

Comparison of Step-Down Versus Step-Back Hand Preparation Technique of Root Canals

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Abstract

Objective: The aim of this study was to compare the frequency of flare-up in terms of post-operative pain and/or swelling, after step down and step back root canal preparation technique.

Methods: A randomized clinical trial was conducted from 28th October 2011 to 27th April 2012 in de'Montmorency College of Dentistry, Lahore. 150 patients with irreversible pulpitis were randomly allotted in two equal groups (Group A and B) and root canals were prepared with step-down and step-back technique respectively. Pain was recorded using visual analogue scale on 1st, 7th and 14th post-operative day. Data was analysed using SPSS version 17.0.

Results: In Group A, 67 patients had no flare-up and 8 patients had flare-up on 14th postoperative day. In Group B, 57 patients had no flare-up and 18 patients had flare-up on 14th postoperative day. Out of 150 patients 26 (17.33%) showed flare-up and 124 (82.66%) showed no flare-up. The overall flare-up in Group A was 10.6% and in Group B was 24% after 14 days.

Conclusions: Step-down technique is better for root canal preparation as evaluated by the comparison of flare-up by step-down and step-back techniques.

Keywords: Pain, postoperative, root canal preparation, pulpitis, visual analogue scale.

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Introduction

The basis of the endodontic treatment is to treat infected vital and necrotic dental pulps so that patients can maintain their natural teeth in form and function. For the successful endodontic therapy, the most important step in any root canal treatment is canal preparation. This is very essential step because during cleaning and shaping of root canals dentine chips, pulp tissue remnants, necrotic tissues, microorganisms and irrigation solutions may be extruded from the main canal to the periradicular tissues. It is stipulated that extrusion of the material or debris to the periapical tissues is directly related to postoperative pain and flare-up¹.

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Pulp damage is caused by dental caries, infection consequent to trauma, or infection as a result of operative procedure². Most of the time these painful teeth have to be managed by root canal treatment (RCT). The basic principles of RCT are the eradication of root canal irritant, obturation of the root canal system, and preservation of the natural dentition. The procedure can be done in single visit or multiple visits. It is directed toward the prevention and/or the elimination of the pulpal/periradicular microorganisms³.

Techniques of root canal preparation include manual root canal preparation techniques, automated root canal preparation, sonic and ultrasonic preparation, and the use of laser systems. Manual root canal preparation techniques can be broadly, divided into those techniques that adopt an apical to coronal preparation procedures and those that adopt a coronal to apical approach. Hybrid approaches have been also developed⁴.

Step-back and step-down techniques for long have been the two major approaches to shaping and cleaning procedures. Serial, telescopic or step-back techniques commence preparation at the apex with small instruments. Following apical enlargement instrumentation length may be reduced with increasing instrument size. After each step-back, the original working length file or one size smaller is reintroduced to the apex to ensure the canal patency, a procedure known as recapitulation⁴. Step-down techniques commence preparation using larger instrument sizes at the canal orifice, working down the root canal with progressively smaller instruments. Major goals of step-down techniques are reduction of periapically extruded necrotic debris and minimization of root canal straightening. Since during the step-down there is less constraint to the files and better control of the file tip, it has been expected that apical zipping is less likely to occur⁵. Postoperative pain is defined as pain of any degree that occurs after initiation of RCT, whereas flare-up has been defined as the onset or continuation of pain and/or swelling after endodontic treatment. Flare-up is subset of postoperative pain. The development of postoperative pain after RCT is usually due to acute inflammatory response in the periradicular tissues. It commences within few hours or days after endodontic treatment. It is a poor indicator of pathosis and unreliable predictor of long-term success³. Limited data is available nationally and internationally regarding pain after RCT by step-down versus step-back hand preparation technique⁵. The parameter that will help in deciding which treatment to execute will be less incidence of flare-up after RCT.

A study by Ahmed MZ assessed post-operative endodontic pain and showed incidence of 31.7% at one day after obturation in a multi visit endodontic therapy prepared in crown down manner using both rotary and manual methods in teeth with acute pulpitis⁶.

Another study by Ahmad MA compared protaper rotary and manual step-back technique in single visit endodontics in teeth with irreversible

pulpitis and/or acute apical periodontitis. The results showed an incidence of pain in 13.5% with step-down and 15.7% in protaper group within 48 hours¹.

To the best of our knowledge, there is no study available which compared the manual step down and manual step-back technique exclusively in teeth with irreversible pulpitis with no pre-existing periapical pathosis/ apical periodontitis. So, the objective of our study was to compare the incidence of post-operative pain and swelling using these two techniques in patients with irreversible pulpitis.

From the literature, it is evident that both the treatment modalities give acceptable results in the longterm follow-up, but a significant difference in short term follow-up in terms of pain and swelling, which is of our utmost concern. In addition, there is no significant difference in postoperative pain after single-visit or multi-visit root canal treatment. Therefore, we assume that flare-up, if any, is more related to the root canal preparation technique^{3,4,7}. The objective of this study was to compare the frequency of flare-up in terms of post-operative pain and swelling, after step-down versus step-back RCT.

Subjects and Methods

Study was conducted in de'Montmorency College of Dentistry/Punjab Dental Hospital Lahore from 28th October 2011 to 27th April 2012. Sample size of 150 cases; 75 patients in each group, was calculated with 80% power of test, 1% level of significance and taking expected percentage of flare-up (in terms of pain and/or swelling after one week or two) in both groups, i.e. 20% in step-down group versus 48% in step-back group.

Sampling was non-probability purposive sampling. Patients were included who had age above 16 years and single rooted tooth with symptomatic irreversible pulpitis without apical periodontitis, assessed clinically by percussion/thermal testing and radiograph. Multi rooted teeth, with apical pathosis and/or pulpal diagnosis other than irreversible pulpitis were excluded. Study design was random-

ized clinical trial. Approval from Hospital Ethical Committee was taken prior to conduct the study. All patients presenting to operative dentistry department and meeting the inclusion criteria were included in this study.

Informed consent of the patient was taken for performing various diagnostic procedures, use of photographic and radiographic records of the patients for scientific and educational purposes and publication of these materials wherever required, after explaining the expected outcome of operative procedure. Patients were randomly divided into two groups, i.e. group A, patients receiving RCT with step-down preparation and group B, patients receiving RCT with step-back preparation techniques. Patient's demographic details including name, age, gender and contact were recorded. The RCT was performed under local anaesthesia and follow-up by the researcher himself. In group ARCT was performed by step-down root canal preparation technique using Pro Taper Nickel Titanium hand files (Dentsply), after determination of working length on periapical radiograph and establishing glide path with stainless steel K file # 15 (Sybron endo).Sx was used for coronal flaring and orifice widening. Then S1 was used up to full working length and cleaning and shaping performed. Next, S2 was used. After achieving canal shaping, we shifted to F1and F2 up to full working length. Recapitulation was done after each protaper file with #15 K- File. Copious amount of sodium hypochlorite (NaOCl) was used in between each instrument change. Ethylene Diamine Tetra Acetic Acid (EDTA) was used as a lubricant and for the removal of smear layer with each file.

In Group B, RCT was performed by step back root canal preparation technique using Stainless Steel hand K files, after determination of working length with stainless steel k file # 15 on periapical radiographs. After apical preparation until master apical file (MAP), each successive file was used 1mm shorter with recapitulation in between file changes and irrigation with NaOCl and EDTA as lubricant.

Patients were recalled for follow-up on 1st, 7th day and 14th day after root canal preparation for assessment of flare-up, if any; pain > 0 at any time during this period and/or swelling on 1st, 7th and 14th day post-operative visit will be considered as flare-up. All the observations were entered on pre-formed proforma (Annexure I).

Data was entered & analysed by using SPSS version 17.0. Mean and Standard Deviation was calculated for quantitative variables like age. Frequencies and percentages were computed for categorical variables such as gender and flare-up. Both the groups were compared for the frequency of flare-up, if any, using a chi-square test (p-value ≤ 0.05 as significant).

Results

The demographic data regarding gender distribution is summarized in Table 1. The sample of one hundred and fifty patients included the age range from 18 to 65 years with mean age of 40 years. The mean average age of patients in group-A was 40.57 + 10.40 years and 40.66 + 12.13 years in group-B.

Postoperative flare-up was assessed and documented after 2 weeks of the procedure. Results were declared on the 14th day. Patients were followed at day 1st, 7th and 14th day postoperatively (2 weeks). Out of 150 patients, 41 patients had flare-up on 1st post-operative day which reduced on next follow-up appointments. No patient developed flare-up after 1st post-operative day.

The difference between two groups was highly significant in terms of post-operative flare-up. The data is summarized in table 4.

Table 1. Distribution of patients by gender

Gender	Frequency	Percent
Females	63	42%
Males	87	58%
Total	150	100%

Table 2. Distribution of patients by flare-up in group A (Step-down)

Flare-up	Frequency	Percentage
No	67	89.4%
Yes	8	10.6%
Total	75	100%

Table 3. Distribution of patients by flare-up in group B (Step-back)

Flare-up	Frequency	Percentage
No	57	76%
Yes	18	24%
Total	75	100%

Table 4. Comparison of post-operative flare ups in both groups

	1 st day	7 th day	14 th day	p-Value (14 th Day)
Group A	14/75 (18.6%)	11/75 (14.6%)	8/75 (10.6%)	0.0001
Group B	27/75 (36%)	24/75 (32%)	18/75 (24%)	
Total	41/150 (27.33%)	35/150 (23.33%)	26/150 (17.33%)	

Discussion

One of the most important steps in root canal treatment is cleaning and shaping of the root canal. Cleaning is necessary to remove all the pulp tissue, necrotic debris, microorganisms and the infected layer of dentine from the canal walls, whilst shaping involves the enlargement of the canal system to facilitate the placement of a root filling⁸.

Endodontic treatment can be followed by numerous short and long-term complications. Some of the problems of RCT are post obturation pain, inter appointment pain and swelling. Post obturation pain is the pain of any degree after endodontic treatment⁹.

Cleaning and shaping of the root canal system can be accomplished by mainly two types of approaches step-back and step-down. Step-back method involves the preparation of the pulp space from the apical to the coronal part of the radicular canal, whereas it is reverse in case of step-down method. Both hand and rotary files can be used with either of the methods¹⁰.

All preparation techniques and instrumentation have been reported to be associated with extrusion of infected debris, irrespective of the preparation being maintained short or up to the apical terminus. The difference resides in the fact that some techniques extrude more debris than the others do¹¹.

Postoperative flare-up is the development of pain or swelling within few hours or days after RCT³. Different scales and methods have been used for the assessment of pain after endodontic therapy. Among them, the visual analogue scale (VAS) is considered to be a valid and reliable ratio scale for measurement of pain⁴. In our study we have compared the frequency of flare-up in terms of post-operative pain and/or swelling, after step-down versus and step-back root canal preparation technique, using visual analogue scale. In our study male gender predominated i.e. 87(58%). This is consistent with the study conducted by Martín-Gonzalez et al¹² which also shows that male predominated in the study i.e. 57.5%. Another study was conducted by Ali et al¹³ which showed similar results i.e. 55.3% were male. A study conducted by Khan et al¹⁴ showed that male predominated in the study i.e. 57.3%. Similar results were shown by Jabeen et al⁹ which documented that 53.3% were males. A study conducted by Elmubarak et al³ showed female predominance i.e. 62.4% female. Another study conducted by Christopher and Emmanuel¹⁵ also showed female predominance i.e. 60%.

In our study mean age of patients was 40 ± 10 years. This is consistent with a study conducted by Alonso-Ezpeleta et al¹⁶ in which the mean age of the patients was 42 ± 14 years. Another study conducted by Martín-Gonzalez et al which showed that most of the mean age was 40.2 ± 16.5 years. A study conducted by Ince et al¹⁷ revealed the average age of patients was 45 years. In another study conducted by Molander et al¹⁸ showed the mean age of 55 years.

In our study, we found that patients treated with step-down root canal preparation technique had fewer flare-ups as compared to step-back technique. We declared our results on 14th post-opera-

tive day. 10.6% patients had flare-up with step-down technique on 14th post-operative day and 24% patients had flare-up with step-back technique on the 14th day post-operative. In a similar study conducted by Ozer⁷, there was 20% flare-up with step-down technique and 48% flare-up with step-back technique within two weeks during the root canal treatment session. There was statistically difference between step-down and step-back techniques as shown in Ozer's study.

We also noted the flare-up on the 1st and 7th post-operative days. In our study on 1st post-operative day, 18.6% patients had flare-up in step-down technique, whereas 36% had flare-up with step-back technique. This is similar to the study conducted by Mustafa¹⁹ in which step-back technique reported a significantly higher incidence of postoperative pain after two days i.e. 6.5% flare-up in step-back and 2.4% flare-up in step-down root canal preparation technique. In another study conducted by Ahmed MA¹, there was not statistically significant difference in pain between the two techniques although patients treated with step-down technique had fewer flare-ups as compared to step-back i.e. 13.3% flare-up in step-down and 15.7% flare-up in step-back technique. Al Negrish⁴ found that there was 10.6% flare-up with step-back technique and 8.6% with step-down on 2nd postoperative day.

In our study, on 7th postoperative day, 14.6% patients had flare-up with step-down and 32% had flare-up with step-back technique. Our study is similar to the study conducted by Al Negrish⁴ who also showed greater flare-up with step-back technique on the 7th postoperative day i.e. 3.5% flare-up with step-back and 1.7% flare-up with step-down. In another study conducted by Al-Jabreen²⁰, no patient (0%) had flare-up with step-down and 4% had flare-up with step-back technique.

In another study conducted by Martín-González¹¹ 18.2% patients had flare-up with step-back and 9.1% patients had flare-up with step-down root canal preparation technique.

Conclusions

Within the limitations of this study we conclude that the step-down technique, besides being less time consuming and cost effective, also gives rise to less postoperative endodontic complications and better results as compared to step-back technique and thus is more appropriate when indicated.

Conflict of Interest

Authors have no conflict of interests and no grant/funding from any organisation.

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