

# Analysis of the Effectiveness of Modified Non-Traumatic Filling Technology in the Treatment of Pediatric Dental Caries

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**Abstract:** *Objective:* To analyze the effectiveness of modified non-traumatic filling technology in the treatment of pediatric dental caries. *Methods:* Ninety-seven children with dental caries who were treated in our hospital (Panyu Maternal and Child Care Service Center of Guangzhou) from January 2022 to December 2023 were selected and randomly divided into two groups, with 48 cases in the experimental group and 49 in the control group. The experimental group was treated with modified non-traumatic filling techniques, while the control group was treated with conventional filling techniques. Observation indicators such as the total effectiveness of the treatment, incidence of adverse events, treatment compliance, and pain scores were analyzed after the intervention. *Result:* After intervention, the total effectiveness of the treatment in the experimental group was higher than that in the control group ( $P < 0.05$ ). The incidence of adverse events in the experimental group was lower than that of the control group ( $P < 0.05$ ). The treatment compliance of patients in the experimental group was higher than that in the control group ( $P < 0.05$ ). The pain score of the experimental group was lower than that of the control group ( $P < 0.05$ ). *Conclusion:* The application of modified non-traumatic filling technology in the treatment of pediatric dental caries showed good therapeutic outcomes. After the intervention, the child's symptoms were significantly alleviated, the incidence of adverse events such as filling material falling off was reduced, their compliance was improved, and the pain was relieved. This procedure is worth to be promoted for clinical application.

**Keywords:** Improved non-traumatic filling technology; Treatment effect; Pediatric caries

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## 1. Introduction

Pediatric dental caries is a common dental disease<sup>[1]</sup>. It is mainly caused by the presence of bacteria and other factors that affect the child's teeth, resulting in chronic and progressive destruction of their hard tissues. Diet and oral hygiene habits are closely related to the occurrence of this disease. Affected children are often present with toothache and other conditions, which affect their normal daily eating functions, increase the burden on the stomach, and further accelerate the disease. The development of the dental and maxillofacial system has a serious impact and can easily induce acquired deformities. Children of school age are primarily affected.

To ensure the child's oral health, timely and active therapeutic intervention is required. In clinical practice, conventional filling surgery is often used for acute treatment of dental caries. Instruments such as burs and low-speed rotators are often used during the surgery to remove decay and prepare cavities. The temperature stimulation and increased tooth pressure will result in negative emotions and reduced compliance. With the continuous development of medical technology, improved non-traumatic filling technology has been widely used due to its good therapeutic effects and reduced pain to the patient [2,3]. Hence, it is more likely to be tolerated and accepted by children and has a better prognosis. Nonetheless, the specific effects of this treatment require further studies. Forty-eight subjects in the experimental group were selected to undergo modified non-traumatic filling technology treatment intervention and the effects after its implementation were observed.

## **2. Materials and methods**

### **2.1. General information**

The research subjects included 97 children with dental caries who were treated in our hospital from January 2022 to December 2023 and were randomly divided into two groups, with 48 cases in the experimental group and 49 cases in the control group.

The control group consisted of 24 males and 25 females aged 2–9 years old, with an average of  $5.69 \pm 0.64$  years. The experimental group consisted of 24 males and 24 females aged 3–8 years old, with an average of  $5.71 \pm 0.69$  years. The basic information (gender, age) of the subjects was compared and analyzed by statistical software. The results yielded no significant difference ( $P > 0.05$ ).

Inclusion criteria: (1) Patients with a good mental state; (2) parents of the patient who consented. Exclusion criteria: (1) Patients with other malignant tumors; (2) other hematological diseases and major infections; (3) severe heart, liver, and kidney diseases.

### **2.2. Methods**

The control group was given conventional filling surgery intervention. After a detailed and comprehensive examination, the child was given routine filling surgery intervention based on their condition. A high-speed handpiece was used to thoroughly clean the carious dentine on the inner and outer layers of the child's teeth to ensure that the caries form retention and resistance cavities. Then, routine disinfection operations were performed, the cavity was filled, and a photocoagulation single-component complex was used to perform the filling operation. If the child is very sensitive, local anesthesia intervention is required before operating [4].

The experimental group was given modified non-traumatic filling technology therapeutic intervention. After a detailed and comprehensive examination, modified non-traumatic filling technology intervention was carried out based on the actual condition of the child. A specialized treatment plan that is more suitable for the child was formulated, where a more appropriate portable digging spoon was used to clean the caries and fissures of the child's teeth and remove corrosive substances in the cavity. Subsequently, cleaning fluid was applied to the child's teeth to wipe and clean them. Then, the teeth were rinsed with water and dried using dry cotton balls. Glass ionomer cement was prepared and the cavity was filled to remove excess filling material effectively. Necessary adjustments were then made to complete the treatment.

### **2.3. Observation indicators**

#### **2.3.1. The total effective rate of treatment**

By observing and evaluating the symptoms of the child's dental pain and other symptoms, the results were divided into "markedly effective," whereby there was significant relief at the symptom site; "effective" when

there was general relief at the symptom site; “ineffective” when there was no relief at the symptom site and the symptoms worsen. The total effective rate of treatment = markedly effective rate + effective rate.

### 2.3.2. Occurrence rate of adverse events

The occurrence rate of filling material loss, secondary caries, gum swelling, etc., during the study was recorded.

### 2.3.3. Treatment compliance

The child’s compliance, resistance, and other behaviors during the research process were recorded.

### 2.3.4. Pain score

Changes in the child’s pain levels during the operation were measured using the visual analog scale (VAS), ranging from 0–10 points. The score was directly proportional to the level of pain.

## 2.4. Statistical analysis

Statistical analysis was carried out using the SPSS 26.0 software. Measurement data were expressed as mean ± standard deviation and compared using the t-test. Count data was expressed as % and compared using the chi-squared ( $\chi^2$ ) test. Results were considered statistically significant at  $P < 0.05$ .

## 3. Results

### 3.1. Total effectiveness of the treatment

As shown in **Table 1**, the total effectiveness of treatment in the experimental group (97.92%) was higher than that of the control group (85.71%), ( $P < 0.05$ ).

**Table 1.** Comparison of the total effective rate of treatment between the two groups [ $n$  (%)]

Group	Markedly effective	Effective	Ineffective	Total effective rate
Control group ( $n = 49$ )	20 (40.82)	22 (44.90)	7 (14.29)	42 (85.71)
Experimental group ( $n = 48$ )	23 (47.92)	24 (50.00)	1 (2.08)	47 (97.92)
$\chi^2$	-	-	-	4.771
$P$	-	-	-	0.029

### 3.2. Probability of adverse events

As shown in **Table 2**, the incidence of adverse events in the experimental group (2.08%) was significantly lower than that of the control group (16.33%), ( $P < 0.05$ ).

**Table 2.** Comparison of the odds of adverse events between the two groups [ $n$  (%)]

Group	Fillings falling out	Swollen gums	Secondary caries	Probability of adverse events
Control group ( $n = 49$ )	4 (8.16)	2 (4.08)	2 (4.08)	8 (16.33)
Experimental group ( $n = 48$ )	0 (0.00)	1 (2.08)	0 (0.00)	1 (2.08)
$\chi^2$	-	-	-	5.844
$P$	-	-	-	0.016

### 3.3. Treatment compliance

As shown in **Table 3**, the treatment compliance of the experimental group (95.83%) was higher than that of the control group (81.63%), ( $P < 0.05$ ).

**Table 3.** Comparison of treatment compliance between the two groups [ $n$  (%)]

Group	Compliant	Non-compliant	Total treatment compliance
Control group ( $n = 49$ )	40 (81.63)	9 (18.37)	40 (81.63)
Experimental group ( $n = 48$ )	46 (95.83)	2 (4.17)	46 (95.83)
$\chi^2$	-	-	4.863
$P$	-	-	0.027

### 3.4. Pain score before and after intervention

As shown in **Table 4**, the pain scores of the experimental group ( $4.38 \pm 1.07$ ) were lower than that of the control group ( $6.12 \pm 1.18$ ), ( $P < 0.05$ ).

**Table 4.** Comparison of pain scores between the two groups before and after intervention (mean  $\pm$  **standard deviation**, points)

Group	Before intervention	After intervention
Control group ( $n = 49$ )	$7.36 \pm 2.15$	$6.12 \pm 1.18$
Experimental group ( $n = 48$ )	$7.28 \pm 2.28$	$4.38 \pm 1.07$
$t$	0.178	7.603
$P$	0.859	0.000

## 4. Discussion

As a common disease, pediatric dental caries have a severe impact on the daily lives of children, hinder the normal development of their teeth, and cause patients varying degrees of pain. This disease is frequently related to changes in the child's eating habits, such as increased consumption of carbonated drinks, acidic foods, snacks, etc., which increases the incidence of the disease [5,6]. Dental caries is often found under dental plaques and good occlusal relationships are usually established during childhood. The occurrence of dental caries directly affects the child's dental health and will also seriously affect the corresponding relationship between the maxillary and mandibular teeth. Prompt treatment is required, including alignment of the teeth. Conventional filling surgery is often used in clinical intervention. Although it can better alleviate the clinical symptoms of children with dental caries, it also warrants pain to the children [7,8]. This leads to a decrease in compliance of the children which could affect treatment outcomes and recovery. Improved non-traumatic filling technology treatment is a better alternative that can relieve the pain of children, improve the treatment outcome, and have a better prognosis.

In this study, the experimental group was selected to undergo the modified non-traumatic filling technology treatment intervention. The observation group's total effective rate of treatment was higher than that of the control group ( $P < 0.05$ ). The Children also had relatively few incidences of adverse events after the treatment. The incidence rate of adverse events in the experimental group was lower than that of the control group ( $P < 0.05$ ). Furthermore, the treatment compliance of the experimental group was higher than that of the control

group ( $P < 0.05$ ). The pain score of the observation group was lower than that of the control group ( $P < 0.05$ ). These findings were consistent with the results of Guo *et al.* [9]. During the treatment process, the proportion of children who were brave and cooperated with the treatment was higher in the experimental group than that of the control group ( $P < 0.05$ ). A greater proportion of children in the observation group with intact fillings 1 year and 3 years after treatment, as compared to the control group ( $P < 0.05$ ), indicating that the improved non-traumatic filling technology provided better outcomes. Conventional filling surgery is a commonly used clinical treatment measure, which mainly uses dental instruments to remove carious tooth tissue, fill cavities, and repair the damaged teeth of children. However, dental instruments can cause strong pain to children and their low compliance may lead to poor treatment outcomes. However, the improved non-traumatic filling technology uses hand instruments to remove carious tissue, which can effectively reduce pain. It can effectively alleviate the child's dental damage and reduce their pain. It is also minimally invasive and has a low readmission rate [10,11]. The glass ionomer cement material used in the improved non-traumatic filling technology has a relatively higher filling quality, lasts longer, is simple to use, and is more easily accepted by children. In addition, it should be noted that this treatment should be carried out by skilled doctors. When preparing the glass ionomer cement materials, the powder-liquid mixing ratio, preparation method, and time were taken into consideration to avoid contamination. It affects the filling quality, improves the probability of successful treatment, and ensures the therapeutic effect [12].

## 5. Conclusion

The results from this study showed that improved non-traumatic filling technology achieved better results in treating children with dental caries. The child's symptoms were alleviated and the incidence of adverse events such as filling material falling off after treatment was reduced. Furthermore, their treatment compliance improved and their pain was relieved. Compared with conventional filling surgery, this intervention is more suitable for widespread promotion.

## Disclosure statement

The author declares no conflict of interest.

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