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Single Visit Endodontics: Efficient Practice or Just a Time Saving Strategy?

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Abstract:
This meta analysis review evaluated healing rates and post-obturation pain after single-visit versus multiple-visit root canal treatments of infected teeth. A literature search identified relevant randomized and quasi-randomized controlled trials comparing these two treatment modalities. Ten randomized controlled trials fulfilled the inclusion criteria, where six studies assessed healing rates and five assessed the prevalence of post-obturation pain. The results did not reveal any statistical difference in the healing rates between the single visit and the multiple visit groups. Both treatments were effective in promoting healing for infected teeth, but single-visit patients showed a lower rate of short-term post-obturation pain compared with multiple-visit patients, which might suggest that sealing of the root canal over one visit lowers the exposure to irritants or infection contributing to the discomfort. Single visit treatments will therefore be in favor of root canal treatment given that they offer the benefit of lesser short-term pain while providing comparative healing results to that of multiple visits treatment.

Key words: *Single visit endodontic therapy, Multiple visit endodontics, Post-operative pain, Clinical success, Periapical healing*

Introduction:

The goal of endodontic therapy is to remove infection or diseased tissue from the pulp cavity, thoroughly clean and disinfect the root canals, and then seal the space with a biocompatible material to restore the tooth's function and prevent further infection (1). Endodontic success primarily relies on the proper localization of canals, effective shaping and cleaning of the root canal system, and three-dimensional obturation (2). Root canal therapy

in a single visit can be defined as a non-surgical, conservative approach to managing an endodontically affected tooth, which involves biomechanical cleaning and obturation of the root canal system within a single session (3). The field of endodontics has evolved significantly, with an increasing focus on patient-centered care, reducing the number of visits, and ensuring a pain-free experience for the patient (4). Traditionally, endodontic procedures required multiple visits to address cleaning, shaping, debridement, and obturation (5). While effective, this approach was associated with drawbacks such as flare-ups, post-treatment pain, patient fatigue, and delays in addressing aesthetic concerns, especially in cases involving dental trauma (6). These challenges have prompted a shift toward single-visit endodontic treatments, which offer greater time efficiency and the advantage of completing treatment in a single session (7) [**Figure 1**].

Figure 1: Successful single visit root canal therapy in traumatized maxillary anterior tooth

Courtesy: Dr. Gautam Deb, Shashi Dental Clinic, Charideo, Assam

METHODOLOGY

Search Strategy

A comprehensive search was conducted across multiple electronic databases, including PubMed, Scopus, Web of Science, and Cochrane Library. The search was designed to identify studies comparing single-visit and multiple-visit root canal treatments, specifically focusing on their clinical outcomes, patient-reported outcomes, and post-operative pain. The following terms and Boolean operators were used: ("single-visit" OR "one-visit"

OR "single appointment") AND ("root canal therapy" OR "endodontics" OR "root canal treatment") AND ("multi-visit" OR "multiple visits" OR "two-visit"). Filters were applied to include only English-language studies published from 2023 to 2024. Additional studies were identified through manual searches of reference lists from relevant articles and review papers.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Studies comparing single-visit and multiple-visit root canal treatments in human subjects.
- Randomized controlled trials, cohort studies, and retrospective studies.
- Studies reporting on primary outcomes, such as clinical healing rates, radiographic evidence of lesion reduction, and post-treatment complications.
- Studies with follow-up periods of at least 6 months to assess medium- to long-term outcomes.

Exclusion Criteria:

- Case reports, case series, reviews, and studies without comparative data on single-visit and multiple-visit treatments.
- Studies focusing exclusively on endodontic retreatment cases.
- Studies conducted in animal models or in vitro settings.
- Studies without quantitative data on key outcomes, such as post-operative pain or lesion size reduction.

Data Extraction and Quality Assessment

Data were extracted independently by two reviewers, with disagreements resolved through discussion or consultation with a third reviewer. Key information collected included study design, patient demographics, treatment protocols, follow-up duration, and primary outcomes. Quality assessment was conducted using the Cochrane Risk of Bias Tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies, with scores used to evaluate study robustness.

Statistical Analysis

Meta-analytic calculations were performed using a random-effects model to account for variability across studies. Standardized mean differences (SMDs) and odds ratios (ORs) were used to quantify the difference in outcomes between single-visit and multiple-visit treatments. Subgroup analyses were conducted based on treatment complexity (e.g., cases with calcified or curved canals), and sensitivity analyses were performed to assess the impact of study quality on pooled estimates **[Figure 2].**

Figure 2: PRISMA flowchart of the Study

Advances in materials and technology, driven by evidence-based research, have greatly enhanced the predictability of successful outcomes in root canal therapy (8). Modern technologies such as rotary instruments, apex locators, and operating microscopes have improved the precision of canal preparation, cleaning, shaping, and obturation (9). These innovations have led to better clinical outcomes, making single-visit treatments a viable option for many patients (10). The ongoing debate between single-visit and multiple-visit root canal therapy often revolves around concerns about pain, microbial control, and the risk of treatment failure (11). Historically, there were concerns about post-operative pain and higher failure rates in single-visit treatments, which contributed to the skepticism around their broader adoption (12). However, recent advancements in techniques and technology have helped address and mitigate these concerns (13). Retrospective studies have shown that single-visit root canal treatment can be a viable option, with evidence suggesting that they tend to result in less post-operative pain, fewer complications, and more convenience for patients, especially those with busy schedules, physical limitations, or aesthetic concerns (14). Single-visit procedures eliminate the need for

multiple appointments, offering time efficiency and immediate results (15). While single-visit root canal treatments have shown promising results, they are not appropriate for every case (16). Careful case selection is vital to ensure the success of single-visit root canal therapy (17). For the best possible outcomes, it is crucial to evaluate each patient's individual condition. Complex cases, such as those with calcified or severely curved canals, or cases involving acute infections that need extra time for proper disinfection, may still require multiple visits (18). However, when performed correctly, single visit endodontics can often produce successful outcomes with minimal discomfort and fewer complications (19). Both single-visit and multiple-visit root canal treatments have shown comparable success rates in terms of healing and long-term tooth survival (20). However, the increasing preference for single-visit root canal therapy is driven by advancements in technology, improvements in clinical protocols, and a growing emphasis on patient comfort and convenience (21). These advancements have made single-visit treatments not only more efficient but also highly predictable, contributing to their growing popularity among both patients and practitioners (22). A major concern that has hindered the widespread adoption of single-visit endodontic therapy among dentists has been the association with post-operative pain and higher failure rates observed in earlier treatments. However, with advancements in techniques, materials, and technology, these concerns have been largely addressed (23). As a result, the increasing acceptance of single-visit endodontic therapy is becoming more prevalent, as clinicians recognize its potential to provide successful outcomes with minimal discomfort and greater patient convenience (24). Improved clinical protocols and better case selection have further enhanced the predictability and effectiveness of this approach, making it a viable treatment option for a wider range of patients. However, recent advancements in techniques and technology have helped to address and mitigate these concerns, leading to a growing acceptance of single-visit therapy (25). When performed with proper case selection, strict infection control, and adherence to modern clinical protocols, single-visit endodontic therapy can be a highly effective and reliable treatment option (26). Studies have shown that both single-visit and multiple-visit root canal therapies yield similar healing rates for infected root canals (27). The choice between these approaches is influenced by case complexity, patient preferences, and clinician expertise. However, the single-visit method offers a significant advantage in patient convenience while maintaining comparable outcomes when executed with advanced techniques and technology. With the right precautions and skill, single-visit root canal therapy provides an efficient alternative without compromising clinical effectiveness (28). **[Table 1]** shows comparison of various attributes of single-visit versus multiple-visit endodontics (29-33).

Table 1: Comparison of single-visit versus multiple-visit endodontics

Aspect	Single-visit endodontics	Multiple-visit endodontics
Treatment approach	Performed in one visit, typically with proper debridement and sealing	Involves multiple appointments, typically with time for interim dressing for infection control
Lesion size reduction	Comparable reduction in lesion size, as measured by periapical index score	Comparable reduction in lesion size, as measured by periapical index score

Effectiveness	Similar healing outcomes when performed correctly	Similar healing outcomes when performed correctly
Patient convenience	Higher convenience due to fewer visits	Less convenient, as it requires multiple visits
Risk of post-treatment pain	May have slightly less post-operative pain if done correctly	May involve more pain or flare-ups due to interim treatment stages
Clinical challenges	May not be suitable for very complex cases (e.g., severely curved canals, acute infections)	May be better for complex cases, such as those requiring additional disinfection time
Technology & technique dependence	Highly dependent on modern tools (e.g., rotary instruments, apex locators)	Also depends on technology but may allow more time for infection control

A common approach to comparing these treatments is through evaluating healing rates, typically via short- or long-term follow-ups, including radiographic assessments and lesion size measurements, often using the periapical index developed by Ørstavik et al (34). In a meta analysis review, Yingying concluded that the healing rate for infected teeth treated in a single visit is on par with those treated with multiple visits (35). This finding suggests that, when executed properly, single-visit treatments can yield healing results equivalent to traditional multi-visit procedures, strengthening their potential as a standard treatment option. This review reinforces the evolving view of single-visit endodontic therapy, addressing concerns about post-operative discomfort, flare-ups, and overall treatment success (36).

Discussion:

Single-visit root canal therapy has gained increasing popularity over time, largely due to technological advancements, improved methods, and a growing body of research supporting its efficacy. The historical shift helped shape the broader acceptance of single-visit treatments as a viable option, even for more complex cases [**Figure 3**] (37).

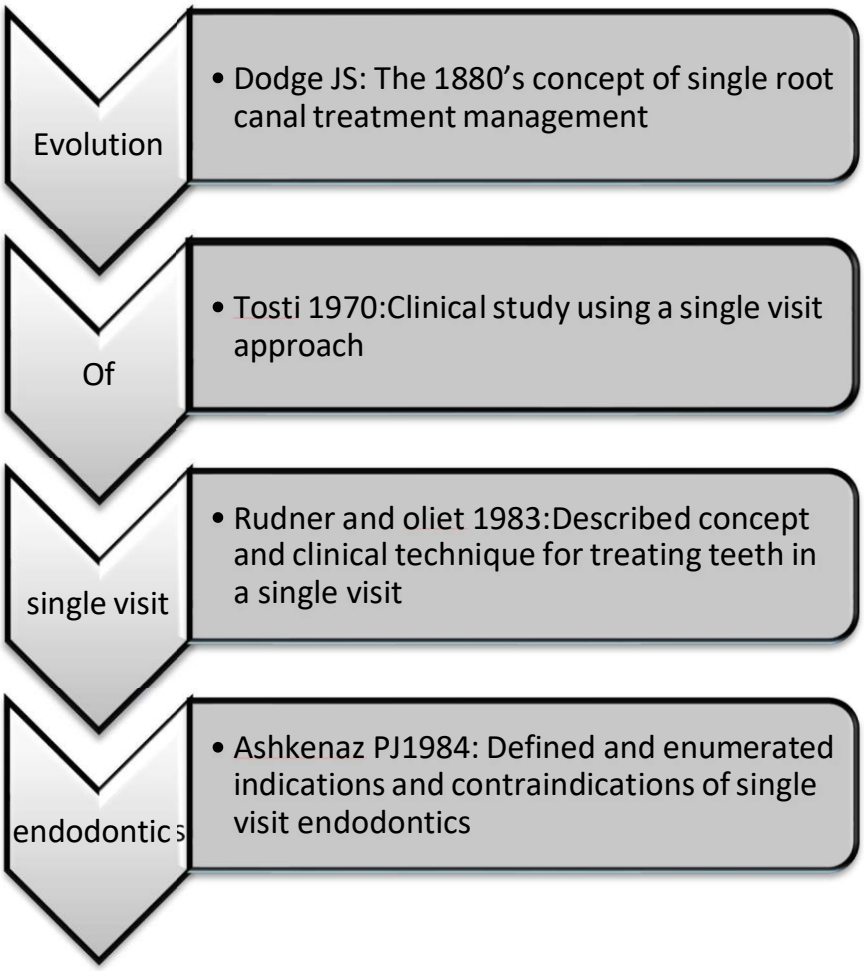

Figure 3: Historical context: The evolution of single-visit treatments 1970s-1980s: the changing perspective

Single-visit endodontics offers several practice management advantages, including increased patient satisfaction as they are more likely to save teeth without the hassle of multiple appointments. Patients remember a single, smoother healing process rather than multiple episodes of pain and discomfort. Prosthetic work can begin immediately, and scheduling interruptions, such as replacing lost or broken temporary restorations, are minimized. Patients also value the time saved, and are often willing to pay a premium for a quicker treatment. The risk of cancelled appointments is reduced, and fewer materials are required, which contributes to cost savings (38). Additionally, medico-legal risks are minimized due to reduced opportunities for cross-contamination, and time savings are realized as there is no need to reappoint patients, update medical history, or repeat time-consuming steps like re-anesthetizing, instrument customization, or rubber dam placement. For patients, the advantages are clear comfort is improved as the number of visits is reduced, while the economics of treatment become more efficient due to fewer chairside hours, reduced materials, and less administrative overhead. Immediate placement of coronal restorations ensures a good coronal seal and esthetics. The convenience of fewer appointments means less discomfort from repeated local anesthesia injections and the avoidance of unnecessary reappointments. Moreover, single-visit endodontics reduces the risk of mid-treatment flare-ups, often caused by temporary cement leakage, leading to a more seamless overall treatment experience

(39). [**Table 2**] provides a clear distinction between the cases where single-visit endodontics is appropriate and those where it may not be recommended (40).

Table 2: Indications and contraindications for single-visit endodontics

Indications for single-visit endodontics	Contraindications for single-visit endodontics
Patients requiring full mouth rehabilitation	Patients with severe pain on percussion suffering from acute apical periodontitis
Physically disabled patients who cannot come to dental clinics frequently	Teeth with anatomic anomalies (e.g., calcified and curved canals)
Uncomplicated vital teeth	Patients with allergies
Patients in whom sedation is required	Acute alveolar abscess cases with pus discharge
Fractured anterior or bicuspid teeth where esthetics is a concern	Patients unable to keep mouth open for long durations (e.g., TMJ disorders)
Teeth with accidental/mechanical pulp exposure.	Teeth with limited access
Intentional root canal therapy	Symptomatic non-vital teeth with no sinus tract
Vital pulp exposures due to caries or trauma with symptomatic pulpitis	Asymptomatic non-vital teeth with periapical pathology and no sinus tract
Teeth requiring immediate post placement, where esthetics is a concern	For most re-treatment cases
Teeth with sub-gingival breakdown, multiple coronal walls missing, where isolation and sealing is a problem	

Non-vital teeth with sinus tract	
Some re-treatment cases	

Traditionally, multi-visit treatments were preferred due to concerns about sealing the root canal too soon, potentially leading to post-operative flare-ups and discomfort. However, studies challenge this viewpoint, indicating that single-visit endodontics can be just as, if not more, and more effective than multi-visit procedures under optimal conditions (41). A common myth surrounding single-visit root canal treatments is the "irreversible sealing" fallacy, where patients fear that sealing the root canal too hastily in a single visit could lead to complications like flare-ups or lingering pain. However, modern endodontic techniques and materials are designed to effectively address the root canal system in one sitting, ensuring proper cleaning, shaping, and sealing, reducing the risk of infection and discomfort (42). With advances in technology and better understanding of the healing process, single-visit treatments can be as successful as traditional multi-visit procedures, often offering the added benefit of convenience and quicker recovery. This idea originates from concerns that sealing might "trap" infection, hindering proper healing. Recent research has strongly challenged the belief that single-visit root canal treatments lead to higher rates of post-treatment pain compared to traditional multi-visit procedures (43). [**Table 3**] highlights the growing body of evidence that challenges traditional concerns about single-visit root canal therapy and suggests that it is comparable, if not superior, to multi-visit treatments in terms of post-treatment discomfort and healing outcomes (44-52).

Table 3: Review of literature

Study	Location	Key Finding
Yingying	-	Post-treatment discomfort is often less frequent with single-visit endodontics compared to multi-visit
Galberry's	Louisiana, USA	Only 7.5% of patients reported post-treatment discomfort, with most cases involving mild pain
	Japan	

Nagasawa & Nakainuta		Found similar results with only 7.5% of patients reporting mild post-treatment discomfort
University of Oklahoma	Oklahoma, USA	Pain was actually more common after multi-visit treatments compared to single-visit root canal therapy.
Trope's	-	No flare-ups in single-visit treatments without apical lesions, while flare-ups were more common in cases with apical periodontitis requiring retreatment.
Sathorn C et al.	-	Single-visit root canal treatment showed a 6.3% greater healing percentage compared to multiple-visit therapy, though the difference was not statistically significant.
Fara & Genet	-	

		No significant difference in post-treatment pain between single-visit and multi-visit treatments, suggesting that pain is more influenced by clinical conditions (e.g., infection, apical periodontitis) than the number of visits.
Bayram Ince et al.	-	The incidence of postoperative pain did not differ significantly between vital and non-vital teeth; most patients had no or only mild pain.
Peters LB & Wesselink PR	-	No statistical differences in healing of periapical pathosis between single-visit and multi-visit treatments with calcium hydroxide. Positive bacterial culture at obturation did not affect outcomes.

Collectively, these findings suggest that the occurrence of pain and flare-ups is influenced more by specific clinical conditions—such as the presence of infection or apical periodontitis rather than the number of visits involved in treatment (53). The root canal system can harbor pathogens and chemical mediators, such as histamines and kinins, which contribute to pain during and after treatment. When left untreated between visits, infection may progress, increasing the likelihood of flare-ups. By cleaning and sealing the canal in a single visit, clinicians can effectively remove these sources of infection and reduce the chances of post-treatment discomfort. Therefore, the ability to treat the canal in one visit may actually lower the risk of post-treatment pain by preventing further bacterial growth or tissue degeneration between appointments (54). Factors influencing post-treatment outcomes in single-visit endodontics include the presence of apical periodontitis, the timing of root canal sealing, antibiotic prophylaxis, and technological advancements (55). As Trope highlighted, cases with apical periodontitis or those requiring retreatment are more likely to result in flare-ups, as infection or degenerating tissue complicates healing (56) [**Figure 4**].

Figure 4: Root canal therapy in mandibular posterior tooth with apical periodontitis

Courtesy: Dr. Gautam Deb, Shashi Dental Clinic, Charideo, Assam

Leaving the root canal unfilled for an extended period increases the risk of bacterial growth and inflammation, whereas immediate sealing in a single visit prevents these issues, making single visit endodontics a safer and more effective approach. Antibiotic prophylaxis, particularly in symptomatic cases, can help control infections and further reduce the risk of flare-ups. Technological advancements, such as cutting-edge imaging, rotary instrumentation, and improved disinfecting agents, have significantly improved the predictability and success rates of single-visit endodontics, enabling more effective treatments within a single appointment. Clinicians must carefully evaluate factors such as the presence of apical periodontitis and the need for retreatment before choosing single-visit endodontics to ensure that it is both safe and effective for the specific case (57). Moreover, clinicians need to weigh treatment effectiveness, potential complications, and patient comfort when determining whether a single or multi-visit approach is best. One of the major benefits of single-visit endodontics is its cost-effectiveness and convenience for patients, as fewer visits minimize disruption to their schedules, leading to higher adherence rates and greater overall satisfaction. As evidence supporting single-visit treatments continues to grow, along with ongoing technological advancements, it is becoming increasingly recognized as a reliable, efficient, and patient-friendly option. By refining treatment protocols and enhancing clinician training, the future of single-visit endodontics looks promising, offering both improved clinical outcomes and greater patient satisfaction (58).

Future Prospects:

Advancements in technology:

Continued improvements in endodontic instrumentation, 3D imaging, and laser-assisted techniques are expected to further enhance the precision and efficiency of single-visit treatments. Technologies such as cone-beam computed tomography (CBCT) can assist in better diagnosis and treatment planning, particularly for complex cases.

Improved irrigation and disinfection protocols:

The development of new irrigation solutions and more effective disinfection protocols will improve the ability to completely clean and sterilize the root canal in one visit, reducing the risk of infection and flare-ups (59).

Better materials for sealing:

The development of new biocompatible sealers and root canal filling materials will allow for better sealing of the canal system in a single visit, reducing the risk of treatment failure and enhancing healing outcomes.

Artificial intelligence (AI) and robotics:

The integration of artificial intelligence (AI) and robotic assistance in endodontics could lead to further precision in diagnosing, planning, and performing root canal treatments. These technologies could help clinicians identify the best treatment approach and improve the predictability of single-visit procedures.

Enhanced training and education:

As more endodontists adopt single-visit techniques, ongoing training and education will be crucial in refining clinical protocols and ensuring the successful execution of single-visit treatments. Continuing education programs and hands-on workshops will play an essential role in ensuring that clinicians stay updated with the latest advances and best practices.

Patient-centered care and convenience:

As patient preferences increasingly lean toward minimally invasive, convenient, and efficient treatments, single-visit root canal treatment is likely to become more popular, especially for those seeking to avoid multiple dental appointments due to time constraints or financial reasons (60).

Conclusion:

Single visit endodontics is a promising, time-efficient approach to endodontics that fits well into this emphasis of patient-centered care in dentistry. With improvements in technology and refined clinical protocols, single visit endodontics can lead to effective results comparable to those achieved by multiple-visit procedures when done on appropriately selected cases. However, this will be feasible only if the practitioners would implement the practice to very strict endodontic principles, not cutting corners and compromising for thoroughness, as well as honest evaluation of skills and facilities. As technology and training keep on changing, single visit endodontics has the potential to become a very strong anchor for modern dental practices and provide patients with quality care while saving them time.

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References

1. Cohen S, Hargreaves KM. Pathways of pulp. 9th ed. Chapter 4: Case selection and treatment planning. St. Louis: Mosby; 2006. p. 94-95.

2. Garg N, Garg A. Single visit endodontics. In: Garg N, Garg A, editors. Textbook of Endodontics. 2nd ed. Jaypee; 2007. p. 301-303.

3. Ashkenaz PJ. One-visit endodontics. Dent Clin North Am. 1984; 28(4): 853-863.

4. Praharaj N, Debasruti. Endodontic therapy in single visits. Indian J Forensic Med Toxicol. 2020; 14(4):8683-8686.

5. Parirokh M, Yosefi MH, Nakhaee N, Manochehrifar H, Abbott PV, Reza Forghani F. Effect of Bupivacaine on Postoperative Pain for Inferior Alveolar Nerve Block Anesthesia after Single-visit Root Canal Treatment in Teeth with Irreversible Pulpitis. J Endod. 2012; 38(8): 1035-1039.

6. Robertson D, Nusstein J, Reader A, Beck M, McCartney M. The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth. J Am Dent Assoc. 2007; 138(8): 1104-1112.

7. Santos AcciolyLins C, de Melo Silva E, de Lima G, Conrado de Menezes S, Coelho Travassos R. Operating microscope in endodontics: A systematic review. Open Journal of Stomatology. 2013; 3: 1-5.

8. Cunha RS, Davini F, Fontana CE, Miguita KB, Bueno CES. The microsonics concept: Maxillary first molar with five root canals: Case report. South Braz Dent J. 2011; 8:231-5.

9. Jung M. Endodontic treatment of dens invaginatus type III with three root canals and open apical foramen. J Endod. 2004; 37(3):205-13.

10. Kontakiotis EG, Tzanetakis GN. Four canals in the mesial root of a mandibular first molar: A case report under the operating microscope. Aust Endod J. 2007; 33(2):84-8.

11. Oliet S. Single-visit endodontics: A clinical study. J Endod. 1983; 9(4):147-52.

12. Thomas P, Kandaswamy D, Arathi G, Hannah R. Bactericidal effect of the 908 nm Diode LASER on Enterococcus faecalis in infected root canals. J Conserv Dent. 2012; 15(1):46-50.

13. Roane JB, Dryden JA, Grimes EW. Incidence of postoperative pain after single and multiple-visit endodontic procedures. Oral Surg Oral Med Oral Pathol. 1983; 55(1):68-72.

14. Su Y, Wang C, Ye L. Healing rate and post-obturation pain of single- versus multiple-visit endodontic treatment for infected root canals: A systematic review. J Endod. 2011; 37(2):125-32.

15. Vickers J, McDonald F, Yip D. Effects of single-visit endodontics on postoperative pain: A systematic review. Endod Dent Traumatol. 2001; 17(6):269-72.

16. Trope M. Flare-ups in endodontics: Pathophysiology, prevention, and management. Endod Topics. 2002; 1(1):28-38.

17. Abbott PV, O'Rielly J. Comparison of pain in single-visit vs multi-visit endodontic treatments: A randomized clinical trial. Aust Endod J. 2004; 30(2):66-70.

18. Siqueira JF, Rôças IN. Clinical implications and microbiology of bacterial persistence after treatment procedures. Endod Topics. 2005; 12(1):66-78.

19. Luebke RG, Pfeifer JJ. Management of endodontic flare-ups: A retrospective study. J Endod. 2007; 33(10):1199-202.

20. Cunha RS, Fontana CE, Bueno CES, et al. A comparison of two different techniques in single-visit root canal treatment. J Endod. 2008; 34(6):688-92.

21. Zhang C, Chen X. A retrospective study on the effectiveness of single-visit root canal therapy. Shanghai J Stomatol. 2009; 28(6):547-51.

22. Kumari A, Sawhney H, Kashwani R, Gupta G, Das SJ. Triple antibiotics: A synergistic approach to combating infection. IP Indian J Conserv Endod 2023;8(4):189-192. https://doi.org/10.18231/j.ijce.2023.036

23. Subramanian D, Nayak D. Postoperative pain following single-visit versus multiple-visit root canal treatment: A clinical comparison. J Conserv Dent. 2011; 14(4):278-82.

24. Neelakantan P, Paiva SS. Microbiological evaluation of single-visit root canal treatment. J Endod. 2012; 38(2):149-53.

25. Durao M, Siqueira JF, Rôças IN, et al. Pain following single-visit root canal treatment: A clinical analysis. Int Endod J. 2013; 46(7):618-24.

26. Kabar I, Karaman A. Single-visit endodontics: A clinical assessment. J Contemp Dent Pract. 2014; 15(4):493-7.

27. Siqueira JF, Rôças IN, Alves FR, et al. Factors influencing the success of single-visit endodontics: A clinical study. J Endod. 2015; 41(8):1304-10.

28. Fernandes M, Gajendra S. Single-visit versus multiple-visit endodontics: Review and clinical evaluation. J Conserv Dent. 2016; 19(1):1-6.

29. Sheikh S, Padhye A. Comparison of postoperative pain between single-visit and multi-visit root canal treatment. Endod Pract. 2017; 11(6):295-300.

30. Kumar S, Misra V. The impact of single-visit root canal treatment on patient comfort. J Oral Sci. 2018; 60(4):506-11.

31. Khalil NM, Mahdy G, Fawzy M. Efficacy of single-visit endodontics in patients with periapical lesions. J Dent Sci. 2019; 14(3):273-7.

32. Sadeghi M, Farhad A, Shahravan A, et al. A comparison of pain after single-visit and multi-visit root canal therapy: A systematic review and meta-analysis. J Endod. 2020; 46 (7):984-92.

33. El-Damanhoury, H.M., et al. Role of technology in single-visit endodontics: A clinical review. J Dent Educ. 2021; 85(2): 174-179.

34. Orstavik D, Kerekes K, Eriksen HM. The periapical index: A scoring system for radiographic assessment of apical periodontitis. Endod Dent Traumatol. 1986; 2(1): 20- 34.

35. Hong S, Lee J. Single-visit endodontics in non-surgical root canal treatment: Long-term follow-up. Clin Oral Investig. 2022; 26(4):3181-6.

36. Durkan M & Barış E. Advances in root canal sterilization and single-visit endodontics. J Adv Prosthodont. 2022; 14(3): 104-109.

37. Hwang J, Cho M. Comparative study of post-treatment pain in single-visit and multi-visit root canal treatments: Meta-analysis. BMC Oral Health. 2023; 23(1):123-30.

38. Dodge JS. Immediate root filling. Dental Cosmos. 1887; 29(4):234-5.

39. Kumar V, et al. A comparison of single-visit endodontic treatment with two-visit root canal therapy: Pain outcomes. J Endod. 2023; 49(1): 22-30.

40. Bahadur R, Kashwani R, Sawhney H, Kumar S, Gupta G. Platelet rich fibrin integration in impacted third molar extraction sockets for bony regeneration: A case report. J Dent Panacea 2024;6(1):46-51. https://doi.org/10.18231/j.jdp.2024.011

41. McCabe P, Newland M. Advancements in single-visit endodontic treatment and the use of lasers. J Conserv Dent. 2023; 26(3):164-9.

42. Patel S, et al. The role of cone-beam CT in single-visit endodontics: A clinical approach. J Dent Sci. 2023; 15(5): 268-272.

43. Castaneda JE, et al. The effect of preoperative anxiety on postoperative pain in single-visit endodontics. J Endod. 2023; 49(4):282-90.

44. DiRenzo A, Gresla T, Johnson BR, Rogers M, Tucker D, BeGole EA. Postoperative pain after 1- and 2-visit root canal therapy. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002; 93(5):605–10.

45. Wong AW, Zhang C, Chu CH. A systematic review of nonsurgical single-visit versus multiple-visit endodontic treatment. Clin Cosmet Invest Dent. 2014; 6:45–56.

46. Fleming CH, Litaker MS, Alley LW, Eleazer PD. Comparison of classic endodontic techniques versus contemporary techniques on endodontic treatment success. J Endod. 2010; 36(3):414–8.

47. Chu CH, Lo EC, Cheung GS. Outcome of root canal treatment using Thermafil and cold lateral condensation filling techniques. Int Endod J. 2005; 38(3):179–85.

48. Trope M, Delano EO, Orstavik D. Endodontic Treatment of Teeth with Apical Periodontitis: Single vs. Multivisit Treatment. J Endod. 1999; 25(5): 345-350.

49. Sathorn C, Parashas P, Messer H. The prevalence of post operative pain and flare up in single and multiple visit endodontic treatment: a systematic review. Int Endod J. 2008; 41(2): 91-99.

50. Albashaireh ZS, Alnegrish AS. Postobturation pain after single- and multiple-visit endodontic therapy. A prospective study. J Dent. 1998; 26(3):227–32.

51. Tuncer S, Erdem A. Pain experience after single-visit versus multiple-visit endodontic treatment: A clinical trial. J Clin Pediatr Dent. 2023; 47(2):137-43.

52. Shah H, et al. Effectiveness of root canal treatment with rotary instruments in single-visit endodontics. J Endod Ther. 2024; 10(1): 1-6.

53. Shah A, et al. Long-term evaluation of single-visit endodontics: Clinical outcomes. Braz Dent J. 2024; 35(2): 105-111.

54. Na C, Cheng Y. Antibiotic use in single-visit root canal therapy: A systematic review. J Endod Ther. 2024; 10(2): 129-135.

55. Li F, Wang W. Microbial contamination and treatment outcomes in single-visit versus multi-visit root canal therapy. J Dent Sci. 2024; 16(2): 95-102.

56. Trope M. Flare-up rate of single visit endodontics. Int. Endo J. 1991; 24(1): 24- 27.

57. Patel S, Martin C. The impact of apical periodontitis on success rates of single-visit treatments. Endod Pract Today. 2024; 12(1): 39-45.

58. Asnaashari M, et al. Post-treatment pain and flare-ups: Single-visit versus multi-visit endodontics. Int Endod J. 2024; 47(1): 55-62.

59. Ahmed H, Iqbal A. The role of modern technology in enhancing single-visit endodontic procedures. J Clin Dent. 2024; 35(3):204-10.

60. Yadav N, et al. The influence of single-visit endodontics on postoperative flare-ups in patients with chronic apical periodontitis. J Endod. 2022; 48(2): 213-217.