Evaluation of the Application and Nursing Care Effects of M3 Nickel-Titanium Rotary Files in Single-Visit Root Canal Treatment for Elderly Patients (Post-Print)

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Abstract

Objective To evaluate the advantages and nursing effects of M3 rotary nickel-titanium files in single-visit root canal treatment for elderly patients. Methods One hundred sixty elderly patients clinically diagnosed with chronic pulpitis requiring single-visit root canal treatment (including premolars and molars) were selected and randomly divided into two groups of 80 cases each. The study group used M3 rotary nickel-titanium files (M3-Path orifice opener, M3 PRO nickel-titanium files) for canal negotiation and preparation, while the control group used traditional hand root canal instruments (C-files, K-files). Treatment time and postoperative pain scores were compared between the two groups to evaluate nursing effectiveness. Results The root canal preparation time in the study group was significantly shorter than that in the control group ($P<0.05$). The mean postoperative pain score of patients in the study group was significantly lower than that in the control group ($P<0.05$). Conclusion The use of M3 rotary nickel-titanium files combined with high-quality nursing cooperation can shorten root canal preparation time, reduce postoperative pain response, and has positive significance for shortening chairside cooperation time of nursing staff, improving clinical work efficiency, and enhancing patient satisfaction.

Full Text

Preamble

Title: Application of M3 Nickel-Titanium Rotary Files in One-Visit Root Canal Therapy for Elderly Patients and Evaluation of Nursing Effects

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Abstract

Objective: To evaluate the clinical advantages and nursing effects of M3 nickel-titanium rotary files in one-visit root canal therapy for elderly patients.

Methods: Elderly patients clinically diagnosed with chronic pulpitis requiring one-visit root canal therapy were selected and randomly divided into two groups of [number] cases each (including premolars and molars). The experimental group used M3 nickel-titanium rotary instruments (M-Path glide path files and M-Pro nickel-titanium files) for canal negotiation and preparation, while the control group used traditional hand instruments (C-files and K-files). Treatment time and postoperative pain scores were compared between groups to evaluate nursing effectiveness.

Results: The experimental group demonstrated significantly shorter root canal preparation time compared to the control group ($P<0.05$). The mean postoperative pain score in the experimental group was also significantly lower than that in the control group ($P<0.05$).

Conclusion: The use of M3 nickel-titanium rotary files combined with high-quality nursing cooperation can significantly shorten root canal preparation time, reduce postoperative pain response, and positively impact nursing chairside assistance time, clinical work efficiency, and patient satisfaction.

Keywords: elderly patients; M3 nickel-titanium rotary instruments; one-visit root canal therapy; oral nursing

Introduction

With advancements in root canal therapy instruments and techniques, elderly patients with chronic pulpitis can preserve their affected teeth for longer periods through systematic and comprehensive root canal treatment and restoration, significantly improving their quality of life. However, root canal treatment in elderly patients presents considerable challenges due to complex canal morphology, calcification, and narrowing. Effective canal negotiation and shaping are critical factors determining treatment success. High-quality nursing cooperation is equally essential for successful outcomes. Nickel-titanium rotary instruments have been widely applied clinically in recent years, with M3 files demonstrating superior flexibility and canal adaptability. The M-Path glide path file features a flat tip design that reduces resistance during preparation and substantially

saves operation time. The M-Pro series exhibits minimal rebound force, allowing adaptive rotation along the canal center to uniformly cut canal walls while preserving original canal anatomy. Under excessive stress, M-Pro files demonstrate unwinding rather than fracturing, showing excellent fatigue resistance. The proprietary golden nano-coating on M-Pro files penetrates microcracks, further enhancing fracture resistance. This study compares M3 nickel-titanium rotary files with traditional hand instruments across multiple dimensions to evaluate clinical efficacy and nursing effects in one-visit root canal therapy for elderly patients.

Materials and Methods

Study Design and Participants

Elderly patients diagnosed with pulpitis who required root canal therapy were selected from our hospital. Patients were randomly divided into experimental and control groups of [number] cases each, with equal distribution of premolars and molars between groups. No statistically significant differences were observed between groups in terms of gender, age, tooth position, preoperative diagnosis, or clinical symptoms ($P>0.05$). All patients and their families provided informed consent.

Materials and Equipment

The following materials were used: Morita apex locator, YiRui M3-Path glide path files, YiRui M3-Pro nickel-titanium files, VDW electric motor, hand C-files and K-files, SybronEndo ultrasonic unit, BeeFill system, and AH-Plus root canal sealer.

Operative Procedures

All procedures were performed by the same operator. Both groups received preoperative radiographs and underwent access cavity preparation under anesthesia for one-visit root canal therapy. In the experimental group, canals were negotiated with YiRui M3-Path files before working length determination, followed by crown-down preparation with M3-Pro files. The control group used hand C-files for negotiation and K-files with step-back technique for preparation. Both groups received routine canal irrigation with EDTA and sodium hypochlorite, followed by SybronEndo P5 ultrasonic activation, paper point drying, obturation with gutta-percha and AH-Plus sealer using BeeFill system, glass ionomer temporary sealing, and postoperative radiographs.

Nursing Cooperation Protocol

Preoperatively, nursing staff applied petroleum jelly to patients' mouth corners and instructed them to signal any issues by raising their left hand and avoid

moving their right hand or head during treatment. Intraoperatively, nurses reminded patients to keep their mouth open, breathe through their nose, and relax their body while promptly using the three-way syringe to remove debris and strong suction to eliminate saliva and splatter, maintaining a clear operative field. Before using M3 instruments, nurses reminded operators of usage counts and adjusted torque settings as needed. Deformed files were replaced immediately. For elderly patients under articaine anesthesia (which contains epinephrine), nurses closely monitored respiratory rate, facial color, and limb movements for adverse reactions. Timely suctioning reduced foreign body sensation and prevented aspiration. Due to high rotational speeds of M3 files, nurses assisted with mouth props when necessary to prevent sudden mouth closure and instrument fracture. Postoperatively, patients were instructed to avoid chewing hard foods on the treated side and to return for regular follow-up.

Statistical Analysis

SPSS software was used for data analysis. Measurement data were expressed as mean±standard deviation (x±s) and compared using independent samples t-test. Categorical data were expressed as percentages (%) and analyzed using chi-square test. Statistical significance was set at $P<0.05$.

Results

Root Canal Preparation Time

Both premolars and molars in the experimental group showed significantly shorter mean preparation times compared to the control group ($P<0.05$). The average preparation time using M3 nickel-titanium rotary files was markedly less than that using traditional hand instruments .

Postoperative Pain Assessment

Within one week postoperatively, patients treated with M3 files predominantly experienced mild pain, whereas those in the control group mainly reported moderate pain . The mean postoperative pain score in the experimental group was [value] points, significantly lower than the control group's [value] points (t=-[value], $P<0.05$), indicating higher comfort and satisfaction in the experimental group.

Discussion

Root canal preparation is a critical determinant of endodontic success. Elderly patients present unique challenges including complex canal anatomy, systemic diseases, and relatively poor compliance, making treatment more diffi-

cult. Proper use of M3 nickel-titanium rotary files can substantially reduce clinical operation time and patient cooperation time while achieving optimal canal morphology. Completing canal preparation and obturation in a single visit minimizes return appointments and reduces infection risks associated with inter-appointment dressings, thereby decreasing postoperative pain and improving success rates.

High-quality nursing cooperation is paramount throughout treatment. Preoperatively, nurses should assist with patient education about one-visit root canal therapy, alleviating anxiety and promoting cooperation. Nurses must possess comprehensive knowledge of root canal anatomy and assist with radiographic evaluation to understand root morphology and length. Intraoperatively, nurses should anticipate challenges such as difficulty in mouth opening, noise, and lengthy procedures, providing reassurance and support. For elderly patients unable to lie flat comfortably, nurses must adjust chair positions appropriately and establish clear communication signals. Since treatment is performed under articaine anesthesia containing epinephrine, nurses must closely monitor vital signs and be prepared for emergency intervention. Timely suctioning maintains a clear field and prevents aspiration. Given the high rotational speeds of M3 files, nurses should employ mouth props to prevent sudden closure and instrument fracture. Postoperatively, nurses should provide detailed health education, instructing patients to eat and drink only after complete anesthesia resolution to avoid biting oral mucosa. Patients should be informed that post-treatment discomfort is normal but requires emergency review if pain intensifies. Due to prolonged mouth opening, nurses should advise postoperative warm compresses for temporomandibular joint fatigue and apply petroleum jelly to mouth corners to prevent fissuring.

Instrument management requires meticulous care. Before opening sterile packages, nurses must inspect M3 files for deformation, twisting, or unwinding to prevent intracanal separation. After use, files should be stored moist, with usage frequency recorded. Following ultrasonic cleaning and rinsing, files must be dried and examined under magnification for defects. Packaging should indicate working length and usage count before steam sterilization.

In summary, M3 nickel-titanium rotary files combined with high-quality nursing care significantly reduce root canal preparation time and postoperative pain, improving clinical efficiency and patient satisfaction in elderly patients undergoing one-visit root canal therapy.

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Conflict of Interest Statement: The authors declare no conflicts of interest.

Note: Figure translations are in progress. See original paper for figures.