

Review

Clinical Outcomes of Single-Visit Versus Multiple-Visit Endodontic Treatment in Mature Permanent Teeth

Omar Musaad Alshammari^{1*}, Matar Abdulrahman Alzahrani², Bassam Saleh Alamri³, Hajar Saeed Aldira⁴

¹ Department of Dentistry, Ministry of Health, Hail, Saudi Arabia

² General Dentistry, Faculty of Dentistry, Taif University, Taif, Saudi Arabia

³ General Dentistry, Private Clinic, Jeddah, Saudi Arabia

⁴ General Dentistry, Private Hospitals, Abha, Saudi Arabia

Correspondence should be addressed **Omar Musaad Alshammari** Department of Dentistry, Ministry of Health, Hail, Saudi Arabia. Email: Omar-f-16@hotmail.com

Copyright © 2026 **Omar Musaad Alshammari**. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 20 May 2026, Accepted: 13 June 2026, Published: 14 June 2026.

Abstract

Root canal treatment is a widely performed procedure aimed at eliminating infection from the root canal system, preserving natural teeth, and promoting healing of periapical tissues. The optimal number of treatment visits required to achieve favorable clinical outcomes has long been debated in endodontics. Traditionally, multiple-visit treatment has been recommended to allow the placement of intracanal medicaments between appointments, whereas advances in instrumentation, irrigation, and obturation techniques have increased the feasibility of completing treatment in a single visit. As a result, comparisons between these treatment strategies have become an important area of clinical research. Clinical outcomes associated with single-visit and multiple-visit endodontic treatment have been evaluated through randomized clinical trials, systematic reviews, and meta-analyses. Measures commonly assessed include treatment success, periapical healing, postoperative pain, flare-ups, and patient-centered outcomes. Available evidence indicates that both approaches achieve high rates of clinical and radiographic success in mature permanent teeth when adequate disinfection and obturation are accomplished. Periapical healing outcomes are generally comparable between the two protocols, with no consistent evidence demonstrating clear superiority of either treatment schedule. Postoperative pain may occur following both approaches, although reported differences are often temporary and tend to diminish during follow-up. Similarly, flare-up rates remain relatively low and do not appear to be strongly influenced by the number of treatment visits. Clinical decision-making is influenced by several factors, including pulpal diagnosis, presence of apical pathology, complexity of root canal anatomy, degree of infection, operator experience, and patient preferences. Single-visit treatment offers advantages related to convenience, reduced chair time, and fewer appointments, while multiple-visit treatment may be preferred in selected cases requiring additional intracanal disinfection or management of persistent symptoms. Contemporary evidence supports a patient-centered and case-specific approach rather than routine reliance on a single treatment protocol. Careful assessment of clinical conditions and treatment objectives remains essential for achieving predictable outcomes and maintaining long-term tooth function in mature permanent teeth undergoing endodontic therapy.

Keywords: *Single-visit endodontics, Multiple-visit endodontics, Root canal treatment, Periapical healing, Postoperative*

Introduction

Endodontic treatment is a cornerstone of restorative dentistry and is primarily aimed at eliminating infection from the root canal system, preventing reinfection, and preserving the natural dentition. Advances in instrumentation, irrigation protocols, magnification, and obturation techniques have significantly improved the predictability of root canal treatment over recent decades. Among the most debated aspects of contemporary endodontic practice is the optimal number of treatment visits required to achieve favorable clinical outcomes. Traditionally, root canal therapy was performed over multiple appointments, allowing the placement of intracanal medicaments between visits to reduce microbial load and enhance periapical healing. However, the development of improved cleaning and shaping techniques has increased the feasibility of completing treatment in a single visit (1).

Single-visit endodontic treatment involves cleaning, shaping, and obturating the root canal system during one appointment, whereas multiple-visit treatment includes one or more interappointment periods, often with the use of calcium hydroxide or other intracanal medicaments. Advocates of single-visit treatment emphasize its advantages, including reduced treatment time, fewer appointments, lower risk of interappointment contamination, improved patient convenience, and potential cost savings. In addition, completing treatment in a single session may reduce the likelihood of temporary restoration failure and bacterial leakage between appointments (2).

Despite these advantages, concerns remain regarding the ability of a single appointment to achieve adequate disinfection in teeth with complex anatomy, necrotic pulps, or apical periodontitis. Multiple-visit protocols have historically been recommended in such cases because intracanal medicaments can provide additional antimicrobial activity and may contribute to further reduction of residual microorganisms. The persistence of microorganisms within the root canal system is recognized as a major factor influencing endodontic failure, and the effectiveness of different treatment

schedules in addressing this challenge continues to be investigated (3).

Clinical outcomes used to compare single-visit and multiple-visit endodontic treatment commonly include periapical healing, treatment success rates, postoperative pain, flare-ups, and patient satisfaction. Numerous randomized clinical trials and systematic reviews have attempted to determine whether one treatment approach provides superior outcomes. Evidence accumulated over the past two decades has generally suggested that both approaches achieve comparable rates of long-term healing and tooth survival when appropriate case selection and treatment protocols are followed. However, differences in postoperative pain experiences, incidence of flare-ups, and management of specific clinical conditions remain subjects of ongoing discussion (1, 4).

Review

The findings reported across the literature indicate that both single-visit and multiple-visit endodontic treatment protocols can achieve favorable clinical outcomes in mature permanent teeth when appropriate case selection and treatment procedures are employed. Recent evidence suggests that differences in long-term treatment success and periapical healing between the two approaches are generally minimal, supporting the concept that thorough canal debridement and effective obturation may be more important determinants of outcome than the number of visits alone (5). Advances in rotary instrumentation, irrigation strategies, and obturation techniques have further strengthened the feasibility of completing root canal therapy in a single appointment without compromising treatment quality. Some clinicians continue to favor multiple-visit treatment in cases involving necrotic pulps, persistent exudation, or extensive periapical lesions because the use of intracanal medicaments may provide additional antimicrobial benefits. A recent systematic review and meta-analysis evaluating healing of periapical lesions reported no consistent superiority of either treatment approach, although variations in study design, follow-up duration, and patient

characteristics may influence reported outcomes (6).

Treatment Success and Periapical Healing Outcomes

Treatment success in endodontics is commonly assessed through the absence of clinical symptoms together with radiographic evidence of periapical healing. Comparisons between single-visit and multiple-visit root canal therapy have therefore focused largely on these parameters to determine whether the number of treatment appointments influences long-term outcomes. Evidence from randomized clinical trials has demonstrated comparable healing rates between the two approaches when adequate cleaning, shaping, disinfection, and obturation protocols are followed. In a clinical trial evaluating nonsurgical endodontic treatment, similar success rates were observed for single-visit and multiple-visit procedures during follow-up, suggesting that treatment quality may exert a greater influence on healing than the number of visits alone (4).

The biological rationale supporting multiple-visit treatment has traditionally centered on the use of intracanal medicaments, particularly calcium hydroxide, to reduce microbial populations that may persist after instrumentation. Persistent infection remains one of the principal causes of endodontic failure, especially in teeth presenting with pulpal necrosis and apical periodontitis. Nevertheless, advances in irrigation techniques, nickel–titanium instrumentation, and enhanced disinfection protocols have improved the effectiveness of single-visit treatment, reducing the dependence on interappointment medicaments for many clinical situations. Contemporary studies have therefore reported limited differences in periapical healing outcomes between the two treatment schedules, even in cases associated with preoperative periapical lesions (7).

Systematic reviews evaluating available clinical evidence have also indicated that healing outcomes remain largely comparable across both approaches. Variability among studies is frequently related to differences in case selection, diagnostic criteria,

lesion size, follow-up duration, and methods used to assess radiographic healing. Such heterogeneity complicates direct comparisons and may account for inconsistencies reported in individual investigations. Despite these methodological differences, pooled analyses have generally failed to demonstrate a clear advantage for either protocol regarding long-term success or resolution of apical pathology (8).

The relationship between treatment visits and healing outcomes may also be influenced by factors such as coronal seal integrity, host immune response, root canal anatomy, and operator experience. Teeth with uncomplicated anatomy and adequate infection control frequently show favorable healing regardless of whether treatment is completed in one appointment or over several visits. Reports from recent meta-analyses continue to support the view that both treatment strategies can achieve high success rates in mature permanent teeth, with observed differences often lacking sufficient magnitude to be considered clinically meaningful (9).

Postoperative Pain, Flare-Ups, and Patient-Centered Outcomes

Postoperative pain remains one of the most frequently evaluated outcomes when comparing single-visit and multiple-visit endodontic treatment. Evidence synthesized in systematic reviews has shown that postoperative pain can occur following both single-visit and multiple-visit procedures, with most episodes being mild to moderate in intensity and resolving within a few days. The Cochrane review by Figini and colleagues reported no substantial differences in long-term clinical success between the two approaches, although a slightly greater incidence of pain and analgesic consumption was observed in certain single-visit treatment groups during the early postoperative period (1). These findings have been echoed in later investigations, suggesting that while differences in pain experience may exist shortly after treatment, they tend to diminish over time.

Flare-ups, characterized by severe pain and/or swelling requiring unscheduled intervention,

represent a less common but clinically important complication. Concerns have historically been raised that completing treatment in a single appointment could increase the risk of acute exacerbations because intracanal medicaments are not used between visits (10). However, available evidence has not consistently demonstrated a higher flare-up incidence associated with single-visit therapy. Meta-analytic data indicates that flare-up rates remain relatively low for both protocols when contemporary treatment techniques and effective irrigation procedures are employed (3). The ability to achieve adequate disinfection and prevent extrusion of infected debris beyond the apex appears to play a greater role than the number of appointments themselves.

Patient-centered considerations have become increasingly relevant in modern endodontic practice. Single-visit treatment is often perceived favorably because it reduces the number of appointments, minimizes travel requirements, and decreases time away from work or daily activities. Surveys of practicing endodontists and patients have highlighted convenience and treatment efficiency as major advantages of the single-visit approach (11). Economic factors may also influence patient preferences, particularly in healthcare settings where multiple visits generate additional costs. Research examining postoperative experiences has shown that patient satisfaction is frequently linked not only to pain levels but also to convenience, treatment duration, and overall quality of care received (12).

Clinical Decision-Making

The selection of a single-visit or multiple-visit endodontic protocol is influenced by a combination of biological, technical, and patient-related considerations. Although current evidence generally supports comparable treatment outcomes between the two approaches, clinical circumstances frequently determine which strategy is most appropriate. The pulpal diagnosis, presence of periapical pathology, degree of canal infection, complexity of root canal anatomy, and ability to achieve adequate disinfection during treatment all contribute to decision-making. Clinicians must

therefore evaluate each case individually rather than relying solely on a predetermined treatment philosophy. Teeth presenting with vital pulps and uncomplicated canal systems are often considered suitable candidates for single-visit treatment because microbial contamination is usually limited and canal preparation can be completed efficiently (13). By contrast, cases involving necrotic pulps, persistent exudation, retreatment procedures, or extensive periapical lesions may prompt the use of multiple visits, particularly when additional intracanal disinfection is deemed beneficial. A recent randomized clinical trial comparing different intracanal medicaments reported favorable outcomes for both treatment schedules but emphasized the importance of tailoring treatment according to the biological condition of the tooth and the clinician's ability to control infection effectively during instrumentation and irrigation procedures (14).

The quality of root canal debridement has become increasingly important in contemporary treatment planning. Technological developments such as nickel–titanium rotary instruments, enhanced irrigation activation systems, apex locators, and improved obturation techniques have expanded the range of cases that can be managed successfully in a single appointment. As a result, treatment decisions are now less dependent on the traditional assumption that multiple visits are necessary for adequate canal disinfection. Reviews assessing healing outcomes have reported that procedural quality, adherence to aseptic techniques, and maintenance of a sound coronal seal exert substantial influence on long-term success irrespective of the number of appointments scheduled (6).

Patient-related considerations also shape treatment planning. Time constraints, travel requirements, financial factors, dental anxiety, and previous treatment experiences frequently affect patient preferences. Many individuals favor single-visit treatment because it minimizes disruption to daily activities and reduces the need for repeated appointments. Clinicians, however, must balance these preferences against the biological demands of

the case. Surveys evaluating practitioner attitudes indicate that treatment decisions often reflect a combination of evidence-based recommendations, clinical experience, and practical considerations encountered in routine practice (11). Current systematic reviews continue to emphasize the absence of strong evidence supporting universal superiority of either protocol. The available literature instead supports a case-based approach in which treatment decisions are guided by clinical findings, patient expectations, and the anticipated ability to achieve effective microbial control within the root canal system (15, 16).

Conclusion

Single-visit and multiple-visit endodontic treatments demonstrate comparable success rates and periapical healing outcomes in mature permanent teeth when performed using appropriate clinical protocols. Evidence indicates that differences in postoperative pain and flare-up incidence are generally limited and do not consistently favor either approach. The choice of treatment schedule should therefore be guided by case complexity, pulpal and periapical status, clinician expertise, and patient preferences. Individualized treatment planning remains essential to achieving predictable outcomes and optimizing patient care in contemporary endodontic practice.

Disclosure

Conflict of interest

There is no conflict of interest.

Funding

No funding.

Ethical consideration

No considerations.

Data availability

All data is available within the manuscript.

Author contribution

All authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

References

- Figini L, Lodi G, Gorni F, Gagliani M. Single versus multiple visits for endodontic treatment of permanent teeth: a Cochrane systematic review. *Journal of endodontics*. 2008;34(9):1041-7.
- Wong AW, Zhang C, Chu C-h. A systematic review of nonsurgical single-visit versus multiple-visit endodontic treatment. *Clinical, cosmetic and investigational dentistry*. 2014:45-56.
- Schwendicke F, Göstemeyer G. Single-visit or multiple-visit root canal treatment: systematic review, meta-analysis and trial sequential analysis. *BMJ open*. 2017;7(2):e013115.
- Wong AW-Y, Tsang CS-C, Zhang S, Li K-Y, Zhang C, Chu C-H. Treatment outcomes of single-visit versus multiple-visit non-surgical endodontic therapy: a randomised clinical trial. *BMC oral health*. 2015;15(1):162.
- Manfredi M, Figini L, Gagliani M, Lodi G. Single versus multiple visits for endodontic treatment of permanent teeth. *Cochrane Database of Systematic Reviews*. 2016(12).
- Theodoridis A, Economides N. Single versus multiple visits endodontic therapy on healing rate of periapical lesions: A systematic review and meta-analysis. *Balkan Journal of Dental Medicine*. 2023;27(3):140-7.
- Drouri S, Laslami K, Dhaim S, Jabri M. Influence of number of visits on the outcome of endodontic treatment. *Journal of Conservative Dentistry and Endodontics*. 2024;27(12):1211-20.
- Rajurkar K, Shingane S, Tandil Y, Mohkar S, Adwani C, Patil S. Single-visit root canal treatment: A systematic review and meta-analysis. *Journal of Dental Research and Reviews*. 2023;10(4):213-20.
- Rao V, Shah AG, Desai EC, Agrawal H, Patel K, Patel P, et al. Outcomes of single-visit versus multi-visit root canal therapy: A meta-analysis of success rates. *European Journal of Cardiovascular Medicine*. 2025;15:62-7.
- Ordinola-Zapata R, Noblett WC, Perez-Ron A, Ye Z, Vera J. Present status and future directions of intracanal medicaments. *International endodontic journal*. 2022;55:613-36.
- Pervez J, Adil HM, Saleem S, Batool SM, Nazir A, Manzoor SA. COMPARING SINGLE VISIT OR MULTIPLE VISIT ROOT CANAL TREATMENT: PREFERENCES AMONG THE

- ENDODONTISTS'™ IN THEIR PRACTICE. Pakistan Oral & Dental Journal. 2023;43(4):194-8.
12. Waseem RF, Khan KI, Khan M, Moiz A, Jehan N, Zahir H. Comparative Evaluation of Postoperative Pain Following Single Visit and Two Visit Endodontic Therapy in Non-vital Teeth: Postoperative Pain in Non-vital Teeth. Pakistan Journal of Health Sciences. 2022:145-9.
 13. Bjørndal L, Fransson H, Simon S. Treatment of vital pulp conditions. Textbook of Endodontology. 2018:79-100.
 14. Darak D, Choudhary D, Shah N, Patel P, Mavani H, Pisal V. Comparative Evaluation of Success Rate in Single-visit and Multiple-visit Endodontic Treatment Using Different Intracanal Medicaments: A Randomized Clinical Trial. World Journal of Dentistry. 2025;15(12):1043-9.
 15. Mergoni G, Ganim M, Lodi G, Figini L, Gagliani M, Manfredi M. Single versus multiple visits for endodontic treatment of permanent teeth. Cochrane Database of Systematic Reviews. 2022(12).
 16. Moreira MS, Anuar ASN-S, Tedesco TK, Dos Santos M, Morimoto S. Endodontic treatment in single and multiple visits: an overview of systematic reviews. Journal of endodontics. 2017;43(6):864-70.