Long-term Photographic and Radiographic Assessment of Bonded Resin Composite Strip Crowns for Primary Incisors: Results After 3 Years

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Abstract

Purpose: The aim of this study was to examine the photographic and radiographic success of the treatment of maxillary anterior primary incisors with composite resin strip crowns (SCs) placed in a private-practice setting after a minimum of 18 months.
Methods: This was a retrospective, clinical study of patients who had SCs placed on primary maxillary incisors, returned for at least one 18-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.
Results: One hundred forty-five restorations, placed in 52 children, were evaluated. The evaluations were performed after the crowns had been in place for an average of 31.3 months. None of the restorations were totally lost: 20% were rated as having lost some resin material, resulting in an 80% overall retention rate; 92% of the teeth demonstrated healthy pulps; 6% had some pulpal changes, but did not require immediate attention. Only 2 teeth showed radiographic evidence of pulpal pathology requiring treatment.
Conclusions: SCs performed well for restoring primary incisors with large or multisurface caries for periods of over 3 years. This study suggests that SCs are likely to be successful and may be indicated as an excellent treatment choice for carious primary incisors with adequate tooth structure after caries removal, especially if esthetic concerns predominate. (Pediatr Dent 2005;27:221-225)

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Among the most esthetic and popular restorations for carious primary anterior incisors are composite resin strip crowns (SCs). Research regarding their clinical success, however, is lacking. In a previous study,[1] the short-term clinical performance of these restorations in young children was reported, with an average evaluation time of 18 months after their placement. This report presents an extension of that study to examine more long-term success of the SCs.

The aim of this study was to examine, after a minimum of 18 months, the clinical and radiographic success of the treatment of maxillary anterior primary incisors with SCs placed in a private-practice setting.

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Methods

This retrospective study was designed to evaluate the clinical success of SCs placed in a private practice in healthy middle- and upper-class preschool children treated for dental caries or trauma of the primary maxillary incisors. The study sample comprised patients with carious primary incisors or who had required treatment for trauma to their incisors. The participants had to have returned for at least one 18-month recall examination, and their parents had to grant consent to participate in the study—including permission for photographs and any necessary diagnostic radiographs. Clinical photographs and radiographs were used for evaluation.

Using a standardized crown placement protocol, the principal investigator placed all restorations. The clinical technique and procedures were described in detail in a previous report.[2] Strip crowns (3M-ESPE Dental Products, St. Paul, Minn) 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 of at least one half to two thirds of the clinical crown was required to ensure sufficient surface area

Table 1. Evaluation Criteria

Clinical photographic assessment for color match	
A	No noticeable difference from adjacent teeth
B	Slight shade mismatch
C	Obvious shade mismatch
Clinical photographic assessment for 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, narrower
C	Crown not esthetic; detracts from appearance of the mouth
D	Crown not present
Clinical photographic assessment for presence of restoration failure	
A	Crown appears normal; no cracks, chips, or fractures
B	Small, but noticeable areas of material loss
C	Large loss of crown material
D	Complete loss of crown
Clinical photographic assessment for 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
Radiographic assessment of pulpal and periapical tissues	
A	Healthy; no pathosis noted
B	Pathosis apparent, but not requiring immediate treatment
C	Pathosis apparent, requiring immediate treatment
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

for bonding. Traumatized incisors with crown fractures involving at least one third of their clinical crown were also treated with SCs.

Uncooperative and precooperative children were treated with conscious sedation coupled with passive medical immobilization; none of the restorations was placed on patients under general anesthesia. Crowns were photographed during a routine recall examination, and the images were processed via a standardized method. 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.[3] The definitions and criteria for the rating system are detailed in Table 1.

Briefly, the photographic examination included an evaluation of the SCs' color, shape, and integrity. The radiographic findings were defined as: (1) unremarkable, (2) pathological external root resorption; (3) internal root resorption; (4) periapical bone destruction; and (5) calcific metamorphosis.

Premature resorption was identified when:

1. one primary tooth root was significantly shorter (3 to 4 mm) than the other central or lateral; or
2. when resorption of the root was well in advance (4 mm or more) of the erupting permanent tooth.

Radiographic success was defined as the absence of:

1. pathologic internal or external root resorption; or
2. periapical radiolucency.

Each case was first evaluated with the clinical photograph followed by its radiograph. The 2 evaluators rated the images independently. Both evaluators were experienced pediatric dentists and had both served as evaluators

Table 2. Crown Retention Rates

Crown retention–recall time			
Recall time/rating	A	B	C
18-23 mos (N=36)	83% (30)	14% (5)	3% (1)
24-29 mos (N=46)	83% (38)	13% (6)	4% (2)
30-35 mos (N=23)	74% (17)	17% (4)	9% (2)
>36 mos (N=40)	78% (31)	15% (6)	7% (3)

in the previous short-term study. When ratings were not in agreement, the 2 examiners reviewed the images together and reached a consensus rating.

Results

There were 145 restorations placed in 52 children, with the average age at treatment being 35.6 months. Twelve of the subjects had participated in the previous study.[1] Evaluations were performed after crowns had been in place for an average of 31.3 months (range=18 to 63 months). Inter-rater reliability for crown assessments was 83%, while intrarater reliability was 88%. The distribution of restorations and their retention rate, according to the length of time since initial placement, are shown in Table 2. Color, crown contour, and retention evaluations are presented in Table 3.

Evaluation of the SC's clinical appearance demonstrated good results. Color match of the crowns was very good, with 88% of the crowns showing no discernable difference with adjacent teeth. Ninety-eight percent of the crowns were rated as having acceptable or ideal contour. Of these, 59% were judged as being very cosmetic and 39% as being acceptable, but could have been contoured a little more naturally.

None of the restorations was totally lost; however, 20% were rated as having lost some resin material, resulting in an 80% overall retention rate. The gingival health surrounding the crowns and adjacent teeth and the radiographic evaluation of crown margins are presented in Tables 3 and 4, respectively. Ninety-nine percent of the SCs demonstrated either no gingival inflammation (43%) or mild marginal gingivitis (56%). Mild gingival inflammation was about twice as likely around the SCs as around the adjacent teeth without crowns. The radiographic evaluation of the crown margins demonstrated that 89% of the SCs had either a nice, continuous crown contour (54%) or a slight overhang or an area of radiolucency at the margin (35%). Pulpal and periapical tissue evaluations are also shown in Table 4.

Ninety-two percent of the teeth demonstrated healthy pulps, while 6% had some pulpal changes but did not require immediate attention. Among the pathologies detected were: (1) premature resorption (N=5); (2) calcific metamorphosis (N=3); and (3) internal resorption (N=1). Only 2 teeth showed radiographic evidence of pulpal pathology requiring immediate treatment.

Table 3. Photographic Evaluation of Restorations and Gingiva

Clinical evaluation of restorations and gingiva			
Rating	A	B	C
Color match	88% (127)	1% (14)	3% (4)
Crown contour	59% (86)	39% (56)	2% (3)
Restoration retention	80% (116)	14% (21)	6% (8)
Gingival health above restoration	43% (62)	56% (81)	1% (2)
Gingival health of adjacent teeth without crowns	71% (103)	29% (42)	None

Table 4. Radiographic Results*

Radiographic evaluation of crown margin			
Rating	A	B	C
(N=145)	54% (79)	35% (50)	11% (16)
Radiographic evaluation of pulp and periapical area of restored teeth			
Rating	A	B	C
(N=145)	92% (134)	6% (9)	1% (2)

*Only 5 teeth (3%) had pulpal treatment.

Discussion

The SCs' retention rate in the present study was high: 83% demonstrated in SCs present between 1.5 to 2 years, and a slightly lower rate of 78% in those present for over 3 years. This should encourage clinicians to choose this type of restoration, since the age of primary incisor exfoliation is within this time span in many young children needing anterior restorations.

This long-term study's results were similar to those found in the preceding study,[1] which examined SCs after a minimum of 6 months (88% at an average of 18 months). This retention rate is superior to at least 1 type of anterior preveneered primary stainless steel crown, as indicated in a recent study.[4] In that study, the crown's average age at evaluation was 17.5 months. Only 61% of the crowns were rated as having complete resin retention without any fracture or signs of wear resulting in partial or total facing loss.

Based on this study's results, apparently the color match and color stability of SCs is very good. After a minimum of 18 months, nearly all the crowns demonstrated no discernable difference in color to adjacent teeth. Clinical crown contour was also judged as being either very good or acceptable for nearly every crown.

Radiographically, marginal contour, however, was not as good as what was observed clinically. When evaluating crown margins on the radiographs, evaluators often found

Figure 1. Two central incisors rated after 48 months. The patient's left restoration (tooth F) was rated as B in gingival health, crown contour, and restoration failure due to the small but noticeable loss of material. The right restoration (tooth E) was evaluated as A in all clinical aspects.

Figure 2. Four strip crowns on maxillary incisors rated after 39 months. The right central incisor demonstrates a large loss of crown material, and the left central incisor indicates a smaller but noticeable loss of material. The laterals show no signs of material loss.

small areas of radiolucency. It was impossible to determine if the radiolucency represented recurrent decay, an undercontoured (too short) margin, or a thick layer of bonding agent. Consequently, these areas were all given a lower rating, even though it was possible that the margins were intact. There are some possible explanations regarding the health of the gingiva surrounding the SCs being slightly more inflamed than around teeth without crowns:

1. Crowns may lead to more cervical plaque accumulation and, hence, more inflammation.
2. The radiographic finding of less-than-ideal crown margins on 35% of the crowns may also contribute to more inflammation.

It should be noted that, of all clinical and radiographic parameters evaluated by the 2 examiners, the most difficult to ascertain and, consequently, the instigator of most evaluator disagreements was gingival health. The evaluators found that judging gingival health from a 2-dimensional photograph was much more difficult than an actual clinical evaluation where gentle probing and evaluation could be performed.

When considering the treatment options of decayed anterior primary incisors, SCs may be considered a very good treatment choice if adequate tooth structure remains after caries removal. The preveneered stainless steel crowns:

1. are substantially more expensive than SCs;
2. have limited or no ability to contour or crimp the facial surface;
3. have decreased esthetics due to facing loss.

If caries removal results in insufficient tooth surface area for bonding or extensive subgingival margins, however, or if moisture control is a problem, the preveneered stainless steel crown should be considered as an alternative to SCs.

A few of this study's limitations should be noted. This was a retrospective study involving 1 operator. A prospective, multioperator study is needed to extrapolate this study's results to other clinicians and clinical situations. There are several difficulties, however, in designing clinical studies to evaluate restorative options of primary incisors[5]—which may be obstacles to obtaining good clinical data on restorative options for primary incisors These difficulties include: (1) behavior management; (2) the child's young age; (3) parental consent; (4) treatment costs; and (5) differences in caries risk.

Additionally, due to the young age of patients needing these restorations, and their need of some type of pharmacosedation, few clinicians will consider placing these children into an "experimental" situation where restoration failure can mean a significant replacement problem.

Even if all these obstacles are overcome, it is difficult to have long-term follow-ups in university or hospital settings. Another limitation is that, while clinical photographs provide a representation of the clinical facial appearance, an actual clinical evaluation would likely provide an even better evaluation and include all aspects of the restorations.

Another limitation is that the results here represent one composite resin material (Z100 Restorative Extended Range Shade-Pedo Paste, 3M-ESPE Dental Products, St. Paul, Minn) and 1 bonding agent (Single Bond, 3M-ESPE Dental Products, St. Paul, Minn). It is possible that results may differ with different materials.

The ultimate goals of restoring severely decayed anterior primary teeth are to allow the:

1. patient to retain these teeth functionally with an esthetic result;
2. natural exfoliation of these teeth without the need to retreat the restoration and without any pulpal complications.

The retention rate (83%) and good radiographic evaluation of pulp health (93%) found in this study both demonstrated a high level of successful treatment with resin strip crowns.

Conclusions

Based on this study's results, the following conclusions can be made:

1. Overall clinical success was very good with SCs used to restore primary incisors with large or multisurface caries, demonstrating an 83% retention rate after 1.5 years and 78% retention rate after 3 years.
2. This study suggests that SCs are likely to be successful and may be indicated as an excellent choice for the treatment of carious primary incisors with adequate tooth structure after caries removal, especially if esthetic concerns predominate.
3. SCs appear to have few negative effects on pulpal health.

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Abstract of the Scientific Literature

An Important Cause of Bell's Palsy in Children

Peripheral facial paralysis in children can be caused by a range of disorders, including congenital anomaly, trauma, otitis media, and viral infections. The reactivation of herpes simplex virus type 1 is thought to be a major cause of adult idiopathic peripheral facial paralysis (Bell's palsy). The purpose of this study was to examine the pathogenesis of this condition in children.

Recruited from a pool were 30 children under 15 years old who had hospital encounters within 10 days of an onset of Bell's palsy. Serological assays and polymerase chain reaction analysis of paired sera and saliva samples were used to try and identify evidence of a herpes virus, mumps virus, varicella-zoster virus (VZV), and herpes simplex type 1 (HSV-1) virus. The results showed the presence of VZV reactivation in 11 of the 30 patients. The prevalence of this reaction in patients between 6 and 15 years old was significantly higher than in those younger than 5. It was also found that HSV-1 is not a significant factor underlying Bell's palsy in childhood.

Comments: As clinicians, we would generally not be called upon to diagnose the cause of Bell's palsy in 1 of our patients, but this article may increase our understanding of its etiology. Most patients recover completely. As practititioners treating the dental and orofacial needs of a pediatric population, however, this article can help expand our awareness about an often puzzling condition. **GM**

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