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Research Paper

Manual versus rotary instrumentation for primary molar pulpectomies- A 24 months randomized clinical trial

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ABSTRACT

Objective: The study compared manual and rotary canal instrumentation differences in primary molars receiving pulpectomy and their effect on clinical success after two years.
Materials and methods: Sixty pulpally involved primary mandibular second molars requiring pulpectomy treatment were randomly assigned for manual or rotary instrumentation in children aged 4–7 years. The endodontic procedural steps were similar except the method of root canal instrumentation i.e. manual group (Stainless steel files 2% taper) and rotary group (Hyflex CM NiTi rotary files 4% taper).
Results: The mean instrumentation time for the manual and rotary groups were 25.71 ± 3.84 and 19.37 ± 4.94 min respectively with a statistically significant difference ($p < 0.001$) between the groups. The differences between the groups' obturation time, quality of obturation, and complications during instrumentation were not statistically significant ($p > 0.05$). At 24 months, the clinical success was 92.3% and 85.2% ($p = 0.52$) whereas the radiographic success was 65.4% and 66.7% ($p = 0.78$) comparing the manual and rotary groups respectively.
Conclusion: Rotary instrumentation takes significantly less time than manual. There was no difference in obturation time, quality of obturation, or success rates after 24 months.

1. Introduction

Despite the emphasis on prevention, damage to dental pulp still occurs. This can be from the progression of dental caries, restorative procedures, or traumatic injuries [1]. Premature loss of primary teeth still remains a common problem. Retaining pulpally involved primary teeth preserves arch space which decreases aberrant tongue habits, maintains esthetics, and helps in normal eruption of succedaneous teeth [2]. One of the treatment options for pulpally affected primary molars is pulpectomy, which has several advantages over

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extraction. The procedure includes removal of irreversibly inflamed or necrotic radicular pulp tissue, cleaning the root canal system, followed by root canal filling. The success of pulpectomy treatment depends on the method and the quality of instrumentation, irrigation, disinfection and obturation of the root canals [3,4].

Instrumentation of root canals in primary teeth is carried out with the primary objective to remove the infection [5]. It is challenging due to the presence of extensive webbing of pulpal tissue within the narrow and curved roots of primary teeth which exhibit continuous physiological resorption [6].The traditional method of cleaning and shaping the root canals in permanent teeth using manual stainless steel files can lead to undesirable curvatures in root canal morphology making a proper filling of the root canals difficult. It is also time-consuming and sometimes leads to iatrogenic errors [7]. Rotary nickel-titanium instrumentation techniques have been developed to overcome these problems. Several investigators have reported the superiority of rotary instrumentation over manual in permanent teeth [8]. However, there is a paucity of literature regarding the use of rotary instruments in primary teeth. Some in-vitro studies have demonstrated the superiority of nickel titanium rotary instruments over the manual one with regard to time efficiency and cleaning capacity for instrumentation of root canals in primary teeth [9–15].

There are no published papers on primary tooth pulpectomy comparing different instrumentation methods and their effect on success after two years. The majority of the trials are either in-vitro or are cross-sectional in design [9–16]. The purpose of this investigation in primary teeth was two-fold: (1) to evaluate if there was any difference between manual and rotary canal instrumentation time, obturation time, quality of fill and complications during instrumentation; (2) to compare the clinical and radiographic pulpectomy success when using hand files versus rotary files after two years.

2. Materials and methods

2.1. *Sample selection*

Based on history, clinical signs and symptoms and radiographic examination a total of 60 decayed primary mandibular second molars, requiring pulpectomy treatment were selected from children aged 4–7 years, attending the Outpatient Unit of Pediatric and Preventive Dentistry at Oral Health Sciences Centre, Postgraduate Institute of Medical Education and Research, Chandigarh. Inclusion criteria for the sample were teeth that exhibited any one or more of the following: a necrotic pulp, sinus tract, irreversible pulpitis symptoms, radiolucent areas in furcation or periapical region, and had at least two-thirds of each root remaining. Exclusion criteria were teeth with any of the following associated characteristics: tooth structure inadequate for restoration, perforated pulpal floor, swelling (intraoral or extraoral) and excessive mobility. In addition, children with mental disabilities, systemic diseases, and those requiring sedation/general anesthesia for management were not included in the study.

An ethical clearance was obtained from Institute Ethic Committee before the commencement of the study. The parents were informed about the objectives of the study and a written informed consent was obtained.

2.2. *Randomization*

The selected mandibular second primary molars were randomly allocated to one of the two treatment groups using block randomization technique of varying block sizes using computer generated sequence. It was provided by an independent researcher not involved in the study. The allocation was done using serially numbered concealed envelopes opened just after working length determination by a person other than the operator. Block randomization ensures equal chance of selection without any allocation bias also the sample remain equally distributed at any given point of time.

2.3. *Clinical procedure*

The pulpectomy procedure was performed on all the selected teeth in a single appointment by the same operator (Principal Investigator). Routine non-pharmacological behavior management techniques were used to manage the children. The standard endodontic procedural steps were performed on all the selected teeth. The intervention (rotary group) and control (manual group) differed only in terms of root canal instrumentation technique. The clinical procedural steps included; administration of local anesthesia (2% lignocaine, Lignox, Bangalore, India), application of rubber dam and adequate root canal access preparation. The pulpal debris was removed with broaches and canals were irrigated with 2.5% sodium hypochlorite (Alfa Laboratories, India). No. 15 fine reamers and files (Mani Inc. Japan) were gently inserted into the canals and a diagnostic radiograph was obtained to establish the length of root canals. In the manual group, instrumentation of the root canals was done using manual stainless steel files (No.15–30 files with 2% taper Mani Inc. Japan) in a sequential manner to the predetermined working length. Copious irrigation was done using 2.5% sodium hypochlorite and normal saline alternatively. All the canals were enlarged up to a size of No. 30 file. In the rotary group, instrumentation of the root canals was done using hyflex-CM [17–19] nickel titanium rotary files (Coltène Whaldent Inc., USA) with 4% taper operating at 500 rpm with minimum torque setting. After establishing the working length, an orifice opener (08/25,19 mm) of 8% taper, size 25, length 19 mm was used in the coronal root canal up to 3–4 mm using a crown-down method to widen the canal orifice. Further, cleaning and shaping of the root canals was carried out using rotary files nos. 04/20, 04/25, 04/30 in a sequential manner to the predetermined working length. Care was taken to avoid any over instrumentation. Copious irrigation was done using 2.5% sodium hypochlorite and normal saline alternatively. All the canals were enlarged up to a size of No.30 file.

The prepared canals were dried with absorbent paper points (SSWhite, Lakewood, New Jersey) followed by obturation with a mixture of calcium hydroxide paste (Apexcal, Ivoclar Vivadent, USA) and zinc oxide powder (Septodont, India). The obturation mixture was prepared by mixing a 7.5 cm long strip of calcium hydroxide paste (Apexcal, Ivoclar Vivadent, USA), 70 mg of Zinc oxide powder (Septodont, India)

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