# Application Effect of Rubber Dam in Nursing Coordination for Root Canal Treatment of Primary Incisors (Postprint)

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## Abstract

Objective To investigate the importance of rubber dam isolation technique in nursing cooperation for root canal treatment of primary incisors. Methods Ten physicians in standardized training, three senior nurses, and 64 pediatric patients were selected as study subjects. The pediatric patients underwent two treatments in a crossover manner using traditional cotton roll isolation technique and rubber dam isolation technique. The nursing cooperation operation time for the two treatments was recorded, and the difficulty of cooperation, anxiety level of pediatric patients, and satisfaction were evaluated. Results Compared with traditional isolation technique, the nursing cooperation operation time was shortened and the anxiety level of pediatric patients was significantly reduced when using rubber dam isolation technique. Conclusion Compared with traditional cotton roll isolation technique, rubber dam isolation technique can shorten nursing cooperation operation time, reduce the anxiety level of pediatric patients, and decrease the difficulty of nursing cooperation.

## Full Text

## Abstract

**Objective**: To evaluate the application of rubber dam isolation in nursing cooperation during root canal treatment of deciduous incisors.

**Methods**: A total of [number] dentists requiring standardized training, [number] senior dental nurses, and [number] pediatric patients were recruited in this study. All pediatric patients were randomly treated twice using both traditional cotton roll moisture isolation technology and rubber dam moisture isolation technology in a crossover design. The duration of nursing cooperation was recorded, and the difficulty of nursing cooperation, anxiety levels, and satisfaction of the pediatric patients were measured.

**Results**: The findings showed that the duration of nursing cooperation procedures for children using rubber dam isolation was shorter than that of children using conventional cotton roll isolation, and a lower degree of anxiety was observed in children using rubber dam isolation.

**Conclusion**: Compared with traditional cotton roll moisture isolation technology, rubber dam moisture isolation technology may shorten operation time, relieve anxiety levels of patients, and reduce the difficulty in nursing cooperation.

**Keywords**: rubber dam isolation; deciduous incisor; root canal treatment; nursing cooperation

## Introduction

In the 1860s, Barnum et al. introduced the rubber dam [1], and this isolation method has become a standard procedure in dental treatment [2]. The importance of rubber dam technology has been increasingly recognized by dental practitioners, and the use of rubber dam systems can improve clinical efficiency and effectiveness [3]. With the development of stomatology in China and advances in clinical technology, the requirement and demand for popularizing and implementing rubber dam isolation technology have become increasingly urgent. The revised National Physician Qualification Examination Syllabus (for licensed stomatologists and assistant stomatologists) in December 2018 added rubber dam isolation technology [4], which was first implemented in the practical skills examination for the dental practitioner qualification exam in June 2019. However, the application of rubber dam remains uneven both domestically and internationally, and its promotion in China still requires vigorous efforts. Domestic surveys have shown that the usage rate of rubber dam by residents in anterior tooth root canal treatment is lower than that of graduate students and undergraduates [5]. Therefore, there is still room for improvement in rubber dam usage by residents in anterior tooth root canal treatment.

Pulpectomy is a widely used clinical technique for treating deciduous tooth pulpitis and apical periodontitis [6] and represents essential content that must be mastered during standardized residency training in clinical stomatology. The procedure can be broadly divided into several steps: pulp chamber opening, root canal preparation, root canal disinfection, root canal filling, and coronal restoration. Foreign studies observing clinical evaluations of root canal treatment in pediatric dentistry have demonstrated the superiority of rubber dam isolation technology [7]. However, the current usage rate of rubber dam in pediatric dental treatment remains low [8], and rubber dam placement is one of the most anxiety-provoking procedures for dental students in pediatric dentistry practice [9]. This study compared the application effects of rubber dam isolation technology and traditional cotton roll isolation technology in nursing cooperation during root canal treatment of deciduous incisors by standardized training residents, providing a reference for clinical nursing work in standardized residency

training programs.

## Materials and Methods

### Study Participants

This study recruited 10 residents rotating in the Department of Pediatric Dentistry at the Outpatient Clinic of Peking University School and Hospital of Stomatology, 3 senior dental nurses, and 64 pediatric patients aged 4-5 years. Inclusion criteria for pediatric patients were: no systemic diseases, very cooperative with clinical procedures, and strong parental and patient support and willingness to participate. Exclusion criteria were: teeth with destroyed cervical morphology that prevented rubber dam isolation; parents and/or children who could not accept or cooperate with treatment; non-restorable teeth; children unable to tolerate local anesthesia; children allergic to local anesthetic or treatment medications; and children with systemic diseases.

### Treatment Procedures

Each resident treated two primary incisors per patient that required two-visit root canal treatment, with the two teeth distributed symmetrically in the same jaw. The treatment protocol followed the *Standard Clinical Operating Procedures: Stomatology* [10]: At the first visit, pain control was achieved through local anesthesia, carious tissue was removed, cavity preparation was performed, access opening was made, the pulp chamber roof was removed, coronal pulp was extirpated, and diseased pulp tissue, bacteria, and toxins were cleaned from the root canal. The canal was irrigated and cleaned to remove residual material and debris, and root canal disinfectant medication was placed. At the second visit, under effective isolation, the root canal medication was removed, and root canal filling material was introduced or injected into the canal with pressure. A base was placed, and routine resin filling was completed.

### Nursing Cooperation Protocol

Nurses first confirmed that the child had good general health, no drug allergies, and no latex allergy. Local anesthetic was loaded into a syringe and handed to the dentist, who assisted in stabilizing the child' s head and reminded the child to raise their left hand to indicate pain.

**During treatment**: The nurse used high- and low-volume suction to assist with saliva control, passed the rubber dam isolation system or cotton roll isolation system, and ensured proper moisture isolation. The nurse passed the pulp needle handle with the barbed broach installed, used a clean stand to pass root canal files, and assisted with alternating irrigation using 1% sodium hypochlorite while coordinating suction. Paper points were passed, calcium hydroxide paste was given to the dentist for root canal medication, and temporary filling material was obtained with a cement plugger and handed to the dentist.

The next appointment was scheduled with the child' s family. At the second visit, rubber dam or cotton roll isolation was passed, and high- and low-volume suction assisted with saliva control. The dentist was given 1% sodium hypochlorite, paper points, root canal filling paste, and appropriate small cotton balls. Temporary filling material was passed, glass ionomer cement was mixed for the base, and the nurse assisted with routine resin filling. One deciduous incisor used cotton roll isolation while the other used rubber dam isolation. Clinical nursing cooperation operation time was recorded, and any discomfort or pain experienced by the child during the procedure was observed.

### Evaluation Metrics

Clinical nursing cooperation operation time was recorded, and any discomfort or pain experienced by the child during treatment was observed. After treatment, based on clinical evaluations by senior clinicians and assessments by residents and nurses, the effectiveness of rubber dam isolation technology was analyzed through children' s comfort experiences with the two isolation techniques, as well as their anxiety levels and cooperation.

### Statistical Analysis

SPSS software was used for data analysis. Measurement data were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$), and paired t-tests were used for inter-group comparisons. Count data were expressed as percentages (%), and $^2$ tests were used. The significance level was set at $\alpha = 0.05$.

## Results

### Nursing Cooperation Operation Time

In this study, all root canal treatments of deciduous incisors were performed by senior dentists and met standards upon examination. Immediate examination showed no filling detachment, and postoperative X-rays showed dense root canal filling. The first visit using cotton roll isolation for root canal treatment averaged [number] minutes, and the second visit averaged [number] minutes. The first visit using rubber dam isolation averaged [number] minutes, and the second visit averaged [number] minutes. Rubber dam isolation technology shortened operation time compared with traditional isolation technology (Table 1).

Traditional Cotton Roll Isolation vs. Rubber Dam Isolation Nursing Cooperation Operation Time

### Patient Comfort, Anxiety, and Cooperation Evaluation

During the procedure, when asked, [number] (%) children using traditional cotton roll isolation complained that the medication "tasted bad," while [number] (%) children using rubber dam isolation mentioned the same issue. When using rubber dam isolation, [number] children reported that the rubber dam

affected nasal breathing, and [number] (%) reported excessive saliva accumulation. When asked about comfort differences between the two isolation methods, [number] (%) children found rubber dam isolation more comfortable, [number] (%) found no significant difference, and [number] (%) found traditional cotton roll isolation more comfortable.

### Evaluations by Residents and Nurses

Residents and nurses reported different difficulties with the two methods. Cotton roll isolation was simple to operate but had a short effective time. During root canal irrigation, isolation cotton rolls needed frequent replacement, and complete preoperative preparation and intraoperative operation were required to avoid accidental swallowing or aspiration of instruments, necessitating skilled cooperation. Rubber dam isolation had technical difficulties in proper placement, but allowed longer operation time during root canal treatment without frequent cotton roll replacement and without concerns about medication causing nausea, vomiting, or accidental swallowing or aspiration.

In this study, [number] (%) children found the comfort level of both isolation techniques to be basically the same, which differs from domestic studies on adult patients reporting that rubber dam isolation technology significantly improved patient comfort and nursing satisfaction [11]. This discrepancy is mainly attributed to the fact that both techniques require children to maintain an open mouth position, pulpectomy itself causes discomfort, children experience tension and anxiety, and rotating residents have slightly longer operation times. These discomforts and issues also exist when applied to adult patients [12].

This study found that rubber dam isolation technology can shorten nursing cooperation operation time and improve clinical treatment efficiency, offering advantages that traditional cotton roll isolation cannot match. These results are consistent with domestic and international studies [13]. Compared with traditional cotton roll isolation, rubber dam isolation reduces clinical operation time for residents during root canal treatment of deciduous incisors and improves nursing cooperation efficiency. Currently, the awareness and usage rate of rubber dam among residents in Chinese dental schools is slightly low [14]. Therefore, increasing the usage rate of rubber dam isolation technology in this population and improving its application from a nursing cooperation perspective has good clinical significance.

## Discussion

Since its introduction and application in clinical dental practice, rubber dam isolation technology has proven to be the standard isolation technique in dentistry, with no other technical means comparable for isolation and creating an ideal operative field. However, for various reasons, the promotion and usage of rubber dam isolation technology in China remain uneven. In pediatric dentistry, patients are young, have psychological fear of dental treatment, limited mouth

opening, and sensitive throats, making them prone to adverse events such as accidental swallowing or aspiration or lip laceration. Rubber dam isolation technology can reduce the risk of these adverse events, improve treatment safety and clinical outcomes, and simultaneously reduce patient anxiety.

In this study, the main causes of discomfort for children using rubber dam isolation technology were anxiety, affected nasal breathing, oral saliva retention, and mild gingival pain. These shortcomings can be improved and avoided through nurse-patient communication, adjustment of rubber dam sheet placement, local anesthesia, and timely observation of saliva volume with suction assistance. In contrast, the main cause of discomfort using traditional cotton roll isolation technology was the irritation from root canal medication. Since the current routine deciduous tooth root canal irrigation uses 1% sodium hypochlorite solution, cotton rolls cannot completely prevent the leakage of odor and taste. As deciduous incisors were selected as the observation teeth in this study, requirements for mouth opening and tongue control were relatively low, and the operation difficulty for residents was lower. Both isolation techniques could meet the basic requirements for root canal treatment of deciduous incisors in this age group. However, in root canal treatment of deciduous molars, higher requirements for patient cooperation and operator proficiency would likely result in differences in nursing cooperation difficulty and operation time between the two techniques.

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**Conflict of Interest Statement**: The authors declare no conflict of interest.

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