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Application of Rotary Instrumentation in Paediatric Endodontics - A Review

Abstract

The premature loss of primary teeth may cause changes in the chronology and sequence of eruption of permanent teeth. Maintenance of primary teeth until physiological exfoliation contributes to mastication, phonation, aesthetics and prevents deleterious habits in children. Therefore, primary teeth with pulpitis or necrosis are indicated for endodontic treatment. Paediatric endodontics is one of the important clinical procedures among the various treatment options for cariously involved non vital teeth. The removal of organic debris is the main purpose of instrumentation in pulpectomy procedures in primary teeth. This goal can be achieved with manual or rotary nickel titanium instruments. In order to develop better techniques, a new generation of endodontic instruments has been designed. This article will focus on the use of rotary endodontic techniques in pulpectomy procedure in primary teeth.

Key Words

Rotary endodontics; rotary files; pulpectomy; primary teeth

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INTRODUCTION

One of the most important concerns in paediatric dentistry is the loss of necrotic primary molars leading to space loss. Hence pulpectomy of primary teeth with severe pulpal involvement should be considered as a treatment of choice. The treatment is considered successful when the tooth is painless, firm, without any signs of inflammation, infection or mobility. Radiographic success is when the lesions is resolved within six months and no pathologic root resorption is observed.[1-3] Root canal treatment procedures are done in primary teeth even with evidence of severe chronic inflammation or necrosis of the radicular pulp. A practical pulpectomy technique for the primary dentition should include the following features: a) fast and simple procedures; b) short treatment times; c) minimal number of appointments; d) effective debridement of the root canals without weakening the tooth structure or endangering the underlying permanent teeth; e) few procedural complications, and; f) restoring the tooth to maintain function.[4] Root canal instrumentation is performed with files, reamers, burs, sonic instruments and recently with rotary instruments. Although manual instrumentation is widely used in primary teeth, there are limitations regarding effective cleaning of root canals, possible ledge formation, perforations, dentine compaction and instrument fracture.[5] The use of Nickel titanium (NiTi) rotary files in primary teeth root canals was first described by Barr *et al*.[6] The development of nickel titanium alloys and the possibility of changing the traditional design and taper have allowed use of rotary instruments in endodontic treatment. Their ability to rotate on their own axes in the root canal without any risk or

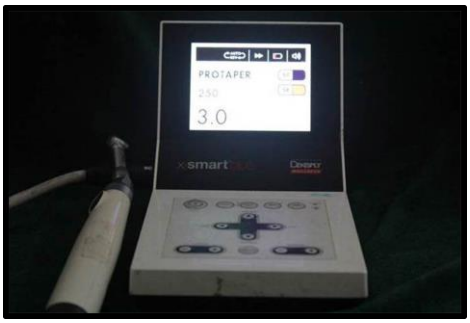

Fig. 1: Endodontic system (X smart plus, Denstply Malliefer, Switzerland)

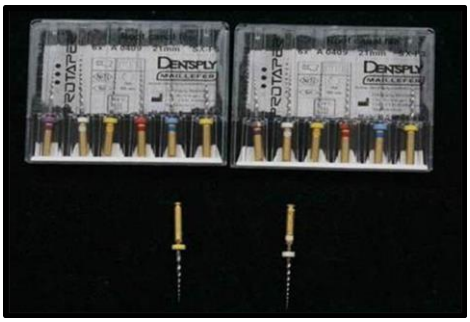

Fig. 3: Endodontic system (X smart plus, Denstply Malliefer, Switzerland)

damage to the original anatomy is very important. Among other advantages, the nickel titanium files do not need to be precurved due to elastic memory, and the root canal preparation is quicker because they are activated by an endomotor. The possibility of root canal deformation is reduced due to its elastic memory and radial land that maintain the file in the center of the root canal by wall support.[5,7,8] In primary teeth, perforations occur more often due to thin dentinal walls. Apical overextension of the NiTi can result in an enlarged apical foramen and causes overfill of obturation paste. Sterile water, saline or sodium hypochlorite (1% or 2.5%) can be used to for irrigation of canal. Instrumenting the canals dry or aggressively can result in broken file tips, especially in the smaller size files. Frequently inspect each file for flute unwinding or distortion and discard immediately. If no flute distortion is detected, discard the files after use in five primary teeth. To keep track of file usage, the file shanks can be notched with a bur at the end of each case.[5] When compared to the permanent dentition, the rotary instrumentation is faster in deciduous teeth, probably due to the smaller root canal length. The rotary technique also facilitates obturation and minimizes the extrusion of material. Rotary files also favour the patient's cooperation by shortening treatment time for cleaning canals. However, the high cost of NiTi rotary systems and need for training to learn the techniques are disadvantages

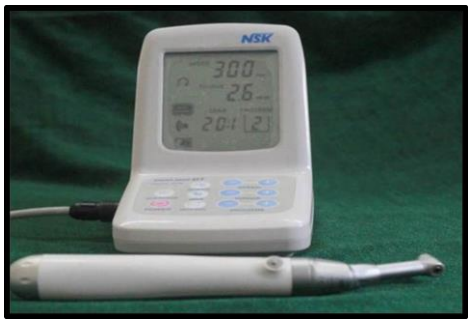

Fig. 2: Endodontic system (Endomate, NSK)

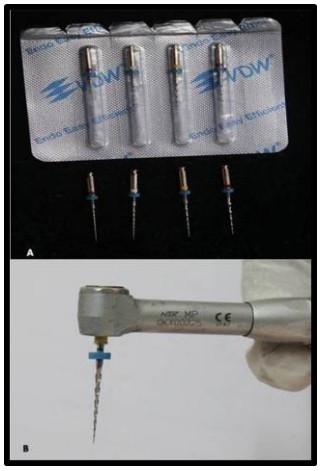

Fig. 4: Endodontic system (Endomate, NSK)

of NiTi rotary files (Fig. 1 & Fig. 2).[6,9] Many authors have reported clinical success in primary molars with a modified protocol using Profile, ProTaper (Fig. 3), Mtwo (Fig. 4) , Flexmaster, Light Speed LSX, Hero 642 and K3 rotary files. The present article presents a comprehensive, critical summary of current knowledge and application of rotary instrumentation techniques in pulpectomy procedure in primary teeth.

Application of rotary instrumentation techniques in pulpectomy procedure:

According to Barr *et al*.,[6] in 2000, Crespo S *et al*.,[20] in 2008, the pulpectomy procedure begins with a standard access and removal of coronal tissue. Pre-treatment radiograph was taken to determine the working length. A NiTi file was chosen that approximates the canal size. It was inserted into the canal while rotating till the calculated working length. The canal was cleansed and shaped with sequentially larger files until the last file binds. Each time the file was withdrawn, it was cleaned of pulp tissue and dentinal debris. For cleaning and shaping of root canals in primary teeth, ProFile 0.04 instruments was used at slow speed of 150 to 300 rpm. It is not necessary to use a "crown down" instrumentation technique in primary teeth since the dentin cuts more easily than in permanent teeth. This has also been proved by the study done

by Silva *et al*.,[5] in 2004 and Canoglu H *et al.*,[19] in 2006 in which the root canal was instrumented with rotary Profile .04 (Dentsply/Maillefer) instruments up to a 35 size file. Then the files were stepped back with 40, 45, and 50 size rotary Profiles .04 in root canals. Ching Kou *et al.*,[4] in 2006 used Sx file for instrumentation of canal to about 3 mm beyond the root canal orifice with a slight buccolingual brushing motion to remove any remaining overlying dentin and to improve straight line access. The S2 file was then inserted into the canal while rotating and taken to the working length as previously determined. If a point of resistance was encountered, no attempt was made to go beyond the resistance point to avoid risk of instrument separation. Pulp tissue was commonly wrapped around the S2 file when it was withdrawn. This was uncommonly found with stainless steel files. Copious irrigation with 2.5% sodium hypochlorite and normal saline was used during each file. Lateral perforation was avoided by using only SX and S2 files during preparation. S1 and F series files were not used as they said the increased taper and tip size resulted in excessive apical dentin removal in primary molars. Since the tooth was already undergoing physiological root resorption, the greater taper and F2 file might be a better choice than S2. Nagaratna PJ *et al.*,[10] in 2006 instrumented root canal with profile 0.04 taper 29 series rotary instruments starting from size 2 to 7 in reduction gear hand piece. Files were advanced slowly towards the apex, which were withdrawn when working length was reached. Bahrololoomi Z *et al.*,[11] in 2007 performed instrumentation with 25-mm-long flexmaster Ni-Ti rotary files (VDW, Germany) using a modified crown down technique with 35/0.06, 35/0.04, 30/0.06 and 40/0.02 tapers. Shaping was completed with a gentle advance and withdrawal motion. Instruments were removed when resistance was felt and changed for the next instrument. Kummer TR *et al.*,[12] in 2008 prepared root canal with the Hero 642 system (MicroMega) and a reducing 50:1 handpiece (MicroMega). Preparation was performed with 21 mm nickel titanium instruments with 2% and 4% taper using the crown down technique. The protocol established for instrumentation comprised a kit with 3 instruments: 1) Hero 642 taper 0.04, size 30, 2 mm short of the working length; 2) Hero 642 taper 0.02, size 35, up to the working length; 3) Hero 642 taper 0.02, size 40, up to the working length. Each Hero instrument was introduced into the canal with a gentle push and pull motion. Moghaddam KN *et al.*,[13] in 2009 instrumented with rotary Flex Master (VDW) instruments. At first the root canal orifices were enlarged with the orifice shaper "Introfile" (VDW) until the root canal middle third was reached. Crown down preparation was performed with a 64:1 speed gear reduction handpiece as follows. At first 25/04 was used until the resistance was felt followed by 25/02 till the working length.

Azar MR, Mokhtare M,[14] in 2011 and Azar MR *et al.*,[9] in 2012 used 21 mm long Mtwo NiTi rotary files driven with a torque limited rotation with maximum speed of 280 rpm for preparing root canals. Four Mtwo instruments (10/0.04, 15/0.05, 20/0.06 and 25/0.06) were used in a crown down technique till the working length in primary teeth.

According to Pinheiro SL *et al.*,[15] in 2012, root canals were prepared using ProTaper using a handpiece with an electric motor X-Smart (Dentsply). At a speed of 300 rpm and torque of 3N/cm, S1 and S2 ProTaper files were used for shaping the primary molar root canals. For F1 and F2, 2N/cm torque with speed of 300 rpm was used with an anticurvature filing method for finishing the canals. Azar MR *et al.*,[9] in 2012 modified the sequence of the three ProTaper instruments slightly to prepare the canals. Root canals were cleaned in a crown down method with three instruments in the sequence from S1 in the coronal third of the root canal, S2 in the middle third, and F1 till the working length. Pinheiro SL *et al.*[16] in 2012 used hybrid technique for instrumentation of canals in primary molars with the ProTaper system and K-files (Dentsply Maillefer). Root canals were prepared initially by manual instrumentation using a size 15 K-file followed by S1 and S2 of the rotary system; then again instrumenting with manual instrumentation with size 15 and 20 K-files followed by rotary using a system F1. Finally instrumentation was done with manual instrumentation with size 25 K-file and F2 using a rotary system. Ozen, B, Akgun OM,[17] in 2013 used Protaper and Hero 642 for instrumentation of the canals. The protocol followed was using Sx, S1, S2 in a crown down manner with the ProTaper system. This was followed by F1, F2 and F3 till the working length. For Hero 642, 2% and 4% taper files were used in the crown down technique for preparation of canal. Vieyra JP, Enriquez FJ[18] in 2014 instrumented root canals with rotary Light Speed LSX instruments (Discus Dental, USA) and ProTaper file (Maillefer, Ballaigues, Switzerland).

The rotary Light Speed LSX instruments were used in the canal preparation to a size 50 for anteriors and to size 40 for molars. For Protaper the root canals were instrumented with SX orifice opener rotary file for widening the orifice and then with S1 to F2 till the full working length.

Rotary instrumentation, instrumentation time and cleaning ability in primary teeth

The rotary instrumentation technique was more effective for root canal instrumentation in primary molars, presenting shorter treatment time and better cleaning ability compared to the manual technique.[3,5,9-18]

Advantages of rotary instrumentation in primary teeth [5,6]

- Tissue and debris are more easily and quickly removed
- The nickel titanium files are flexible, allowing easy access to all canals
- Nickel titanium files do not need to be precurved
- Nickel titanium rotary files follow original root canal anatomy
- Less instrumentation time
- Prepared canals are funnel shaped, resulting in a more predictable uniform fill of obturation paste

Disadvantages of rotary instrumentation in primary teeth [6]

- Cost of the endomotor and handpiece
- Increased cost of NiTi endodontic files
- Cyclic fatigue of endodontic instruments
- Endodontic instruments are prone to fracture
- Learning the technique

CONCLUSION

The literature on rotary root canal preparation techniques is limited and there are not many studies available for use in primary teeth. The comparison between the various systems is limited and therefore conclusions are difficult to draw. Rotary instrumentation can be used in pulpectomy procedures in primary teeth because of its greater ease in technique. The decrease in instrumentation time lessens the chair time which is important factor while treating children.

REFERENCES

1. McDonald RE, Avery DR. Dentistry for the child and adolescent. 7th ed. St. Louis: Mosby, 2000. p. 401.
2. Cohen S, Hargreaves KM. Pathways of the Pulp. 9th Edition. St. Louis: Mosby, 2006. p. 301-11, 842.
3. Moghaddam KN, Mehran M and Zadeh HF. Root canal cleaning efficacy of rotary and hand files instrumentation in primary molars. Iran Endod J 2009;4(2):53-7.
4. Kuo C, Wang Y, Chang H, Huang G, Lin C, Li U, *et al*. Application of Ni-Ti rotary files for pulpectomy in primary molars. J Dent Sci 2006;1(1):10-5.
5. Silva LA, Leonardo MR, Nelson-Filho P, Tanomaru JM. Comparison of rotary and manual instrumentation techniques on cleaning capacity and instrumentation time in deciduous molars. J Dent Child 2004;71(1):45-7.
6. Barr ES, Kleier DJ, Barr NV. Use of nickel-titanium rotary files for root canal preparation in primary teeth. Pediatr Dent 2000;22(1):77-8.
7. Walia H, Brantley W and Gerstein H. An Initial Investigation of Bending and Torsional Properties of Nitinol Root Canal Files. J Endod 1988;14(7):346-51.
8. Coleman CL, Svec T, Wang M, Suchina J, Glickmaan GN. Stainless steel versus nickel-titanium K-files: Analysis of instrumentation in curved canals. J Endo 1995;21(4):221.
9. Azar MR, Safi L, Nikaein A. Comparison of the cleaning capacity of Mtwo and ProTaper rotary systems and manual instruments in primary teeth. Dent Res J 2012;9(2)146-51.
10. Nagaratna PJ, Shashikiran ND, Subbareddy VV. In vitro comparison of NiTi rotary instruments and stainless steel hand instruments in root canal preparations of primary and permanent molar. J Indian Soc Pedod Prev Dent 2006;24(4):186-91.
11. Bahrololoomi Z, Tabrizizadeh M, Salmani L. In Vitro Comparison of Instrumentation Time and Cleaning Capacity between Rotary and Manual Preparation Techniques in Primary Anterior Teeth. J Dent Tehran Univ Med Sci 2007;4(2):59-62.
12. Kummer TR, Calvo MC, Cordeiro MM, de Sousa Vieira R, de Carvalho Rocha MJ. Ex vivo study of manual and rotary instrumentation techniques in human primary teeth. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;105(4):84-92.
13. Moghaddam KN, Mehran M and Zadeh HF. Root canal cleaning efficacy of rotary and hand files instrumentation in primary molars. Iran Endod J 2009;4(2):53-7.
14. Azar MR, Mokhtare M. Rotary Mtwo system versus manual K-file instruments:

Efficacy in preparing primary and permanent molar root canals. Indian J Dent Res 2011;22(2):363.

15. Pinheiro SL, Neves LS, Pettorossi Imparato JC, Duarte DA, da Silveira Bueno CE, Cunha RS. Analysis of the instrumentation time and cleaning between manual and rotary techniques in deciduous molars. RSBO 2012;9(3):238-44.
16. Pinheiro SL, Araujo G, Bincelli I, Cunha R, Bueno C. Evaluation of cleaning capacity and instrumentation time of manual, hybrid and rotary instrumentation techniques in primary molars. Int Endod J 2012;45(4):379–85.
17. Ozen, B, Akgun, OM. A Comparison of Ni-Ti Rotary and Hand Files Instrumentation in Primary Molars. J Int Dent Med Res 2013;6(1):6-8.
18. Vieyra JP, Enriquez FJ. Instrumentation Time Efficiency of Rotary and Hand Instrumentation Performed on Vital and Necrotic Human Primary Teeth: A Randomized Clinical Trial. Dentistry 2014;4:214.
19. Canoglu H, Tekcicek MU, Cehreli ZC. Comparison of conventional, rotary, and ultrasonic preparation, different final irrigation regimens, and 2 sealers in primary molar root canal therapy. Pediatr Dent 2006;28(6):518-23.
20. Crespo S, Cortes O, Garcia C, Perez L. Comparison between rotary and manual instrumentation in primary teeth. J Clin Pediatr Dent 2008;32(4):295-8.