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Comparative study on periapical healing followed by single visit vs multiple visit endodontic therapy in type 2 diabetes mellitus and non-diabetes- A systematic review

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Abstract
Background: Diabetes mellitus is a syndrome which affects the various pathways of metabolism and decreases the immune response leading to delayed healing [2]. The most prevalent inflammatory condition of pulp is pulpitis and is seen most commonly in diabetic patients due to delayed healing and uncontrolled blood sugar level. Current debate is on choice of one-visit versus two-visit root canal therapy for apical periodontitis. Therefore, the present study aims at evaluating the healing outcome of periapical diseases in patients having a co-morbidity of type 2 diabetes mellitus in a single visit vs multiple visit endodontic treatment.
Objectives: 1. In patients undergoing endodontic treatment, does a single-visit approach, compared to a multiple visit approach, result in a higher healing of single visit endodontic treatment?
2. In patients undergoing endodontic treatment, does a single-visit approach, compared to a multiple visit approach, result in a higher success rate of single visit endodontic treatment?
Materials and methods: Articles were reviewed using the National Library of Medicine (MEDLINE PubMed) and the Cochrane Central Register of Controlled Trials (CENTRAL), Google Scholar, Google, Clinical trials registry and manual search using DPU college library resources. All cross-reference lists of the selected studies were screened for additional papers that could meet the eligibility criteria of the study. The databases were searched up to and including 2017 using the search strategy.
Results: Periapical healing showed a significantly lower success rate in the type 2 diabetic group than the nondiabetic group between one-visit therapy and two-visit therapy.
Conclusion: Diabetes mellitus in a single visit endodontic treatment poses a significant effect on healing outcome, as they present with compromised periapical disease. Control of blood sugar levels increases the healing rate and RCT is effective even in uncontrolled diabetes.

Keywords: Diabetes mellitus; Single visit endodontics; Periapical healing

Introduction
Diabetes mellitus is a syndrome characterized by carbohydrate, lipid and protein metabolism t hat affects immune system function and is associated with delayed healing and impaired immu ne re-action [1]. India leads with the largest number of diabetic subjects in the world, earning the distinction of being called the "diabetes capital of world". The number of individuals affected by diabetes is going to increase to 69.9 million by 2025, an estimate by Diabetes Atlas [2].

Irreversible pulpitis is the most common inflammatory disorder in pulp, caused by noxious stimulus and apical periodontitis can be defined is an inflammatory reaction around the apex of a tooth root, mainly a sequence for the microbial infection of the pulp space of the tooth [3].
Studies suggest one-visit endodontic treatment in teeth with apical periodontitis has been shown to be more efficient A root canal therapy of the tooth is the primary treatment modality for irreversible pulpitis with apical periodontitis. For achieving the highest result in canal disinfection one visit root canal treatment (RCT) is believed to reduce the risk of infection [4].
Endodontic treatment takes several visits, primarily because the therapy takes significant time to finish. In endodontic circles, it has become increasingly apparent that root canal therapy only requires one-visit, which has led to dentists and endodontics questioning whether' standard of care' involves a one-visit procedure [3].

The use of modern techniques, such as magnification and illumination, electronic apex systems, rotary nickel titanium files and so forth, not only increases the success rate of endodontic therapy but also shortens the time required for therapy [5]. With obvious advantages of one-visit endodontics and positive patient acceptance, it is not obviating that this treatment mode has become prevalent [3].

Thus, this present study is directed to compare and assimilate the outcome of single visit and multiple visit therapy in type 2 diabetes and non-diabetes.

Materials and methods

Inclusion criteria: teeth with irreversible pulpitis, both anterior and posterior teeth as well as maxillary and mandibular teeth; Subjects diagnosed with type 2 diabetes mellitus; Subjects presented with mature teeth with infected necrotic root canals and radiographic evidence of periapical bone loss (as an indication of pre-operative canal infection); All selected root canals had not received any endodontic treatment previously; Subjects underwent non-surgical root canal treatment during the study.

Exclusion criteria: Patients with periodontal disease or systemic disorders other than DM, patients taking steroids, pregnant patients, patients with cracks/fractures, patients who underwent a procedural error, smokers, and patients with a history of antibiotic intake in the preceding month were excluded from the study; no healing rate present, studies other than English language; Animal studies

Formulation of PICO format

P - Participants: Patient with type diabetes mellitus
I - Intervention: Single visit
C - Comparison: Multiple visit
O - Outcome- periapical healing

Search strategy

(diabetes mellitus OR type 2 diabetes) AND (periapical healing OR healing rate OR success rate) AND (endodontic treatment OR endodontic therapy OR root canal treatment OR root canal therapy) AND (single-visit OR one-visit OR 1-visit)

Information sources

Internet sources of evidence was used for study purpose: Google Scholar Cochrane Central Register of Controlled Trials (CENTRAL) The National Library of Medicine (MEDLINE) PubMed, Google Scholar and manual search using college library resources. Cross-reference lists of the studies that were screened were searched for papers that could meet the eligibility criteria of the study. The databases were up to and including 2019 using the search strategy

Data Collection Process

Preliminary screening consisted total of 18800 articles out of which 267 articles were identified, and 260 papers were excluded because they were review papers, case reports, data studies, or irrelevant reports. There were 2 papers on clinical trials and the full texts of these publications were retrieved. A manual search was performed on the references of these papers, leading to the discovery of 1 additional publication. A standard pilot form in excel sheet was initially used and then all those headings not applicable for review were removed. Data extraction was done for one article and this form was reviewed by an expert and finalized. This was followed by data extraction for all the articles. The papers were screened independently by two reviewers Any disagreement between the two reviewers was resolved after additional discussion. Therefore, a total of 3 publications were included in this review that reported periapical healing followed by single visit vs multiple visit endodontic therapy in type 2 diabetes mellitus were summarized in Tables 1 and figure 1.

Results

Table 1: shows studies on periapical healing in type 2 diabetes mellitus

Author	Method	Main Finding
Arya S *et al*.	60 mandibular molars Diabetic – 30 Non diabetic–30 teeth evaluation period: 12 months	Diabetes mellitus may have a negative impact on the outcome of endodontic treatment in terms of periapical healing.
Rudranaik S *et al*.	80-teeth with irreversible pulpitis Diabetic-40 Non diabetic- 40 evaluation period: 6 months	The periapical lesions in patients with poor diabetic control showed failure. The clinical and radiographic healing outcome of single visit endodontic therapy was delayed in diabetic patients
Fouad AF *et al*.	Total cases-5244 Without diabetes -5002 Insulin dependent-58 Non-insulin dependent-184 Evaluation period 2 yr. – 4 yr.	Increased periodontal disease in teeth involved endodontically and have a reduced likelihood of success of endodontic treatment in cases with preoperative periradicular lesions

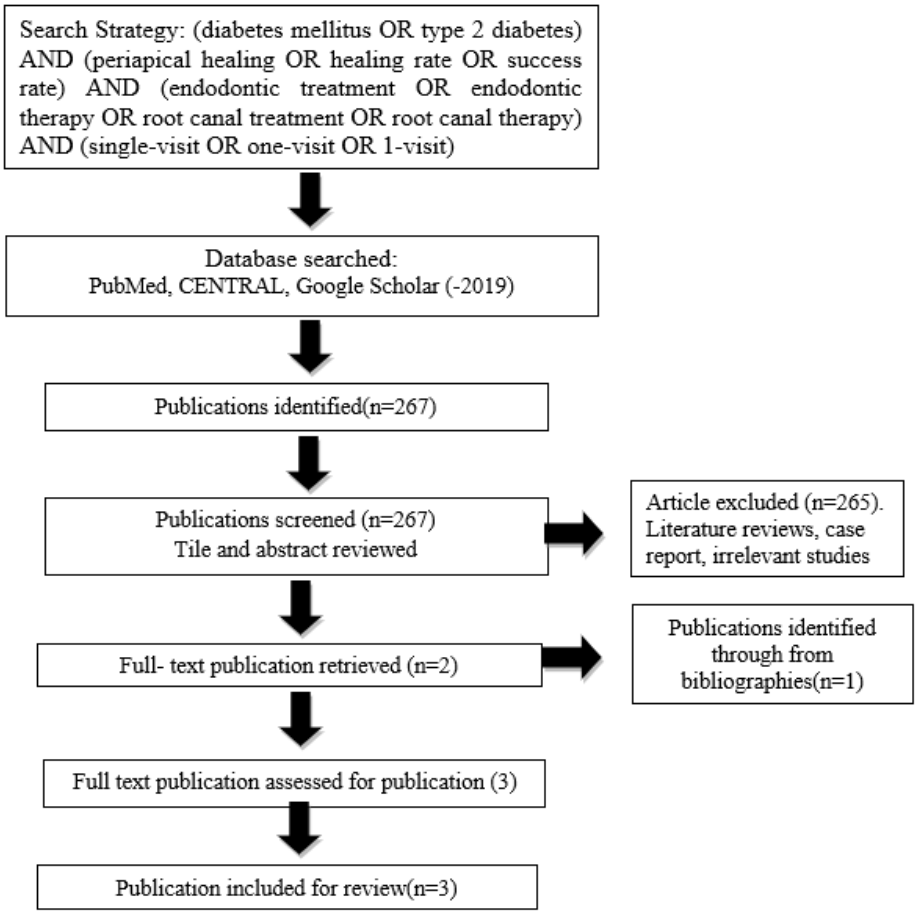

Fig 1: Flowchart of the literature search

Discussion

In the current research, the three papers were systematically evaluated for the healing of periapical lesions after one visit or multiple visits endodontic therapy. Fouad *et al.* [6] was of suggestion that DM may be a modulating factor for endodontic infection that can affect periapical tissue healing [7]. The compromised circulation within pulp due to endarteritis obliterans and lack of collateral circulation along with altered polymorphonuclear activity in diabetics are considered as predisposition for infection or pulp necrosis [8]. In diabetic patient the management of apical periodontitis involves infection control by cleaning and shaping and obturation of root canal. Endodontic treatment and diabetic patients that has almost three times increased failure rate [3].

Success rate of endodontic treatment was reported 87% by Britto LR *et al.* [5] However, the history of pain, presence of the sinus tract and apical tenderness influences the result of endodontic treatment. But evaluation of pain, sinus tract and apical tenderness has shown success over a 6-month period [9]. Results by Rudranaik S and Chugal *et al.*, who found that success rate of teeth with a preoperative sinus tract was less than patient presented without sinus tract [10]. But contrary to this Fouad *et al.* [6] maintained the presence of a preoperative sinus tract did not reveal any significant differences in treatment outcome.

Diabetic subjects demonstrate greater size than non-diabetic lesions. The findings are consistent with the research undertaken by Iwama *et al.*, which showed that there were more large periradicular lesions and that alveolar bone resorption in diabetics [10]. A success rate of 70% over a duration of one year was observed in ≥3 mm sized lesions [9]. In their analysis, Friedman *et al.* discovered that apical periodontitis teeth were successful at about 74% to 86% [11].

It was suggested that it may be 4 or 5 years before healing is assessed appropriately [12, 13]. Considering the difficulties to gather resource and nature of clinical studies and patient dropouts over time, many studies have used 12 months as an end point [14-16]. It's ideal to use longer observation periods, but evidence of periapical changes in bone density associated with healing should be apparent at 12 months when using the periapical index score (PAI) [17].

In terms of periapical healing, study by Arya S *et al.* [18] showed success rate of the Type 2 diabetic group was significantly lower than that of the non-diabetic group at 43%. But 90% of instances were reported as enhanced periapical status even amongst type 2 diabetics. In their research, Byström *et al.* proposed that the lesion should not be marked as failure until the lesion has shown continuously declined in size [19].

Type 2 diabetes, have been associated with a greater risk of ill response to odontogenic pathogens by periradicular tissues [20]. Patients with diabetes have more complicated and impaired periapical disease presentation and the condition has a major impact on the healing outcome of single-visit endodontic therapy. Rudranaik S [9] conducted a study to evaluate single visit endodontic treatment in type 2 diabetic patients with irreversible pulpitis and apical periodontitis with 6 months follow up and came to conclusion diabetic subjects showed delayed healing. Poorly controlled diabetics showed delayed healing in comparison with good and well-controlled subjects. A success rate of 90% in non-diabetic patients and 60% in diabetic patients was seen in 2 months on radiographic criteria. Even after one year of follow-up, 15% of diabetic patients showed no healing thus failure, but at the same time 100% of non-diabetic patients attained healing in six months. Good and fair glucose controlled diabetic subjects led to

better healing than badly controlled diabetic subjects. Cheraskin and Ringsdort showed radiographic healing of periapical lesion in a high glucose group demonstrates progress in only 48% while in relative 74% was present with low glucose group [21]

DM impacts many immune system tasks and jeopardizes immune responses. DM influences immune cell activity causing an inflammatory rise in monocyte / polymorphonuclear leucocyte pro-inflammatory cytokines and decline in growth factors. This results in chronic inflammation, chronic destruction of tissue and decreased ability to heal [22]. Pulpal necrosis is thought to have a more virulent microbial appearance in diabetics, with increased in *Prevotella intermedia, Porphyromonas gingivalis, F. Nucleatum, P. microns and streptococci* Hence, antimicrobial root canal regimens should be handled effectively for diabetics. The most efficient root canal irrigants have been shown to be as chlorhexidine and sodium hypochlorite (NaOCl) [9, 23]. Proteins, lipids, and nucleic enzymes have also been suggested to become irreversibly glycated and transformed into advanced glycation end products (AGEs). This accumulation of AGEs and their communication with tissue receptors could contribute to enhanced inflammation, which could in fact boost the general opposition to insulin and affect metabolic restrictions [24], and can also lead to increased bone resorptive and less of bone formation [25, 26].

Conclusion

In summary, after initial nonsurgical root canal treatment with apical periodontitis of necrotic teeth, evidence suggests no distinction between periapical treatment and two-visit treatment. Its suggested by literature subjects with diabetes were more susceptible to larger and chronic periapical lesions. In diabetic patients, periapical lesions were also seen more frequently. Smaller lesions indicated faster healing rates, on the contrary, larger lesion showed higher failure. Healing result in uncontrolled diabetics varies from poor, fair and well-controlled diabetics. Although few lesions may persist over a one-year radiographic follow-up, a reduction in lesion size is considered success Therefore, long-term follow-up trials are needed to evaluate and determine periapical healing. Even in uncontrolled type 2 diabetic patients, root canal therapy is still efficient in preserving teeth

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