications associated with prostheses.[28] Considering all these factors in treatment planning is crucial for ensuring optimal functional stability and longevity of endodontically treated teeth.

This case presented several challenges, including difficulty bypassing the ledge due to the curvature of the mesial canal and limited remaining PCD due to excessive prior access cavity preparation. These anatomical constraints increased the risk of further transportation or perforation during instrumentation. A limitation of the treatment was the inability to fully assess the canal morphology using CBCT, which may have provided better visualization of the ledge position. Long-term restorative protection with cuspal coverage was also recommended, but has not yet been completed, which may affect the long-term prognosis. The management of procedural errors in this case, such as ledge formation and overprepared access cavities, requires a combination of accurate technique, appropriate use of instruments, and restorative strategies to ensure successful outcomes. This case highlights the importance of thorough preoperative assessment, gentle and precise instrumentation, and the use of modern restorative materials to overcome challenges in endodontic therapy. This case report entails a successful management of ledge and overprepared access cavity in mandibular molar.

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REFERENCES

1. Makanjuola JO, Oderinu OH, Umesi DC. Treatment outcome and root canal preparation techniques: 5-year follow-up. Int Dent J 2022; 72: 811–818.
2. El-Kishawi M, Khalaf K. An update on root canal preparation techniques and how to avoid procedural errors in endodontics. Open Dent J 2021; 318–324.
3. Estrela C, Pécora JD, Estrela CRA, Guedes OA, Silva BSF, Soares CJ, Sousa-Neto MD. Common operative procedural errors and clinical factors associated with root canal treatment. Braz Dent J 2017; 28: 179–190.
4. Mehta SD, Malhan S, Bansal C. Iatrogenic complications arising from cleaning and shaping : A review. International journal of health sciences 2021; 5: 56–62.
5. Hajihassani N, Bakhshi M, Shahabi S. Frequency of iatrogenic errors through root canal treatment procedure in 1335 charts of dental patients. JIOH 2015; 7: 14–7.
6. Mihaela S, Oana Ţ, Tudor H, Cristi G, Corina C, Cristina A, Claudia T, Anca M. Management of endodontic iatrogenia: a review. Romanian Journal of Oral Rehabilitation 2023; 15: 331–340.
7. van der Vyver PJ, Vorster M, Paleker F, de Wet FA. Errors in root canal preparation: a review of the literature and clinical case reports. South African Dental Journal 2019; 74: 246–254.
8. Mohamed Khazin S, Mustaffa M. Management of radix entomolaris on permanent mandibular first molar complicated with ledge: a case report. IJOHS 2022; 3: 147–152.
9. Tamilselvi R, Kumari VA, Porkodi I. Factors influencing ledge formation and its management in endodontics. IJFMT 2020; 14: 1193–1197.
10. Josic U, Mazzitelli C, Maravic T, Fidler A, Breschi L, Mazzoni A. Biofilm in endodontics: in vitro cultivation possibilities, sonic-, ultrasonic- and laser-assisted removal techniques and evaluation of the cleaning efficacy. Polymers 2022; 14: 1334.
11. Chan MYC, Cheung V, Lee AHC, Zhang C. A literature review of minimally invasive endodontic access cavities - past, present and future. Eur Endod J 2022; 7: 1–10.
12. Marvaniya J, Agarwal K, Mehta DN, Parmar N, Shyamal R, Patel J. Minimal invasive endodontics: A comprehensive narrative review. Cureus 2022; 14: 1–8.
13. Arora V, Yadav MP, Singh SP. Peri-cervical dentin (PCD) : a new paradigm for endodontic success. GJRA 2016; 4: 490–493.
14. Kuriakose A, Joy B, Mathew J, Hari K, Joy J, Kuriakose F. Modern concepts in endodontic access preparation: a review. International Journal of Science and Research 2020; 9: 1457–60.
15. Jose T, Shashikala K, Prasad BSK. Endolight concept: a minimally invasive endodontic future. IOSR-JDMS 2020; 19: 6–17.
16. Assiri AYK, Saafi J, Moaleem MMA, Mehta V. Ferrule effect and its importance in restorative dentistry: A literature review. J Popl Ther Clin Pharmacol 2022; 29: 69–82.
17. Tabassum S, Khan FR. Failure of endodontic treatment: The usual suspects. European Journal of Dentistry 2016; 10: 144.
18. Attik N, Colon P, Gauthier R, Chevalier C, Grosgogeat B, Abouelleil H. Comparison of physical and biological properties of a flowable fiber reinforced and bulk filling composites. Dental Materials 2022; 38: e19–e30.

19. Selvaraj H, Krithikadatta J. Fracture resistance of endodontically treated teeth restored with short fiber reinforced composite and a low viscosity bulk fill composite in class II mesial-occlusal-distal access cavities: an ex-vivo study. Cureus 2023; 15: 1–8.
20. Atalay C, Yazici A, Horuztepe A, Nagas E, Ertan A, Ozgunaltay G. Fracture resistance of endodontically treated teeth restored with bulk fill, bulk fill flowable, fiber-reinforced, and conventional resin composite. Operative Dentistry 2016; 41: 1–10.
21. Magaravalli SR, Patel SJ, Rangaswamy P, Ramachandra S, Govindappa K, Hiremath V. Effect of smart dentin replacement, biodentine, and Its combination for dentin replacement as alternatives to full-crown coverage for endodontically treated molars: an in vitro study. Journal of International Society of Preventive and Community Dentistry 2019; 9: 559–565.
22. Bhuva B, Giovarruscio M, Rahim N, Bitter K, Mannocci F. The restoration of root filled teeth: a review of the clinical literature. International Endodontic Journal 2021; 54: 509–535.
23. Hafez ME, Abd El-ghany AA, Taha AI, Amin A. In vitro assessment of fracture resistance of endodontically treated teeth restored with short fiber reinforced resin based composite and ceramic overlays. BMC Oral Health 2025; 25: 211.
24. Abbas AH, Abdulameer ZM. Effect of different restoration designs on fracture strength of endodontically treated teeth weakened with MOD cavities. J Res Med Dent Sci 2023; 9: 190–196.
25. Oncescu Moraru AM, Preoteasa CT, Preoteasa E. Masticatory function parameters in patients with removable dental prosthesis. J Med Life 2019; 12: 43–48.
26. Cicvaric O, Grzic R, Simunovic Erpusina M, Simonic-Kocijan S, Bakarcic D, Ivancic Jokic N. Association of masticatory efficiency and reduced number of antagonistic contacts due to extraction, changing dentition or malocclusion in children. Dent J (Basel) 2023; 11: 1–11.
27. Cárcamo-España V, Cuesta Reyes N, Flores Saldivar P, Chimenos-Küstner E, Estrugo Devesa A, López-López J. Compromised teeth preserve or extract: a review of the literature. J Clin Med 2022; 11: 1–15.
28. Ravichandran R, Kumar D, K HK, Nair VV. Preservation of residual alveolar ridge using tooth supported overdenture prosthesis - a case report. Int J Adv Res 2024; 10: 345–50.
29. Matoug-Elwerfelli M, Abdou A, Almutairi W, Alhuthayli M, Aloyaynaa S, Almohareb R. Radiographic assessment of endodontic mishaps in an undergraduate student clinic: a 2-year retrospective study. PeerJ 2022; 10: 1–15.
30. Berutti E, Alovisi M, Moccia E, Carossa M, De Caro G, Roccuzzo A, Pasqualini D, Scotti N. Micro-computed tomographic evaluation of endodontic ledge position in relation to canal curvatures. BMC Oral Health 2022; 22: 1–6.
31. Wahyuniwati W, Nugroho JJ, Trilaksana AC, Rovani CA, Natsir N, Mattulada IK. Microhardness characteristics values of root canal dentin after application with different types of EDTA. Journal of Dentomaxillofacial Science 2016; 1: 49–52.
32. Algamaiah H, Sampaio CS, Rigo LC, Janal MN, Giannini M, Bonfante EA, Coelho PG, Reis AF, Hirata R. Microcomputed tomography evaluation of volumetric shrinkage of bulk-fill composites in class II cavities. Journal of Esthetic and Restorative Dentistry 2017; 29: 118–127.
33. Sajjan GS, Sahu KK, Varma KM, Sigadam A, Chennanjali K. A comparative evaluation of pushout bond strength of comprehensive techniques for intracanal rehabilitation of structurally compromised roots: an in vitro study. J Oper Dent Endod 2020; 5: 1–5.
34. Dennis D, Leonardy A, Abidin T. The effect of stress-decreasing resin thickness as intermediate layer on fracture resistance of class II composite restoration: in vitro study. World Journal of Dentistry 2020; 11: 91–94.
35. Leong JZ, Beh YH, Ho TK. Tooth-supported overdentures revisited. Cureus 2024; 16: 1–11.
36. Aeran H, Seth J, Dhami R, Kesavan A. Unleashing the potential of mandibular tooth supported overdenture to enhance stability and support – a case report. International Journal of Oral Health Dentistry 2023; 9: 147–150.