

Scientific Article

Parental Satisfaction with Preveneered Stainless Steel Crowns for Primary Anterior Teeth

Cariann Champagne, DDS¹ • William Waggoner, DDS, MS² • Marcia Ditmyer, PhD, CHES³ • Paul S. Casamassimo, DDS, MS⁴

Abstract: Purpose: The purpose of this study was to evaluate parental satisfaction with preveneered stainless steel crowns placed on their child. **Methods:** A questionnaire using a 5-point Likert-type scale was administered by a trained assistant to a convenience sample of 58 parents at recall of their child at least 6 months after placement of preveneered stainless steel crowns (PVSSCs; NuSmile). The questionnaire asked about: (1) durability; (2) color; (3) size; and (4) shape. Fifty-eight children ranged in age from 18 months to 12 years were approached for participation. Crowns were placed by pediatric dental residents or private practice pediatric dentists. **Results:** Fifty-four of 58 parent questionnaires were usable. The average age of the children was 5 years, 2 months at recall. The children had crowns present an average of 13 months at evaluation. Overall, parental acceptance of NuSmile PVSSCs was very high at 93% (N=50). Parents were most satisfied with the crown's: (1) size (N=52; 97%); (2) shape (N=51; 94%); (3) shade and retention (N=48; 89%); (4) metal visibility (N=40; 74%); and (5) durability (N=38; 70%). Forty-three parents (80%) stated that their children were satisfied with the crowns. **Conclusions:** Parent satisfaction with the NuSmile preveneered stainless steel crowns was very high. (*Pediatr Dent* 2007;29:465-9) Received November 14, 2006 / Revision Accepted January 14, 2007.

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Early childhood caries (ECC) describes rampant caries in infants and toddlers. ECC has reached epidemic proportions in some US minority populations.¹ In early ECC, maxillary anterior primary teeth are primarily affected. Dental treatment is often both extensive and expensive. Carious primary teeth often require full coverage restoration, and the most reliable restoration is the stainless steel crown (SSC). In today's cosmetically conscious society, however, most parents demand more esthetic restorations, often preferring extraction to a metal crown's unattractive appearance.²

A restoration growing in popularity is the preveneered stainless steel crown (PVSSC). Currently, at least 4 manufacturers fabricate this product: (1) Cheng Crowns, Cheng Laboratory, Frazer, Pa; (2) NuSmile Crowns, Orthodontic Technologies, Houston, Tex; (3) Kinder Crowns, Mayclin Laboratory, Minneapolis, Minn; and (4) Dura Crowns, Space Maintainers Laboratory, Chatsworth, Calif, fabricate this product. With a PVSSC, composite or thermoplastic resin is

bonded to the facial surface of a traditional SSC. The advantages of PVSSCs include: (1) ease of placement; (2) hemorrhage does not significantly affect the retentive properties or color; and (3) working time is relatively short compared to other restorative choices.^{3,4}

Parents are more pleased with these crowns compared to an open-face crown because no metal is visible from conversational distance.⁵ Disadvantages of PVSSCs include: (1) reduced retention from limited crimping; (2) postplacement contouring with a handpiece⁶; (3) greater expense than SSCs; and (4) availability in only 2 shades.

Only 2 studies document and compare both function and parental acceptance of PVSSCs. In the first clinical retrospective study of preveneered SSCs using Whiter Biter II crowns (Whiter Biter, Inc), which are no longer commercially available, Roberts et al found that, while all Whiter-Biter II crowns remained intact and retentive, one third of the facings showed complete or substantial loss.⁶ Despite this failure rate, overall parental acceptance remained surprisingly high, with most stating they would choose the preveneered crowns for their child again. The lowest scores were received for appearance and color, while parents were most satisfied with the shape and size of the resin-veneered crowns.

A similar study by Shah et al compared the failure rate of Kinder Crowns and parental acceptance.⁷ Forty-six teeth were

¹Drs. Champagne and ²Waggoner are pediatric dentists in private practice in, respectively, Sparks and Las Vegas, Nev; ³Dr. Ditmyer is Assistant Professor in Residence, School of Health and Human Sciences, University of Nevada, Las Vegas; and ⁴Dr. Casamassimo is professor and section head, College of Dentistry, The Ohio State University, Columbus, Ohio.
Correspond with Dr. Casamassimo at casamassimo.1@osu.edu

evaluated in 12 children. Resin fracture resulting in partial or total loss of the facing was observed in 24% of crowns. Wear was limited to the crown's incisal one third in 15% of teeth. Overall, the PVSSCs were well accepted by parents. When considering such factors as appearance, color, shape, size, and durability, the crowns' appearance received the lowest score, while parents were most happy with the crown's size.

Little information is available on the psychosocial impact of anterior caries or unattractive restorations in primary teeth. The purpose of this report was to describe a retrospective clinical study to evaluate parental satisfaction with NuSmile Crowns, a type of preveneered stainless steel crown for restoring primary anterior teeth.

Materials

Sample. Fifty-eight 18 month- to 12-year-old children with primary anterior teeth previously restored with NuSmile crowns comprised the convenience sample for this institutionally approved study, and participated with consent of their parents. Subjects were required to have had 1 or more NuSmile crowns placed on maxillary and/or mandibular primary anterior teeth (including any or all teeth from canine to canines) more than 6 months prior to evaluation. Crowns were placed either at:

1. the Enterprise Clinic at the School of Dental Medicine of the University of Nevada (UNSDM), Las Vegas, Nev; or
2. an associated outpatient surgery center.

The crowns were placed by either:

1. first- or second-year UNSDM pediatric dental residents; or
2. 1 of 2 private practice pediatric dentists.

All crowns were cemented with glass-ionomer cement (Ketac-Cem, 3M ESPE, Minneapolis, Minn). Excluded from the study were crowns:

1. on teeth near exfoliation and out of arch alignment;
2. placed less than 6 months prior to evaluation; or
3. placed by a general dentist.

Procedure. From March 1, 2005 through May 1, 2005, parents were approached at scheduled 6-month preventive care appointments to invite them to participate in the study and complete a survey at: (1) the UNSDM Enterprise Clinic; (2) the UNSDM; or (3) a private dental office. Examiners underwent calibration sessions prior to data collection in order to standardize the explanation of the parental survey to parents or guardians. Examiners trained the dental assistants to explain concepts of durability, color, size, and shape to the parent or guardian and to verify inclusion criteria. A trained dental assistant was present when the survey was completed at the end of the visit. Children received a dental prophylaxis

and the regularly scheduled 6-month evaluation by the examiner or a trained dental assistant.

Data collection. A power analysis for statistical significance determined that a minimum of 25 surveys would be needed to achieve a large effect size of $d=0.80$, with a power of 0.80 using a 1-tailed test with an alpha level of .05. Data were analyzed using: (1) *t* test; (2) logistic regression; and (3) chi-square test.

Survey. On the survey, using a 5-point Likert-type scale, parents were asked to rate: (1) color; (2) size; (3) shape; (4) retention; (5) durability; (6) overall satisfaction; (7) metal visibility; (8) child satisfaction; (9) tooth pain, injuries, and their characteristics; and (10) bruxing. Demographic data were also assessed, including: (1) patient age; (2) relationship to respondent; and (3) parental/guardian level of education.

Table 1. DEMOGRAPHIC AND CROWN VARIABLES

Demographic variable	N	%
<i>Relationship of parent or guardian</i>		
Mother	48	89
Father	4	7
Grandmother	2	4
<i>Education of respondent</i>		
No high school diploma	18	33
High school diploma	15	28
Some college	19	35
No response	2	4
<i>Treatment by provider</i>		
First-year resident	20	37
Second-year resident	23	43
Private practice pediatric dentist	11	20
<i>Distribution of crowns by primary tooth</i>		
Maxillary canine	44	19
Maxillary lateral	72	30
Maxillary central	72	30
Mandibular canine	10	4
Mandibular lateral	22	9
Mandibular canine	18	8

Results

Demographics. Fifty-eight parent-child pairs were approached to participate. Three parents declined, and 1 survey was eliminated due to incompleteness. This yielded 54 usable

parent surveys, equally distributed by gender of the child—accounting for 238 crowns with an average of 5 crowns per child. Mean patient age was:

- a. 4 years, 1 month at the time of crown placement; and
- b. 5 years, 2 months at the time of evaluation.

The mean was 13 months between placement and evaluation. Table 1 shows additional demographic data on subjects and crowns.

Parental satisfaction survey. The parental satisfaction survey (Table 2) evaluated factors such as: (1) shade; (2) durability; (3) size; and (4) overall esthetics. A Likert-type scale from 1 to 5 was used for this section of the survey, with 1 being very satisfied to 5 being very dissatisfied. To assess satisfaction or dissatisfaction, answers were collapsed: (a) 1 and 2 were combined and renamed “satisfied”; (b) 4 and 5 were combined and renamed “dissatisfied”; (c) neutral responses were discarded for statistical purposes. Overall, parental acceptance of NuSmile PVSSCs was very high at 93% (N=50). Parents were most satisfied (N=52; 96%) with the size of the NuSmile crowns. Fifty-one (94%) were satisfied with the shape, while 48 (89%) were satisfied with both the shade and the retention. Forty-three (80%) of the parents stated that their children were satisfied with the crowns, while 40 (74%) were satisfied with the metal visibility. Thirty-eight (70%) were satisfied with the crown’s durability. No parents reported overall dissatisfaction.

Table 2. PARENTAL AND CHILD SATISFACTION WITH PREVENEERED STAINLESS STEEL CROWNS*

Category	Satisfied N (%)	Dissatisfied N (%)
Shade	48 (89)	1 (2)
Size	52 (96)	1 (2)
Shape	51 (94)	0 (0)
Retention	48 (89)	1 (2)
Durability	38 (70)	8 (15)
Overall satisfaction	50 (93)	0 (0)
Metal visibility	40 (74)	5 (9)
Child’s satisfaction	43 (80)	2 (4)

* N=54 (neutral responses were discarded, therefore not all categories=100%).

Additional parental satisfaction data. The last part of the evaluation asked a series of questions related to the history of the PVSSCs. When asked if their child ever complained of any discomfort related to the NuSmile crowns, 32 (59%) of the parents reported no complaints, while 21 (39%) reported occasional complaints from the child. Only 1 child in this

study’s sample (2%) complained to the parent on a continual basis. Despite complaints, no child returned for care due to discomfort. When parents were asked if they would choose the same type of crown for future treatment:

- a. 49 (91%) would choose a NuSmile crown again;
- b. 4 (7%) would choose a completely different type of restoration; and
- c. only 1 parent (2%) would prefer extraction.

When asked if their child had suffered any injuries to the restored teeth:

- a. 42 (78%) of the parents reported no injuries;
- b. 12 (22%) reported some type of injury, including 6 veneers which had chipped and 4 crowns which were completely dislodged; and
- c. 2 parents reported that crowns had been removed by food and not by trauma.

When asked if the child had a history of grinding:

- a. 41 (76%) reported no grinding;
- b. 12 (22%) reported grinding only at night; and
- c. 1 parent did not answer (2%).

Subsequent clinical examination revealed that only 27 of 238 crowns (11%) demonstrated a chip or fracture of the veneer.

Relationships among variables. The data were submitted for statistical analysis using the Wilcoxon rank-sum test. Variables were tested and compared at a *P*=.05 level of significance (Table 3).

Table 3. SIGNIFICANT RELATIONSHIPS BETWEEN SELECTED VARIABLES AND PARENTAL SATISFACTION WITH PREVENEERED STAINLESS STEEL CROWNS

Variable	<i>P</i> -values
Grinding vs satisfaction with ability to resist chipping	.151
Parent level of education vs overall satisfaction	.569
Shade vs overall satisfaction	.490
Size vs overall satisfaction	.635
Shape vs overall satisfaction	.137
Retention vs overall satisfaction	.532
Durability vs overall satisfaction	.125
Metal visibility vs overall satisfaction	.394
Overall satisfaction with residents vs overall satisfaction with private practitioner	.773
Overall level of parental satisfaction vs gender of patient (male)	.001
Overall level of parental satisfaction vs future treatment choice	.001
Overall level of parental satisfaction vs child satisfaction	.001

* N=54.

† *t* tests.

Data were first separated to compare the parental satisfaction with children who were treated by a: (1) first-year pediatric dental resident; (2) second-year pediatric dental resident; and (3) private pediatric dentist. Factors were grouped together for each provider and then analyzed, such as: (1) shade; (2) size; (3) shape; (4) durability; and (5) overall satisfaction. When comparing the level of practitioner experience for each variable, no difference was found for the level of satisfaction. Parents were satisfied with treatment, regardless of the provider's experience.

Next, all data from all providers were combined and tested. Three variables tested were found to be statistically significant. The level of parental satisfaction was significantly related to the: (1) patient's gender; (2) future treatment choices; and (3) interpretation of the child's satisfaction. Specifically, parents with male patients were found to be less satisfied overall than those with female patients ($p=.001$). Parents who noted a high level of satisfaction were more likely to choose the NuSmile crown again for future treatment ($p=.001$), and parents who believed that their child was satisfied were also likely to report a high level of overall satisfaction ($p=.01$). Again no significant relationship was found with: (1) location of the crowns in the mouth; (2) the child's age; (3) parent's education level; (4) shade; (5) size; (6) shape; (7) retention; (8) durability; or (9) metal visibility.

Discussion

This is only the third known study to report the level of parental satisfaction with prefabricated resin-faced SSCs to restore carious anterior primary teeth. In 2 previous studies that evaluated Whiter Biter II crowns⁶ and Kinder Krowns,⁷ parental satisfaction was shown to be high. The present study similarly demonstrated a high level of satisfaction with NuSmile crowns. The earlier studies only required parents to evaluate: (1) appearance; (2) shade; (3) shape; (4) size; and (5) durability. The present study not only asked parents to evaluate these factors, but also to address other concerns (trauma, child satisfaction, and discomfort) and provide candid written feedback. The 2 earlier studies evaluated a limited number of children (<15), whereas this study included 54 cases.

Overall satisfaction was not significantly influenced by the majority of factors. For instance, the shade, size, and shape did not significantly affect the parents' satisfaction with the crown's overall esthetic appearance. Size and shape received the highest satisfaction scores, while shade received a slightly lower rating, similar to the Whiter Biter II study.⁶ In the comments section of the questionnaire, some parents noted that, although the crowns appeared to be too white against adjacent natural teeth, they would continue to choose

NuSmile restorations over any other treatment. At the time of crown placement, NuSmile crowns were manufactured using one veneer shade. Presently, the company (Orthodontic Technologies, Houston, TX) offers a second, slightly less white shade.

The overall satisfaction level was not significantly influenced by patient age or the parent's education level. With the children's ages ranging from 2 to 8 years, parents were similarly pleased with the PVSSCs, whether the child was in the primary or mixed dentition. Those parents with a college education were as pleased with the treatment results as those without a high school diploma.

Parents were equally satisfied with the treatment given by either a pediatric dental resident or a private pediatric dentist. The authors concluded that acceptable esthetic placement of NuSmile PVSSCs is not dependent on the clinician's experience level. The ease of tooth preparation and placement of the crowns may be suitable for all levels of dental practitioner, including pediatric dental residents with limited experience.

Although the lowest ratings were received for metal visibility and durability, (a satisfaction score of 74% and 71% respectively), overall satisfaction was not significantly dependent on these 2 factors. In the few cases in which the facing had been chipped or fractured and metal was visible, parents were still pleased with the crown and stated that they would choose a NuSmile crown for future restorative needs. Even the few parents who reported poor retention, resulting in a dislodged crown due to trauma or food, remained very high in satisfaction and would again choose a NuSmile crown. Overall, an overwhelming majority (49 of 54 parents; 91%) would choose a NuSmile crown for future treatment.

Two concerns about preveneered crowns expressed by practitioners are that:

1. the veneer may chip, revealing the stainless steel beneath it; and
2. due to the inability to crimp these crowns, they may not have good retention.

In the present study, of 238 crowns placed, only 27 (11%) demonstrated a chip or fracture of the veneer and only 6 (<1%) of the crowns were completely dislodged. Failure rates from previous studies of preveneered crowns were between 32% to 39% of crowns with some part of the facing lost.^{6,7} The relatively small number of failures in the present study indicates that NuSmile crowns can be expected to be fairly durable restorations.

Parents reporting that the child was upset or complained of pain also reported lower scores for overall satisfaction. No parent/child participant who complained of pain, however, requested subsequent treatment to alleviate discomfort. Of 22 parents who reported complaints from the child, only 2 (9%)

requested a different restoration for future treatment in the survey, while 52 (91%) would still choose a NuSmile crown.

Variables demonstrating a significant statistical difference when compared to overall satisfaction included: (1) gender of the child; (2) future treatment choice; and (3) the child's perceived satisfaction. Parents were less satisfied with crowns placed on male subjects. Parents, mostly mothers, seemed to be more critical of the NuSmile crowns when used to restore their sons' anterior teeth. In contrast, mothers were less critical and appeared to be more satisfied with their daughters' final appearance. This is a puzzling finding that contradicts the authors' perception that mothers are more critical of their daughters' appearance. The parent's perception of whether the child liked or disliked the crowns greatly influenced their overall satisfaction. Since the majority of children were perceived to be highly satisfied with the crowns, it makes sense that overall satisfaction was high (93%). In addition, a majority of parents (91%) would choose the same type of crown for future treatment, if necessary. Statistical analysis concluded that overall satisfaction is directly proportional to future treatment choice. Thus, a parent and a child who are pleased with the results will most likely choose the same type of crown.

Limitations of this study included:

1. A doctor-patient relationship may have existed between the provider and family that might soften criticism of the esthetic result.
2. Perceptions at the time of placement may have changed for better or worse by the time of evaluation.
3. Patients ranged in age to 12 years, so some may have had a crown in place for many years, obtunding initial parental concerns.
4. The authors did not separate out patients who had 1 or 2 crowns from those who had >2 crowns to see whether this was a factor.
5. While overall satisfaction was very high, some parents, when probed by questionnaire, did find room for improvement in elements of the esthetic result, although this was not significant.

Conclusions

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

1. Parental satisfaction with preveneered stainless steel crowns was highly positive.
2. The highest satisfaction scores were given for size and shape of the crown, while the lowest satisfaction scores were for durability and metal visibility.
3. No participant reported an overall dissatisfaction with the crowns.
4. Factors that had a direct influence on overall satisfaction were gender of the child and child's perceived satisfaction.
5. Parental satisfaction was not influenced by the level of clinical experience of the practitioner.

References

1. Tinanoff N, O'Sullivan DM. Early childhood caries: Overview and recent findings. *Pediatr Dent* 1997;19:12-6.
2. Croll TP. Primary incisor restoration using resin-veneered stainless steel crowns. *J Dent Child* 1998;65:89-95.
3. Waggoner WF. Restoring primary anterior teeth. *Pediatr Dent* 2002;24:511-6.
4. Waggoner WF. Clinical tips for restoring primary anterior teeth with preveneered anterior stainless steel crowns. *J Pediatr Dent Care* 2003;9:25-9.
5. Croll T, Helpin M. Preformed resin-veneered stainless steel crowns for restoration of primary incisors. *Quintessence Int* 1996;27:309-13.
6. Roberts C, Lee JY, Wright JT. Clinical evaluation of and parental satisfaction with resin-faced stainless steel crowns. *Pediatr Dent* 2001;23:28-31.
7. Shah PV, Lee JY, Wright JT. Clinical success and parental satisfaction with anterior preveneered stainless steel crowns. *Pediatr Dent* 2004;26:391-4.