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REVIEW ARTICLE

Rotary endodontics in primary teeth – A review

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Abstract Endodontic treatment in primary teeth can be challenging and time consuming, especially during canal preparation, which is considered one of the most important steps in root canal therapy. The conventional instrumentation technique for primary teeth remains the "gold-standard" over hand instrumentation, which makes procedures much more time consuming and adversely affects both clinicians and patients. Recently nickel–titanium (Ni–Ti) rotary files have been developed for use in pediatric endodontics. Using rotary instruments for primary tooth pulpectomies is cost effective and results in fills that are consistently uniform and predictable. This article reviews the use of nickel–titanium rotary files as root canal instrumentation in primary teeth. The pulpectomy technique is described here according to different authors and the advantages and disadvantages of using rotary files are discussed.

Contents

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1. Introduction

One of the most important concerns in pediatric dentistry is the loss of necrotic primary molars leading to space loss. Although the morphology of root canals in primary teeth renders endodontic treatment difficult (Schafer et al., 2006a,b), pulpectomies of primary teeth with severe pulpal involvement should be considered as the treatment of choice.

Bacteria play an essential role in the initiation and perpetuation of pulpal and periapical disease (Dantas, 1997). The primary objectives when cleaning and shaping the root canal system is to remove soft and hard bacteria-containing tissue, provide an irrigation path for to the apical third, instilling space for instruments, subsequent obturation, and retaining the integrity of radicular structures (Cohen and Hargreaves, 2006). Thus, success of pulpectomy depends on elimination of irrigation pathway by cleaning and shaping the root canals (Yang et al., 1996).

Root canal preparation is performed with reamers, files, burs, sonic instruments, mechanical apparatuses, and with nickel–titanium (Ni–Ti) rotary file systems. Since most hand preparation techniques are time consuming and can lead to iatrogenic errors (i.e., ledging, zipping canal transportation, and apical blockage), much attention has been directed toward root canal preparation technique with Ni–Ti rotary instruments (Walton and Torabinejad, 2002). Numerous studies have reported that they could efficiently create smooth, predetermined funnel-form shapes with minimal risk of ledging and transportation (Dantas, 1997; Esposito and Cunningham, 1995; Thompson and Dummer, 1997). The design and high flexibility of Ni–Ti files allow instruments to closely follow the original root canal path, especially in curved canals (Esposito and Cunningham, 1995; Gluskin et al., 2001; Hidsmann et al., 2003; Sonntag et al., 2003). However, all these studies were done in permanent teeth.

A practical pulpectomy technique for the primary teeth should include the following (Kuo et al., 2006):

1) Fast procedure with short treatment time and minimal number of appointments.
2) Effective debridement of the root canal without weakening the tooth structure or endangering the underlining permanent teeth.
3) Minimal procedural complications.
4) Maintaining tooth function until it is naturally exfoliated.

Negotiation and thorough instrumentation of bizarre and tortuous canals encased in roots programed for physiological resorption are the main challenges for pulpectomy (Ahmed, 2013).

Mechanical preparation of primary teeth utilizing Ni–Ti rotary files was first done by Barr et al. (2000). They concluded that the use of Ni–Ti rotary files for root canal preparation in primary teeth was cost effective, faster, and resulted in consistently uniform and predictable fillings. Several investigators have reported the advantages of preparation with rotary Ni–Ti instruments over the manual method for both experienced and inexperienced operators (Nagaratna et al., 2006; Sleiman et al., 2007). Silva et al. reported that Ni–Ti rotary preparation for extracted teeth was faster than hand preparation but the canals were not as clean (Silva et al., 2004).

Ni–Ti rotary instruments of different designs are available. Manufacturers highlight their cleaning efficacy for root canal preparations, simple procedures, and decreased procedure times, which is especially important in children. Various designs for taper, blades, grooves, and tips have been suggested (Bergmans et al., 2003). The shaft designs can be grouped according to taper into two categories: progressive or constant. It has been reported that instruments with progressive tapers can shape canals more quickly than constant taper instruments (Veltri et al., 2005). In the progressive ProTaper system, the shaping files (S) have an increasing taper in the coronal direction, whereas the finishing files (F) have a decreasing taper. It has been claimed that the increasing taper instruments have enhanced flexibility in the middle region and at the tip, and that the decreasing taper instruments provide a larger taper in the important apical region but make them stiff (Bergmans et al., 2003).

According to authors who initially advocated rotary technique in primary teeth, the pulpectomy technique begins with a standard access and removal of coronal tissue (Barr et al., 1999, 2000). Ni–Ti PROFILE® is chosen according to that which approximates the canal size. It is inserted into the canal while rotating and is taken to working length as determined by pre-treatment radiography. The rotating file is withdrawn and cleaned of pulp tissue and dentinal debris. The canal is cleansed and shaped with sequentially larger files until the last file binds. Apical overextension of Ni–Ti file can result in an enlarged apical foramen and cause an overfill of pulpectomy paste. Sterile water or chlorhexidine can be used to keep the canals moist. Frequently inspecting each file for flute unwinding or distortion is important, and files with these characteristics should be discarded immediately. If no flute distortion is detected, discard the file after using on five primary teeth. After irrigation, the canals are dried and filled with zinc oxide and eugenol using a hand files to push the paste just short of the apex.

Shashikiran et al. also compared the Ni–Ti rotary PROFILE and K files hand instrumentation on root canal preparation of primary and permanent molars for their efficacy in preparation time, instrumentation failure, and shaping the canals. They concluded that PROFLE 0.04 taper 29 series prepared canal rapidly than conventional K files (Shashikiran, 2006).

According to Kuo et al., the clinical procedure is as follows - under appropriate local anesthesia and rubber dam isolation, the pulpectomy begins with complete caries removal, a standard access opening and removal of coronal pulp tissue (Kuo et al., 2006). The shelf of dentin overlying most canal orifice is reduced using a high speed round bur until the entire canal orifice is clearly identified. An approximate working length is derived terminating approximately 1 mm above the root apex. Before instrumentation, the pulp chamber is copiously irrigated with 2.5% sodium hypochlorite. A number 10 k file is first used to explore the canals. Then the ProTaper SX file is inserted into the 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 is then inserted into the canal