

Comparative Evaluation of Clinical & Radiographic Success Rate of Hand Protaper vs Rotary Protaper in Single Visit Root Canal Treatment on Non-Vital Teeth with Periapical Radiolucencies: 12 Month Follow-Up Study

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ABSTRACT

Background Several hand instruments and rotary systems have been evaluated for success and failure of single visit root canal treatment. Moreover; studies focusing on the comparison of the effectiveness of rotary systems versus hand instrumentation have yielded mixed results in the terms of clinical and radiographic success of single visit root canal treatment. However; most dentist they reserve single visit root canal treatment for vital pulp. Therefore; in this study we have evaluated the success rate of single visit root canal treatment on teeth with non-vital pulp.

Aim: The aim of study was to determine the clinical and radiographic success rate of single visit root canal treatment performed on non-vital tooth along with periapical radiolucency ranging from 0-2 mm in diameter by hand and rotary protapers.

Methods & material: 40 single rooted non-vital teeth with single root canal from the patients in the age range of 30-40 years were selected for the study. Single visit endodontic treatment was done in all the teeth with hand & rotary protaper. Two groups were made with 20 patients each. Group A treatment was done with hand protaper and group B with rotary protaper. Zinc oxide eugenol sealer and Lateral condensation technique was used to obturate the canals. All the patients were given the recall at 6 and 12 month interval, to decide the clinical and radiographic success of treatment done.

Result: Both hand & rotary protaper group showed 100% success rate at 6 month recall, there was no statistically significant difference ($p>0.05$) of success rate in the two groups at 6 month recall. At 12 month recall hand protaper group showed 100% success rate, while rotary protaper group showed a success rate of 85%. The difference of success rate at 12 month in the two group was not statistically significant ($p>0.05$). Chi-square test and Kruskal Wallis test were used for statistical analysis.

Conclusion: One visit endodontics can be performed on teeth with necrotic pulp and/or associated with small periapical lesions with hand and rotary protaper.

Received: Nov. 25, 2017; Accepted: Dec. 30, 2017

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Keywords: NiTi instruments, Crown-Down technique, Multiple Taper, Convex Triangular Cross Section.

INTRODUCTION

Endodontics is the branch of clinical dentistry associated with the prevention, diagnosis and treatment of pathosis of the dental pulp and their sequelae. The concept of single visit endodontics (SVE) started at least 100 years back. SVE implies to cleaning, shaping and disinfection of the root canal system followed by the obturation of the root canal at the same appointment [1]. Until 1970's opinion opting single visit against multiple visit procedures were based on few clinical observations and inadequate scientific studies. However some studies compared the success and failure between single and multiple visit endodontic procedures and found no difference in both the groups. The failure rate was higher in teeth being retreated [2, 3].

With the evolution of newer techniques, instruments, materials and better understanding of the canal anatomy, the way endodontics has been progressing is totally changed now days. The newer cervical flaring techniques like 'crown down' technique has proved to extrude minimal amount of debris beyond the apex compared to conventional step back technique further eliminating the chances of postoperative pain and curtailing the inflammation [3].

The protaper system is available in the form of hand-operated instruments and rotary instruments. They are recommended for use in 'reaming' or "modified balance force" motion [4]. The mechanical stresses acting on a hand operated instrument might differ from those on engine-driven instruments. Engine-driven instruments operate in continuous rotation and are mainly subjected to unidirectional torque; whereas hand protaper instruments can be used in alternated clockwise and counter clockwise motion [5]. Hence, the aim of this study was to determine the clinical and radiographic success rate of single visit root canal treatment performed by rotary and hand protaper using contemporary techniques of canal cleaning, shaping and obturation.

MATERIALS AND METHODS

The present study was conducted in the department of conservative dentistry & endodontics, ACPM

dental college, Dhule, Maharashtra from march 2010 to june 2011, with the objective to determine the clinical and radiographic success rate of single visit root canal treatment performed by rotary and hand protaper using contemporary techniques of canal cleaning, shaping and obturation.

40 maxillary or mandibular single rooted teeth with single root canal and non-vital pulp tissue along with periapical radiolucency ranging from 0-2 mm in diameter in both male and female patients with the age range between 30-40 years were selected for the study. Oral and written informed consent was obtained from all the study participants. Preoperative diagnostic information was obtained. Out of 40 patients, first 20 single rooted non-vital teeth, the treatment was done with hand protaper (group A) and next 20 treatment was done with rotary protaper (group B). Intraoral periapical radiograph (IOPA) was taken by standardised paralleling angle technique. Radiograph was taken preoperatively and at 6 month and 12 month recall. Periapical radiolucency was measured by two observers, before the start of treatment that is preoperatively and at 6 month and 12 month recall with the help of geometry divider and scale.

Inclusion criteria:

Maxillary or mandibular single rooted non-vital teeth with single root canal were selected for the study and all the teeth had periapical radiolucencies ranging from 0-2 mm in diameter.

Exclusion criteria:

Patients with age below 30 years and above 40 years and with any kind of systemic diseases and retreatment cases were excluded from the study. Teeth with more than one canal, vital pulp tissue and periapical radiolucencies greater than 2mm in diameter were also excluded from the study.

A total of 40 teeth were selected and divided into two group according to the type of protaper file to be used, Group A of 20 teeth (hand protaper) [DENTSPLY Maillefer, Switzerland] and Group B of 20 teeth (rotary protaper) [DENTSPLY Maillefer, Switzerland]. After access cavity preparation, pulp chamber was flooded with 5.25% of Naocl solution. Canal patency was establish with No.10 or 15 K file.

17% EDTA was used as lubricant and 5.25% NaOCl, saline as irrigants. Working length was obtained by apex locator (IPEX, NSK, JAPAN). Files in both the groups were used in a sequence of Sx-S1-S2-F1-F2-F3. After instrumentation was complete, canals were dried with paper points and then obturation was done with gutta-percha cones and zinc oxide eugenol sealer (Tubli-seal, Sybron-Endo), using cold lateral condensation technique.

Recall period of 6 month and 1 year was given to all patients from the day of treatment to evaluate the clinical condition and radiographic healing. Success or failure of root canal treatment was determined by criteria of **Field & Gutmann (2004) [6]**.

Table 1: Guidelines for clinical success and failure (Gutmann 2004)

Clinical success		Clinical failure	
1	No tenderness to percussion or palpation.	1	Persistent subjective symptoms.
2	Normal mobility.	2	Recurrent sinus tract or swelling.
3	No sinus tract or periodontal disease.	3	Predictable discomfort to percussion or palpation.
4	Tooth function.	4	Evidence of irreparable tooth fracture.
5	No signs of infection or swelling.	5	Excessive mobility or periodontal breakdown.
6	No evidence of subjective discomfort.	6	Inability to function on the tooth.

Table 2: Guidelines for radiographic success and failure (Gutmann 2004).

Radiographic success		Radiographic failure	
1	Complete healing that is normal to	1	No healing that is no change or increase in

	slightly thickened periodontal ligament space.		lesion size.
2	Incomplete healing that is reduction in lesion size.	2	Increased width of periodontal ligament space.
3	Elimination of previous rarefaction.	3	Lack of osseous repair within rarefaction or increased rarefaction.
4	Normal lamina dura in relation to adjacent tooth.	4	Lack of new lamina dura.
5	No evidence of resorption.	5	Presence of osseous rarefaction in periradicular areas where previously none existed.

Teeth which showed all the parameters from clinical and radiographic success column at 6 month and 12 month recall were called as a successful treatment, while the teeth which showed absence of any of the parameters from the clinical and radiographic success column and/or presence of any of the parameters from the clinical and radiographic failure column at 6 month and 12 month recall were called as a failed treatment.

RESULT

On 6 month recall follow-up of 20 patients with hand protaper, 2 did not come for recall, while in 18 patients (90%) success of treatment was found. In rotary protaper group 1 patient had not come on 6 month recall, while 2 patients got their teeth extracted. Remaining 17 patients (85%) had success of treatment. The difference in the follow-up at 6 month recall in the two group was not statistically significant ($p > 0.05$).

Table 3: Distribution of patients in both groups according to 6 month recall.

Treatment		Recall at 6 month			Total
		Not came	Success	Tooth extracted	
Hand Protaper	N	2	18		20
	%	10.0%	90.0%		100.0%
Rotary Protaper	N	1	17	2	20
	%	5.0%	85.0%	10.0%	100.0%
Total	N	3	35	2	40
	%	7.5%	87.5%	5.0%	100.0%

At 12 month recall those patients with hand protaper, all 20 had success of treatment. 2 (10%) patients from rotary protaper group had not come on recall out of 20, 1(5%) patient the failure was noted. While in 17 (85%) there was a success of treatment. This difference of the outcome of the treatment at 12 month recall in between two groups was not statistically significant ($p>0.05$).

Table 4: Distribution of patients in both groups according to 12 month recall.

Treatment		Recall at 12 month			Total
		Not Came	Failure	Success	
Hand Protaper	N			20	20
	%			100.0%	100.0%
Rotary Protaper	N	2	1	17	20
	%	10.0%	5.0%	85.0%	100.0%
Total	N	2	1	37	40
	%	5.0%	2.5%	92.5%	100.0%

On comparison of success rate of the treatment it was found that all 18 (100%) patients with hand protaper and 17 (100%) of rotary protaper had success at 6 month recall. There was no statistically significant difference ($p>0.05$) of success rate in the two groups at 6 month recall.

At 12 month recall all 20 (100%) patients with hand protaper had success and of 18 with rotary protaper 17 (94.4%) had success and 1 (5.6%) had failure at 12 month recall. The difference of success rate at 12 month in the two group was not statistically significant ($p>0.05$).

Table 5: Success rate at 6 & 12 month in both the groups.

Treatment		Recall at 6 month	Recall at 12 months	
		Success	Success	Failure
Hand Protaper	N	18	20	
	%	100.0%	100.0%	
Rotary Protaper	N	18	17	1
	%	100.0%	94.4%	5.6%
Total		36	37	1

Test statistics

	Recall at 6 month	Recall at 12 months
Chi-Square	.000	1.111
Df	1	1
P Value	1.000	.292
Significance	N.S ($p>0.05$)	N.S ($p>0.05$)

DISCUSSION

Protapers are currently one of the most successful file line available as evidenced by their extensive utilization internationally. In 1995 the engineers from Maillefer, Dr Pierre Machtou, John West and Clifford Ruddle envisioned three shaping and three finishing files with unique geometries. The shaping files are designed for the purpose of enlarging coronal and middle third of the root canal. The finishing files prepare the apical third after most of the dentin has been removed with the shaping files. Protapers are at present the only multiple taper instruments that are available in both engine-driven and hand operated version (Ruddle CJ 2002) [7]. This design improves flexibility, decrease the engagement zone and limits finishing files working in their apical extent. Importantly, a decreasing percentage tapered design respects external root concavities, reduces the possibility of over preparing the coronal two-third of the canal and maximize remaining dentin (Ruddle CJ 2005) [8].

The Protaper files are used in crown-down technique/pre-enlargement technique to avoid stress on instruments by early opening of the coronal part of the root canal. In crown-down technique, once the coronal two-third of the canal has been optimally shaped, then the apical one-third of the canal is negotiated and working length is

established. In our study we had followed this well known crown-down technique with hand protaper and rotary protaper files [9, 5].

Nickel titanium files are five times more likely to achieve success than stainless steel files because they maintain the original canal shape during instrumentation (Pettiette MT & Delano EO et al 2001) [10]. NiTi instruments can predictably enlarge root canals while maintaining the original path, to sizes not routinely available with stainless steel files. Since larger preparation removes more bacterial cells, a higher rate of treatment success are expected (SM Londhe & HG Garge 2007) [11].

At 12 month recall 6 females from hand protaper group and 10 females from rotary protaper group had 100% success rate. Also 100% success was seen in 14 males treated by hand protaper. In rotary protaper group success rate in males was 87.5% and failure rate was 12.5% at 12 month recall. These findings of our study were similar to that of (Rashid A 2008 & Smith CS, Setchell DJ et al 1993) who reported the higher failure rate in females than in males, but it was not statistically significant because there were 201 females and only 121 males [12, 13].

In our study, treatment was done on patients with age group between 30 to 40 years. At 12 month recall mean age of patients who succeeded the treatment by hand protaper was 33.2 years and by rotary protaper was 32.3 years. These finding of our study was similar to that of (**Andreasen JO & Andreasen FM 1994**) who stated that wound healing is faster and regeneration is more complete in younger than in older individual [14].

Sjogren et al (1997) and Ashkenaz (1979) also included single rooted teeth in their study and found success rate of 83.3% and 97.0% respectively[15, 16]. Runder & Oliet (1981) divided the data by tooth type and found slight increase in success when going from molars to anteriors teeth (85.7% in molars, 90.4% in premolars and 91.8% in anterior teeth) [54]. The findings of our study are similar to those **Sjogren et al (1997), Ashkenaz (1979), Runder & Oliet (1981)** who noticed high success rate with both hand and rotary protaper on single rooted non-vital teeth with single canal, in which most of the teeth were anterior [15, 16, 17].

Limitation

Within the limitation of study, single visit RCT can be performed on non vital teeth with periapical pathology ranging from 0-2 mm in diameter. However more such studies are needed in future, to further correlate single sitting RCT in non vital tooth with periapical pathology.

CONCLUSION

Within the limits of this study, the use of hand and rotary protaper systems in preparing single rooted teeth in single appointment therapy showed a high success rate. Single visit endodontics can be performed on teeth with necrotic pulp and/or associated with small periapical lesions with hand and rotary protaper. However; long term studies with big sample sizes should be performed to further correlate the healing of periapical lesions.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Garg A, Garg N. Textbook of endodontics. 1st ed.
2. Ingle J, Bakland L, Baumgartner C. Endodontics 6. 6th ed.
3. Grossman L, Oliet S, Rio C. Endodontic practice 11th ed.
4. Tseng PSK. Root canal preparation with hand protaper. Contemporary endodontics. Hong Kong, China: Dentsply Asia, 2004: 14 – 6.
5. Damiano P, Nicola S, Lorenzo T, Federica E, Elio B. Hand-operated and rotary protaper instruments: A comparison of working time and number of rotation in simulated root canals. Journal of Endodontics 2008; 34: 314 – 317.
6. Field J, Gutmann J, Solomon E, Rakusin H. A clinical-radiographic retrospective assessment of the success rate of single-visit root canal treatment. International Endodontic Journal 2004; 37: 70-82.
7. Ruddle C. The protaper technique. Endodontic Topic 2005; 10: 187-190.

8. Ruddle C. Cleaning and shaping of root canal system. In pathways of pulp 8th ed. St Louis: Mosby 2002; 232-291.
9. Gandhi A, Gandhi T. Comparison of canal transportation and centering ability of hand protaper files and rotary protaper files by using micro computed tomography. RSBO 2011; 8: 375-380.
10. Pettiette MT, Delano EO, Trope M. Evaluation of success rate of endodontic treatment performed by students with stainless steel k-files and nickel-titanium hand files. Journal of Endodontics 2001; 27: 124-127.
11. Londhe SM, Garge HG. Siingle visit root canal treatment. Journal of Endodontics 2007; 63: 273-273.
12. Rashid A. Retrospective assessment of the success rate of single visit root treatment: a clinical and radiographic analysis. Al-Rafidain Dental Journal 2008; 8: 104-109.
13. Smith CS, Setchell DJ, Harty FJ. Factors influencing the success of conventional root canal therapy – a 5 year retrospective study. International Endodontic Journal 1993; 126: 321-383.
14. Andreasen JO, Andreasen FM. Textbook and colour atlas of traumatic injuries to the teeth. Copenhagen: Munksgaard 1994.
15. Sjogren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of the root filling on the outcome of endodontic treatment of teeth with apical periodontitis. International Endodontic Journal 1997; 30: 297-306.
16. Ashkenaz PJ. One visit endodontics. Dental clinic of North America 1984; 28: 853-863.
17. Runder WL, Oliet S. Single visit endodontics: a concept and a clinical sstudy. Compendium of continuing education in dentistry 1981; 2: 63-68.