

ASSESSMENT AND COMPARISON OF ANXIETY LEVEL AND BEHAVIOR CHANGE OF CHILDREN UNDERGOING PEDIATRIC ENDODONTIC TREATMENT USING MANUAL AND ROTARY FILE SYSTEMS

Paediatric Dentistry

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ABSTRACT

Introduction- Children and adolescents, with their diverse attributes such as age, competence, maturity, personality, and cultural backgrounds, present unique challenges for dental practitioners. Invasive dental procedures can increase anxiety and negative behavior in children, influencing treatment decisions. The maintenance of primary teeth through procedures like pulpectomy is vital for preserving arch integrity and preventing malocclusion. The success of pulpectomy relies on proper biomechanical preparation, which can be time-consuming with conventional manual instrumentation. Rotary instrumentation become significantly relevant when dealing with endodontic preparation of primary teeth since appointment length is a crucial factor for pediatric patient compliance **Aims-** To assess and compare anxiety level and behavior changes of children undergoing the endodontic treatment using Rotary Files and Manual K-Files system and to compare the mean instrumentation using them. **Methodology-** The clinical study encompassed 60 primary molars in patients aged 4-6 years. Pulpectomy procedure was performed in two visits. The total treatment duration was not more than 40 minutes in each visit. Behavior change, Anxiety levels and instrumentation time were compared. Following chemo-mechanical preparation, canals were obturated. **Results-** The current study resulted that increased level of anxiety and more negative behavior while using manual hand K files on comparing with rotary hand files. **Conclusion-** The current study concludes that increased level of anxiety and more negative behavior was noticed during the instrumentation of the canal with Manual K files.

KEYWORDS

Pediatric, Behavior Management, Endodontics, Rotary Files, Manual Hand K- Files, Pro Af baby Gold

INTRODUCTION

Dental professionals face distinct challenges when treating children and adolescents due to their varying ages, skills, maturity levels, temperaments, and cultural backgrounds. Some patients may need extra support to feel at ease during dental procedures.¹ Regular dental check-ups are essential for maintaining oral health throughout the life.² Infrequent visits have been associated with poorer self-rated oral health and more clinical dental problems (Richards et al.³; Thomson WM et al.⁴; Crocombe LA et al.⁵).

Dental anxiety is prevalent, particularly among children, with 6-15% skipping routine dental appointments. This anxiety is linked to higher incidences of decayed and extracted teeth and a lower quality of life-related to oral health.⁶ Understanding the social factors influencing a child's behavior is critical for effective dental care, as recognizing signs of negative behavior can significantly impact treatment. Additionally, dental anxiety can persist into adulthood, potentially leading to further dental issues.⁷

Maintaining primary teeth through treatments such as pulpectomy is crucial for preserving the dental arch structure and preventing misalignment. A pulpectomy involves removing the pulpal tissue, cleaning the canal space, and filling it with a resorbable material (Fuks et al.⁸).

The use of rotary instrumentation in pediatric dentistry has shown promising results, including reduced chair time, improved patient compliance, and better conservation of tooth structure. The introduction of rotary files, particularly after Barr et al.⁹ introduced Profile 0.04 taper rotary instruments, has been influential. Pediatric dentists have since adopted various rotary Ni-Ti systems for primary root canal procedures. The features of rotary instruments are essential for efficient root canal preparation in primary teeth.

This study aimed to compare anxiety levels and behavioral changes in children undergoing endodontic treatment using manual versus rotary file systems. Standardized rating scales were employed to evaluate the effects of these techniques, providing valuable insights into pediatric dental practices.

MATERIALS AND METHOD

The study included 60 children from various backgrounds attending the Out Patient Department of Institution. These children were undergoing pulpectomy treatment for their primary molars and had no pre-existing conditions that could influence the study outcomes. The parents were informed about the study's objectives and written informed consent was obtained.

Inclusion Criteria

- Age group of 4-6 Years
- Children with no previous visit to the dental office]
- Children with no previous post-traumatic stress disorders or specific phobia-related dental settings.
- Children with no history or previous experience of intra-oral blocks and injections.
- Primary molar teeth with asymptomatic irreversible pulpitis.
- Primary molar teeth with necrotic canals or an abscess or sinus tract.
- Radiolucent areas in the furcation region

Exclusion Criteria

- Children with special healthcare.
- Children with limited or lacking cooperative abilities.]
- Children requiring sedation/general anaesthesia for behavior management.

Clinical Procedure

At the initial visits, the children were given a brief tour of the dental operatory and informed about the procedure using communication and the Tell-Show-Do technique. They were also introduced to the instruments and explained the tasks involved. The same treatments were provided to all the children, including oral prophylaxis, fluoride application, and glass ionomer cement restoration. Each visit lasted no longer than 40 minutes. Following the initial visits, a single experienced dentist performed the pulpectomy procedure over two sessions, utilizing rotary and manual instrumentation techniques in a sterile environment.

Visit 1: Local anaesthesia was administered to the patients, followed by isolation, access cavity preparation, and pulp extirpation. The working length (WL) was established using #15 or #20 K-Files, with simultaneous irrigation of the pulp chamber. According to the standard Ingle's method, the working length was maintained 1 mm short of the radiographic apex. The routine pulpectomy procedure protocol was consistently applied to all children to minimize potential bias. The second visit was scheduled 3 days after the First Visit.

Visit 2: The lottery system randomization was used to sort the selected children into two groups

Group I (n=30)	Rotary Pro AF Baby Gold	Dentobizz, India
Group II (n=30)	Manual K files	Mani, INC, Japan

For Group I i.e., Rotary Pro AF Baby Gold Files

The root canals were enlarged according to the manufacturer's recommended sequence using the Pro AF Baby Gold rotary file system and an endo motor (CalPro CL2i, Coltene Whaledent). All root canals were initially negotiated with lubricated files and 17% EDTA. Initial patency was confirmed with a #15 No. K-File from Mani, Japan. The Pro AF Baby Gold pediatric rotary files were employed with the endomotor handpiece set to 300 RPM, 2N torque, and auto-reverse mode. The procedure included extensive irrigation and recapitulation, followed by final irrigation with saline. Canal instrumentation was performed using a pecking motion until the working length was reached, after which the files were withdrawn with a lateral brushing motion.

For Group II i.e., Manual K-Files

Hand instrumentation was performed using K-Files up to #40 with a quarter turn and pull motion. Following canal preparation, the root canals were dried with absorbent paper points. The primary molar root canals were then obturated with Metapex (Metapex Plus, Meta Biomed Co. Ltd). A post-obturation radiograph was taken to assess the quality of the obturation. The pulp chamber was cleaned with a moist cotton pellet and then restored with type II glass ionomer cement (Ketac Molar, 3M). Final restoration was completed with stainless steel crowns (3M ESPE, USA) at the subsequent appointment, scheduled within one week after obturation. All participants were advised to report any symptoms, such as pain or swelling. Parents or guardians were present during all treatment visits. Each treatment session lasted no longer than 40 minutes, and to maintain consistency, all children were treated in the morning between 10:00 am and 12:00 pm.

During these visits to pulpectomy, the behavior and anxiety of the patients were assessed using the Frankl's behavior rating scale and Facial Image Scale, respectively.

Behavior and anxiety were assessed at the first visit of pulpectomy and were divided into following five phases:

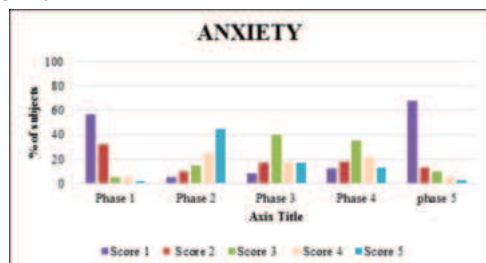
- (1) **Phase I:** 5 minutes before the start of the treatment.
- (2) **Phase II:** During administration of local anaesthesia.
- (3) **Phase III:** During access cavity preparation.
- (4) **Phase IV:** During pulp extirpation.
- (5) **Phase V:** 5 minutes after completion of treatment.

To assess the anxiety and behavior, the second visit (root canal instrumentation procedure) was divided into four phases:

- (1) **Phase I:** 5 minutes before the start of the instrumentation of the root canal.
- (2) **Phase II:** During instrumentation of root canal.
- (3) **Phase III:** Immediately after instrumentation of root canal.
- (4) **Phase IV:** 5 minutes after the completion of the instrumentation of the root canal.

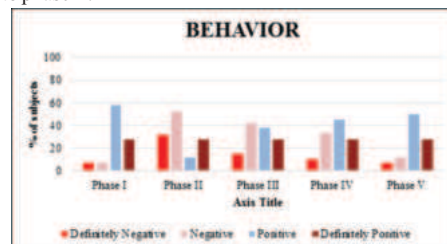
The duration of instrumentation is the time taken to prepare and shape the root canals after accessing and determining the working length. The type of instrumentation used was undisclosed to participants, assessors. The operator could not be blinded due to distinct characteristics of the files. Assessment included anxiety, behavior, and instrumentation duration, with data recorded.

RESULTS



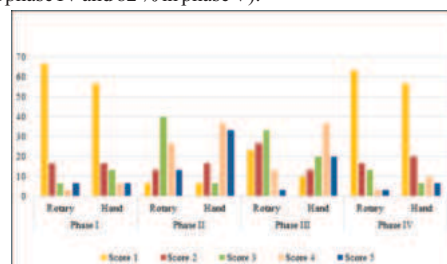
Graph 1: Percentages of children with different anxiety scores during visit 1

A maximum number of subjects demonstrated the least level of anxiety (corresponding to score 1) of 57%, & 68% during phase I (5 mins before the treatment) and phase V (5 minutes after the treatment) respectively. On the contrary, most subjects demonstrated a maximum level of anxiety (correspondence to score 5) of 45%, in phase II during the administration of LA, followed by 17% in phase III (during cavity preparation) and 13% in phase IV (during pulp extirpation). A complete reversal of anxiety score distribution was observed from phase I to phase II.



Graph 2 Percentages of children with different behavior during visit 1

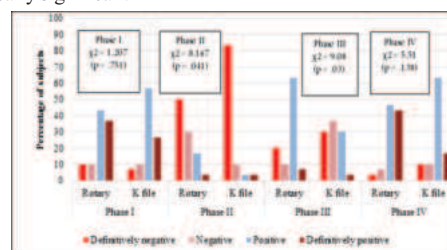
The distribution of all positive and all negative responses across different phases of visit 1 is depicted in graph 2. In first phase maximum children (87%) exhibited positive behaviour, which was reversed in phase II, during administration of LA, with positive behaviour by 17% and negative behaviour by 83 %. In the following phases, (phase III, IV and V), there is a gradual decrease in negative behaviour (from 57 % in phase III to 43 % in Phase IV and 18 % in phase V) and increase in positive behaviour (from 43 % in phase III, to 57 % in phase IV and 82 % in phase V).



Graph 3 Distribution of anxiety scores across different phases of treatment in rotary and manual treatment groups.

The graphical representation of the percentages of anxiety scores in different phases of rotary and manual treatment is presented in graph 3, Intergroup comparison (between treatment groups) of anxiety scores revealed statistically significant differences in the response outcome in phase II, $\chi^2 (3, 60) = 10.30, p < .05$, and in phase III $\chi^2 (3, 60) = 10.77, p < .05$.

The response outcome in phase I and IV did not appeared to be statistically significant



Graph 4 Distribution of behavior scores across different phases of treatment in rotary and manual treatment groups.

The graphical representation of the percentages of behavioral pattern responses in different phases of rotary and manual treatment is presented in graph 4. Intergroup comparison (between treatment) of behavior response performed separately for different phases showed statistically significant differences in the response outcome in phase II, $\chi^2 (3, 30) = 8.17, p < .05$, and in phase III $\chi^2 (3, 30) = 9.08, p < .05$. The response outcome in phase I and IV did not appeared to be statistically significant.

The mean duration of treatment required for rotary and manual file

system. A statistically significant difference is observed between the treatment group with the K file system requiring more time (mean 27 ± 2.66 min) as compared to rotary Pro AF Baby Gold (mean 18.1 ± 1.33 min).

DISCUSSION

Sweet CA¹⁰ was the pioneer in introducing a novel approach to dental care, suggesting that decayed teeth should be retained until they naturally fall out. Currently, pulpectomy is the preferred treatment for symptomatic primary teeth, with its success relying significantly on the use of rotary files for canal preparation.¹¹

Traditionally, endodontic treatment of primary teeth has relied on hand files. However, **Barr et al.**⁹ demonstrated that rotary instruments are a superior alternative to hand files for this purpose. The integration of rotary instruments into root canal preparation for pulpectomy in primary teeth has transformed endodontics, offering a safer and more efficient method for achieving optimal results.¹² Rotary instruments provide more precise canal preparation, which reduces the risk of accidental slippage and leads to better-filled canals. This advancement enhances the success of the pulpectomy procedure by facilitating easier and more accurate insertion of filling materials.

Participants in this study were chosen from the 4 to 8-year age group because primary molars typically complete their root formation by age 4, while root resorption has not yet started. According to **Brar GS et al.**¹³ pulpectomy success rates are significantly higher in primary teeth with minimal or no preoperative root resorption compared to those with extensive (> 1 mm) resorption. Additionally, **Cademartori MG et al.**¹⁴ found that children under four are more sensitive to pain and exhibit more negative behavior compared to older children. Therefore, the study focused on children aged 4 to 8 and excluded decayed primary teeth to prevent any bias related to pain perception and behavior during treatment.

Milgrom P et al.¹⁵ and **Sharma et al.**¹⁶ suggested that dental anxiety may arise from several factors, often associated with conditioned phobias resulting from negative dental experiences. Additionally, **Ten Berge M et al.**¹⁷ provided evidence supporting a link between invasive dental procedures and heightened levels of dental anxiety in children.

In this study, children with no previous dental experience were selected and introduced to a child-friendly dental environment where they were familiarized with dental tools and materials before undergoing endodontic therapy. Each child received a series of treatments, including oral cleaning, fluoride application, and restoration with glass ionomer cement.

Frankl's behavior rating scale (Figure 3) was employed to compare the behavior of children when subjected to instrumentation using manual and rotary files as it is most dependable tool for evaluating the behavior of children based on the research done by **Venham LL**¹⁸ also **H Buchanan and Niven N**¹⁹ found that the Facial Image Scale (Figure 4) which is used in this study, a reliable tool for assessing dental anxiety in children so was used for the assessment of anxiety levels.

Pekruhn RB²⁰ conducted a comprehensive study, although without specific criteria, and found that the two-visit treatment group had a significantly lower failure rate compared to the one-visit treatment group. **Singla et al.**²¹ also noted that the success rates of multiple-visit and single-visit root canal treatments were almost identical. Furthermore, a single-visit pulpectomy generally takes 45 to 60 minutes, with children typically showing the most cooperation during the first 30 minutes. To ensure a consistent treatment schedule, this study divided the pulpectomy procedures into two appointments, each lasting no more than 40 minutes.

Angelo and Polyvios²² identified a strong link between pain and anxiety, noting that procedures frequently induce anxiety in patients. While local anesthesia is effective for managing pain, it can still provoke anxiety, particularly during the initial visit. Administering anesthesia to children can be particularly challenging due to their fear of injections. **Midha V et al.**²³ also found that children commonly experience fear of injections and the dentist, resulting in elevated levels of anxiety.

The use of local anesthesia may have alleviated anxiety in children during their initial appointment, contributing to a shift from negative to

positive behavior in phases III, IV, and V. These results are consistent with the research conducted by **Babu KLG and Kavyashree Gururaj**²⁴

Govindaraju L et al.¹¹ found that anxiety levels in children decreased in the rotary group when using the X-smart motor, which resembles a video game controller. The children also viewed the rotary files as miniature vibrating brushes that effectively remove bacteria from the tooth.

Shorter treatment duration in pediatric patients leads to higher engagement, better adherence, increased task completion, and more productive progress. **Davidovich E et al.**²⁵ define short treatment as less than 30 minutes, while long treatment is over 45 minutes. **Wright GZ and Alpren GD**²⁶ found that as the procedure lengthens, children are more likely to become agitated and display unfavourable behavior.²⁷ The appointment time in this study did not exceed 40 minutes.

Using rotary file systems significantly reduced root canal instrumentation time compared to manual file systems, potentially improving behavior in children treated with rotary files. These results are consistent with previous studies conducted by **Silva LAB et al.**,²⁸ **Shah et al.**,²⁹ and **Waly et al.**³⁰

This indicates that the choice of instrumentation may have influenced anxiety levels, with notable differences observed only during phase II of visit II. Children exhibited reduced anxiety when rotary files were used, likely due to the faster canal preparation process.

The current study found that higher levels of anxiety and more negative behavior were observed during the administration of treatment in visit 1 and during canal instrumentation in visit 2. A significant difference was noted in the time required for canal instrumentation between the two systems: the manual K-file system took longer (mean 27 ± 2.66 minutes) compared to the rotary Pro AF Baby Gold files (mean 18.1 ± 1.33 minutes). Increased anxiety and negative behavior were also associated with the use of manual K-files. Thus, rotary instrumentation is recommended for primary canal preparation in pediatric dentistry due to its positive impact on Child's behavior and contribution to successful treatment outcomes.

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