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# Impact of Preformed Crown Restoration Combined with Non-invasive Filling Technique on Young Children with Severe Dental Caries

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## Abstract

**Objective:** To investigate the effects of prefabricated crown restoration combined with non-invasive filling techniques on young children with severe dental caries. **Methods:** A total of 80 young children with severe dental caries admitted for treatment from January 2024 to January 2026 were screened and divided into a control group (n = 40) and a study group (n = 40) based on treatment methods. The control group received non-invasive filling techniques, while the study group underwent prefabricated crown restoration combined with non-invasive filling techniques. Periodontal indicators, masticatory efficiency, and aesthetic outcomes were compared between the two groups. **Results:** At 3 months post-treatment, the study group showed lower periodontal indicator scores and higher masticatory efficiency and aesthetic scores compared to the control group ($P < 0.05$). **Conclusion:** Prefabricated crown restoration combined with non-invasive filling techniques can improve periodontal indicators, enhance masticatory efficiency, and enhance dental aesthetics in young children with severe dental caries.

## Keywords

Preformed crown restoration; non-traumatic filling technique; young children with severe dental caries

Early childhood dental caries has become a global public health challenge, with the proportion of severe caries showing an upward trend in recent years [1]. Severe caries not only leads to impaired masticatory function and inadequate nutrient intake but may also cause long-term complications such as permanent tooth enamel hypoplasia and dental crowding, significantly affecting children's oral health and systemic development [2]. Traditional treatments predominantly employ glass ionomer or resin fillings, yet for cases with extensive caries or weak tooth structure, issues such as filler detachment, high risk of secondary caries, and insufficient occlusal function recovery persist. Non-invasive filling techniques, utilizing chemical desiccation and minimally invasive procedures, maximize the preservation of healthy tooth tissue, particularly suitable for young children with limited cooperation [3]. Currently, prefabricated crown restoration technology has emerged as the mainstream solution for severe deciduous tooth caries due to its advantages of high strength, full crown protection, and durable retention [4]. Building on this, this study focuses on the synergistic application of prefabricated crown restoration combined with non-invasive filling techniques, aiming to explore whether a dual mechanism of "chemical desiccation + mechanical protection" can enhance treatment outcomes in young children with severe caries and provide clinical evidence for optimizing pediatric caries management strategies.

# 1. Materials and Methods

## 1.1 General Data

A total of 80 pediatric patients with severe dental caries admitted for treatment from January 2024 to January 2026 were screened and divided into a control group (n = 40) and a study group (n = 40) based on different treatment methods. This study was approved by the Medical Ethics Committee. The control group comprised 23 male and 17 female patients, aged 3-6 years (mean age: 4.74 ± 0.67 years), with caries locations including 21 cases in the maxilla and 19 cases in the mandible. The study group included 22 male and 18 female patients, aged 3-6 years (mean age: 4.85 ± 0.62 years), with caries locations including 24 cases in the maxilla and 16 cases in the mandible. Both groups had single affected teeth. Baseline characteristics showed no significant differences between the two groups ($P > 0.05$), indicating comparability.

## 1.2 Inclusion and Exclusion Criteria

Inclusion criteria: diagnosed with severe dental caries [5]; absence of serious systemic diseases; age range of 3-6 years; signed informed consent by the child's guardian.
Exclusion criteria: irreversible pulpitis, pulp necrosis, or periapical lesions in the affected tooth; documented history of hypersensitivity to materials used during treatment.

## 1.3 Methods

The control group underwent a non-invasive filling technique with the following procedures: Routine tooth surface cleaning to remove food debris and soft plaque. Carious dentin was manually removed using a hand pick and ART-specific instruments with gentle manipulation to preserve healthy dental tissues. The cavity was cleaned with a moist cotton ball to remove debris, followed by drying with a dry cotton ball to maintain relative dryness. High-strength glass ionomer cement was selected for filling, with finger pressure technique applied to ensure tight material adhesion to the cavity walls, slightly exceeding the cavity margin. A polyester film strip was placed over the filling, and the child was instructed to apply occlusal pressure. After initial setting of the material, the shape was refined and excess material removed.

The study group employed prefabricated crown restoration combined with non-invasive filling techniques for treatment. The non-invasive filling procedure was performed similarly to the control group, with the addition of a prefabricated crown restoration step: after completing the non-invasive filling, the crown preparation of the affected tooth was conducted. High-speed mobile phones and carabiners were used to uniformly remove approximately 1.0-1.5 mm of dental tissue, ensuring sufficient space on the buccal, lingual, and occlusal surfaces to accommodate the prefabricated crown. The occlusal surface was reduced by approximately 1.0-1.5 mm, maintaining a gap of about 1.0 mm with the opposing tooth. The occlusal surface was cut to the contact point and gently separated to form an axial morphology with slight convergence toward the occlusal direction from the self-curing gel. All line angles were rounded to avoid sharp edges. A suitable prefabricated crown model was selected based on the size of the affected tooth. During trial wear, the crown margin was checked to ensure it was positioned approximately 0.5-1.0 mm subgingivally, with tight marginal contact without lifting, no occlusal interference, and good occlusal relationships. Glass ionomer adhesive was applied to the inner surfaces of the affected tooth and prefabricated crown, followed by crown placement. The child was instructed to bite down on a cotton roll. After complete curing of the adhesive, excess adhesive was removed, and the marginal smoothness was inspected.

## 1.4 Observation Indicators

(1) Periodontal indicators at 3 months post-treatment. Gingival Index (GI) total score ranges from 0 to 3: 0 indicates normal gingiva; 1 indicates mild gingival edema with no bleeding upon probing; 2 indicates moderate gingival edema with bleeding upon probing; 3 indicates severe gingival edema with spontaneous bleeding. Assessment was performed at four sites on the affected tooth: buccal proximal, buccal midline, buccal distal, and lingual surfaces, with the mean value calculated. Plaque Index (PLI) total score ranges from 0 to 3: 0 indicates no plaque; 1 indicates a thin plaque layer detectable upon probing; 2 indicates moderate plaque accumulation on the tooth surface; 3 indicates abundant plaque. The same sites were used for GI measurement. Gingival Gully Bleeding Index (SBI) total score ranges from 0 to 5: 0 indicates healthy gingiva with no bleeding upon probing; 1 indicates healthy gingiva with pinpoint bleeding upon probing; 2 indicates normal gingival color with linear bleeding upon probing; 3 indicates

congested and edematous gingiva with bleeding beyond the gingival sulcus upon probing; 4 indicates significant gingival redness and swelling with spontaneous bleeding; 5 indicates severe spontaneous gingival bleeding.
(2) Chewing efficiency. Before treatment and at 3 months post-treatment, children were instructed to chew 2 g of peanuts within a specified duration. The expelled residue was collected, then washed, filtered, and dried before weighing. Chewing efficiency = 1- (residue volume/total volume) × 100%.
(3) Aesthetic quality. Three months post-treatment, a self-developed aesthetic quality scoring scale (0-10 points) was used for evaluation, including restoration color matching, morphological naturalness, marginal occlusion, and overall harmony. Higher scores indicate better aesthetic quality.

### 1.5 Statistical Analysis

Data were organized and analyzed using SPSS 26.0 software. Periodontal indicators, masticatory efficiency, and aesthetic quality were all measured data conforming to normal distribution, expressed as ( $\bar{x} \pm s$ ), and analyzed using *t*-tests. Categorical data were presented as percentages (%) and analyzed using the Chi-square test ($\chi^2$ test). A P-value < 0.05 was considered statistically significant.

## 2. Results

### 2.1 Comparison of Periodontal Indicators Between the Two Groups

At 3 months post-treatment, the study group exhibited lower scores in GI, PLI, and SBI compared to the control group (P < 0.05). Details are shown in Table 1.

**Table 1. Comparison of periodontal indicators between the two groups ( $\bar{x} \pm s$ , points)**

| Group | n | GI | PLI | SBI |
|---|---|---|---|---|
| Study group | 40 | 0.82 ± 0.21 | 0.91 ± 0.24 | 1.05 ± 0.22 |
| control group | 40 | 1.15 ± 0.28 | 1.32 ± 0.31 | 1.41 ± 0.25 |
| *t-value* | - | 5.963 | 6.614 | 6.837 |
| *P-value* | - | < 0.001 | < 0.001 | < 0.001 |

### 2.2 Comparison of Chewing Efficiency Between the Two Groups

Three months after treatment, the chewing efficiency in the study group was significantly higher than that in the control group (P < 0.05) (see Table 2 for details).

**Table 2. Comparison of chewing efficiency between the two groups ( $\bar{x} \pm s$ , %)**

| Group | n | Pretherapy | 3 months after treatment |
|---|---|---|---|
| Study group | 40 | 76.37 ± 7.29 | 95.83 ± 2.87 |
| control group | 40 | 75.26 ± 6.49 | 90.82 ± 3.86 |
| *t-value* | - | 0.719 | 6.588 |
| *P-value* | - | 0.474 | < 0.001 |

### 2.3 Comparison of Aesthetic Quality Between the Two Groups

The aesthetic quality score in the study group was (8.92 ± 0.85), while that in the control group was (6.85 ± 1.12), indicating a significantly higher score in the study group (t = 9.311, P < 0.001).

## 3. Discussion

Severe dental caries in young children is a common and frequently occurring condition in pediatric oral clinical practice. Due to the thin enamel and dentin of deciduous teeth, carious lesions progress rapidly, often leading to extensive tooth structure loss [6]. Traditional treatment methods predominantly employ non-invasive filling techniques, which are simple to operate and minimally invasive, making them particularly suitable for clinical

management in young children. However, pure non-invasive filling techniques exhibit limitations such as insufficient filling body strength, poor wear resistance, and suboptimal marginal adaptation, resulting in restricted long-term success rates. Preformed crown restoration, as a mature technique for deciduous tooth restoration, enables complete coverage of affected teeth while preserving anatomical morphology and occlusal function. This approach offers advantages, including high strength, excellent durability, and superior marginal adaptation.

This study found that at 3 months post-treatment, the study group exhibited lower GI, PLI, and SBI scores compared to the control group ($P < 0.05$). Due to the excellent marginal adaptation of precast crowns, they form a smooth transition with dental tissues, reducing plaque retention and dead zones. Additionally, the smooth surface of precast crowns is less prone to plaque adhesion compared to non-traumatic glass ionomer materials used for fillings [7]. The study also revealed that at 3 months post-treatment, the study group demonstrated higher masticatory efficiency than the control group ($P < 0.05$). Precast crowns restored the anatomical morphology and occlusal relationships of deciduous molars, reconstructing effective masticatory functional units. Moreover, precast crowns exhibited superior hardness and wear resistance compared to glass ionomer fillings, maintaining good occlusal contact even after long-term use [8]. The study further showed that the study group achieved higher aesthetic scores than the control group ($P < 0.05$). Precast crowns demonstrated excellent morphological restoration capabilities, accurately reproducing dental anatomical contours with better color and shape harmony with adjacent teeth. In contrast, control group glass ionomer fillings were prone to staining, discoloration, and increased surface roughness in oral environments, leading to significant aesthetic deterioration over time [9]. Additionally, precast crowns achieved marginal adaptation, avoiding pigmentary bands at the filling-dental interface. The precast crown restorations exhibited strong integrity without visible interfaces between fillings and teeth, closely resembling natural tooth appearance [10].

In conclusion, the combination of premade crown restoration with non-invasive filling techniques can improve periodontal indicators in young children with severe dental caries, enhance chewing efficiency, and enhance dental aesthetics.

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