Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.10.044

Comparison of time required by three different retreatment file systems for retrieval of Gutta Percha- An In Vitro Study

Nishitha Arun[1], Pradeep Solete[2]*, Ganesh Jeevanandan[3], Delphine Priscilla Antony S[4], Sowmya Kavoor[5], Adimulapu Hima Sandeep[6]

[1]Graduate Student , Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

[2]Associate Professor, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences , Saveetha University,162 , PH Road , Chennai 600077, TamilNadu , India

[3]Associate Professor, Department of Pediatric and Preventive Dentistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University

[4]Associate Professor, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University

[5]Senior Lecturer, Department of Conservative dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University

[6]Associate Professor, Department of Conservative dentistry and Endodontics, Saveetha Dental College and Hospitals Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai-600077, Tamil Nadu, India.

***Corresponding author:** Pradeep Solete, Associate Professor, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences , Saveetha University,162 , PH Road , Chennai 600077, TamilNadu , India, Email:pandu.pradeep@gmail.com

Submitted: 26 March 2023; Accepted: 19 April 2023; Published: 04 May 2023

ABSTRACT

Background: When there is a failure of primary root canal treatment there is a need for retreatment. This retreatment mainly aims at the disinfection of the canal space and in attaining hermetic seal of the canals.

Aim: To determine the time taken by three different file systems in retrieval of Gutta Percha from the root canal space.

Materials and Method: 60 freshly extracted single rooted teeth were divided primarily into three groups (n=20) Group A- Neo Endo Retreatment Files, Group B- Solite RS3 and Group C- ProTaper Retreatment Files (PTUR). These were further subdivided into 2 groups with and without magnification. The files were used as specified by the manufacturer.

Results: Neo Endo Retreatment file system was significantly slower in removal of Gutta Percha when compared to PTUR and Solite RS3 with and without Magnification (p=0.000). In the group without magnification there was no significant difference in time required for GP retrieval between Solite RS3 and ProTaper Universal retreatment file system (p= 0.985). With magnification using DOM the

ProTaper Universal retreatment file system was significantly faster in removal of Gutta Percha than Solite RS3 (p=0.001).

Conclusion: ProTaper retreatment files and Solite RS3 were significantly faster than Neo Endo Retreatment files when used with and without Magnification. Without magnification both PTUR and Solite RS3 performed similarly but with magnification PTUR was significantly better than other two systems.

Keywords: *Retreatment, Time taken, SoliteRS3, ProTaper, NeoEndo, Medical, Health*

INTRODUCTION

There is a need for retreatment root canal treatment when the primary treatment fails (1). Prognosis of root canal treatment greatly depends on the complete removal of necrotic and infected debris and proper disinfection followed by hermetic sealing of the root canal space, when these are not fulfilled it leads to failure of root canal treatment. In recent decades, root canal therapy has been found to exhibit a success rate ranging between 62% and 96%. Regrettably, a certain proportion of teeth that have undergone endodontic treatment necessitate retreatment. Numerous factors have been ascribed to the lack of success in root canal therapy, including inadequate preparation and filling of canals, difficulties pertaining to instrumentation, excessive use of filling materials and intricate root canal morphology(2,3). In 1986, Dr. Herbert Schilder introduced the term "Retreatodontics" and posited that the future of endodontic practice would entail a focus on addressing the failures of previous endodontic interventions. In instances where root canal therapy proves ineffective, alternative treatment modalities such as conventional retreatment, periradicular surgery or extraction may be considered. Whenever feasible, the preference is given to the retreatment alternative due to its highly conservative nature as a problem-solving strategy(4,5).

The existence of missed canals in endodontic therapy can result in the retention of tissue, bacteria, and other irritants, which can ultimately give rise to various clinical symptoms and lesions with endodontic etiology(6)(7)(1,8–10)(1,8–11). This raises the need for non-surgical or surgical treatment(12,13). The Non surgical retreatment is the primary choice as it is more reasonable and conservative than surgical retreatment.

The objective of non surgical retreatment is to regain access to the apical foramina. This can be done by retrieving all the Gutta Percha and sealer that was used during obturation to create an hermetic seal(14)(15)(16)(17,18). Retrieval of Gutta Percha from the canals can be done using thermal, chemical or mechanical methods. Thermal method is considered the safest but when used alone is not effective. Chemical methods of using xylene or chloroform pose a threat of toxicity to the periapical tissues. Mechanical method is effective but it can also lead to canal transportation, instrument separation and ledge formation(19). Ultrasonics Can also be utilized in Gutta Percha removal(20,21).

Initially Gates glidden drills, Peeso reamers and hand files were used for retrieval of GP but these were replaced by NiTi rotary instruments. Various retreatment file designs in relation to cross- section, tip design, continuous or reciprocating motion and different heat treatments such as CM-wire, M- wire and blue technology have been recently introduced(8,10,22,23).

The aim of the present study is to determine the time required for GP retrieval using three different retreatment file systems with and without magnification.

MATERIALS AND METHODS

This In vitro study was conducted after the ethical approval from the Institutional ethical board. A total of 100 freshly extracted single rooted teeth were examined. Teeth with calcification and severe root curvature were excluded. 60 single root teeth were randomly included. To standardize the teeth, all the decoronated at 16mm from the apex. Access

opening was done, working length was established 1mm short of apex. Biomechanical preparation was done using the Heat treated Niti rotary file system (ProTaper Gold). Irrigation was done using 3% NaOCl, 17% EDTA and saline. Canal was dried using paper points and obturation was using 6% tapered Gutta Percha and resin based sealer (AH plus sealer). Entrance filling was done using Cavit and the teeth were stored in 100% humidity and 37 degree Celsius.

Retreatment Procedure

60 single rooted teeth were randomly divided into 3 groups (n=20) Group A- Neo Endo Retreatment Files, Group B- Solite RS3 and Group C- ProTaper Retreatment Files (PTUR). These were further subdivided into 2 groups with and without magnification. No solvents were used during retreatment, the canal was rinsed with saline. When the retreatment file surface and the saline used for rinsing the canal was devoid of Gutta Percha remnants, the retreatment was considered complete. The time taken was recorded using a stopwatch.

File Systems Used

Group 1- Neoendo Retreatment Files

Files used in sequential manner- N1, N2 and N3

Motion- Light apical pressure using crown down technique

Speed-350 rpm

Group 2- Solite RS3

Files used in sequential manner- RS, RS2 and RS3

Motion- Brushing motion and crown down technique

Speed- 350 rpm

Group 3- ProTaper Universal Retreatment file

Files used in sequential manner- D1,D2 and D3

Motion- Brushing motion and crown down technique

Speed- 500 rpm

Statistical Analysis

The time taken for GP retrieval with and without magnification was entered in the data sheet. This data was then exported for statistical analysis to IBM SPSS Statistics 23. To assess the significance of variation between variables, one-way ANOVA and Tukey's Post Hoc test for multiple comparisons was done using the exported data. $p<0.05$ was considered significant.

RESULTS

The mean and standard deviation for time required for GP retrieval with and without magnification for the three retreatment file systems are reported in (Table1 and Table 2). In both with and without magnification groups, Neo Endo retreatment file system required significantly more time for GP retrieval than Solite Retreatment and ProTaper Universal Retreatment file system ($p=0.000$). In the group without magnification there was no significant difference in time required for GP retrieval between Solite RS3 and ProTaper Universal retreatment file system ($p= 0.985$) (Figure 1). In the group with magnification using DOM, the ProTaper Universal retreatment file system was significantly faster in removal of Gutta Percha than Solite RS3 ($p=0.001$)(Figure 2). There was a significant difference in time taken for retrieval without and with Magnification using DOM ($p=0.000$).

DISCUSSION

The anatomy of the root canal system is a crucial determinant of endodontic outcomes, both with respect to achieving success and encountering failures. Failure in endodontics may arise due to insufficiencies in the process of shaping, cleaning, and obturation, iatrogenic occurrences, or the recurrence of infection in the root canal system subsequent to the loss of coronal seal following the completion of root canal therapy(1,24–27).

Prior to initiating any therapeutic intervention, it is of paramount significance to contemplate all

interdisciplinary therapeutic alternatives in relation to their temporal, monetary, prognostic, and patient satisfaction implications(1,24–28). It is imperative to assess failures in endodontic treatment in order to determine the most appropriate course of action, namely, nonsurgical retreatment, surgical retreatment or extraction. The objectives of non-surgical retreatment encompass the eradication of substances within the root canal cavity and the rectification of any pathogenic or iatrogenic anomalies that may be identified. Moreover, non-invasive remedial interventions ratify mechanical malfunction, previously undetected canal pathways, or fractures below the root crest level(29–32).

The important part of nonsurgical retreatment is retrieval of GP and sealer, as it denudes the root surface and microbes that are responsible for secondary infection and inflammation(33,34). Previous studies have reported the faster removal of GP associated with the use of NiTi rotary file systems compared to hand files. In the present study no solvents were used, since it would amper the determination of efficacy of the file systems used in retreatment(29).

In the present study it was seen that the time taken by Neo Endo Retreatment files in retrieval of Gutta Percha was significantly higher than the other two groups. Previous in vitro study by Sagare et al. reported that WaveOne was significantly more effective than Neo Endo retreatment files in retrieval of Gutta Percha(35,36). Wahane et al in his study evaluated the efficacy of Gutta Percha Removal using Cone Beam Computed Tomography reported that WaveOne was significantly better than Neo Endo file system(9,37–39).

In our study it was found that the Protaper Retreatment file system and Solite RS3 systems were significantly faster than Neo endo retreatment files. The difference in time taken by the ProTaper Retreatment files and Solite RS3 file were insignificant when used without magnification. The advantage of ProTaper retreatment files is attributed to the convex triangular cross section, which increases the cutting efficiency. This engine driven files when used without irrigant or solvent generate heat inside the canal which plasticises the Gutta Percha resin and enables the easy removal from the canal(40–44).

On the other hand, Solite RS3 is a 3 file system. Files are made of NiTi and are heat treated for better resistance against fracture and facilitates its usage in curved canals. RS1 and RS2 files have cutting tips, while RS3 is non-cutting.

Along with the estimation of time taken for Gutta Percha Retrieval, there is a further need to evaluate the remnant Gutta Percha in the root canals using these different retreatment file systems to enable better understanding about these file systems.

CONCLUSION

ProTaper retreatment files and Solite RS3 were significantly faster than Neo Endo Retreatment files when used with and without Magnification. Without magnification both PTUR and Solite RS3 performed similarly but with magnification PTUR was significantly better than other two systems.

REFERENCES

1. Wong R. Conventional endodontic failure and retreatment. Dent Clin North Am. 2004 Jan;48(1):265–89.
2. Rhodes JS. Advanced Endodontics: Clinical Retreatment and Surgery. CRC Press; 2005. 218 p.
3. S DPA, Solete P, Jeevanandan G, Syed AA, Almahdi S, Alzhrani M, et al. Effect of Various Irrigant Activation Methods and Its Penetration in the Apical Third of Root Canal-In Vitro Study. Eur J Dent. 2023 Feb;17(1):57–61.
4. Rhodes JS. Advanced Endodontics: Clinical Retreatment and Surgery. CRC Press; 2005. 218 p.
5. Antony D, Subramanian A, Nivedhitha M, Solete P, Balasubramaniam A. Post-endodontic pain with different engine-driven endodontic instruments in multi-visit root canal therapy: A systematic review and meta-analysis. J Int Oral Health. 2022;14(1):1.
6. Berman LH, Hargreaves KM. Cohen's Pathways of the Pulp Expert Consult - E-Book. Elsevier Health Sciences; 2015. 928 p.
7. Kvist T. Endodontic Retreatment: Aspects of Decision Making and Clinical Outcome. 2001. 57 p.

8. Kulkarni S, Wahane K, Daokar S, Patil K, Patel K, Thorat T. An assessment of the efficacy of a rotary and a reciprocating retreatment file system for removal of gutta-percha from root canals: An in vitro cone-beam computed tomography study. Endodontology. 2021;33(1):20.
9. Azim AA, Wang HH, Tarrosh M, Azim KA, Piasecki L. Comparison between Single-file Rotary Systems: Part 1—Efficiency, Effectiveness, and Adverse Effects in Endodontic Retreatment [Internet]. Vol. 44, Journal of Endodontics. 2018. p. 1720–4. Available from: http://dx.doi.org/10.1016/j.joen.2018.07.022
10. Rodrigues CT, Duarte MAH, de Almeida MM, de Andrade FB, Bernardineli N. Efficacy of CM-Wire, M-Wire, and Nickel-Titanium Instruments for Removing Filling Material from Curved Root Canals: A Micro–Computed Tomography Study [Internet]. Vol. 42, Journal of Endodontics. 2016. p. 1651–5. Available from: http://dx.doi.org/10.1016/j.joen.2016.08.012
11. Witherspoon DE, Small JC, Regan JD. Missed canal systems are the most likely basis for endodontic retreatment of molars. Tex Dent J. 2013 Feb;130(2):127–39.
12. Khayat B, Jouanny G. Microsurgical Endodontics. Quintessence Publishing (IL); 2019.
13. Pratheebha C, Gayathri R, Veeraraghavan VP, Kavitha S. Knowledge, awareness, and perception on root canal treatment among South Indian population - A survey. J Adv Pharm Technol Res. 2022 Nov;13(Suppl 1):S302–7.
14. Indi S, Desai SR, Hambire A, Mustafa M, Almokhatieb AA, Abuelqomsan MAS, et al. Comparison of the Time Required by Six Different Retreatment Techniques for Retrieval of Gutta-Percha: An In Vitro Study [Internet]. European Journal of General Dentistry. 2022. Available from: http://dx.doi.org/10.1055/s-0042-1750089
15. Styleitaliano A. Retreatments: Solutions for Periapical Diseases of Endodontic Origin. Edra; 2020. 536 p.
16. Hoen MM, Pink FE. Contemporary endodontic retreatments: an analysis based on clinical treatment findings. J Endod. 2002 Dec;28(12):834–6.
17. In vitro bacterial penetration of coronally unsealed endodontically treated teeth. J Endod. 1990 Dec 1;16(12):566–9.
18. Teja KV, Ramesh S, Battineni G, Vasundhara KA, Jose J, Janani K. The effect of various in-vitro and ex-vivo parameters on irrigant flow and apical pressure using manual syringe needle irrigation: Systematic review. Saudi Dent J. 2022 Feb;34(2):87–99.
19. Nasim I, Professor and Head, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, India. Effect of nanoparticles based root canal disinfectants on Enterococcus faecalis - A systematic review. Int J Dent Oral Sci. 2021 Jun 30;2898–904.
20. Evaluation of an Ultrasonic Technique to Remove Fractured Rotary Nickel-Titanium Endodontic Instruments from Root Canals: Clinical Cases. J Endod. 2003 Nov 1;29(11):764–7.
21. Natanasabapathy V, Durvasulu A, Krithikadatta J, Namasivayam A, Deivanayagam K, Manali S, et al. Current Trends in the Use of Irrigant Activation Techniques Among Endodontists & Post-Graduate Dental Students in India -A Knowledge, Attitude and Practice Based Survey. Eur Endod J. 2020 May 22;5(2):73–80.
22. Azim AA, Wang HH, Tarrosh M, Azim KA, Piasecki L. Comparison between Single-file Rotary Systems: Part 1—Efficiency, Effectiveness, and Adverse Effects in Endodontic Retreatment [Internet]. Vol. 44, Journal of Endodontics. 2018. p. 1720–4. Available from: http://dx.doi.org/10.1016/j.joen.2018.07.022
23. Divya S, Jeevanandan G, Sujatha S, Subramanian EMG, Ravindran V. Comparison of quality of obturation and post-operative pain using manual vs rotary files in primary teeth - A randomised clinical trial. Indian J Dent Res. 2019 Nov-Dec;30(6):904–8.
24. Khayat B, Jouanny G. Microsurgical Endodontics. Quintessence Publishing (IL); 2019.
25. Ma J, Al-Ashaw AJ, Shen Y, Gao Y, Yang Y, Zhang C, et al. Efficacy of ProTaper Universal Rotary Retreatment system for gutta-percha removal from oval root canals: a micro-computed tomography study. J Endod. 2012 Nov;38(11):1516–20.
26. Indi S, Desai SR, Hambire A, Mustafa M, Almokhatieb AA, Abuelqomsan MAS, et al. Comparison of the Time Required by Six Different Retreatment Techniques for Retrieval of Gutta-Percha: An In Vitro Study [Internet]. European Journal of General Dentistry. 2022.

Available from: http://dx.doi.org/10.1055/s-0042-1750089
27. Nivedhitha N, Professor and Head, Department of Conservative Dentistry and Endodontics, Saveetha Dental college and Hospital, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India. Comparing the effectiveness of various irrigant activation techniques with conventional needle irrigation - A systematic review. Int J Dent Oral Sci. 2021 May 30;2626–31.
28. Siddique R, Nivedhitha MS, Jacob B. Quantitative analysis for detection of toxic elements in various irrigants, their combination (precipitate), and para-chloroaniline: An inductively coupled plasma mass spectrometry study. J Conserv Dent. 2019 Jul-Aug;22(4):344–50.
29. Lopes HP, Elias CN, Vedovello GAF, Bueno CES, Mangelli M, Siqueira JF. Torsional Resistance of Retreatment Instruments [Internet]. Vol. 37, Journal of Endodontics. 2011. p. 1442–5. Available from: http://dx.doi.org/10.1016/j.joen.2011.06.004
30. Endodontic retreatment—Case selection and technique. Part 2: Treatment planning for retreatment. J Endod. 1988 Dec 1;14(12):607–14.
31. Kim S. Color Atlas of Microsurgery in Endodontics. 2001. 200 p.
32. Teja KV, Kaligotla AV, Gummuluri S. Antibacterial Efficacy of Conventional Versus Herbal Products on Streptococcus mutans in Adult Population- a Systematic Review & Meta-analysis. BDS. 2020 Sep 30;23(4):18p – 18p.
33. Bhagavaldas MC, Diwan A, Kusumvalli S, Pasha S, Devale M, Chava DC. Efficacy of two rotary retreatment systems in removing Gutta-percha and sealer during endodontic retreatment with or without solvent: A comparative study. J Conserv Dent. 2017 Jan-Feb;20(1):12–6.
34. Sundar S, Varghese A, Datta KJ, Natanasabapathy V. Effect of guided conservative endodontic access and different file kinematics on debris extrusion in mesial root of the mandibular molars: An study. J Conserv Dent. 2022 Sep 12;25(5):547–54.
35. Sagare SV, Chandra P, Kaur T, Ganorkar O, Khade A, Mehta SD. A comparative study of the efficacy of WaveOne and NeoEndo retreatment file system for the removal of Gutta percha from the root canal. J Pharm Bioallied Sci. 2021 Nov;13(Suppl 2):S1682–5.
36. Hima Sandeep A, Senior Lecturer, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences. Prevalence and associated factors of root canal treated mandibular anterior teeth with and without post endodontic crowns. Int J Dent Oral Sci. 2019 Nov 30;87–91.
37. Kulkarni S, Wahane K, Daokar S, Patil K, Patel K, Thorat T. An assessment of the efficacy of a rotary and a reciprocating retreatment file system for removal of gutta-percha from root canals: An in vitro cone-beam computed tomography study. Endodontology. 2021;33(1):20.
38. Sagare SV, Chandra P, Kaur T, Ganorkar O, Khade A, Mehta SD. A comparative study of the efficacy of WaveOne and NeoEndo retreatment file system for the removal of Gutta percha from the root canal. J Pharm Bioallied Sci. 2021 Nov;13(Suppl 2):S1682–5.
39. Janani K, Teja KV, Ajitha P, Sandhya R. Evaluation of tissue inflammatory response of four intracanal medicament - An animal study. J Conserv Dent. 2020 Dec 4;23(3):216–20.
40. Khayat B, Jouanny G. Microsurgical Endodontics. Quintessence Publishing (IL); 2019.
41. Ma J, Al-Ashaw AJ, Shen Y, Gao Y, Yang Y, Zhang C, et al. Efficacy of ProTaper Universal Rotary Retreatment system for gutta-percha removal from oval root canals: a micro-computed tomography study. J Endod. 2012 Nov;38(11):1516–20.
42. Indi S, Desai SR, Hambire A, Mustafa M, Almokhatieb AA, Abuelqomsan MAS, et al. Comparison of the Time Required by Six Different Retreatment Techniques for Retrieval of Gutta-Percha: An In Vitro Study [Internet]. European Journal of General Dentistry. 2022. Available from: http://dx.doi.org/10.1055/s-0042-1750089
43. Siddique R, Nivedhitha MS, Ranjan M, Jacob B, Solete P. Comparison of antibacterial effectiveness of three rotary file system with different geometry in infected root canals before and after instrumentation-a double-blinded randomized controlled clinical trial. BDJ Open. 2020 Jun 8;6:8.
44. Siddique R, Nivedhitha MS. Effectiveness of rotary and reciprocating systems on microbial reduction: A systematic review. J Conserv Dent. 2019 Mar-Apr;22(2):114–22.

TABLE 1: Mean and Standard Deviation of time taken by three different file systems for the removal of Gutta Percha without magnification. P<0.05 is statistically significant.

Retreatment File System	Mean Time Taken for GP removal (seconds) without magnification	Significance	
Neo Endo	262±30	Solite ProTaper	P=0.000
Solite	152±17	ProTaper	P=0.985
ProTaper	150±17		

TABLE 2: Mean and Standard Deviation of time taken by three different file systems for the removal of Gutta Percha with magnification. P<0.05 is statistically significant.

Retreatment File System	Mean Time Taken for GP removal (seconds) with magnification	Significance	
Neo Endo	522±21	Solite ProTaper	P=0.000
Solite	300±38	ProTaper	P=0.001
ProTaper	248±21		

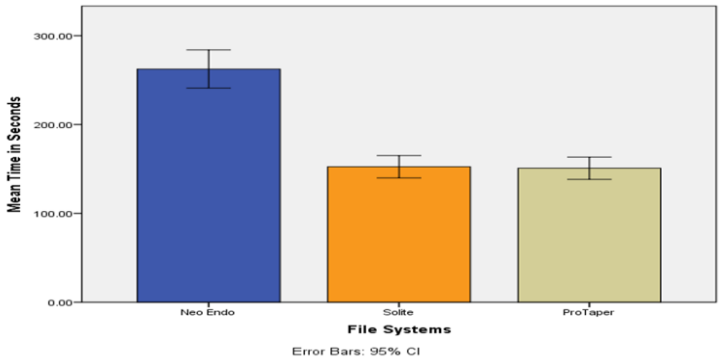

FIGURE 1: Time taken by three different Retreatment file systems for the removal of Gutta Percha without magnification

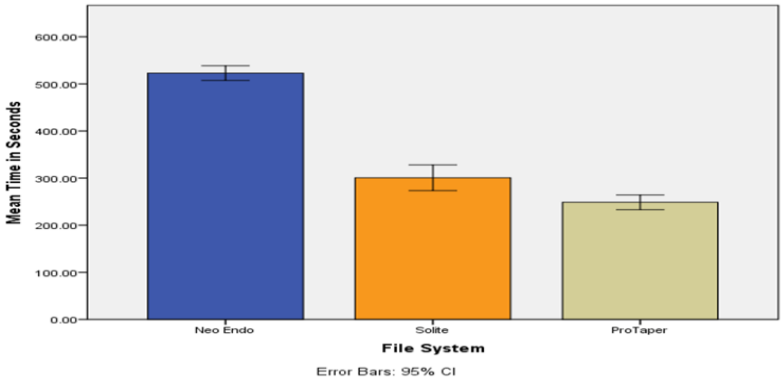

FIGURE 2: Time taken by three different Retreatment file systems for the removal of Gutta Percha without magnification

J Popul Ther Clin Pharmacol Vol 30(10):e399–e405; 04 May 2023.