

Rotary Instrumentation in Primary Teeth: A Review

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Pediatric Endodontics has evolved a great deal in the past few decades. There are advancements in the techniques and materials used for pulpectomy therapy in primary teeth. Rotary instrumentation has been very popular and routinely technique in permanent teeth. Despite this, the manual technique is a preferred method in primary teeth. In-vitro or cross-sectional studies have revealed rotary instrumentation to be more advantageous than manual in terms of procedural time, cleaning efficiency and quality of root filling. Though instrument fracture is a potential concern with rotary files there are not enough evidence to contraindicate its use in primary teeth. This paper has briefly reviewed the literature related to the use of rotary instrumentation in primary teeth and discussed the necessity to carry out long-term clinical trials to adopt the technique in routine or contraindicate its use in primary teeth.

KEYWORDS: Pulpectomy, Rotary instrumentation, Primary teeth

INTRODUCTION

In spite the emphasis on prevention, damage to dental pulp from factors such as dental caries and traumatic injuries cannot be eliminated. The premature loss of primary tooth due to pulpal involvement still remains a common problem. It leads to mesial drift of the permanent teeth resulting into a malocclusion.¹ The successful management of the pulpally involved primary teeth is critical in preserving arch space, preventing aberrant tongue habits and speech problems. It also helps to maintain esthetics and normal eruption time of the succedaneous tooth apart from preventing psychological effects associated with early tooth loss.²

The success of pulpectomy treatment depends on a number of factors which include the method as well as the quality of instrumentation, irrigation, disinfection, and obturation of root canals.^{3,4} Therefore, the procedures aimed at preventing and treating pulp disease in the primary and immature permanent teeth remain an integral part of contemporary dental practice. The primary tooth with severe chronic inflammation or necrosis of the radicular pulp needs to be treated with pulpectomy. The therapy includes the removal of irreversibly inflamed or necrotic pulp tissue by cleaning the root canal, followed by

filling with a material that can resorb at the same rate as the primary tooth.² Therefore there is continuous scope to improve and carry out the research in perfecting the procedure and materials aiming at evolving better outcome of root canal treatment in these teeth.

Pediatric Endodontics has evolved a great deal in the past few decades. There are advancements in the techniques and materials used for pulpectomy procedure. The root canal instrumentation is an important step of the endodontic procedure in primary teeth, as the main objective of the procedure in these teeth is to effectively remove the infection. At the same time, it is challenging also, due to narrow and curved roots of primary teeth which are undergoing physiological resorption.⁵ Rotary instrumentation has been a very popular and routinely used technique in permanent teeth. Despite this, the manual technique is a preferred method in primary teeth. It has been found to be associated with undesirable curvatures in the root canal morphology. This makes the proper filling of the root canals difficult. The manual instrumentation is time-consuming and can lead to iatrogenic errors.⁶ Therefore, an ideal instrumentation technique in these teeth should be efficient in

both preparation time as well as root canal shaping, promoting a better quality of filling.

REVIEW OF THE LITERATURE

Rotary instrumentation is an evolution in the field of endodontics. The technique has overcome many problems associated with manual instrumentation. Although, several investigators have reported the superiority of rotary nickel-titanium [NiTi] instrumentation over the manual one for cleaning and shaping of permanent teeth.⁷ There is a paucity of literature regarding its use in primary teeth. A number of authors have carried out in-vitro studies in primary teeth to compare the manual and rotary techniques of root canal instrumentation⁸⁻¹⁶ [Table 1]. The results of majority revealed the NiTi rotary instrumentation to be superior over the manual instrumentation in terms of time of instrumentation and efficiency to clean the root canal system of primary teeth.

Nickel-titanium alloy was developed in 1960s and first NiTi rotary file appeared in the market around 1993, used in permanent teeth. Barr et al. (2000)¹⁹ was the first to use nickel titanium rotary files for instrumentation of root canals in primary teeth. He was of the opinion that the root canal preparation in primary teeth was cost-effective and rapid, resulting in consistently uniform and predictable obturation. Despite its advantages the use of rotary instruments in primary teeth is not much popular. Very few investigators have carried out in-vivo studies with majority being cross-sectional without long term follow up^{20,21,22} [Table 2].

DISCUSSION

The pulpectomy procedure in primary teeth has improved significantly over the past few years in terms of irrigating solutions, obturating materials, post-obturation restorations etc. Though, rotary instrumentation technique is very popular and used routinely in permanent teeth. However, no such change has been observed in the technique of root canal instrumentation in primary teeth. Despite the advantages of rotary instrumentation technique over manual one, there are no clear guidelines or instructions regarding its use in the primary teeth.

The introduction of the nickel titanium rotary files for instrumentation of root canals in primary teeth

is recent and to best of our knowledge no study in the literature has evaluated the long clinical and radiographic success of pulpectomy using rotary instrumentation technique. Also, there are no clinical trials comparing the long term success of pulpectomy treatment using the manual and rotary techniques.

The fracture of rotary instrument can be a limiting factor for its use in a primary tooth with its subsequent adverse effect on the developing succedaneous tooth. However, the question still arises why the technique is then so popular in permanent teeth? The fracture of rotary instruments is multifactorial phenomenon depends upon operator skill and experience and number of times instrument has been used.²³ There should be established clinical guidelines and indications for use of rotary instrumentation in primary teeth. The clinical studies with long term follow ups should be carried out before recommending or contraindicating the use of rotary technique of root canal instrumentation in primary teeth.

CONCLUSION

1. No long term clinical trials exist in the literature to recommend or contraindicate the use of rotary technique of instrumentation in primary teeth.
2. There is a lack of clinical data to compare rotary technique with the standard manual technique for instrumentation of root canals in primary teeth.

CONFLICT OF INTEREST

Authors declare no conflict of interest. Research is independent and not funded by any agency.

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Cite this article as:

Morankar R, Goyal A. Rotary Instrumentation in Primary Teeth: A Review. Int Healthcare Res J 2017;1(5):10-6.

Source of support: Nil, **Conflict of interest:** None declared**AUTHOR AFFILIATIONS:**

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LEGENDS

Authors, Year and Country Reference	Sample	Study design and instrument used	Parameters and observations	Outcome
Silva et al. (2004) Brazil ⁸	33 primary molar root canals from 17 maxillary and mandibular extracted deciduous molars	Group I- Manual K files, Group II-Rotary Profile 0.04 instruments Group III-unprepared root canals.	Cleaning efficacy Instrumentation time	The manual and rotary techniques did not differ in cleaning efficiency in each of the three root thirds. Statistically significant reduction in instrumentation time with rotary technique (3.46 minutes) compared to that of manual technique (9.06 minutes).
Nagaratna et al. (2006) Davangere India ⁹	Extracted primary mandibular second molars (n=20) and permanent mandibular first molars (n=20)	<i>Group I- primary molars</i> IA -Manual stainless steel K-files IB- Profile nickel-titanium rotary files (0.04 taper) <i>Group II- Permanent molars</i> IIA – Manual stainless steel K-files IIB- Profile nickel-titanium rotary files (0.04 taper)	Instrumentation time Instrument fracture Shaping of canal	Instrumentation time using rotary files was significantly less compared to manual files Deformation was a prominent feature seen in manual stainless steel group while fracture was seen more with NiTi rotary instruments Canals prepared with rotary nickel-titanium files had good canal taper and smoothness compared to those prepared with manual K files
Bahrololomi et al. (2007) Iran ¹⁰	44 extracted primary anterior teeth	Group I- Manual K-files, Group II - Rotary Flex-master instruments	Instrumentation time Cleaning capacity	Statistically significant difference in instrumentation time and cleaning capacity between the two techniques

Kummer et al. (2008) Brazil ¹¹	80 extracted human primary teeth	Group I- Manual stainless steel K-files (n=40) Group II- Rotary HERO 642 files (n =40)	Amount of dentin removed and risk of perforation Time required for canals preparation	Rotary instrumentation causes lesser dentin removal, allowed uniform preparation of root canal and required lesser instrumentation time
Moghadda M et al. (2009) Iran ¹²	68 canals of twenty three extracted primary molars	Group I (n=30) Manual K-files for instrumentation Group II (n=30) <i>Rotary Flex master files</i> for instrumentation Group III (n=8) Control - No instrumentation	Cleaning efficacy Instrumentation time	The two experimental groups did not differ significantly in cleaning efficacy at the cervical, middle and apical third of the root canal. Instrumentation with Flex Master rotary files was significantly less time consuming
Madan et al. (2011) Karnataka India ¹³	75 extracted primary molars	Group I- Rotary Profiles Group II- Manual stainless steel k files	Cleaning efficacy Instrumentation time	Rotary <i>ProFiles</i> cleaned better than manual K-files in the coronal one-third of root canal. The overall difference in the cleaning efficiency was statistically non- significant. Profiles took more instrumentation time compares to manual stainless steel k files
Mohammad Reza Azar et al. (2012) ¹⁴	80 extracted primary mandibular molars (47 first molars and 33second molars)	Group I- Mtwo rotary system Group II- ProTaper rotary system Group III- Manual stainless steel k files	Cleaning efficacy	No statistically significant difference between manual and rotary instrumentation in cleaning efficiency ProTaper rotary files were better in the coronal and middle thirds than in the apical third of root canals
Pinheiro et al. (2012) Brazil ¹⁵	15 extracted deciduous molars (7 maxillary and 8 mandibular molars)	Group I- Manual stainless steel k files Group II- Endowave, rotary system Group III- ProTaper rotary system	Instrumentation time Cleaning efficacy	No significant difference between groups in Cleaning efficacy The ProTaper system presented significantly shorter instrumentation time compared to manual instrumentation. Endowave system didn't show any statistically significant difference in instrumentation time compared to the other groups
Bugra Ozen et al. (2013) Ankara Turkey ¹⁶	Extracted primary second molars maxillary (n=27) and mandibular (n=27)	Group I: Manual K-files. Group II: ProTaper rotary system Group III: Hero 642 rotary system	Risk of perforation Instrumentation time	Risk of perforation in Group III was 22% as compared to 17% each in Group I and Group II. No statistically significant differences between three groups. No statistically significant difference between rotary and manual techniques of instrumentation with regards to time

Musale et al. (2014) India ⁷	60 extracted primary mandibular second molars	Group I : Manual K-files Group II :Rotary ProFile system Group III: Rotary ProTaper files Group IV: Rotary Hero Shaper files	Shaping of root canal Cleaning efficacy Instrumentation time Instrument distortion	Taper of the prepared canals with rotary files was significantly better than with manual K-files. No difference in shaping ability amongst the different rotary file groups. Cleaning efficacy of rotary files was significantly better than manual K-files. Instrumentation time with K-file group was significantly higher compared to rotary. None of the rotary files were found to be distorted/ fractured during study
Katge et al. 2014 India ⁸	84 extracted primary molars	Group I- Manual K- files Group II- Rotary ProTaper files Group III-Wave One reciprocating system	Instrumentation time Cleaning efficacy	Wave One was better in terms of cleaning efficacy than the ProTaper and K-file. Mean instrumentation time of Wave One group was significantly lesser than ProTaper and K-file group.

Table 1. In-vitro studies comparing the manual vs. rotary method of root canal instrumentation in primary teeth

Author, year and country	Sample	Age group	Study design and instrument used	Parameters and observations	Follow up period	Outcome
Barr et al. (2000) Texas USA ¹⁹	A primary central incisor and a primary mandibular second molar	-	ProFile Rotary Instruments	Advantages and disadvantages of using rotary files in primary teeth		Rotary instrumentation technique effectively debride the uneven walls of primary teeth. It also allows easier insertion of obturation paste and causes less over-obturation.
Kuo et al. (2006) Taiwan ²⁰	51 primary molars (5 maxillary first molars, 9 maxillary second molars, 16 mandibular first molars, 21 mandibular second molars) in 22 children	Mean age 4 year 8 months (Age range 3 years 2 months to 7 years 8 months)	ProTaper rotary files SX (19 mm) and S2 (21 mm)	Success rate of endodontic treatment Instrumentation time Complications related to instrumentation procedure	12 months	Success rate was 95 % at the 12-month recall examination. Instrumentation time was approximately 4-5 minutes. Ledges, over- instrumentation, instrument fracture or lateral perforation were not encountered during instrumentation procedure.
Romero et al. (2011) Mexico ²¹	40 children	5-9 years	Group I- Manual k files Group II- K ₃ rotary Ni-Ti files	Instrumentation and Obturation time Quality of obturation	-	Instrumentation time 'in the manual technique group (17.7; 10.3-30.6 min) was significantly longer than that in the rotary technique group (13.3; 2.2-17.5 min). Obturation time in the manual technique group (2.1; 1.1-5.7 min) was significantly longer than in the rotary technique group (1.5; 0.4-3.2 min). With the manual technique, 50% teeth were optimally filled, 40% were underfilled, and 10% were overfilled. With the rotary technique, 80% teeth were optimally filled, 10% were underfilled and 10% were overfilled and differences were statistically significant.
Subramaniam et al. (2013) India ²²	60 first and second primary molars	5-9 years	Group A: HERO shaper rotary NiTi files Group B: Hand NiTi files Group C: Stainless steel hand files	Reduction in microflora of root canals after instrumentation	-	There was a significant reduction in both aerobic and anaerobic mean microbial count in all three groups following root canal instrumentation. There was no statistically significant difference between three groups

Table 2. In-Vivo studies comparing manual vs. rotary method of root canal instrumentation in primary teeth