Clinical Success and Parental Satisfaction With Anterior Preveneered Primary Stainless Steel Crowns

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Abstract

Purpose: The purpose of this study was to evaluate the clinical success of and parental satisfaction with treatment using prefabricated resin-faced stainless steel crowns (SSCs; Kinder Krowns, Mayclin Dental Studios, Minneapolis, Minn) on anterior primary teeth.
Methods: Patients treated with Kinder Krowns within the last 3 years were recalled for clinical evaluation and completion of a parental satisfaction survey in this retrospective cross-sectional study. Clinical evaluation was performed for crown retention, facing retention, and resin veneer wear.
Results: Forty-six teeth were evaluated in 12 children. The average age of the crown at the time of examination was 17.5 months (range 5-38 months). All crowns were present in the mouth, and resin fracture resulting in partial or total facing loss was seen in 24% of the crowns. No resin facing fracture or visible wear was seen in 61% of the crowns. Six crowns had total facing loss from fracture (13%), while 5 (11%) had partial facing fracture. Wear (7 crowns, 15%) was limited to less than the incisal one third of the crown. The parental satisfaction with the preveneered SSCs overall was high, with satisfaction for appearance and the shape being the lowest.
Conclusions: Kinder Krown prefabricated resin-faced SSCs showed a low failure rate, and the parental satisfaction with treatment was positive. (*Pediatr Dent.* 2004;26:391-395)

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Despite the continuing prevalence of dental caries in primary maxillary anterior teeth in preschool children, the esthetic management of these teeth remains problematic.[1,2] Esthetic restoration of primary anterior teeth can be especially challenging due to the:

1. small size of the teeth;
2. close proximity of the pulp to the tooth surface;
3. relatively thin enamel and surface area for bonding;
4. issues related to child behavior.[3,4]

While there is limited information on the potential psychosocial impact of anterior caries or unaesthetic restorations in primary teeth, optimal esthetics should clearly be the treatment goal whenever possible for the well-being of children and parents.[5] Restoration of primary anterior teeth that have extensive caries or that are deformed, traumatized, and/or missing can be accomplished using a variety of techniques capable of producing excellent esthetic results.[3,6,7]

The ideal anterior restoration should be easily placed, inexpensive, durable, and esthetic. Several options are available for providing full coverage restoration for the anterior primary dentition, with each approach having advantages and disadvantages.[6] For example, composite strip crowns use readily available materials and are considered the most esthetic anterior restorative therapy but have several disadvantages.[8] Placement of these restorations is technique sensitive, requires cooperation from the child, optimal isolation, moisture control and a sufficient amount of tooth structure for bonding. Although previous studies indicated that resin strip crowns have a low success rate (49%), more recent studies indicate a clinical retention rate of 80% after 2 years.[9,10]

Prefabricated resin crowns are typically bonded, so they present many of the same technique issues as resin strip crowns.[3] Additionally, prefabricated resin crowns are prone to excessive wear and have limited capacity for marginal

finishing and contouring. There have been no clinical studies to evaluate these copolyester resin crown restorations (ie, Pedo Jacket, Space Maintainers Laboratory, Chatsworth, Calif).[3]

Stainless steel crowns (SSCs), offer excellent durability and can be placed on teeth having limited tooth structure and where lesions extend subgingivally—however, they provide poor esthetics. Open-face SSCs are one cosmetic solution to SSCs, although they also have several disadvantages.[11] The procedure is time consuming and requires additional preparation and use of multiple materials. An esthetic veneer bonded to the facial surface of the SSC is another promising treatment approach directed at enhancing the esthetics of anterior SSCs while maintaining the advantages of ease of placement, durability, and retention.

Disadvantages of preveneered SSCs include:

1. being substantially more expensive than plain SSCs or the celluloid strip crowns;
2. limited or no ability in many of these crowns to contour or crimp the facial surface;
3. facings that can fracture and wear, thereby reducing esthetics.[3,4]

Although there have been several laboratory studies evaluating preveneered SSCs, there has been only one clinical study published.[4,12,13] This clinical study of Whiter Biter crowns showed a relatively high failure rate of facing retention (24% had complete facing loss) but did indicate a high level of parental satisfaction with the preveneered SSC esthetics.[4]

The lack of clinical information regarding the longevity and wear of preveneered SSCs led the authors to complete the following study for the purpose of determining the clinical success and parental satisfaction with one commercially available resin-veneered SSC (Kinder Krowns, Mayclin Dental Studios, Minneapolis Minn).

Methods

The University of North Carolina (UNC) human subject institutional board approved this retrospective cross-sectional study, and consent was obtained from each participant's parent or guardian. Children ages 3 to 6 years who had been treated at the UNC faculty dental practice within the last 3 years were identified from patient care records by the authors. All crowns were placed under ideal conditions while the children were being treated with the aid of general anesthesia. All treated teeth had multiple carious surfaces and were generally considered poor candidates for resin-bonded strip crowns due either to the lack of tooth structure remaining and/or extensive subgingival caries—making isolation and maintaining a dry field problematic.

Treatment options—including extraction, strip crowns, and resin-faced SSCs—were discussed with the parents prior to obtaining informed consent for treatment. Parents/guardians of these children were contacted by phone and asked to participate in the study by returning for clinical evaluation and completion of a parental satisfaction survey. A total of 50 children had received such treatment and were, therefore, eligible for inclusion in the study. Only resin-veneered SSCs purchased commercially and manufactured by Kinder Krown were evaluated. All the crowns evaluated included incisal locks for mechanical retention of the resin that were not present in an earlier version of this commercially available crown. The crowns were cemented with glass ionomer cement (Ketac, 3M ESPE, St. Paul, Minn).

The authors completed all clinical evaluations and reviewed all photographs for consistency with the chairside clinical assessment. The clinical data collected included the patient's age and gender and date of restoration placement. All restorations were clinically photographed adjacent to a control Kinder Krown to document color stability and the presence of wear or fracturing. A gingival score on a scale of 0 to 3 was determined: 0=no inflammation; 1=mild inflammation; 2=moderate inflammation; 3=marked inflammation.[14] The clinical parameters for evaluating each crown have been previously described and included retention of the crown's facing, facing fracture, facing repair history, facing color match, marginal integrity of the facing, and the surface texture of the resin facing as shown in Table 1.[4]

Table 1. Clinical Evaluation Criteria

Treated tooth exfoliated	0=yes 1=no
Retention of crown's facing	0=crown's facing is intact 1=partial or complete facing loss 2=loss of crown
Facing fracture	0=no fracture 1=small fracture (less than one fourth facing) 2=bulk fracture (greater than one fourth facing)
Area of facing loss	0=no loss 1=incisal one third only 2=incisal half only 3=entire facing
Interface failure site	0=no failure 1=resin/resin 2=resin/metal 3=metal/metal
Facing repair	0=none 1=repair present
Facing color	0=unchanged 1=minor deviation from original 2=unacceptable discoloration
Facing wear	0=no wear 1=incisal wear only 2=greater than incisal wear
Facing surface texture	0=smooth 1=minor roughness 2=unacceptable surface roughness

Table 2. Facing Fracture and Wear in Kinder Krown Restorations

Clinical parameters measured on 46 teeth	No.	% or mean
Complete resin retention (no fracture or wear)	28	61%
Facing fracture		
Total resin loss	6	13%
Partial resin loss	5	11%
Interface failure		
Resin/resin	9	20%
Resin/metal	2	4%
Wear	7	15%
Color change	9	20%
Gingival inflammation	46	68%=none
Overbite	46	31%
Overjet	46	2.6 mm

Table 3. Parental Satisfaction With Kinder Krown Restorations

Measure	Mean±SD	Minimum	Maximum
Appearance	4.7±0.56	3	5
Color	4.8±0.31	3	5
Shape	4.8±0.59	3	5
Size	4.9±0.24	4	5
Durability	4.8±0.36	3	5
Total parental satisfaction score	**21±1.56**	**19**	**25**

Each child's parent/guardian was asked to provide feedback on a survey evaluating their satisfaction with the restorations. Criteria used in the survey included: (1) crown appearance; (2) shape; (3) size; (4) color; and (5) durability. Each of these criteria were scored using the following scale: 1=very dissatisfied; 2=dissatisfied; 3=neutral satisfied; 4=satisfied; 5=very satisfied.[4]

Data analyses

The clinical data were compiled, and descriptive statistics were generated for each of the clinical parameters to evaluate crown longevity and facing integrity. The 5 areas of the parental acceptance scale were reported on 1 to 5 Likert scale. The authors created a total acceptance measure by combining the scores for each of the 5 areas. A multivariate linear regression model was used to examine factors associated with total parental acceptance and evaluate possible relationships between anterior occlusion and facing failure.[15] The data analysis was completed using STATA Statistical Software (Stata Corporation, College Station, Tex). An alpha level of 0.05 was accepted as significant.

Results

Of this study's 50 eligible participants, 12 parent/child groups participated (8 males, 4 females). A large number of the eligible participants were either not interested in participating in the study or were not reachable, as many families had moved, changed or lost phone services, or were otherwise unreachable. Among the 12 participating children, 48 teeth had received crowns (11 canines, 19 lateral incisors, and 18 central incisors). Of the 48 teeth, 2 teeth were lost to exfoliation. Thus, 46 teeth were evaluated for this study. The average age of the crown at evaluation was 17.3 months (±10.4, range 5-38 months). A minimum of 2 crowns and a maximum of 6 crowns per child were placed.

Description of crown failure

Clinical examination results are summarized in Table 2. None of the SSCs had been lost from the restored teeth, with the exception of 1 exfoliated tooth (100% crown retention). Forty-six teeth with resin-faced SSCs were evaluated, revealing that 6 (13%) crowns had complete facing loss. Total facing loss was observed in 4 maxillary central incisors, 1 maxillary lateral incisor and 1 maxillary primary canine. An additional 5 crowns (11%) had partial facing loss (Figure 1) due to fracturing, and 7 (15%) showed a loss of some incisal resin due to wear. None of the resin faces present had a wear

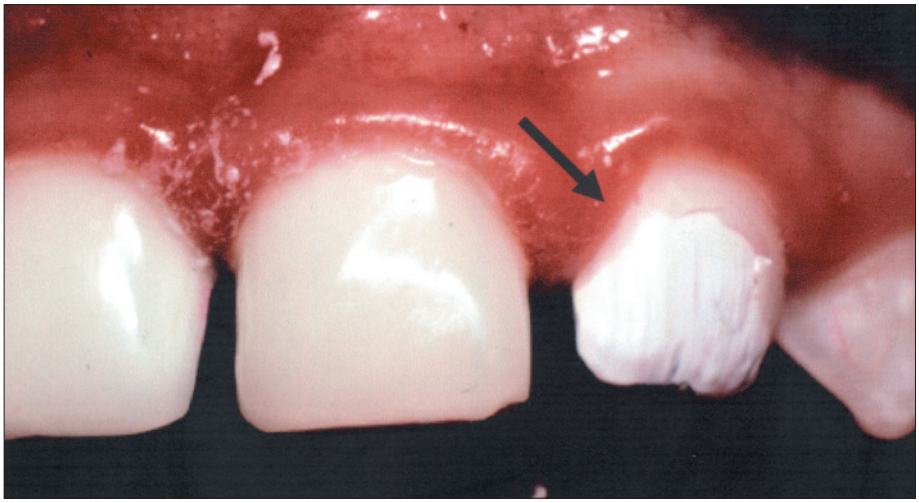

Figure 1. This lateral incisor shows a bulk facing fracture (arrow) that extended to the gingival third of the tooth. The failure occurred at the resin/resin interface, leaving the opaquer intact. The central incisors were both treated with Kinder Krowns and showed only minimal incisal wear.

score greater than 1, showing that wear was limited to less than the incisal one third of the facing. Examination of any relationship between the overjet and overbite factors to clinical fracturing of the resin revealed that an increased overjet was significantly associated with increased facing loss ($P<.05$). Increased overjet also was significantly ($P<.05$) associated with the presence of wear, while increased overbite was weakly associated ($P<.1$) with wear.

Of the crowns showing facing failure, 9 (20%) had resin/resin failure (leaving the white opaque layer bonded to the SSC; Figure 1) and 2 (4%) had resin-metal failure (leaving the SSC surface directly exposed). There was no detectable change in facing color for 80% of the crowns with intact facings, while the remaining 20% of crowns with facings had only minor color deviation. None of the crowns having all or part of their resin facing present showed evidence of marked staining or yellowing of the resin. The resin surface was scored as smooth in 85% of the intact facings and as having minor roughness in 15%. None of the intact resin facings showed marked roughness or pitting.

The gingival health around the crowns was optimal in 61% (N=28) of the teeth and showed mild inflammation characterized by a slight reddening of the tissue in 24% (N=11) of the teeth. The remaining 15% (N=7) had bleeding spontaneously or on probing, and 6 of these crowns were present in 1 child with very poor hygiene—as evidenced by heavy plaque accumulation at the time of examination.

Parental satisfaction

Table 3 presents the data from the parental satisfaction survey. Overall, the resin-faced SSCs were well accepted by the 12 parents surveyed. When considering the parental ratings for appearance, color, shape, size, and durability, the lowest scores received were for appearance. Parents were most satisfied with size. Parents showed an overall positive rating of the crowns with an average total satisfaction score of 21 (range=19-25; 25-point scale). When the factors associated with total parental satisfaction with resin-faced SSCs were explained, the authors found that patient sex (female), overjet, and overbite were significant and had a positive relationship in the model ($P<.05$). Significant clinical factors that had a negative effect on total parental satisfaction were: (1) facing fractures ($P<.05$); (2) color ($P<.05$); and (3) wear ($P<.01$).

Discussion

This is only the second known clinical study reporting the clinical longevity of prefabricated resin-veneered SSCs used for restoring primary anterior teeth. Previous clinical studies repeatedly show SSCs to be highly retentive for both anterior and posterior primary teeth.[4,16] The present study confirmed this, with 100% of the SSCs being retained over an average time period of 1.5 years. This shows that anterior SSCs should be considered as a highly retentive and protective restorative option for the anterior primary dentition. This level of durability makes this treatment approach a desirable option for treating very young children when longevity is critical and/or there is significant loss of tooth structure potentially compromising less durable treatments.

The loss of the entire facing occurred in 13% of the crowns, with partial loss due to wear or fracture occurring in another 26%. In a previous study evaluating Whiter Biter II crowns, there was a 24% complete facing loss rate and 32% had lost all or some of the facing. The Kinder Krowns in the present study performed markedly better over a similar time period compared with Whiter Biter II crowns in terms of total facing loss. These later crowns are no longer commercially available and have been replaced with the Dura Crown.

In the present study, an increased facing fracture and wear rate were both significantly related to overjet ($P=.05$) and increased overbite was weakly associated with wear ($P<.1$). This result supports the presence of a relationship between occlusion and the integrity of resin facings that was reported in a previous study of Whiter Biter II crowns that also showed overjet was significantly associated with fracturing and overbite was weakly associated with increased fracturing.

Both of these studies suggest that the resin-veneered crown's anterior positioning is an important risk factor for facing fracture. Collectively, these studies suggest that clinicians should expect a potentially greater failure rate of preveneered resin facings in children with increased overjet.

The presence of substantial wear on the maxillary primary incisors is not considered abnormal. Therefore, it is not surprising that restorations covering these teeth would also exhibit some degree of wear.[17] Although numerous crowns showed some incisal wear (15%), wear was limited to the incisal one third and, in most cases, was characterized by only minimal resin loss.

Similarly, the Kinder Krowns showed good color stability, with only 20% of the crowns having minor color deviation from the original crown and none showing marked discoloration. The crowns showing minor color deviation had a clinical life of greater than 24 months, while those present for less than 2 years showed no color change. Most primary anterior restorations will have a life expectancy of 3 to 4 years prior to exfoliation, suggesting that the level of wear and degree of color stability observed in the Kinder Krown restorations in this study would be acceptable.[10,18]

Parental satisfaction with the Kinder Krowns was found to be excellent and slightly higher than that reported for the Whiter Biter II crowns. The mean parental ratings for the shape and size were 4.8 and 4.9 for Kinder Krowns, compared with 4.3 and 4.2, respectively, for Whiter Biter II crowns. Those Kinder Krowns having total or partial facing loss most often failed between the resin and the opaque layer used to mask the metal color, leaving the restoration an opaque white color. The fact that the crowns suffering from facing loss still appeared white could, at least partially, account for the improved parental satisfaction with Kinder

Krowns, compared with that reported previously for Whiter Biter II crowns. Mean parental satisfaction was highest for size and lowest for appearance. Not surprisingly, the resin fracturing, color change and wear were significantly associated with more negative parental satisfaction.

Clinical evaluation of the success and parental satisfaction with the Kinder Krown resin-faced SSCs revealed this restoration to:

1. be highly retentive;
2. have a better facing retention rate than previously studied crowns;
3. be well accepted by parents.

Taken together, these findings show that Kinder Krown restorations are reliable for protecting the tooth and providing a good level of esthetics. Parents, however, should still be advised of the possibility of facing loss when discussing treatment options for anterior primary tooth restorations.

Conclusions

1. Kinder Krowns performed well over an average of 1 1/2 years, with 100% of the crowns being retained despite the inability to modify or crimp the facial cervical margin.
2. Resin facings were completely lost in 13% of the crowns, with most of these restorations remaining white due to the presence of the resin opaque.
3. Facing failure was significantly associated with an increased overjet.
4. Parental satisfaction with the appearance, color, shape, and size of the Kinder Krowns restorations was very high.

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