



RESEARCH ARTICLE

EVALUATION OF RADICULAR DENTIN THICKNESS IN PRIMARY MOLARS USING ROTARY KEDO-SG NANO PLUS AND MANUAL K-FILES: A STEREOMICROSCOPIC STUDY

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ABSTRACT

Background: Pulpectomy is a key procedure for retaining primary teeth affected by irreversible pulp pathology. Due to the delicate and complex root anatomy of primary teeth, preserving radicular dentin during canal preparation is essential. In recent years, pediatric nickel–titanium (NiTi) rotary systems have been introduced as a promising alternative to conventional hand instrumentation. **Aim:** To comparatively evaluate radicular dentin thickness and canal shaping characteristics following instrumentation with manual K-files and Kedo-SG Nano Plus rotary files in primary molars using stereomicroscopic assessment. **Materials and Methods:** An in vitro study was conducted on 40 extracted primary molars, which were randomly assigned into two groups (n = 20 each). In Group I, canal preparation was performed using stainless steel K-files, while in Group II, Kedo-SG Nano Plus rotary files were used. After standardized instrumentation and irrigation procedures, the samples were sectioned at coronal, middle, and apical thirds. Radicular dentin thickness was measured under a stereomicroscope. Statistical analysis was carried out using an independent t-test, with the level of significance set at $p < 0.05$. **Results:** Teeth instrumented with rotary files exhibited significantly higher remaining dentin thickness at all evaluated levels compared to those prepared with manual K-files ($p < 0.001$). Manual instrumentation resulted in comparatively greater dentin removal and less uniform canal morphology. No instances of instrument fracture or deformation were recorded in either group. **Conclusion:** Kedo-SG Nano Plus rotary instrumentation demonstrated enhanced preservation of radicular dentin along with improved canal shaping when compared to manual K-file techniques. These findings indicate that rotary systems may provide a safer and more efficient approach for pulpectomy in primary teeth.

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INTRODUCTION

Preservation of primary teeth until their natural exfoliation is essential for maintaining arch integrity, function, and esthetics. Pulpectomy is a commonly performed procedure in primary teeth with irreversible pulp involvement, where thorough cleaning and shaping of the root canals are critical for treatment success (3). Traditionally, stainless steel hand K-files have been used for canal preparation; however, they are associated with procedural errors such as canal transportation, ledging, and excessive dentin removal, particularly due to the thin and curved roots of primary teeth (2). With advancements in pediatric endodontics, nickel–titanium (NiTi) rotary systems specifically designed for primary canals have been introduced. These systems offer improved flexibility, efficient shaping, and reduced chair-side time (5). Rotary instrumentation may also allow better preservation of radicular dentin and more uniform canal preparation. However, limited literature is available regarding the performance of Kedo-SG Nano Plus rotary files. Therefore, this study was undertaken to

compare manual and pediatric rotary instrumentation techniques in primary teeth, focusing on radicular dentin preservation and canal shaping efficiency (6). Primary teeth have thinner roots and reduced dentin thickness, making them more susceptible to excessive dentin removal during instrumentation. Evaluating Kedo-SG Nano Plus rotary files against manual K-files helps determine which technique better preserves radicular dentin, thereby ensuring safer and more effective pediatric endodontic treatment.

AIM: To evaluate radicular dentin thickness and canal morphology following instrumentation with manual K-files and Kedo-SG Nano Plus rotary files in primary molars.

OBJECTIVES

- To assess the amount of radicular dentin removed after manual instrumentation using K-files in primary molars using a stereomicroscope.

- To evaluate the amount of radicular dentin removed after rotary instrumentation using Kedo-SG Nano Plus files in primary molars using a stereomicroscope.
- To compare the radicular dentin thickness between manual and rotary instrumentation techniques using a stereomicroscope.

MATERIALS AND METHODS

The present study was conducted in the Department of Pediatric and Preventive Dentistry.

Study Design: An in vitro experimental study.

Sample Selection: A total of 40 extracted human primary molars were selected based on predefined inclusion and exclusion criteria. Teeth were stored in formalin until use

Sample size estimation: Sample size estimation was performed using standard power analysis for a two-group comparison ($\alpha = 0.05$; power = 80%). As the study utilised extracted primary teeth, specimen availability determined the final sample size. Twenty samples were included per group, and effect sizes with 95% confidence intervals are presented to aid interpretation of the outcomes.

Inclusion criteria

- Teeth with minimal apical resorption with the presence of at least two-thirds remaining root structure.
- Teeth with the absence of visual perforating resorption

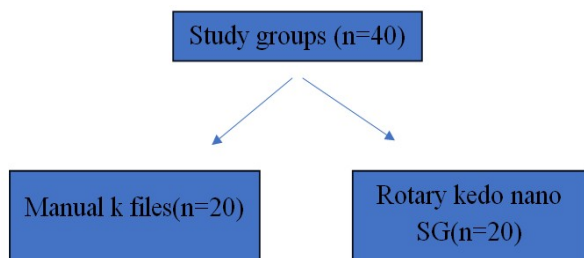
Exclusion criteria

- Teeth with calcified root canals
- Teeth with the presence of any visual perforation on the roots

Grouping: Samples were randomly divided into two groups (n = 20 each):

Group A (Manual instrumentation): Instrumentation done using stainless steel K-files.

Group B (Rotary instrumentation): Instrumentation done using Kedo-SG Nano Plus rotary files.



Procedure: Access cavities were prepared, and the working length was determined 1 mm short of the radiographic apex using a #10 K-file.

Instrumentation was performed as follows:

Group A (Manual): Canals were prepared with stainless steel K-files using the step-back technique up to size 35. During instrumentation, canals were irrigated with 1% sodium hypochlorite followed by saline.

Group B (Rotary): Canals were prepared with Kedo-SG Nano Plus files using a slow-speed endodontic handpiece at

recommended speed (250-300 rpm) and torque (2.2 N.cm) settings, following the crown-down technique. Following instrumentation, teeth were sectioned at three standardised levels: coronal, middle, and apical thirds. Radicular dentin thickness was measured using a stereomicroscope.

DATA ANALYSIS: Statistical analysis was performed using an independent t-test to compare mean dentin thickness between groups. A p-value of less than 0.05 was considered statistically significant

RESULTS

No instrument fracture or deformation was observed in either group. Rotary instrumentation demonstrated significantly greater preservation of radicular dentin at coronal, middle, and apical levels compared to manual instrumentation ($p < 0.001$). Manual instrumentation resulted in greater dentin removal and produced comparatively irregular canal morphology, whereas rotary instrumentation maintained more uniform canal anatomy. Stereomicroscopic evaluation revealed smoother and more regular canal outlines in the rotary group, while manual instrumentation showed irregular canal shapes (Figures 1 and 2).

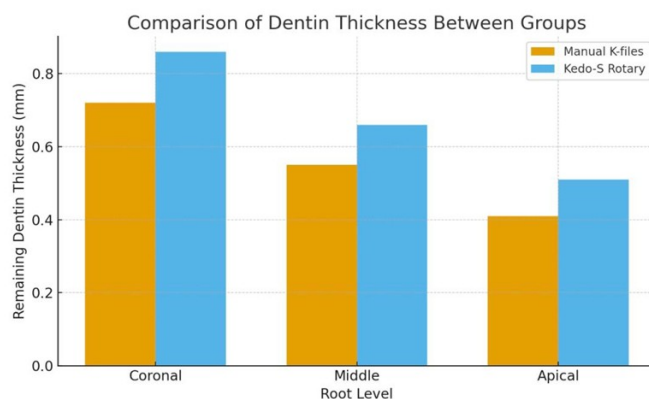


Figure 1. Comparison of Mean Radicular Dentin Thickness at Coronal, Middle, and Apical Levels Between Manual and Rotary Instrumentation

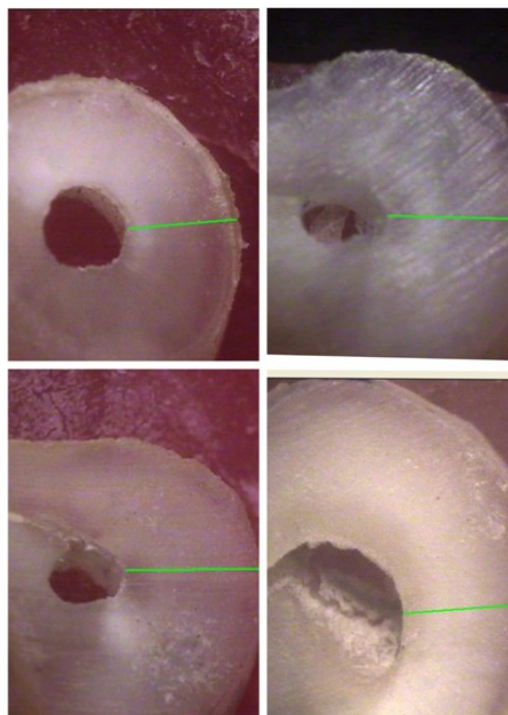


Fig 2. More regular shape of the root canal of the primary molars after instrumentation with kedo nano files

Table 1. Comparison of Radicular Dentin Thickness Between Manual K-files and Kedo-SG Nano Plus Rotary Instrumentation in Primary Molars

Parameter	Manual K-files (n=20) Mean ± SD	Kedo-S Rotary (n=20) Mean ± SD	t-value	P-value
Coronal third (mm)	0.72 ± 0.09	0.86 ± 0.08	4.68	0.001*
Middle third (mm)	0.55 ± 0.07	0.66 ± 0.06	5.12	0.001*
Apical third (mm)	0.41 ± 0.06	0.51 ± 0.05	5.43	0.001*
Instrument fracture	0	0	—	—
Instrument deformation	0	0	—	—
Completion of preparation	20/20 (100%)	20/20 (100%)	—	—
Parameter	Manual k files (N=20)			

*p < 0.05 considered statistically significant



Fig 3. Manual instrumentation with k-files usually provided more irregular shaping



Fig 4. Steriomicroscope

Manual instrumentation removed a larger amount of dentin compared with rotary instrumentation ($P < 0.05$).

DISCUSSION

Successful pulpectomy in primary teeth depends on effective debridement and proper shaping of the root canals while preserving maximum dentin. Primary teeth present unique anatomical challenges, including thin dentinal walls, curved and ribbon-shaped canals, and ongoing physiological root resorption. Therefore, instrumentation techniques that maximize cleaning while minimizing dentin removal are essential to maintain tooth integrity and prevent premature exfoliation (2). According to the American Academy of Pediatric Dentistry guidelines, preservation of radicular dentin is critical for the long-term success of pulpectomy in primary teeth (13).

In the present study, manual instrumentation removed significantly more dentin than rotary instrumentation ($p < 0.05$). These findings are consistent with previous studies by Govindaraju et al. (2017) and Radhakrishnan et al. (2019), which reported that rotary systems are more conservative and provide more uniform canal preparation (1,2). Similar findings were also reported by Jeevanandan and Govindaraju (2018) (12). The greater dentin removal observed with K-files may be attributed to the rigidity of stainless steel instruments and operator-dependent pressure during hand instrumentation. This often results in irregular canal shaping and canal transportation (Nelson-Filho et al., 2011). In contrast, NiTi rotary instruments possess shape memory and superelastic properties, allowing them to better adapt to canal curvature and maintain original anatomy (4,11). The Kedo-SG Nano Plus system, specifically designed for pediatric use, has a shorter length and variable taper suited to primary teeth morphology. Its heat-treated NiTi alloy enhances flexibility and cutting efficiency, resulting in reduced instrumentation time and conservative dentin removal (7,9). Another advantage of rotary instrumentation is reduced chair time, which is particularly beneficial in pediatric patients with limited cooperation (10). Additionally, smoother canal walls may improve obturation quality and sealing ability (6).

No instrument fracture was observed in this study, which is consistent with previous reports (8). However, adherence to recommended speed and torque settings is essential to prevent instrument fatigue. Overall, the findings suggest that rotary instrumentation is a safer and more conservative alternative to manual techniques in pediatric endodontics. Improved preservation of radicular dentin may contribute to better long-term outcomes of pulpectomy in primary teeth. However, this study has limitations. Being an in vitro study with a relatively small sample size, clinical variables such as root resorption, anatomical variations, and operator factors were not evaluated. Future studies with larger sample sizes and advanced imaging techniques such as micro-CT are recommended for more detailed analysis.

CONCLUSION

Kedo-SG Nano Plus rotary instrumentation demonstrated better preservation of radicular dentin and improved canal shaping compared with manual K-file techniques in primary teeth. These findings suggest that rotary instrumentation offers a safer, more efficient, and clinically effective approach for pulpectomy in pediatric patients. Further studies with larger sample sizes are recommended to support these findings.

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