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Single Versus Multi‑ visit Endodontic Treatment of Teeth with Periapical Pathology: A Critical Review

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Abstract: ***Introduction:*** *In spite of the recent developments, most practitioners are reluctant to do single visit Endodontics.This critical review addresses the choices (singleor multiple-visit root canal treatment) clinicians face in dental practice, and aims to provide the current best available evidence upon which clinical decisions regarding root canal treatment can be based.*
Material andReview methods: *Electronic searches were performed in the Medline(PubMed), Scopus& Google Scholar databases using relevant keywords. Textbook searching was also applied. Following selection, articles were fully reviewed to ensure that they met inclusion/ exclusion criteria.Studies with all designs that Single Versus Multi‑ visit Endodontics modality included. The study should refer to Single Versus Multi‑ visit Endodontics with Periapical Pathology, Apical periodontitis, success rates(healing) significance. Data in those studies were independently extracted.*
Results: *Success rates of Single Versus Multi‑ visit Endodontic Treatment of Teeth with Periapical Pathologyhave been investigated, assessed and compared within the dental literature.*
Conclusion: *Single‑ visit root canal treatment can be considered as a viable option for treatment of teeth with periapical pathology.*
Keywords: *Single Versus Multi‑ visit Endodontic, Periapical Pathology, periapical healingrate(success, periapical index, randomized clinical trial.*

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I. Introduction

In endodontics, with continuously evolving newer technology and data gathered from evidencebased research, the art and science of endodontics have taken multiple travelled as well as untraveled roads in their quest for excellence and this may itself have opened new roads to travel [1].

Retrospective analysis suggests that single visit endodontics is a natural corollary to the transformation in the treatment modality of endodontic therapy to an era of rotary endodontics from an earlier era which consisted of handheld files. With research studies, the field of intra canal preparation, culturing, root canal filling materials and techniques has lead to complete alteration in the concept of endodontic practice. Because of the ever expanding newer materials and an increasing number of favorable clinical research studies and clinicians ability to perform more accurate endodontic proceduresusing dental operative microscopes which greatly increases the visualization of the area of interest, enhanced imaging techniques using digital radiography, precise apical foramen detection using modern electronic apex locators, and root canal cleaning and shaping with more refined method of using rotary driven NiTi files used with computer assisted electronic hand pieces, ultrasonics, all for the sake of achieving an optimal result during endodontic treatment ultimately adding to above concept of "Maximum dentistry in Minimum visits" in the present scenario. As time factor is probably one of the more important factor it is possible to use single visit endodontics as the most accepted technique among the patients and operators [2].

In spite of the recent developments, most practitioners are reluctant to do single visit Endodontics. The purpose of these articles is to discuss the various aspects of single visit Endodontics and eventually motivate the practitioner to make single visit Endodontics the rule rather than the exception in one's practice[3].

This critical review addresses the choices (singleor multiple-visit root canal treatment) clinicians face in dental practice, and aims to provide the current best available evidence upon which clinical decisions regarding root canal treatment can be based.

Treatment protocol differences between single and multiple‐ visit endodontic treatment: [16].

A major goal of nonsurgical root canal treatment (NSRCT) is the prevention or treatment of apical periodontitis, leading to the preservation of natural teeth. The presence of bacteria inside the root canal system results in the development of periapical lesions[4].

Traditionally, root canal treatment was performed in multiple visits, with the use of extra disinfecting agents (intracanal dressing) besides the irrigants that is used during the cleaning and shaping procedure which mainly aims to reduce or eliminate microorganisms and their by‐ products from the root canal system before obturation[5]. The most intracanal dressing researched and widely used is the calcium hydroxide (Ca(OH)2) paste[6].Calcium hydroxide a strong alkaline substance,which has a pH of approximately 12.5. In an aqueous solution, Ca(OH)2 dissociates into calcium and hydroxide ions. The hydroxyl ion OH‐ is even smaller and can penetrate through dentin to the cementum. Calcium hydroxide works by a hydrolysis reaction in which the OH‐ ion cuts protein chains and bacterial endotoxin into pieces as it breaks chemical bonds. It does this by inserting water molecules between the carbon‐ carbon bonds (and breaking C‐ C bonds by the process of hydrolysis), the backbone of proteins and endotoxin. So if the pearls on a pearl necklace represent atoms and the string between the pearls represents C‐ C bonds, Ca(OH)2 is like a pair of scissors that cuts the string (hydrolyzes the bonds) between the atoms breaking the protein down into harmless non‐ functional pieces. It is a tissue solvent! It also kills bacteria and it dissolves the endotoxin (bacterial LPS).

However Ca(OH)2 was not capable of eliminating all the bacteria, it helped to reduce the bacteria remaining in the canal after the irrigation[6,7].

The concept of single visit root canal treatment is based on the entombing theory,[8] which the large number of microorganisms removed during cleaning and shaping[9,10] and the remaining bacteria entombed by the root canal obturation, therefore it will miss the essential elements to be survive nutrition and space.[11‐ 13] In addition, the antimicrobial activity of the sealer or the zinc (Zn) ions of gutta‐ percha can kill the residual bacteria.[14,15].

II. Material And Methods

Electronic searches were performed in theMedlinePubmed, Scopus& Google Scholar databases using the keywords:SingleVersus Multi‐visit Endodontics with Periapical Pathology, Apical periodontitis, success rates(healing). Textbook searching was also applied for relevant information. Articles were first selected according to titles and abstracts, and they were then fully reviewed to ensure that they met the inclusion/exclusion criteria.

Inclusion and exclusion criteria used in the analysis

Inclusion criteria

Studies with all designsthatSingle Versus Multi‐visit Endodontics modality included. The study should refer to Single Versus Multi‐visit Endodontics with Periapical Pathology, Apical periodontitis, success rates(healing) significance. Searches were limited to papers written in English and published between 1999 and 2018.

Exclusion criteria

All studies that failed to meet the inclusion criteria. If a study did not referto Single Versus Multi‐visit Endodontics with Periapical Pathology, Apicalperiodontitis, success rates(healing) significance, it was discarded.

III. Results

Success rates of Single Versus Multi‐ visit Endodontic Treatment of Teeth with Periapical Pathology have been investigated, assessed and compared within the dental literature.

1] Trope M, Delano EO, Ørstavik D. Endodontic treatment of teeth with apical periodontitis: single vs. multivisit treatment.**1999 May**Power statistics were conducted to determine the numbers required for significant differences between the groups (single vs. multivisit treatment) and it was shown that large experimental groups on the order of hundreds of patients would be required to show significant differences.

2]Weiger R, Rosendahl R, Löst C. Influence of calcium hydroxide intracanal dressings on the prognosis of teeth with endodontically induced periapical lesions**2000 May**Concluded from a microbiological perspective, one‐ visit root canal treatment created favourable environmental conditions for periapical repair similar to the two‐ visit therapy when calcium hydroxide was used as antimicrobial dressing. One‐ visit root canal treatment is an acceptable alternative to two‐ visit treatment for pulpless teeth associated with an endodontically induced lesion.

3]PetersLB, Wesselink PR. Periapical healing of endodontically treated teeth in one and two visits obturated in the presence or absence of detectable microorganisms. **2002 Aug** ConcludedWithin the limitations of this study, no significcant differences in healing of periapical radiolucency was observed between teeth that were treated in one visit (without) and two visits with inclusion of calcium hydroxide for 4 weeks. The presence of a positive bacterial culture (CFU <102) at the time of filling did not infuence the outcome of treatment.

4] Kvist T, Molander A, Dahlén G, Reit C. Microbiological evaluation of one-and two-visit endodontic treatment of teeth with apical periodontitis: a randomized, clinical trial. Journal of Endodontics**. 2004 Aug** It was concluded that from a microbiological point of view, treatment of teeth with apical periodontitis performed in two appointments was not more effective than the investigated one-visit procedure.

5] Sathorn C, Parashos P, Messer HH. Effectiveness of single- versus multiple- visit endodontic treatment of teeth with apical periodontitis: a systematic review and meta- analysis. **2005 Jun**ConcludedBased on the current best available evidence, single-visit root canal treatment appeared to be slightly more effective than multiple visit, i.e. **6.3% higher healing rate**. However, the difference in healing rate between these two treatment regimens was not statistically significant (P ¼ 0.3809).

6] Molander A, Warfvinge J, Reit C, Kvist T. Clinical and radiographic evaluation of one-and two-visit endodontic treatment of asymptomatic necrotic teeth with apical periodontitis: a randomized clinical trial.**2007 Oct** The present study gave evidence that similar healing results might be obtained through one- and two-visit antimicrobial treatment.

7]Penesis VA et al. Outcome of one-visit and two-visit endodontic treatment of necrotic teeth with apical periodontitis: a randomized controlled trial with one-year evaluation. **2008 Mar**In conclusion, 12 months after initial nonsurgical root canal therapy on necrotic teeth with apical periodontitis, there was no significant difference in radiographic evidence of periapical healing between onevisit therapy and two-visit therapy with an interim calcium hydroxide/ chlorhexidine paste dressing.

8]VeraJ et al. One-versus two-visit endodontic treatment of teeth with apical periodontitis: a histobacteriologic study. Journal of endodontics**. 2012 Aug** In conclusion, this study demonstrated that the 2-visit protocol with an interappointment medication with calcium hydroxide resulted in improved microbiological status of the root canal system when compared with a single-visit protocol. The present results reinforce the concept that current instruments, irrigants, and techniques cannot predictably disinfect the root canal system in a single visit and the use of an antibacterial interappointment agent is necessary to maximize bacterial reduction before filling.

9] Dorasani G, Madhusudhana K, Chinni SK. Clinical and radiographic evaluation of single-visit and multi-visit endodontic treatment of teeth with periapical pathology. **2013 Nov**Within the limitations of this study, there was no statistically significant difference in radiographic evidence of periapical healing between one-visit and two-visit group at 12 months follow-up. Both groups exhibited a statistically significant decrease in PAI scores from baseline to 12 months evaluation. Both groups showed improved healing in almost similar percentage of teeth at the end of 12 months.

10] Wong AW et al Treatment outcomes of single-visit versus multiple-visit non-surgical endodontic therapy: a randomised clinical trial.**2015 Dec** Concluded the success rate and prevalence of postoperative pain of single-visit or multiple-visit treatment had no significant difference. The chairside time for single-visit treatment was shorter than multiple-visit treatment.

11] Patil AA et al Incidence of postoperative pain after single visit and two visit root canal therapy: a randomized controlled trial.**2016 May** Concludedincidence of pain after endodontic treatment being performed in one-visit or two-visits is not significantly different.

12] Gill GS, Single Versus Multi‐ visit Endodontic Treatment of Teeth with Apical Periodontitis: An In vivo Study with 1‐ year Evaluation. **2016**Concludedafter 1‐ year evaluation, no difference in periapical healing was found between single‐ visit treatment and multi‐ visit treatment groups with the given sample size.

13] Fonzar F et al. Single versus two visits with 1-week intracanal calcium hydroxide medication for endodontic treatment: One-year post-treatment results from a multicentre randomised controlled trial. **2017 Mar**Concluded One year after treatment, both groups achieved similar clinical results; however, patients

endodontically treated in a single visit suffered less postoperative pain and took less analgesics than patients treated in two visits, therefore a single-visit treatment should be recommended.

14] Chhabra A et al. Clinical and radiographic assessment of periapical pathology in single versus multivisit root canal treatment: An in vivo study.**2017 Nov**Single-visit root canal treatment can be considered as a viable option for treatment of teeth with periapical pathology.

15] Jamali S, Mousavi E, Farhang R. Clinical and Radiographic Evaluation of One and Two Visits Endodontic Treatment with Apical Periodontitis: A Systematic Review and Meta-analysis.**2018** Concluded that root canal treatment of two and singlevisit represented approximately similar success in the periapical pathology endodontic treatment of teeth.

IV. Discussion

Data summary of included studies[17,18].

Citation	N (total)	Observation time (years	Number of teeth (not healed/total) in single-visit group	Number of teeth (not healed/total) in multiple-visit group	Healing rate (%), single versus multiple visit
Trope et al. (1999)	**41**	**1**	**8/22**	**5/19**	**64 vs. 74**
Weiger et al. (2000)	**67**	**0.5-5**	**6/36**	**9/31**	**83 vs. 71**
Peters & Wesselink (2002)	**38**	**4.5**	**4/21**	**5/17**	**81 vs. 71**
Combined three studies	**146**	**NA**	**18/79**	**19/67**	**77 vs. 71**

Citation	N (total)	Observation time	Number of teeth (not healed/total) in single-visit group	Number of teeth (not healed/total) in multiple-visit group	Healing rate (%), single versus multiple visit
J Vera et al. (2012)	**300**	**1 year**	**155**	**145**	**96.57vs. 88.97**
GogalaDorasani et al.(2013)	**44**	**1 year**	**23**	**21**	**61 vs. 76**
Ajay Chhabra et al.(2017)	**60**	**6 month**	**30**	**30**	**78 vs. 31**
Vince A et al. (2008)	**63**	**1 year**	**33**	**30**	**67 vs. 70**
T. Kvist et al. (2004)	**96**	**1 year**	**52**	**44**	**71 vs. 64**

Single Visit Endodontic Therapy: Acceptance[2]

Healing rate of single visit versus multiple visit endodontic treatment for infected root canals Analyzing the healed and non-healed outcome is the commonest way of comparing both the treatment modality. Short or longterm follow-up of both size of the lesion as well as the bone radiograph is the most commonly used technique to evaluate the process of healing, usually based on PAI score developed by Orstavik, et al.1986 [36].
PAI score description of radiographic findings:

1. Normal periapical structures
2. Small changes in bone structures
3. Changes in bone structure with mineral loss
4. Periodontitis with well-defined radiolucent area
5. Severe periodontitis with exacerbating features.

Yingyingin his systemic review states that healing rate for infected tooth is similar for single visit as compared to multivisits root canal treatment& also hequoted that patients experience less frequency of short-term post-obturation pain after single-visit than those having multiple-visit root canal treatment [37].

If the root canal space is left unfilled for several days tissue fluid and blood will collect and act as a medium for bacterial growth and flare ups. If it is filled this may not occur single visit can be safely tried for vital and non-vital teeth without symptoms. If antibiotics are also started along with one day before, flare up will be minimum. Symptomatic teeth can also be managed by single visit after controlling the abscess infection with antibiotic, provided the root canal is dry without any discharge[41].

Single visit root canal treatment versus the multiple visit root canal treatment has been the subject of a long standing debate within the dental community, when the clinicians are faced with choices of which treatment should be offered to patients, the central issues that should be considered are effectiveness, complication, cost and probably patient /operator satisfaction[2].

Peters LB et.al.Effects of instrumentation, irrigation and dressing with calcium hydroxide on infection in pulpless teeth with periapical bone lesions. **2002** Concluded that a calcium hydroxide and sterile saline slurry limits but does not totally prevent regrowth of endodontic bacteria[42].

De-Deus G, Canabarro A. Strength of recommendation for single-visit root canal treatment: grading the body of the evidence using a patient-centred approach. International endodontic journal.**2017 Mar**Concludedthere is B-level (mid-level) evidence to confirm there is no difference between the two different treatments, based on research addressing clinical outcomes and using some consistent but limited-quality methods of scientific investigation. More studies focused on evaluating patient-centred outcomes are urgently required[43].

V. Conclusion

Under the limitations of the present study, Single‐visit root canal treatment can be considered as a viable option for treatment of teeth with periapical pathology.

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Conflicts of interest
There are no conflicts of interest.

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