

Evaluation of the Radiographic Quality of Obturation Performed by Rotary Method and Conventional Method (Randomized Clinical Trial)

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ABSTRACT

INTRODUCTION

The study aimed to assess the radiographic quality of root canal obturation in teeth prepared with Protaper (Endo motor IPEX Endo 8.7 VDC China) rotary endodontic method *versus* conventional endodontic method with H-files and reamers (Mani Japan).

METHOD

Total 64 patients aged between 18 years to 60 years reporting to operative dentistry department of PIMS hospital Islamabad, requiring endodontic treatment in anterior teeth and premolar were selected based on the inclusion criteria after thorough clinical and radiographic assessment.

Group I was prepared by Protaper rotary system. Group II was prepared with conventional system using hand files. Obturation of both groups was performed with conventional Gutta percha (meta bonded) points using calcium hydroxide-based sealer (Acroseal; septodont) using cold lateral condensation technique. Postobturation periapical radiographs were taken using paralleling technique with the help of Endoray device. Quality of obturation was examined on radiograph by using X-ray film illuminator with magnifying glass of 2x magnification.

RESULTS

Among 64 patients the mean and standard deviation of the age was 36.28 ± 12.81 years. Amongst 32 teeth of group, I prepared by rotary method 27 (84.375%) had adequate length, 4 (12.5%) were under filled and 1 (3.125%) was overfilled. With respect to density in Group I, 30 (93.75%) had adequate density while 2 (6.25%) had inadequate density. With respect to taper in Group I, 32 (100%) had adequate taper. While amongst 32 teeth of Group II prepared by manual method, 17 (53.135%) had adequate length, 12 (37.5%) were under filled, 3 (9.375%) were overfilled. With respect to density in Group II, 23 (71.875%) had adequate density while 9 (28.125%) had inadequate density. With respect to taper in Group II, 29 (90.625%) had adequate

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taper while 3 (9.375%) had inadequate taper. All the three qualities of ideal obturation were found in 48/64 (75%) patients, any two qualities were found in 13/64 (20.3%) patients while any one quality was found in 3/64 (4.7%) patients. Obturation quality in both groups i.e., Rotary method (Group I) and Conventional method (Group II) was not found significantly different. (p-value 0.108).

CONCLUSION

It is concluded that the obturation quality of root filling in teeth prepared by rotary as well as conventional endodontic methods has no statistically significant difference. So, it can be stated that both methods are equally efficient in terms of control of length, taper and density of endodontic filling evaluated by radiograph.

KEYWORDS

Endodontic; Rotary system and conventional system; Radiographic quality of obturation; Radiographic assessment

INTRODUCTION

Endodontic therapy is necessary to conserve a tooth whose pulp has been damaged irreversibly. Successful root canal treatment retains the tooth as a functional unit in the oral cavity. Root canal treatment is considered successful if clinical sign and symptoms are relieved and also there is radiographic evidence of periapical healing [1]. Literature has shown that technical quality of obturation plays an important role in the prognosis of a root canal treatment [2]. Thus, technical quality of root canal filling can be used as a means to evaluate the prognosis of root canal treatment. Multiple criteria have been used for the evaluation of technical quality of root filling. These criteria are based either on clinical evaluation of sign and symptoms or the radiographic evaluation of the treated teeth. Evaluation of post obturation radiographs is one of the methods to evaluate the technical quality of obturation [3-6]. Several variables affect the technical quality of root fillings, such as the length of the filling material in relation to the radiographic apex, the density of the root filling material (presence of voids) and the taper of the canal [7]. These characteristics of root canal filling should be evaluated on radiographs to judge the technical quality.

American Association of Endodontists drafted in 2009 that "For radiographic evaluation of root canal fillings, the three qualities that should be observed are: length, taper

and density. The length of an ideal fill should be from the canal's apical minor constriction to the canal orifice unless a post is planned. The shape of the completed case is somewhat dependent on the instrumentation technique being used. Voids should not be visible on the radiographic image [8]. The introduction of nickel-titanium (NiTi) 4' rotary files to Endodontics almost two decades ago has changed the way root canal preparations are performed; enabling more complicated root canal systems to be shaped with fewer procedural errors [8].

ProTaper instruments may be used safely and effectively by dental students and both inexperienced and experienced NiTi rotary users. The ProTaper instruments provide unique geometries that when sequenced and used correctly, afford extraordinary flexibility, efficiency, safety, simplicity and thus helps in creating tapering canals. The tip of rotary Protaper instruments is modified non cutting making it less aggressive. This allows each instrument to accurately follow a smooth reproducible glide path and thus enhance its ability to control the length of canal. The tactile sensations of various preparatory systems are different that has an effect on controlling canal length and preparation.

Proper condensation of gutta percha and sealer is dependent on the canal preparation. If the canal preparation is ideal only then the root filling material can

be compacted into the canals without voids and spaces. Proper glide path will help the root filling to be condensed up to the level of estimated working length.

Several endodontic epidemiological studies had been carried out in different population groups to assess technical quality of root filling using standard step back canal preparation technique followed by lateral condensation for canal obturation [1,3,4,6,7] and also many comparative studies are available to assess and compare various rotary systems but the present study was done to evaluate the obturation quality between Protaper rotary and conventional instrumentation technique in clinical practice as very limited studies are yet available that compares these both systems.

MATERIAL AND METHODS

Total of 64 subjects were selected on the basis of inclusion and exclusion criteria from the patients reporting to the Operative Dentistry Department, SZABMU, PIMS, Islamabad. Patients of either gender having age between 18 years to 60 years requiring endodontic treatment in anterior teeth and premolars were included in the study while teeth with vertical fracture, obliterated canals, poor periodontal status, incompletely formed apices and retreatment cases were excluded from the study. Extent of carious lesion, periodontal status, and occlusal relationship were clinically examined in a dental unit under good light, using mouth mirror and periodontal probe.

An informed written consent of the patient was obtained as per patient consent Performa attached as Annexure B.

Data was kept confidential as no name of the patient was used. Treatment given to the patient was only for his/her benefit as it was the treatment of their chief complaint. There was no harm of the treatment. The selected 64 subjects were randomly divided into two groups (n = 32 per group) with the help of computer-generated table of

random numbers. Group I was prepared by rotary system (Endo Motor; ipexendo; 8.7 VDC, China). While Group II was prepared with conventional system using hand files i.e., H-files and reamers (Mani, Japan).

Group I Canal Preparation Method

After patient selection, isolation with rubber dam, local anesthesia and access opening of the tooth, requiring root canal therapy, was established. Copious continuous canal irrigation as done in every step. After negotiation and pulpectomy of the root canal, working length of the canal was determined with the help of periapical radiograph with paralleling device. Then glide path was established with the help of # 20 K file having ISO taper of 0.02. Once the glide path was formed the canals were first prepared with the initial shaper files of rotary endodontic system in the sequence of Sx, S1 and S2. The finishing files of rotary endodontic system namely F1, F2 and F3 were then selected and used for final preparation according to the diameter and configuration of the canal. Recapitulation was done between each progressing file.

Group II Canal Preparation Method

After patient selection, isolation with rubber dam, local anesthesia and access opening of the tooth, requiring root canal therapy, was established. Copious continuous canal irrigation was done in every step. After negotiation and pulpectomy of the root canal, working length of the canal was determined with the help of periapical radiograph using paralleling device. After working length, the canal preparation was done with the help of ISO hand files including H files and reamers. Recapitulation was done between each progressing file.

Both the groups (group I and group II) were then obturated with conventional gutta percha (meta bonded) points using cold lateral condensation method using calcium hydroxide-based Sealer (Acroseal; septodont).

Postoperative periapical radiographs of root canal treated

teeth were obtained immediately after the obturation with paralleling technique using paralleling device (safe and sure). The quality of root fillings was evaluated according to the distance between the end of the filling and the radiographic apex (control of length), the density of the filling and the taper of the root filling using the criteria of Barrieshi Nusaretal (Figure 1) [9], and on the basis of this criteria a scoring system (T-score) [9], was made to score technical quality of root filling (Figure 2). The detection of control of length, voids and taper was done by examination of postobturation radiographs by using X-ray film illuminator with magnifying glass of 2x magnification. Radiographic evaluation of post obturation radiograph was analyzed by a third person who was not aware of the procedure and groups. Operator bias while observing voids and taper was eliminated by showing the radiographs only to a single evaluator. Blinding was done on data analysis level.

All the data collected was entered and analyzed using Statistical Package for Social Sciences (SPSS version 23). Mean and standard deviation were calculated for quantitative variables like age. Frequency and percentages were presented for qualitative variables like gender, T-score and obturation quality (control of length, density and taper of root canal). Chi square test was used to compare obturation quality of both the conventional method and rotary method. P-value <0.05 was considered significant.

RESULTS

Among 64 patients, the minimum age was 18 years and maximum age was 60 years with mean and standard deviation of the age was 36.28 ± 12.81 years. Males were 23/64 (35.9%) while females were 41/64 (64.1%).



Figure 1: Post obturation radiograph of lower left first premolar prepared by rotary method (group I) showing adequate length, density and taper.

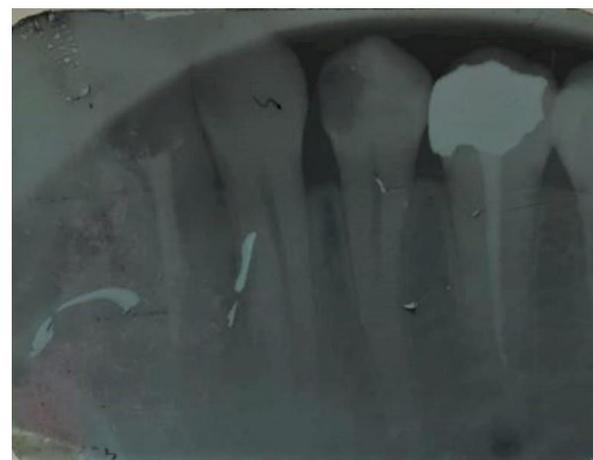


Figure 2: Post obturation radiograph of lower left lateral incisor prepared by rotary method (group I) showing underfilled obturation with adequate density and taper.



Figure 3: Post obturation radiograph of lower left second premolar prepared by rotary method (group 1) showing adequate length, inadequate density and adequate taper.

Amongst 32 teeth of group I was prepared by rotary method 27 (84.375%) had adequate length, 4 (12.5%) were under filled and 1 (3.125%) was overfilled. With respect to density in group I, 30 (93.75%) had adequate density while 2 (6.25%) had inadequate density. With respect to taper in group I, 32 (100%) had adequate taper. While amongst 32 teeth of group II prepared by manual method, 17(53.135%) had adequate length, 12(37.5%) were under filled, 3(9.375%) were overfilled. With respect to density in group II, 23 (71.875%) had adequate density while 9 (28.125%) had inadequate density. With respect to taper in group II, 29 (90.625%) had adequate taper while 3 (9.375%) had inadequate taper (Figure 4 - Figure 6).



Figure 4: Post obturation radiograph of upper right central incisor prepared by conventional method (group II) showing adequate length, density and taper.

All three qualities of ideal obturation were found in 48/64 (75%) patients, any two qualities were found in 13/64 (20.3%) patients while any one quality was found in 3/64 (4.7%) patients. Obturation quality in both groups i.e., Conventional method and Rotary method was not found to vary significantly having p-value 0.108.



Figure 5: Post obturation radiograph of upper left central incisor prepared by conventional method (group II) showing adequate length, inadequate density and adequate taper.



Figure 6: Post obturation radiograph of upper left first premolar prepared by conventional method (group II) showing inadequate length, inadequate density and adequate taper.

DISCUSSION

The prognosis of root canal treatment (RCT) depends on many variables; amongst them is the technical quality of the root filling [9]. During the last decade, endodontic therapy went through a fascinating development. The introduction of rotary nickel titanium instruments, and

Protaper enabled the practitioner to better shape the root canal system.

This current study was conducted to compare the radiographic obturation quality in single rooted teeth (incisors, canines, premolars) between two techniques of root canal preparation (rotary vs conventional method). No statistically significant difference was observed between two groups. Frequency of cases that were adequately filled appeared to be more in rotary group. Frequency of over filled and under filled cases were more in conventional group (manual). This finding was in corroboration with the findings of Govindaraju et al. [10] who reported the same results for the obturation quality in manual instrumentation vs rotary Protaper system.

Kleier DJ et al. [11] conducted a study in order to compare clinical outcomes using a nickel titanium rotary and stainless-steel hand file instrumentation technique. They found that when the rotary file technique was substituted for the hand file technique, appointment time for case completion was significantly decreased ($P < 0.001$) and overall quality of Mandibular mesial root obturations were significantly increased [11]. In the present study, the obturation quality showed no statistical difference between rotary and conventional preparation techniques.

Studies that addressed the lateral adaptation of the root filling as a criterion generally agreed that if void was present between the filling and the canal walls, the filling should be categorized as inadequate. Kirkevang et al. [12] reported that inadequate density may lead to failure of RCT because of microleakage along the root filling.

Similarly, Eriksen & Bjertness [13] stated that the prevalence of apical periodontitis was higher in root filled teeth with poor densities. The result of the present study indicated that adequate density without voids was achieved in 30 teeth (93.75%) and 23 teeth (71.875%) in rotary and manual canal preparation technique respectively. Similarly, Yoldas et al. [14] reported

adequate density without voids was 64% and Sagsen et al. [15] reported 53%. In an *in-vivo* study performed by Makarem et al. [16] on comparing the quality of root filling of rotary and manual instrumentation in mandibular second primary molars, similar results were found between both techniques; however, the quality of rotary instrumentation was more favorable for the mesial canals.

The present study showed no significant difference in obturation quality between the two groups. A study performed by Robia G [9] in 2014, in which they did comparison on the radiographic obturation quality performed by rotary versus conventional method on the basis of same parameters as in our study. They found rotary endodontic method significantly better than the conventional endodontic method [9]. In our study no significant difference was found in both groups. In another study, radiographic technical quality of root canal treatment was observed performed by a new rotary single file system conducted by Marco Columbo et al. [17] in 2017. Overall results showed 60.8% of cases had a good quality of root filling (defined as adequate length, density and taper). Comparing the results with our study, 84% of cases prepared with Protaper rotary endodontic system have shown all three qualities of ideal obturation.

In a study of Negar Mokhtari et al. [18] conventional pulpectomy was compared with a rotary technique. The results for the quality of instrumentation and root filling comparing the conventional and rotary system showed no significant difference (P value = 0.787) and also in our study where the comparison of obturation quality was done between rotary and conventional method, the result showed no significant difference between the two groups having (P value = 0.108) [18]. Based on the performed study it can be argued that obturation quality in rotary system has shown no significant difference in terms of control of length, density and taper when compared with conventional system.

CONCLUSION

It is concluded that the obturation quality of root filling in teeth prepared by rotary as well as conventional endodontic methods has no significant difference. So, it can be stated that both methods are equally efficient in

terms of control of length, taper and density of endodontic filling evaluated by radiograph and can be equally used for performing successful root canal treatments in dentistry.

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