



## To Compare the Clinical and Radiographic Evaluation of Single Visit and Multivisit Endodontic Treatment of Teeth with Periapical Radiolucency. An *In – Vivo* Study

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### Abstract

**Aim:** The purpose of this study is to compare the clinical and radiographic evaluation of single visit and multivisit endodontic treatment of teeth with periapical radiolucency.

**Material and Method:** A comparative study was carried out in 60 patients ranged from 18 to 50 years who fulfilled the criteria. Single rooted teeth of patients with vertuccis type I canal configuration and teeth with radiographic evidence of periapical pathology (periapical index (PAI  $\geq$  3) and pulpal necrosis. The teeth were obturated in single visit and multiple visit and evaluated radiographically for periapical healing.

**Results:** Clinical symptoms were rare during the follow-up period. All the teeth exhibited successful clinical (i.e. for spontaneous pain, presence of sinus tract, swelling, mobility, periodontal probing depths, Tenderness on percussion) outcome at one year follow up. Both groups showed improved healing at the end of 12 months, although the percentage of healed teeth were more in those obturated in multiple visit.

**Conclusion:** There was no statistically significant difference in radiographic evidence of periapical healing between one-visit and two-visit group at 12 months follow-up.

**Keywords:** Ethylenediamine Tetra-Acetic Acid; Radiovisiography; Periapical Index

### Introduction

In general, attitudes and concepts concerning proven, time-tested treatment procedures are very slow and difficult to change in the health professions. Dentists are often reluctant to abandon predictable treatment procedure like "Multiple-visit endodontic treatment" for the fear that the new treatment modality such as "Single-visit endodontic treatment" may not result in the same outcome or rate of success they have come to expect [1].

Completing endodontic treatment in a single-visit is an old concept that can be traced through the literature for at least 100 years.

However, as a result of the tremendous success of conventional multiple-visit endodontic therapy, single-visit endodontic therapy has until recently been a neglected mode of therapy [3]. The resistance to the acceptance of single-visit treatment procedure could be attributed further to controversies such as post-operative pain, flare-ups, rate of successful healing and patient acceptance [4]. Historically root canal treatment was performed in multiple visits mainly to ensure sterility of root canal system prior to obturation. Overzealous use of these medicaments may lead to postoperative complications that were erroneously identified as persistent periradicular infections. This led to one of the two course of treatment

either treat the root canal in one visit or seek an intracanal medication that does not injure the periradicular tissues. In more recent years, studies were attempted to answer major concerns about post-operative pain, flare-ups and success rate between single-visit and multiple-visit endodontic treatment. In fact, the attempt to complete root canal treatment in one-visit has been documented since the end of the nineteenth century (Dodge 1887), but still, to date, the evidence for recommending either one or multiple-visit endodontics is not consistent [1].

Mechanical instrumentation, including adequate apical preparation size, and chemical control through use of an antimicrobial irrigating solution are the 2 key elements that lead to effective reduction in intracanal microbial load [4]. Whether adequate microbial control can be obtained in one appointment is an ongoing source of controversy [2]. Although there might be a reasonable biologic argument to prefer multiple appointment root canal therapy for infected teeth with apical periodontitis, clinical research to date has been equivocal [5].

Calcium hydroxide paste is one of the most commonly used intracanal medications for multiple appointment root canal therapy; however, there is a growing body of evidence that questions the effectiveness of calcium hydroxide against several microorganisms commonly associated with persistent apical periodontitis [6].

## Materials and Methods

### Inclusion criteria

- Single rooted teeth with vertucci type I canal configuration of patients age ranged from 18 to 50 years
- Teeth with radiographic evidence of periapical pathology (periapical index (PAI)  $\geq 3$ ) and pulpal necrosis.

### Exclusion criteria

- Patients with any systemic disease i.e. diabetes, metabolic disorders.
- Patients who are taking antibiotics, NSAIDs or corticosteroids before the time of treatment.
- Patients who seek antibiotic premedication for dental treatment.
- Grossly carious teeth, where rubber dam isolation is difficult,
- Teeth with calcified canals and weeping canals.
- Retreatment cases and teeth that had been previously access prepared.

The institutional ethical clearance was obtained (no. COS/GS/2016/6792). A comparative study was carried out in 60 patients requiring root canal treatment on 64 single rooted teeth with periapical pathology Preoperatively, who fulfilled the criterias. Selected patients were randomly divided into two groups.

- **Group 1** : The teeth in group 1 were obturated in the single visit, **(n=33 teeth)**
- **Group 2** : **The teeth in** group 2 were medicated with CAL –EXCEL and obturated in a second visit 7 days later. **(n=31 teeth).**

Oral and written informed consent was obtained from the patients for the study and understood the need to attend follow up sessions.

Medical and dental history was recorded for all the patients selected for the study.

### Pre-operative clinical findings assessment

- Intra oral examination was done to assess the (spontaneous pain, presence of sinus tract, swelling, mobility, periodontal probing depth greater than baseline measurements, or sensitivity to percussion or palpation
- Electric pulp vitality test was performed to assess the vitality of the teeth
- Oral prophylaxis was done before the start of treatment.

### Pre-operative radiographic findings assessment

Pre-treatment digital radiographs (intraoral periapical) were exposed on a size-1 CMOS RVG sensor via XCP rinn rvg sensor positioner system (DentsplyRinn) (Figure 2). A customized polyvinyl siloxane bite block held in RINN sensor positioning device was used to standardize the pretreatment and all subsequent follow-up radiographs. Inter-appointment, bite blocks were stored in a refrigerator at 4°C.

The X-ray was set at 70 kV and 7mA with an exposure time of 0.12 sec. to standardize the pretreatment and all subsequent follow-up radiographs. Long cone paralleling technique was used. The images were saved in Kodak Dental imaging software and exported in a jpeg format to the patient's file and the preoperative PAI score was recorded.

The periapical status was scored on the basis of Intraoral Periapical Index (PAI) as suggested by Ørstavik D., *et al.* [7]. It is a scoring system for registration of apical periodontitis on radiograph. Its validity is based on the use of reference radiographs of teeth with

verified histological diagnoses. It is a useful tool for epidemiological studies, for clinical trials, and for retrospective analysis of treatment results in endodontics. This is a 5-point scale designed for radiographic interpretation, to determine the presence, absence, or transformation of a diseased state. The reference is made up by making a set of five radiographs along with corresponding line drawings and their associated score on a photographic print [8] (Figure 1).

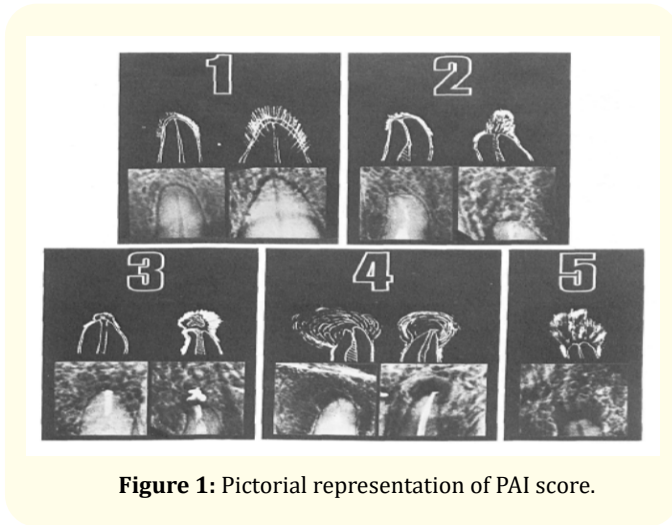


Figure 1: Pictorial representation of PAI score.

It provides an ordinal scale of 5 score.

- Normal Periapical Structures
- Small changes in Bone Structures
- Change in Bone Structure with Mineral Loss
- Periodontitis with well — defined radiolucent area
- Severe periodontitis with exacerbating features.

During the recruitment period, a total of 64 single rooted teeth from 60 patients, 31 male and 29 female, with mean age of 34 years (age range = 18-50) fulfilled the inclusion criteria. Four patients contributed two teeth. A total of 6 patients had to be excluded from the randomization procedure. two patients were on pain or antibiotic medication, one patient was refused to participate in the study and three patients were not to be available for recall.

Standard procedure of the root canal treatment for both the groups was done by single operator (V.K). After infiltration of local anaesthesia, rubber dam application, caries excavation if present, and access preparation. Working length was checked with i-ROOT Electronic Apex Locator. and confirmed by using radiovisiography.

The instrumentation was carried out using hand K-files from no. #15- #60 Files were used in sequence from the smallest to the largest starting with initial binding file at the apical constriction. Instrumentation was done three to four file sizes larger than the initial file which binds to the apex. Copious irrigation was done after alternate instruments and at completion of filing with 5.25% NaOCL and saline. Final irrigation was done with 2% cholehexidine gluconate irrigating solution and kept in canal for 5 min.

For teeth assigned to Group 2, a Lentulo-spiral was used to fill canal with CAL-EXCEL paste (calcium hydroxide paste)and the access cavity was sealed with sterile dry cotton pellet and Cavit temporary filling restoration.

An RVG image with placement of master cone was taken and then teeth in Group1 were obturated in the single visit with gutta-percha cones and sealapex as a root canal sealer using lateral condensation technique. Permanent restoration with 3M FILTEK composite material was done after obturation and Post obturation RVG image was taken.

Patients in Group2 were recalled for the second visit 1 week later. Minimal instrumentation was performed with the master file. Irrigation and obturation was done with similar methods and materials used for Group1 and postobturation RVG image was taken.

#### Follow up and Evaluation Criteria:

The patients were recalled after 3 month, 6 month and 12 months. The following protocol was followed at each follow up visit. A short history was taken regarding any symptoms in the tooth after the treatment procedures. This was followed by evaluation of clinical and radiographic criteria.

#### Postoperative clinical assessment

At three, six and twelve months follow up, the tooth was evaluated clinically for spontaneous pain, presence of sinus tract, swelling, mobility, periodontal probing depths and tenderness on percussion

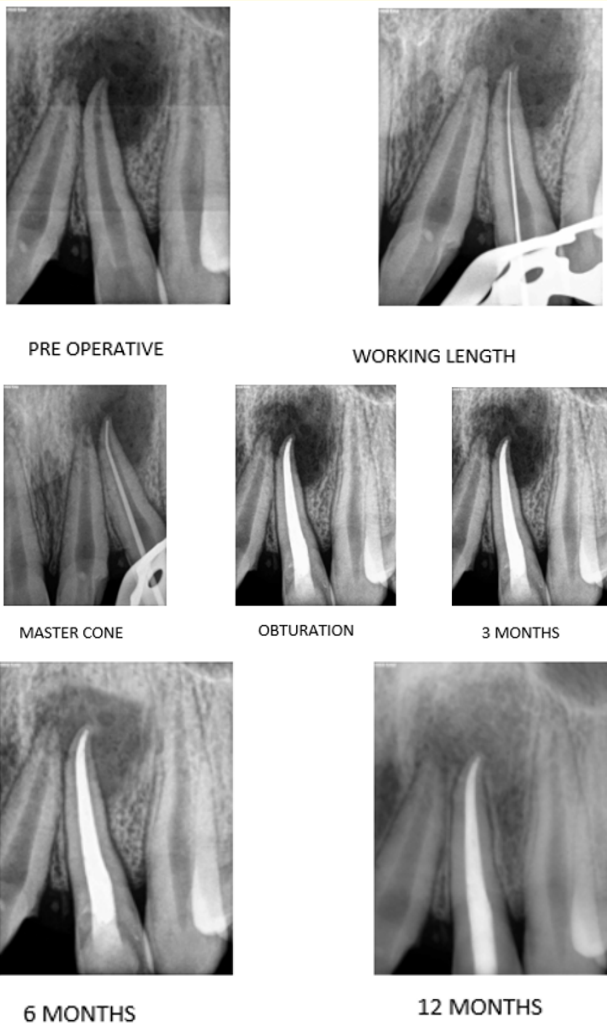
#### Post operative radiographic assessment

- Follow up radiographs were taken at 3, 6 and 12 months.
- For periapical healing preoperative radiograph was compared with the follow up radiographs, and changes in PAI score were noted (Figure 3 and 4)
- For radiographic evaluation, blinding was done by masking the entire tooth by 2 independent blinded endodontists (P.P., R.M.).



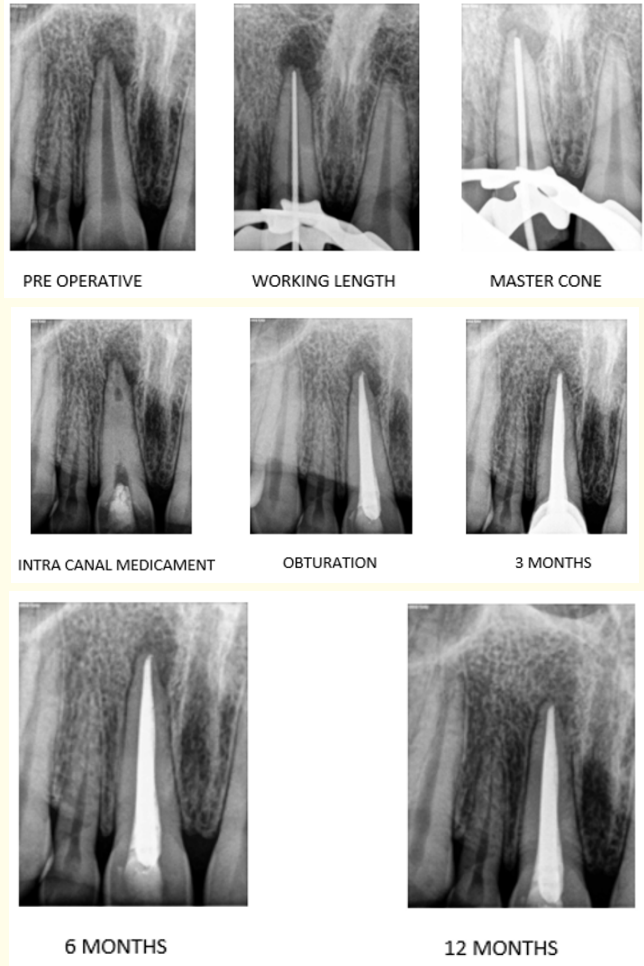
**Figure 2:** Standardized radiographs taken with RINN position indicating device and polyvinyl siloxane bite bloc.

**Single visit endo**



**Figure 3**

**Multi visit endo**



**Figure 4**

**Results**

**Clinical evaluation**

At the 12-months follow-up, 58 teeth were examined in this study 30 in group I and 28 in group II. No tooth had undergone treatment failure. At 12 month follow up, there was no statistically significant difference in the clinical signs and symptoms between groups I and II as compared with preoperative records.

**Radiographic evaluation**

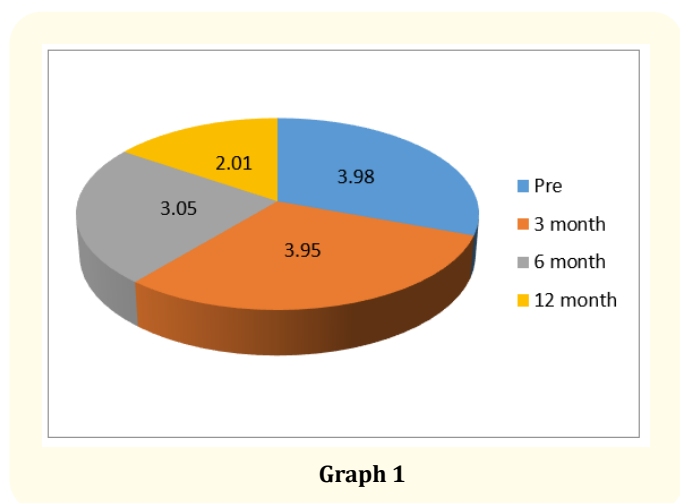
Comparison of PAI score at various time intervals among group 1

Table 1, showed comparison of PAI score at various time intervals among group 1. As per the chi square test, there was gradually decreased with score from pre-operative (3.98) to 12 month (2.01) which showed statistically significant results (p=0.001).

	Mean	Std. Deviation	95% Confidence Interval for Mean		P value
			Lower Bound	Upper Bound	
Pre	3.98	0.63	3.74	4.21	0.001 (S)
3 month	3.95	0.58	3.73	4.17	
6 month	3.05	0.47	2.87	3.22	
12 month	2.01	0.58	1.79	2.23	

**Table 1**

Graph 1, showed comparison of PAI score at various time intervals among group 1. There was gradually decreased with score from pre-operative (3.98) to 12 month (2.01) which showed statistically significant results (p=0.001).

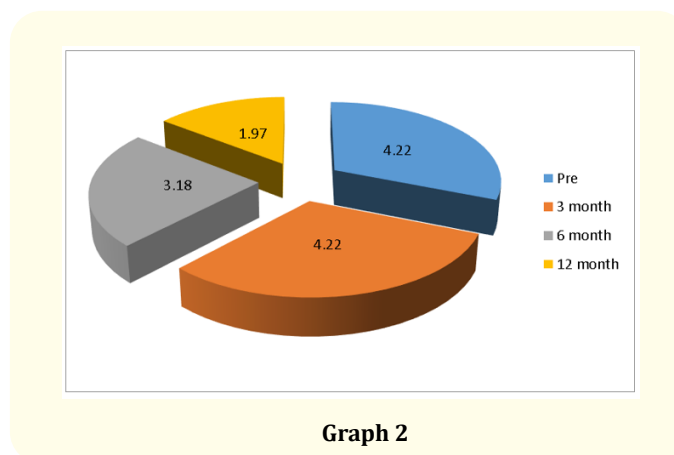


**Graph 1**

	Mean	Std. Deviation	95% Confidence Interval for Mean		P value
			Lower Bound	Upper Bound	
Pre	4.22	0.65	3.96	4.47	0.001 (S)
3 month	4.22	0.65	3.96	4.47	
6 month	3.18	0.52	2.98	3.39	
12 month	1.97	0.49	1.78	2.16	

**Table 2:** comparison of PAI score at various time intervals among group 2.

Graph 2, showed comparison of PAI score at various time intervals among group 2. There was gradually decreased with score from pre-operative (4.22) to 12 month (1.97) which showed statistically significant results (p=0.001).

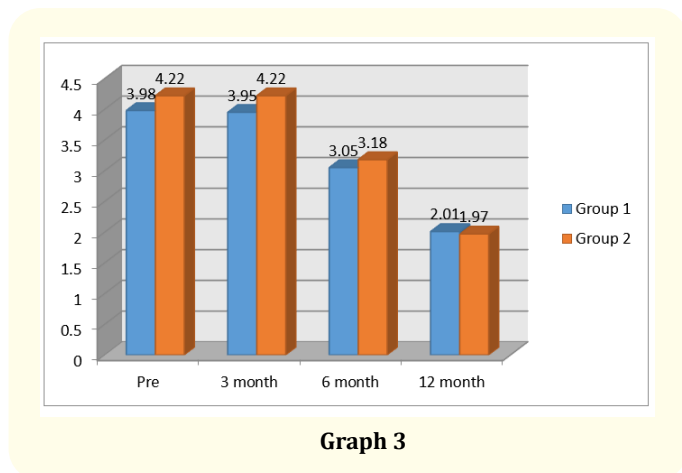


**Graph 2**

		Mean	Std. Deviation	Mean differences	95% confidence interval		P value
					Lower	Upper	
Pre	group 1	3.98	0.63	0.23	-0.57	0.1	0.16
	group 2	4.22	0.65				
3 month	group 1	3.95	0.58	0.26	0.59	0.06	0.11
	group 2	4.22	0.65				
6 month	group 1	3.05	0.47	0.13	0.4	0.12	0.3
	group 2	3.18	0.52				
12 month	group 1	2.01	0.58	0.04	0.24	0.32	0.76
	group 2	1.97	0.49				

**Table 3:** Comparison of PAI score at various time intervals among groups.

Graph 3, showed comparison of PAI score at various time intervals among groups. There was slightly difference found among 1 and 2 for comparison. So, it was showed statistically non-significant results ( $p>0.05$ ).



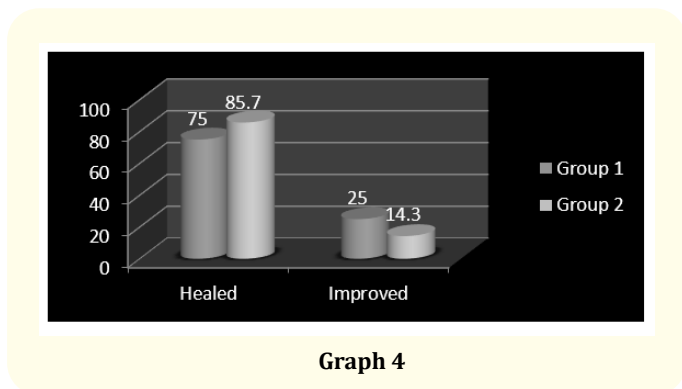
Graph 3

Table 4 and Graph 4 showed that group 2 (85.7%) had slightly more number of healed cases as compared to group 1 (75%).

	Healed	Improved	Worse
Group 1 (n=30)	21 (75)	7 (25)	0
Group 2 (n=28)	24 (85.7)	4 (14.3)	0

**Table 4:** Proportion of teeth healed, improved, unchanged or worse in each group at 12-month evaluation (on basis of number of patients).

Non-significant



Graph 4

## Discussion

The basic biological rationale for achieving ultimate success with Root canal treatment consists primarily of eliminating micro-

organisms from the entire root canal system and creating an environment that is most favourable for healing [9].

Considerable controversy exists over the question regarding difference in quality of treatment, incidence of post-treatment complications or success rates between single-visit and multiple-visit root canal treatment [3]. Hence, to date, the evidence for recommending either one or multiple-visit endodontics is not consistent [1].

In the present study, selected patients were randomly assigned into two treatment groups to avoid bias. To avoid the operator dependent error in the results, all the teeth were operated by a single operator (VK).

One of the major advantage with the multiple-visit root canal therapy is an opportunity to place an intracanal medicament. Calcium hydroxide is the current intracanal medicament of choice when an intracanal medicament is used [10]. Calcium hydroxide has limited effectiveness in eliminating microorganisms commonly associated with treatment failure i.e *E faecalis* and *Candida albicans* [11]. Some studies states its proven antibacterial properties, periapical tissue healing stimulation, and capacity to detoxify bacterial lipopolysaccharides [12].

The vehicle plays a most important role in the overall process because it determines the velocity of ionic dissociation causing the paste to be solubilized and resorbed at various rates by the periapical tissues and from within the root canal. Viscous vehicles permits slower liberation of hydroxyl ions, maintaining its action for a longer period, are preferable in teeth with periapical lesions. Oily vehicles may remain within the root canal forvery long period(i.e. 2-4 months interval) [13].

In the present study, Ca(OH)<sub>2</sub> paste, which is commercially available as CAL EXCEL, was used as an intracanal dressing for 7 days. As per the study by Sjogren., *et al* [7] day usage of calcium hydroxide medicament was sufficient to reduce canal bacteria to a level that gave a negative culture [14]. Polyethylene glycol present in this paste is a viscous vehicle, which maintains Ca(OH)<sub>2</sub> action for a longer period.

In this study, culture test was not performed before obturation in both treatment group to avoid the carryover effect of residual medicament rather than elimination of bacteria from the canal space [15].

The incidence of Endodontic Flare up is one of the major concerns when evaluating endodontic treatment alternatives [16]. During cleaning and shaping procedures; dentin chips, microorganisms, pulpal remnants, irrigating solution or necrotic debris may be pushed into the periapical region causing inflammation and post-operative pain, modern procedures have been advocated to minimize these situation [16].

Irrigation dynamics plays an important role [17]. The effectiveness of irrigation depends on the working mechanism of the irrigant and the ability to bring the irrigant in contact with the microorganisms and tissue debris in the root canal.

In this study, 2% chlorhexidine gluconate (CHX) was used as a final irrigant for 5 minutes, Chlorhexidine has the ability to bind to proteins such as albumin, which is present in serum or saliva, pellicle found on the tooth surface, salivary glycoproteins and mucous membranes. This reversible reaction of uptake and release of CHX leads to substantive antimicrobial activity and is referred to as – substantivity [18]. This effect depends on the concentration used.

In the current study, Ca(OH)<sub>2</sub> based sealer was used, which is commercially available as SEAL APEX root canal sealer. The two most important reasons for using calcium hydroxide as a root-filling material are stimulation of the periapical tissues in order to maintain health or promote healing and secondly for its antimicrobial effect of free hydroxyl ions [19].

An effective coronal seal is very important for a successful outcome after endodontic therapy. In our study, the access cavity of Two visit patients was sealed with Cavit for 7 days because of high linear expansion during setting therefore it exhibits good sealing properties [20]. Post obturation access cavity was sealed with 3M ESPE Filtek Composite restorative material. As there is a incorporation of nanofiller technology to improve physical properties.

It has been reported that subsequent to nonsurgical endodontic treatment (NSET), a follow-up of 1 year is sufficient as most of the radiographic changes are apparent within this time frame, and the “late failures” which are relatively uncommon do not have any significant influence on the overall outcome of a study [21,22]. At three, six and twelve month follow up, all the teeth were assessed clinically and radiographically.

Clinically, the absence or presence of symptoms at each follow up was noted. 24teeth in group 1 and 26 teeth in group 2 had a

preoperative diagnosis of pulp necrosis with symptomatic apical periodontitis. The remaining 6 teeth in group1 and 2 teeth in group 2 had a diagnosis of pulp necrosis with asymptomatic apical periodontitis. Several studies have reported comparable treatment outcomes in asymptomatic teeth and in teeth presenting with pre-treatment symptoms, after initial treatment and retreatment [23]. Thus, presence or absence of symptoms does not appear to influence the potential of healing after non-surgical endodontic treatment.

Clinical symptoms were rare during the follow-up period. All the Teeth in group 1 and group 2 exhibited successful clinical outcome (i.e.for spontaneous pain, presence of sinus tract, swelling, mobility, periodontal probingdepths, Tenderness on percussion). T- test showed no statistically significant difference between groups 1 and 2 at 12 months evaluation.

Results obtained with the PAI cannot be directly interpreted as measures of ‘success’ or ‘failure’; originally, the researchers reported on the extent of increase or decrease in mean scores within compared groups. However, in recent studies PAI scores are dichotomized, with scores 1 and 2 representing ‘healthy’ periapical tissues, and scores of 3 and above representing ‘disease’ [24].

In this study, the postoperative PAI scores were converted into a nominal scale by considering teeth with PAI score  $\leq 2$  as healed and decrease in PAI score from its pre operative score considered improved. Increase in PAI score from its preoperative score considered worse.

At the end of one year, 75% of teeth in group1 showed PAI score $\leq 2$  considered healed and 25% of teeth showed a reduction in the PAI score from its preoperative score were considered improved. while in group 2, 85.7% of teeth considered healed and 14.3% of teeth showed improved. None of the tooth in either group considered worse.

The periapical healing in this study could be attributed to the thorough disinfection of the canal and effective coronal seal during the procedure. The bacteria emerging from the infected root canal provide a stimulus for activation of T-lymphocytes and macrophages thus maintaining the osteoclastic signals in the lesion21It is also reported in the literature that if a canal after cleaning, shaping, and disinfection, can be maintained in a disinfected state, without recurrence of infection, the apical pathology can be healed, and a

biological barrier, composed of fibrous or cementum tissue over the root apex can be achieved [22].

On comparing PAI score at various time intervals among groups. There was slightly difference found among groups 1 and 2 for comparison shows statistically non-significant results ( $p>0.05$ ).

In the present study, although the percentage of healed teeth were more in group II than in group I, but no significant difference observed between the two groups, it could be due to the small sample size. The findings of current study clearly demonstrate that mechanical instrumentation, chemical disinfection, and obturation play an important role in healing of periapical lesions. The size of the periapical lesion was not proven to be a risk factor, larger periapical lesion may associated with a lower probability to resolve within a given period of time than a smaller lesion. Interestingly, the mean age of group 2 patients was quite younger as of group 1, state the significant change in PAI score i.e. from (4.22-1.97). In young age, periapical tissues have a rich blood supply, lymphatic drainage and abundant undifferentiated cells that afford good healing potential [25].

The insignificant results between the two groups in this study may be due to the low sample size. Properly designed randomized clinical trials are needed to further explore the results. The basic demographic characteristics of the two study groups were similar, and neither group varied significantly from the study dropouts.

## Conclusions

Under the conditions of the present *in vivo* evaluation, the following conclusions can be drawn.

Clinical symptoms were rare during the follow-up period. All the Teeth in one visit and two visit group exhibited successful clinical (i.e. for spontaneous pain, presence of sinus tract, swelling, mobility, periodontal probing depths, Tenderness on percussion) outcome at one year follow up. Both groups showed improved healing at the end of 12 months, although the percentage of healed teeth were more in two visit than in one visit.

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.

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