

Success and Failures of Single Visit over Multiple Visit Nonsurgical Endodontic Treatment in Permanent Teeth – A Review

ABSTRACT

Root canal treatment is a common procedure in endodontic dentistry treating the teeth with necrosis of the dental pulp caused by carious processes, coronal crack or fracture, or dental trauma. The success of root canal treatment depends on a number of variables related to the preoperative condition of the tooth, as well as the procedure options for endodontic treatment. Successful root canal treatment is characterised by an absence of symptoms and clinical signs. Single visit root canal treatment used to give more success rate compared to multiple visit treatments. In this paper we aim to treatments based on time, restoration, esthetics, post operative pain, technique and fracture resistance of teeth.

KEY WORDS

Single Visit Root Canal Treatment, Multiple Visit Root Canal Treatment, Access Opening, Working Length, Biomechanical Preparation.

INTRODUCTION

Root canal therapy is a conservative therapeutic option that entails the removal of diseased pulpal tissue and prevents or treat pulpal/periradicular pathosis and safeguards the treated tooth from recurrent microbial invasion.¹ An electronic database (Pubmed, Scopus, Research gate, Medline) were screened with key words endodontic treatment, root canal therapy, single visit and multiple visit endodontics and data were collected from the identified articles.

Single-visit endodontic therapy refers to a conservative, non-surgical approach for treating a tooth with endodontic issues it involves thorough cleansing, shaping, and

filling of the root canal system in just one appointment.² Single visit reduces treatment time and material use compared with multiple-visit treatment.³ As Anjali Sharma et al (2011) said that success rate for treating periapical lesions non-surgically was 86.02%.

⁴ Amy Wai-Yee Wong et al (2015) said that success rate of single visit root canal treatment is 88.9. ⁵

FACTORS FOR SUCCESS AND FAILURE IN SINGLE VISIT ROOT CANAL TREATMENT

Several factors play an important role in the decision-making process of single visit versus multiple visit root canal treatment. Factors contributing to the success of endodontic treatment include objective considerations such as the accuracy of the initial diagnosis, the effectiveness of infection control measures, the complexity of root canal anatomy, and the management of procedural complications. Additionally, subjective factors like the patient's reported signs and symptoms play a crucial role in determining treatment outcomes. Jorge Paredes-Vieyra et al (2012) provided evidence that a meticulously instrumented single-visit root canal treatment will be as successful as a multiple-visit treatment. There was no significant difference in radiographic evidence of periapical healing between single-visit and multiple-visit root canal treatments.⁶

ISOLATION AND SEALING PROBLEMS

Main problem to perform multiple visits treatment was difficulty in effectively sealing off the root canal system from the oral cavity in between visits. In single visit procedure this potential problem of interappointment contamination and/or flare-up can be eliminated.⁷

Teeth with subgingival lesions, coronal walls missing, and caries below finished margins of full coverage restorations can be treated in single appointment.⁷

ANTERIOR ESTHETIC PROBLEMS

Cases with trauma in anterior teeth are probably the most frequently treated in single visit. Therefore, esthetic, isolation and sealing problems were solved in the treated tooth.

Badami V et al (2011) fractures of anterior teeth are relatively common and clinician can complete the treatment in a single visit by reattaching the fractured fragment.⁸ Melia Heptania et al (2022) in complicated crown anterior teeth fracture single visit endodontic treatment gives good outcome than multiple visit.⁹

RESTORATIVE CONSIDERATIONS

Treatments for restorative reasons as overdenture abutments, full jacket crowns; severe coronal breakdown those cannot retain a restoration and teeth that require preparation for desired alignment should be treated intentionally by single visit.

VITAL PULP EXPOSURE AND SYMPTOMATIC PULPITIS

Teeth with pulp exposures caused by trauma, caries, or iatrogenic reasons and teeth that exhibit clinical symptoms to heat or cold stimuli but not percussion were treated in single visit.⁷

HEALTH CONSIDERATIONS THAT CHOOSE SINGLE OR MULTIPLE VISITS

In physically compromised patients, apprehensive but cooperative patient and in medically compromised conditions, single visit root canal treatment was considered over multiple visit treatment. Common psychiatric problems encountered in dental practice stated by ADA are anxiety disorders, mood disorders, psychotic disorders, and eating disorders.¹⁰ Poor oral health in these individuals affect their quality of life with an increased burden on their well-being.

Single visit root canal treatments exhibit more success in these conditions over the multiple visit treatments as systemic health conditions impair the nonspecific immune system and the reparative response of the dental pulp and periapical healing process of teeth. Pro-inflammatory status and impaired immune response associated with systemic diseases can affect the two main endodontic variables: the prevalence of apical periodontitis (AP) and the frequency of RCT.¹¹

TIME

Another advantage in single-visit endodontic treatment was that both operators and patients save time.¹² Major reason for increased patient acceptance was the reduced number of visits to the dental clinic.

POST ENDODONTIC PAIN

The evidence for recommending either single visit or multiple visits root canal treatment was not consistent. The primary cause of post-endodontic pain stems from the inadvertent displacement of canal contents, debris, and microorganisms from the root canal into the periapical region. This occurrence triggers a significant inflammatory reaction, resulting in discomfort after the completion of root canal treatment.¹³ Studies indicate that 25% to 40% of patients experience this discomfort, irrespective of their initial pulp and peri-radicular conditions. Even with careful and thorough endodontic therapy, the persistence of postoperative pain can be distressing for both patients and dentists.¹⁴

In 2019 study, Moayad Ahmed Alomaym et al evaluated the frequency and intensity of post-obturation pain. Their findings revealed a statistically significant difference in pain occurrence between multiple visit and single visit groups. Specifically, they noted a lower incidence of pain in the multiple visit group compared to the single visit group.¹⁵

Singh *et al* (2020) inferred that the mean pain score in the Single Visit was lower than that of the Multiple visit group but however, the difference was statistically insignificant.¹⁶ [Una M Bryce](#) et al (2023) concluded that there was no significant difference in postoperative pain between Single Visit and Multiple Visit treatment.¹⁷ There was moderate certainty evidence of higher proportion of participants reporting pain within one week in single-visit groups compared to multiple-visit groups.

STEPS TO CONSIDER IN SUCCESS OF SINGLE VISIT ROOT CANAL TREATMENT

1.ACCESS OPENING

One of the most important steps of successful endodontic treatment is to prepare access to the pulp chamber and the root canal system.^{18,19} Two different access cavities as like: Traditional endodontic access cavity (TEC) required removal of the

entire roof of the pulp chamber to establish a straight-line access to the root canal system, conservative endodontic access cavity (CEC) was formed by connecting the projection of each root canal orifice on the occlusal.^{20,21} The CEC is less invasive than the TEC.

Utilizing ultraconservative (ninja) access cavity designs in endodontic procedures can potentially enhance the strength of treated teeth by minimizing invasiveness. The application of cone-beam computed tomography (CBCT) imaging facilitates the accurate identification of all canals, thereby preserving dentin integrity during the single visit endodontics thereby increasing the success rate.²² Truss access is designed for teeth with multiple canals, ensuring that a section of the chamber roof and an enamel-dentin bridge are retained to allow direct access to each canal.²³ However, concerns arise regarding the adequacy of space for subsequent treatment stages, although there is presently a lack of sufficient scientific evidence to validate these concerns.

Obada A. Mandil et al (2022) said that Conservative access opening, Ninja access opening, and Truss access opening are the contracted access cavity used as an alternative to Traditional access opening. Conservative access opening is a practical choice for root canal treatment, as it maintains tooth structure while enabling a safe and efficient procedure.²³

Wong A et al (2014) stated that according to the International Conference on Endodontics in 1958, the root canal should be enlarged regardless of its original size, to enable the removal of contaminated dentinal debris and filling of the root canal.²⁴

Conservative access opening exhibits more success in single visit root canal treatment than multiple visit. In multiple visit excess loss of coronal dentin was seen during removal of access seal in subsequent visits leading to decrease fracture resistance of teeth.

2.DETERMINATION OF WORKING LENGTH

An accurate working length determination of root canal during endodontic treatment was very essential and crucial in RCT, serving as a reference point for working

instruments and dictating the end point of the endodontic preparation and obturation.²⁵ It makes endodontic treatment easier for an operator to remove necrotic tissue and prepare canals precisely.²⁶ Radiographs play a crucial role in endodontics for diagnosis, treatment, and postoperative assessment. Yet, they offer a two-dimensional perspective of a three-dimensional object.²⁷

Non radiographic method using Electronic apex locators (EALs) have been employed clinically to locate the file position in the canal in determination of apical constriction.²⁸ Combining electronic apex locators (EALs) with traditional radiography has notably enhanced the precision and accuracy of determining working length (WL) in endodontics. This integration has also reduced the need for multiple radiographs, thereby minimizing patient exposure to radiation.²⁹ According to Shearer AC et al. (1991), digital radiography proves advantageous in endodontic procedures. The diagnostic value hinges on factors such as beam angulation, superimposition of anatomical structures, and patient-related variables.³⁰

Role of apex locators in single visit:

James L. Gutmann in *Problem Solving in Endodontics* (Fifth Edition), (2011) stated that the apex locator found to be significantly more reliable than the radiograph for determining working length. Thus suggest to the use of apex locators as the primary means of determining the working length during single visit endodontic procedures in patients with psychological and systemically compromised health conditions.

Ark, Jin-Sung et al (2007) present a case of single visit root canal treatment using electrical apex locator under general anesthesia in a cerebral palsy patient as dental treatments especially in endodontics, meticulous instrumentation was needed, these muscle discordances may lead to unexpected accidents and taking radiographs for measuring canal length is often hindered by walking and movement disorders.³¹

Dawood A, et al (2009) stated that two-dimensional conventional radiographic methods are insufficient and fail to provide the necessary information. The main advantage of using CBCT for endodontic applications was that it can provide three dimensional (3D) views which intraoral and panoramic radiography cannot provide.^{32,33} While CBCT addresses several drawbacks of intraoral radiography, it's

essential to note that patients are exposed to higher radiation doses compared to intraoral and panoramic radiography.

Dawood A, Patel S, Brown J and Patel S et al concluded that CBCT should be used only if conventional methods are not useful for diagnostic accuracy.^{32,33}

Single visit root canal treatment shows more success compared to multiple visit treatment by using the newer methods in working length determination as it decreases the operator failure to simulate the same in subsequent visits.

3. BIOMECHANICAL PREPARATION

A. Files used in single visit root canal treatment

Commonly files used in single visit root canal treatment are rotary NiTi files, reciprocating files, single file system, heat-treated NiTi files, ultrasonic files and hand files. Current mechanical preparation of root canals uses rotary nickel-titanium (NiTi) instruments that employs either of the two kinematics like rotation or reciprocation.³⁴

Pettiette MT et al (2001) stated that nickel titanium (NiTi) files were five times more likely to achieve success when compared to stainless steel files because they maintain the original shape of canal during instrumentation.³⁵ NiTi rotary instruments can predictably enlarge root canals while maintaining the original path, to sizes not routinely available with stainless steel files. Since larger preparations remove more bacterial cells, a higher rate of treatment success rate was expected.³⁶

Rotary single-file systems like Hyflex EDM (HEDM) are manufactured using a unique method known as electric discharge machining. This process involves spark erosion, which enhances both fracture resistance and cutting efficiency.³⁷

WaveOne Gold (WOG) files are reciprocating files made with M-wire alloy technology, featuring an off-centered parallelogram cross-section. Through a thermal process, the molecular geometry is modified to enhance cyclic fatigue resistance and flexibility.

Riluwan Siddique et al (2019) said that Single-file reciprocating systems was found almost similar microbial reduction when compared with rotary systems.³⁸

Using the newer files either rotary or reciprocating exhibits success in single visit root canal treatment compared to multiple visits as meticulous instrumentation of canals in

subsequent visits for removal of intracanal medicaments lead to excess loss of radicular dentin.

B. Irrigation technique for single visit treatment

Irrigation of prepared canals done frequently to remove and loosen debris and microorganisms and to ensure that the debris are not pushed out the apex which helps in lubrication, flushing and smear layer removal. The most commonly used root canal irrigants include: 17% EDTA, 0.2% Chlorhexidine, 5.25% Sodium hypochlorite, and 10% Citric acid.³⁹

Lantigua Domínguez MC et al (2018) stated that combined solution of 5% NaOCl and 18% etidronate decreased root fracture resistance. EDTA causes alterations in the microstructure of dentin and responsible for dentin erosion due to the demineralization of inorganic components by the chelation of calcium ions present in the hydroxyapatite of root dentin. This action of irrigant solutions was time dependent and directly interferes with root fracture resistance.⁴⁰

Seniha Miçooğulları Kurt et al (2022) stated that in the single visit root canal treatment, irrigation with 5 mL 17% EDTA and 5 mL 2.5% NaOCl, with both solutions manually agitated by using a sterile gutta-percha cone for 1 minute was preferred. Followed by 5 mL 2% CHX used as a final irrigant that was enabled to contact the root canal walls for up to 5 minutes.⁴¹

Irrigation protocol along with manual passive agitation shows more success in single visit root canal treatment than in multiple visit treatments. Exposure of root dentin to chelating irrigants and agitation methods decrease fracture resistance of root dentin in multiple visits.

4. SEALER

Understanding the biological aspects in performing a single-visit endodontic treatment in pulpal pathosis cases is essential. Calcium silicate based sealers (CSSs) and Epoxy resin based sealers (ERSs) are commonly used. Treating pulpal pathosis cases with Calcium silicate based sealers were susceptible to low pH, which can interfere with its setting and mechanical properties. Thus, the inflammatory condition in these teeth may not be appropriate for its use. In those cases, epoxy resin based sealers are used.

In multiple visits RCT, using calcium hydroxide as an intra-canal medicament, offers antibacterial effects, thus facilitates the dissolution of lipopolysaccharides and raises the pH level, which is optional scenario without known limitations for using either ERSs or CSSs sealers. However, the removal of calcium hydroxide may be accomplished to varying degrees. Hence, CSSs have a greater adaptation to the canal wall, probably due to interactions between the calcium hydroxide produced during the sealer's setting to the calcium hydroxide's remnants on dentinal walls.⁴²

5.OBTURATION

Obturation of the canals by cold lateral compaction technique in the manual group and single cone technique in the rotary.⁴³

The technique which was used for the maximum number of times in root canal treatment for both single visit and multi visit was lateral compaction technique. Lateral compaction has been proved to be a successful technique due to its simplicity and does not require specific and expensive instruments and low cost. Also has the advantage of excellent length control and any acceptable fillers. However this technique may not fill canal irregularities.^{44,45} Thermoplasticized obturation technique which was used for a maximum number of times offer several advantages, including improved adaptation to root canal complexities, reduced risk of void formation, and the creation of a dense filling, less time consumption. In single visit root canal treatments Thermoplasticized obturation shows more advantages compared to other obturation methods.

Warm vertical technique was to be the least used treatment in both single visit and multi visit root canal treatment. It is usually difficult to obturate curved canals with this technique.⁴⁶ Also it has a risk of vertical root fracture and extrusion of material into the periradicular tissues.⁴⁷

CONCLUSION

According to the latest comprehensive evidence, single-visit root canal treatment demonstrates a marginally higher efficacy compared to multiple visits. Single-visit root canal treatments are typically based on the clinical judgment that additional treatments wouldn't enhance care quality.

Presently, there is no conclusive evidence favoring either treatment regimen single-visit or multiple-visit root canal treatment as more effective. Neither regimen can entirely prevent postoperative pain and other complications within the first year.

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