



# The Clinical and Radiographic Success of Bonded Resin Composite Strip Crowns for Primary Incisors

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## Abstract

**Purpose:** The aim of this study was to examine the clinical and radiographic success of the treatment of maxillary anterior primary incisors with composite resin strip crowns placed in a private practice setting.

**Methods:** This was a retrospective, clinical study of patients who had strip crowns (SC) placed on maxillary primary incisors, returned for at least 1, 6-month recall examination, and whose parents consented to participate in the study. Radiographic and photographic examinations were used for evaluation. Two evaluators rated the images independently. When ratings were not in agreement, the 2 examiners reviewed the photograph or radiograph together and reached a consensus rating.

**Results:** One hundred twelve restorations placed in 40 children were evaluated. The evaluations were performed after the crowns had been in place for an average of 18 months. None of the restorations were totally lost, and only 12% were rated as having lost some resin material, resulting in an 88% overall retention rate. There was no difference in restoration success if the crowns were placed 4 at a time, or if fewer crowns were placed in a single sitting; the failure rates were comparable. Teeth that had pulpal treatment were judged to have far more significant color match discrepancies than those teeth without pulpal treatment. Ninety-one percent of the teeth demonstrated healthy pulps. Eight percent had some pulpal changes but did not require immediate attention. Only 1 tooth showed radiographic evidence of pulpal necrosis. Only 11 teeth had pulpal treatment, but of these, 10 demonstrated clinical success.

**Conclusions:** Composite resin strip crowns for restoring primary incisors with large or multisurface caries performed well. Color match of these crowns with adjacent teeth may be significantly reduced when placed upon teeth that have undergone pulpectomy treatment and have been obturated with an iodoform paste. However, based upon the results of this study, the strip crown may provide an esthetic and durable restoration for carious primary incisors. (*Pediatr Dent.* 2003;25:577-581)

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Composite resin strip crowns (SC) have been utilized for over 2 decades to restore carious primary teeth.<sup>1</sup> In spite of being utilized for such a long time, there is a paucity of literature concerning the clinical success of these crowns.<sup>2</sup> The SC is the most esthetic of all the available restorations for the treatment of decayed primary incisors<sup>3</sup>; however, they are also the most technique sensitive, and their durability over extended periods of time may be of concern. In one recent study of children whose dental treatment was accomplished under general anesthe-

sia, the composite resin strip crowns had a failure rate of 51%.<sup>4</sup> Other options for the restoration of decayed primary incisors include stainless steel, polycarbonate crowns, and veneered stainless steel crowns. Because the strip crown is widely used by pediatric dentists, more research concerning its clinical performance and longevity is needed.

The aim of this study was to examine the clinical and radiographic success of the treatment of maxillary anterior primary incisors with composite resin SCs placed in a private practice setting.

Table 1. Clinical Photographic Assessment

Color match	
A	No noticeable difference from adjacent teeth
B	Slight shade mismatch
C	Obvious shade mismatch
Crown contour	
A	Crown appears very cosmetic, nicely contoured, and natural looking
B	Crown appears acceptable but could have been contoured better, perhaps longer, shorter, wider, thinner
C	Crown not esthetic; detracts from appearance of the mouth
D	Crown not present
Presence of restoration failure	
A	Crown appears normal; no cracks, chips, or fractures
B	Small but noticeable areas of loss of material
C	Large loss of crown material
D	Complete loss of crown
Gingival health	
A	No obvious signs of inflammation
B	Mild marginal gingivitis—tissue slightly reddened and edematous
C	Moderate marginal gingivitis—tissue obviously reddened and edematous
D	Severe gingivitis—tissue is very swollen; spontaneous bleeding

### Methods

This study was designed to evaluate the clinical success of SCs that had been placed in a private practice, in children treated for dental caries, or trauma of the primary maxillary anteriors over a period of 4 1/2 years. This was a retrospective, clinical study. The study sample was comprised of patients who had carious primary incisors or who had sustained trauma to their incisors requiring treatment. The participants had to have returned for at least 1, 6-month recall examination, and their parents had to have consented to participate in the study. Radiographic and photographic examinations were used for evaluation. The principal investigator, using a standardized protocol of the operative procedure, placed all of the restorations. Restorations were placed on carious primary incisors with extensive caries on 1 surface or moderate carious lesions on 2 or more surfaces. Additionally, adequate tooth structure after caries removal was required to ensure sufficient surface area for bonding. The clinical technique and procedure were described in detail in a previous report.<sup>5</sup>

Briefly, following caries excavation and removal, SCs (3M-ESPE Dental Products, St. Paul, Minn) were fitted. In cases of very deep caries, an application of a resin-modified

Table 2. Radiographic Assessment

Radiographic assessment of crown margins	
A	Continuous with the contour of the crown; nice adaptation
B	Slight overhang or under contour present, or small area of radiolucency noted under restoration
C	Large defects noted
D	Restoration missing
Radiographic assessment	
A	Healthy; no pathosis noted
B	Pathosis apparent but not requiring immediate treatment
C	Pathosis apparent requiring immediate treatment
Radiographic assessment—pulpal treatment	
A	Fill of canals adequate
B	Canals overfilled or underfilled
D	Pulpal treatment obviously failing
H	No pulpal treatment done



Figure 1. An example of a restoration rated as successful in its retention, contour, color, and gingival health.



Figure 2. The restoration on the right central incisor has failed and shows loss of restorative material.

glass ionomer liner/base (Vitrebond, 3M-ESPE Dental Products, St. Paul, Minn) was applied prior to crown fitting for pulp protection. A gel etching agent (Ultra-Etch, Ultradent Products, South Jordan, Utah) was placed for 15 seconds and rinsed off. A bonding agent (Single bond, 3M-ESPE Dental Products, St. Paul, Minn) and resin composite restorative (Z100,

**Table 3. Sample Characteristics**

Age at time of treatment (mo)	39.2
Gender	
Male	26
Female	14
Recall (mo)	17.8
Number of restorations	112
Restorations placed 4 at one time	72
Pulp therapy	
Pulpotomy	4
Pulpectomy	7

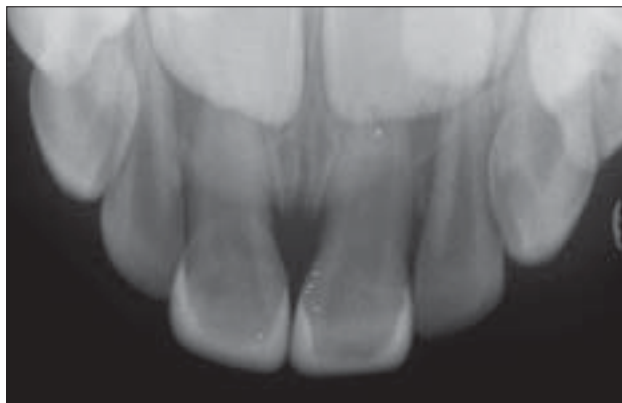


Figure 3. This radiograph demonstrates good crown margins and the absence of any pathosis.

**Table 4. Crown Retention Rates**

Crown retention—multiple restorations			
Number of crowns/rating	A	B	C
4 crowns	89% (64)	8% (6)	3% (2)
<4 crowns	85% (34)	12% (5)	3% (1)
Crown retention—recall time			
Recall time/Rating	A	B	C
6 mo (N=27)	89% (24)	11% (3)	0
7-12 mo (N=24)	96% (23)	0	3% (1)
13-24 mo (N=32)	84% (27)	13% (4)	3% (1)
>25 mo (N=29)	80% (23)	17% (5)	3% (1)

**Table 5. Clinical Evaluation of Restorations and Gingiva**

Rating	A	B	C
Color match	74% (83)	21% (23)	5% (6)
Crown contour	63% (71)	34% (38)	3% (3)
Restoration retention	88% (98)	10% (11)	2% (3)
Gingival health above restoration	57% (64)	43% (48)	None
Gingival health of adjacent teeth without crowns	70% (79)	30% (33)	None

**Table 6. Color—With or Without Pulp Therapy**

Rating	A	B	C
Without pulp therapy	80% (80)	20% (21)	0
With pulp therapy	27% (3)	18% (2)	55% (6)

Restorative Extended Range Shade-Pedo Paste, 3M-ESPE Dental Products, St. Paul, Minn) were used according to the manufacturer's instructions. Uncooperative and preoperative children were treated with conscious sedation in a standardized method described fully in a previous study.<sup>6</sup> No adverse effects were noted in any of the sedations and all treatment was completed.

Crowns were photographed and radiographed during a routine recall examination. The restorations were photographed to allow a blind evaluation of their clinical appearance and the gingival health surrounding the crowns by 2 independent raters (not associated with the principal investigator's practice) without the presence of either the patient or operator. An evaluation rating system was devised similar to the US Public Health Service (USPHS) Alpha criteria rating system.<sup>7</sup> The USPHS system is primarily for posterior teeth, so a new system was developed. The definitions and criteria for the rating system are detailed in Tables 1 and 2. Briefly, the photographic examination included an evaluation of the color, shape, and integrity of the SC (Figures 1 and 2). The health of the labial gingival tissue was evaluated as an indication for the integrity of the cervical margins of the restoration. It was assumed that healthy gingivae are indicative of well-adapted crown margins.

The radiographic findings were defined as: (1) unremarkable (Figure 3); (2) pathological external root resorption; (3) internal root resorption; (4) periapical bone destruction; and (5) calcific metamorphosis. Radiographic success was defined as the absence of pathologic internal or external root resorption, or periapical radiolucency. Each case was evaluated first with the clinical photograph followed by its radiograph. Two evaluators rated the images independently. When ratings were not in agreement, the 2 examiners reviewed the photograph or radiograph together and reached a consensus rating.

Table 7. Radiographic Results

Radiographic evaluation of crown margin			
Rating	A	B	C
N=112	63% (70)	33% (37)	4% (5)
Radiographic evaluation of pulp and periapical area of restored teeth			
Rating	A	B	C
N=112	91% (102)	8% (9)	1% (1)
Radiographic evaluation of pulp treatment			
Rating	A	B	D
N=11	55% (6)	36% (4)	9% (1)

## Results

There were 112 restoration placed in 40 children. Eighteen children had all 4 incisors crowned and evaluated. The other 22 children had 3 or fewer crowns placed. The evaluations were done after the crowns had been in place for an average of 18 months. The study sample and its characteristics are shown in Table 3. The distribution of restorations according to the length of time in the mouth is shown in Table 4. The evaluations of color, crown contour, and retention are presented in Table 5. None of the restorations were totally lost, and only 12% were rated as having lost some resin material, resulting in an 88% overall retention rate. Overall success of the restorations in relation to recall time and multiple placements is compared in Table 4. There was no difference in restoration success if the crowns were placed 4 at a time, or if fewer crowns were placed in a single setting, the failure rates were comparable. With regard to crown color, a comparison between teeth with and without pulpal treatment was made and is presented in Table 6. Teeth that had pulpal treatment were judged to have far more significant color match discrepancies than those teeth without pulpal treatment.

The gingival health representing crown marginal adaptation and its respective radiographic evaluation of crown margins are presented in Tables 5 and 7, respectively. The evaluation of pulpal and periapical tissues are also shown in Table 7. Ninety-one percent of the teeth demonstrated healthy pulps. Eight percent had some pulpal changes, but did not require immediate attention. Only 1 tooth showed radiographic evidence of pulpal necrosis. The success rates of pulpal treatment are also presented and shown in Table 7. Only 11 teeth had pulpal treatment, but of these, 10 demonstrated clinical success.

## Discussion

The retention rate of the SC in the present study was high, with a rate of 88% demonstrated. This was considerably better than the 49% success rate reported by Tate et al.<sup>4</sup> However, the results of another study<sup>8</sup> that compared the quality of restorations in children who had dental treatment



Figure 4. The left central incisor was successfully treated with an iodoform endodontic paste pulpectomy; however, it shows severe clinical coronal discoloration.

under general anesthesia (GA) or sedation were similar to this study. In that study, successful marginal adaptation and anatomic form of strip crowns were more frequent in teeth restored under GA (90% and 86%, respectively) than under sedation (63% and 65%, respectively).

In the present study, the esthetic components of color and crown contour were found to be have fewer ideal ratings (74% and 63%, respectively) than retention (88%). However, if teeth treated pulpally were eliminated from the ratings, the color match ratings improve significantly (Table 6). All of the teeth that were treated pulpally could be detected on the photographs without a radiograph due to the yellow discoloration of the tooth. This may be attributed to the translucent nature of the composite resin, allowing the discolored tooth color to show through the restoration (Figure 4). The endodontic paste used in this study was an iodoform paste (Endoflas, Sanlor Laboratories, Calif, Columbia, South America), which has a yellow color.

The most frustrating aspect of pulpectomy is the presence of future discoloration in the successfully treated tooth, which may be a cause of major parent dissatisfaction. Though it was not utilized in this study, it may be that the discoloration seen with the pulpectomy treated teeth could be minimized by using an opaquing agent on the facial aspect of the preparation prior to SC placement or using a glass ionomer in the coronal one third of the pulp canal to prevent coronal discoloration by the endodontic paste in the canal. These suggestions may reduce the possibility of yellow discoloration showing through the SC. However, parents should be informed that discoloration might occur in teeth that have had pulpal treatment performed.

The ultimate goal of restoring severely decayed anterior primary teeth is to allow the patient to retain these teeth and allow their natural exfoliation without any pulpal complications, which may ultimately result in damage to the permanent successors. The retention rate (88%) and the good radiographic evaluation of pulp health (91%) found in this study both demonstrated a high level of successful treatment with resin strip crowns. It should

be noted that the clinical preference of the operator involved in this study was to avoid pulpal treatment whenever possible. An indirect pulp would be preferable over a pulpotomy with the condition of no radiographic evidence of pulpal involvement and no mechanical exposure. In the present study, only 1 of the pulpal treatments and only 1 tooth that had not been treated pulpally developed signs of radiographic pulpal failure.

No differences were found between the retention rates of crowns placed in multiples of 4 and those cases in which fewer were placed at one time (89% vs 85%). This will encourage clinicians to continue to restore all the anterior teeth at the same time for the convenience of their patients without concern of compromising the outcome.

Some of the limitations of this study should be noted. This was a retrospective study. More information would have been provided if ratings were performed on the crowns immediately after treatment. There is really no way of knowing whether or how these crowns deteriorated. It is possible that color match and contour on some of the crowns was less than ideal at placement and perhaps they remained the same over the 18-month evaluation period. Additionally, a clinical evaluation similar to the photographic one would have been useful to provide a 3-dimensional evaluation to supplement the 2-dimensional photographic evaluation. In spite of these limitations, the photographs did provide an avenue to closely evaluate the esthetics and contours of these crowns.

## Conclusions

1. In this clinical study, composite resin strip crowns performed well to restore primary incisors with large or multisurface caries. They provide an esthetic and durable restoration for carious primary incisors.
2. Color match of these crowns with adjacent teeth may be significantly reduced when placed upon teeth that have undergone pulpectomy treatment and have been obturated with an iodoform paste.

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## ABSTRACT OF THE SCIENTIFIC LITERATURE



### DENTAL CARIES EXPERIENCE IN NORTHERN MANHATTAN ADOLESCENTS

Dental health disparities among children of all ages remain a public health problem. In recent years, there has been much focus on early childhood caries with little new data on dental caries experience among the older adolescent age group. A recent study reported the dental caries experience in northern Manhattan adolescents. Investigators found that adolescents from this predominantly minority community had a DMFT of 3.36 and an untreated disease rate of 36%. This was significantly higher than the finding from NHANES III.

**Comments:** There are many challenges to the access to care problem for minority children. While much attention has focused on early childhood caries, the older adolescent population should not be forgotten. JYL

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