

Four-Handed Nursing Cooperation in Microscopic Apical Barrier Technique Combined with iRoot BP Plus: Experience and Postprint

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Abstract

Objective To investigate the key points of four-handed nursing cooperation in performing apical barrier technique with iRoot BP plus under the microscope. **Methods** A retrospective review was conducted of 108 patients who underwent apical barrier technique treatment in the Department of Conservative Dentistry and Endodontics of our hospital from 2018 to 2019. All patients had an apical barrier established with iRoot BP plus under the microscope, with treatment completed using four-handed nursing cooperation. **Results** The four-handed nursing cooperation process proceeded smoothly. Immediate postoperative radiographs demonstrated that all filling results met the required standards, with satisfactory treatment outcomes. Chairside treatment time was significantly reduced, and work efficiency was markedly improved. **Conclusion** Performing apical barrier technique with iRoot BP plus under the microscope is technically challenging, requiring meticulous and precise operation and demanding high standards for chairside nursing care. High-quality four-handed nursing cooperation can improve overall work efficiency, reduce treatment time, and assist clinicians in better completing the treatment.

Full Text

Nursing Cooperation and Experience in Four-Handed Procedure for Apical Barrier Technique Under Dental Microscope Combined with iRoot BP Plus

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Abstract

Objective: To explore the key points of four-handed procedure and nursing cooperation in apical barrier technique using iRoot BP plus under a dental microscope.

Methods: A total of patients who underwent apical barrier surgery in our hospital from [year] to [year] were retrospectively selected. The apical barrier was established using iRoot BP plus under a dental microscope, and all treatments were completed with four-handed procedure and nursing cooperation.

Results: The four-handed procedure and nursing cooperation proceeded smoothly. Immediate postoperative X-ray films showed that all filling results met the standard criteria, with satisfactory treatment outcomes. Chairside treatment time was significantly shortened, and work efficiency was substantially improved.

Conclusion: Apical barrier technique using iRoot BP plus under a dental microscope is technically demanding, requiring fine and precise operations with high standards for chairside nursing care. High-quality four-handed procedure and nursing cooperation can improve overall work efficiency, shorten treatment time, and help clinicians complete treatments more smoothly.

Keywords: operating microscope; iRoot BP Plus; apical barrier technique; four-handed operating procedure; nursing cooperation

Introduction

With continuous advances in dental nursing technology, higher requirements have been placed on clinical nursing practice. For immature permanent teeth with irreversible pulp damage, the root canal walls are thin and the apical foramen remains open, making these teeth susceptible to periapical infection. Conventional root canal treatment often fails to achieve ideal outcomes in such cases. Apical barrier technique is a non-surgical treatment that creates a barrier by filling biocompatible materials into the apical region of the root canal, thereby protecting the affected tooth. The apical sealing material iRoot BP plus used in this study is a novel bioceramic paste for root canal filling and repair, offering excellent biocompatibility and antimicrobial properties. Its main components include calcium silicate, zirconium oxide, tantalum oxide, calcium dihydrogen phosphate, and fillers (iRoot BP plus, Innovative Bioceramics Inc., Canada). Due to the relative complexity of apical barrier technique and the sub-apical operating site, microscope use facilitates observation and management of lesions by clinicians. Microscope-assisted nursing cooperation demands higher competency from nursing staff, requiring professional nursing knowledge, proficient skills, and effective communication and coordination abilities. This article reviews the clinical data of patients who underwent apical barrier technique

in the Department of Cariology and Endodontology of our hospital, summarizing the key points of four-handed procedure and nursing cooperation in apical barrier technique using iRoot BP plus under a dental microscope.

1. Materials and Methods

1.1 Clinical Data

A retrospective analysis was conducted on the clinical data of patients who underwent apical barrier technique in the Department of Cariology and Endodontology of our hospital from [year] to [year]. The cohort included males and females aged years; tooth positions: cases. All included patients met the disease indications and could actively cooperate with treatment. Patients with uncontrolled severe systemic diseases, hypertension, or diabetes were excluded. The operating clinicians were attending physicians or higher-level specialists in endodontology, and the cooperating nurses had over years of clinical experience in four-handed procedures.

1.2 Materials and Instruments

Materials: iRoot BP plus, 5.25% sodium hypochlorite irrigation solution, 2% chlorhexidine solution, 17% EDTA irrigation solution, rubber dam, endodontic files, dental microscope, ultrasonic scaler, and ultrasonic tip K (French Satelec; German Zeiss Pico).

Instruments: Rubber dam, endodontic files, microscopic mouth mirror, microscopic locking tweezers, vertical condensers, paper points, measuring ruler, plastic mixing spatula, and glass slab.

1.3 Four-Handed Procedure Nursing Cooperation Protocol

Environmental Preparation: The treatment room was cleaned and disinfected before treatment to maintain a tidy environment. Equipment was arranged neatly, and room temperature and humidity were properly regulated.

Patient Preparation: Patient information was verified, and previous medical records and X-ray films were retrieved. Patients were guided to the treatment area and provided with mouthwash for preliminary oral cleaning. Neck pillows, stress-relief balls, and blankets were prepared according to individual patient needs.

Psychological Care: Dental surgery often requires multiple instruments operating simultaneously, which can cause fear and anxiety in patients. Nurses should promptly address patient anxiety, explain the upcoming procedures in simple terms, guide patients to cooperate with treatment, ensure they fully understand the treatment process, and help them mentally prepare to avoid sudden tension or discomfort. This approach enhances patient engagement and helps them recognize the importance of their cooperation for successful treatment.

Item Preparation: - Instrument Preparation: Equipment status was confirmed in advance. The microscope's functional position was adjusted, and the interpupillary distance and field of view were verified. The ultrasonic scaler was set to medium power. - **Material Preparation:** Treatment plans were communicated with the clinician in advance to ensure all necessary materials were prepared, avoiding interruptions during treatment. Surgical materials and instruments were classified and arranged in treatment sequence.

Key Points of Four-Handed Procedure Nursing Cooperation:

Solid Theoretical Foundation: Four-handed procedure nursing cooperation requires nurses and clinicians to work together in treating patients, aiming to improve medical standards and work efficiency. This demands higher professional knowledge from nursing staff. A solid theoretical foundation is essential for seamless nurse-clinician coordination. In clinical practice, while strengthening operational training, regular professional theoretical training should be conducted to understand the purpose and significance of each procedure step, enabling more accurate, rapid, and 默契 cooperation with clinicians.

Rubber Dam Installation: A reasonable installation method was selected based on the patient's dentition. The rubber sheet position was adjusted to avoid covering the nose. For patients prone to allergies, isolation gauze was placed under the rubber sheet to prevent direct contact with skin, ensuring more comfortable patient cooperation.

Instrument Passing: Four-handed procedure nursing cooperation requires nurses to be proficient in the operation process and anticipate upcoming procedures and required instruments. Instruments should be passed promptly and accurately to achieve seamless and smooth surgical cooperation with the clinician. The passing direction should strictly align with the long axis of the treated tooth, with the working end delivered steadily and quickly to the clinician's hand to avoid adjustments or replacements caused by incorrect passing.

Root Canal Disinfection Nursing Cooperation: Thorough infection removal is critical for successful apical barrier technique. Ultrasonic irrigation removes residual tissue debris and bacteria from the root canal through dissolution effects, cavitation effects, ultrasonic flow effects, and thermal effects. During ultrasonic cleaning, chemical irrigation solutions are intermittently used to disinfect the root canal and achieve infection removal. The nurse passes the ultrasonic scaler for canal irrigation, removes intracanal medication, cleans the canal, and uses high-volume suction with the right hand while holding the three-way syringe with the left hand. During treatment, the mouth mirror is kept clear, and the cavity is dried after irrigation to assist the clinician in observing the apical condition.

First, 5.25% sodium hypochlorite solution is passed to the clinician to dissolve necrotic tissue and debris within the canal. Before passing, the needle hub fixation is checked to prevent loosening and medication splashing. During irrigation, the suction tip is held close to the tooth to avoid medication extravasation that

could cause oral burns or discomfort. While cooperating, the nurse must closely monitor the patient's general condition, assessing physical and mental status through facial expressions, demeanor, and subtle movements. In case of any special circumstances, the nurse should immediately inform the clinician, stop the operation, and provide emergency management.

Subsequently, 17% EDTA and 2% chlorhexidine solutions are used for continued chemical disinfection to remove the smear layer and kill bacteria. Between these two chemical disinfectants, the ultrasonic device is passed to irrigate the canal and prevent chemical reactions. When multiple chemical agents are required for root canal disinfection, the irrigation syringes should be clearly labeled and placed in order of use.

iRoot BP plus Filling Nursing Points: A vertical condenser with appropriate taper is selected based on the final file size and passed to the clinician for trial fitting to determine a suitable instrument. The nurse prepares a sterile plastic mixing spatula to retrieve iRoot BP plus, preventing cross-contamination. According to the root taper, approximately 2-3 mm of material is retrieved and placed on a sterile glass slab, divided into three portions, and shaped into 2-3 mm high cylinders using the spatula. Properly sized and shaped material facilitates the clinician's operation. The vertical condenser is marked with a stopper at the working length, and a piece of material is retrieved vertically from the bottom of the iRoot BP plus cylinder according to the working end direction and passed to the clinician for filling under the microscope. During treatment, the nurse must constantly keep the microscopic mouth mirror clean, holding a sterile gauze in the right hand to assist in removing excess material from instruments. The filling process is repeated approximately 2-3 times, after which the vertical condenser is remeasured and marked to determine the length of filling material within the canal. After filling, a wet cotton pellet is passed to wipe the canal and promote rapid setting of iRoot BP plus. Finally, excess material is removed, the cavity is temporarily filled, and the patient is scheduled for an immediate X-ray to confirm the filling effect.

Postoperative Guidance: The nurse inquires about the patient's treatment experience and addresses any concerns. Patients are informed to avoid biting hard objects with the treated tooth, and that discomfort from stress responses will gradually subside. Reasonable follow-up appointments are scheduled, and the clinic's telephone number is provided for patients to call with any concerns, helping them relax and feel secure. Based on collected information, targeted oral health education is provided to help patients correctly understand their disease and related professional knowledge, contributing to improved oral hygiene.

Instrument Maintenance and Care: After microscope use, the light is dimmed before turning off the power to protect the bulb from damage by excessive current. The iRoot BP plus container is immediately capped after use to prevent chemical changes in the material. Hand instruments are cleaned and disinfected according to standard protocols, and the treatment room is disinfected with ultraviolet light according to standards.

2. Results

All 30 patients who underwent apical barrier technique achieved satisfactory immediate filling effects, with material reaching the apical region, thickness of 3-5 mm, and uniform, dense fillings. Treatment time was reasonable, with anterior teeth generally requiring less time than posterior teeth [(35.2±5.6) *mins.* (45.8±7.2) min]. The nursing process proceeded smoothly, with complete and continuous four-handed cooperation and no nursing-related issues. Patient satisfaction was high.

3. Discussion

Strict adherence to aseptic technique and infection control is critical to ensuring successful outcomes in apical barrier treatment. Research has shown that reasonable application of four-handed operation technology in endodontic treatment not only shortens treatment time but also effectively controls nosocomial infection, improves diagnosis and treatment quality, and enhances patient satisfaction, with ideal application effects.

Microscope-assisted operations provide clearer and more explicit visualization of the three-dimensional structure in the surgical field and enable better observation of the apical foramen's position and morphology, allowing for precise and effective operations that are important for treatment outcomes and prognosis. To ensure smooth and orderly microscope-assisted treatment, high-quality four-handed procedure nursing cooperation is required, placing higher demands on nursing staff. Nursing personnel must master professional theoretical knowledge and operational skills, become proficient with various instruments and equipment used in apical barrier treatment, understand different clinicians' operating habits, and possess the ability to anticipate and manage unexpected problems. Through 默契 cooperation between nurses and clinicians, work efficiency is improved, treatment time is reduced, patient comfort and treatment experience are enhanced, ultimately achieving more perfect therapeutic outcomes.

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

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