Scientific Article

A Clinical Study Evaluating Success of 2 Commercially Available Preveneered Primary Molar Stainless Steel Crowns

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Abstract: ***Purpose:*** *To evaluate the success of posterior NuSmile® and Kinder™Krown and to determine the level of parental satisfaction with this treatment option.* ***Methods:*** *Forty-eight crowns were placed in 18 children with a mean age of 5 years. A split mouth design was used. Each participant randomly received each crown type on 2 or 4 pair matched molars. Two trained operators completed all treatments. Two additional trained and calibrated clinicians blindly re-evaluated crowns according to specified variables. A visual analogue scale was used to determine parental satisfaction. Examiner reliability was determined by Cohen's kappa scores and results were analysed statistically using Fisher's exact test.* ***Results:*** *All crowns were retained after 12 months with no statistical difference in the clinical and radiographic success of posterior NuSmile® and Kinder™Krowns. Overall success was high with 81% of facings intact and 83% free of gingival inflammation after 12 months. Radiographically, 81% were successful. Veneer facing wear was significantly more likely to occur with opposing crowns (P=.02). Parental satisfaction was excellent with a mean score of 9.3 out of 10.* ***Conclusions:*** *These crowns combine the durability of conventional stainless steel crowns with improved esthetics and are proposed as a suitable alternative where esthetic demand is increased.* *(Pediatr Dent 2011;33:300-6) Received December 3, 2009 / Last Revision February 21, 2010 / Accepted February 26, 2010*

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Preveneered stainless steel crowns (SSC) offer a potential esthetic and durable restoration for grossly decayed primary teeth, as these crowns allegedly combine the durability of conventional SSC with the esthetic appeal of composite resin[1]. Most esthetic posterior crowns consist of a conventional SSC with a bonded composite facing. The composite veneer covers various surfaces of the crown and varies in thickness, but it is important to realize that the use of any facing restricts the ability to crimp and custom fit that surface to the contour of the tooth. The addition of resin creates a SSC with an increased thickness compared to a conventional SSC, and therefore more extensive tooth preparation is required to allow for proper fit and occlusion. Manufacturers recommend that preveneered crowns fit passively to the tooth and are seated with light digital pressure to minimize stress and the development of micro fractures in the facing. Since their introduction in the mid 1990s, the use of preveneered crowns to improve the esthetics of anterior teeth has received greater attention than their posterior counterparts. However, an increasing number of posterior preveneered crowns are now commercially available (eg, NuSmile® Primary Crown and Kinder™Krown).

To date, there is only one clinical study in which 11 conventional SSCs were compared with 11 NuSmile® mandibular molar crowns in a split mouth design[2]. The preveneered SSCs demonstrated poorer gingival health than the conventional SSC group, but none displayed chipping of the veneer facing after 6 months. In a subsequent report, 10 of these crowns were reviewed after 4 years of service[3]. At this stage, no differences in gingival health were noted between crowns, yet all of the preveneered crowns presented with chipping of the facing and were consequently judged to have a poor esthetic appearance. The authors concluded that NuSmile® crowns were "very expensive, bulky and lacked a natural appearance"[3].

There is only one published study examining posterior preveneered crowns *in vitro* which examined the repair of 22 artificially fractured NuSmile® posterior crowns using two different techniques[4]. Results indicated that both repair materials gave similar esthetic outcomes and shear bond strength values comparable to the original veneer material.

From the limited existing research and anecdotal reports, the disadvantages of preveneered SSCs include their increased cost, limited crimping ability, need for increased tooth preparation and potential for veneer failure, which may render these crowns unesthetic[3,5]. There is a paucity of studies in the literature regarding clinical use of posterior preveneered SSCs, and it was for this reason that the present study was undertaken. This study is the first to clinically evaluate two different types of posterior preveneered SSCs in a split mouth design. The aim was to compare the clinical and radiographic success of posterior NuSmile® and Kinder™Krowns.

Methods

Ethical approval for this study was obtained from the St. James' Hospital / Adelaide and Meath National Children's Hospital Research Ethics Committee. The study population was drawn from patients referred to the Dublin Dental School and

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Hospital and the Pediatric Dental Department of The Adelaide and Meath Incorporating the National Children's Hospital (AMNCH) in Dublin, Ireland. The study period was from January 2008 to June 2009. Patients who fulfilled specified inclusion criteria (Table 1) were asked to enroll in the study, and informed consent obtained. It was our aim to enroll as many participants as possible during the study period, with a goal of at least twice that of the 22 crowns placed by the only other existing clinical study[2]. Two types of commercially available preveneered esthetic SSCs were used in a split mouth design:

1. **NuSmile® Primary Crowns** Shade "new light". (Orthodontic Technologies, Houston, Texas, USA).
2. **Kinder™Krowns** Shade "pedo 2". (Mayclin Dental Studios, Minneapolis, Minnesota, USA).

Each company uses a different bonding system to attach the resin to the underlying metal, but the exact manufacturers' bonding mechanisms remain proprietary. NuSmile® crowns have a resin veneer bonded to an intact SSC base, while Kinder™Krowns have perforations in the metal to allow for mechanical retention in addition to chemical bonding of the veneer (labelled as 'incisal lock' feature). The veneer covering of all first primary molar crowns incorporated both the buccal and occlusal surfaces (Figure 1). The veneer covering of all second primary molar crowns included the buccal surface only (Figure 2).

During the pre-operative phase, all participants presented for an initial visit to instigate a high caries risk preventive regime. Pre-operative standardized bitewing radiographs had been exposed for treatment planning, and clinical photographs were taken. Baseline data for the teeth to be crowned was recorded on designated data sheets prior to and during treatment. For a minority of patients with obvious space loss, orthodontic separators were placed between the primary molars. Each participant was assessed to determine the most

Table 1. SPECIFIED INCLUSION AND EXCLUSION CRITERIA

	Inclusion criteria	Exclusion criteria
Patient	Fit and healthy (ASA I or II) Patient <10 ys old Stainless steel crowns required on 2 or 4 restorable pair-matched primary first or second molars High caries risk Informed consent achieved	ASA ≥III Endocarditis prophylaxis required Informed consent not achieved
Tooth	Multisurface caries Postendodontic treatment Developmental defects of tooth structure Severe erosion Presence of opposing tooth	Acute infection Infraocclusion Mobility Internal root resorption Exfoliation imminent Absence of opposing tooth

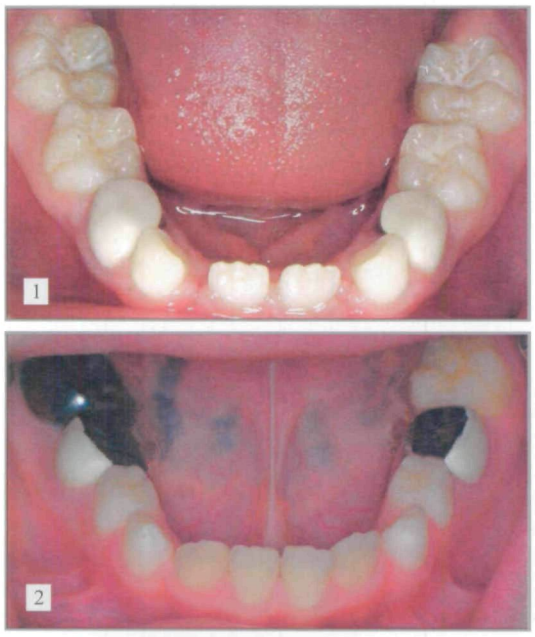

Figure 1. Intact preveneered SSC on primary mandibular right and left first molars.
Figure 2. Intact preveneered SSC primary mandibular right and left second molars.

Table 2. CLINICAL OUTCOME VARIABLES

Crown retention	0=present 1=absent
Customized modified gingival index[7]	0=healthy 1=mild inflammation, involving some papilla 2=moderate inflammation, involving entire papilla 3=severe inflammation
Plaque index[6]	0=no plaque 1=film at gingival margin 2=moderate accumulation 3=abundance of plaque
Stain resistance	0=no staining 1=minor staining 2=noticeable staining
Facing fracture: Buccal surface	0=intact 1=<50% surface chipped 2=>50% surface chipped 3=complete loss
Facing fracture: Occlusal surface (scored for primary first molars only)	0=intact 1=<50% surface chipped 2=>50% surface chipped 3=complete loss
Facing wear	0=no wear 1=wear at cusp tips only 2=> cuspal wear
Gingival marginal extension	0=subgingival 1=supragingival
Occlusion	0=contact: Marked and visible 1=no contact
Opposing tooth	0=natural tooth 1=restored tooth 2=stainless steel crown 3=esthetic crown
Alignment relative to arch form	0=normal alignment 1=rotated 2=malaligned
Proximal contacts	0=good, resistance with floss 1=poor/no contact

appropriate setting for treatment. Behavior management options included local anaesthesia (LA), a combination of LA and nitrous-oxide and oxygen inhalation sedation (LA & N_2O), and general anesthesia (GA). Two trained operators performed treatment in all participants. Training included participation in a hands-on course, crown preparation practice on typodont teeth, and studying DVDs of crown preparation supplied by the manufacturers. The manufacturers' guidelines provided the foundation to develop a step-by-step customized tooth preparation and crown fitting guideline (operations manual) that was followed by each operator during crown placement to ensure all crowns were fitted in a similar manner.

At the treatment visit, each study tooth was assigned a score for plaque and gingival status[6,7]. Coarse occlusal and flame friction grip diamond burs were used for the crown preparation, and new burs were used for each participant. Pair matched molars were randomly designated to receive a NuSmile® crown or a Kinder™Krown. Adjacent esthetic crowns were not placed in this study, as to do so may require excessive interproximal tooth preparation. Administration of local anesthesia and rubber dam isolation was used in all cases. The pulp status was assessed following caries removal prior to completing crown preparation, and appropriate pulp therapy was performed according to current best practice guidelines[8]. The type and size of crown chosen for each molar was recorded as well as any adaption methods used. The status of the opposing tooth was noted. Patients were discharged following provision of post-operative instructions. If crowns were placed during multiple visits using LA only, a further treatment visit was scheduled approximately one week later.

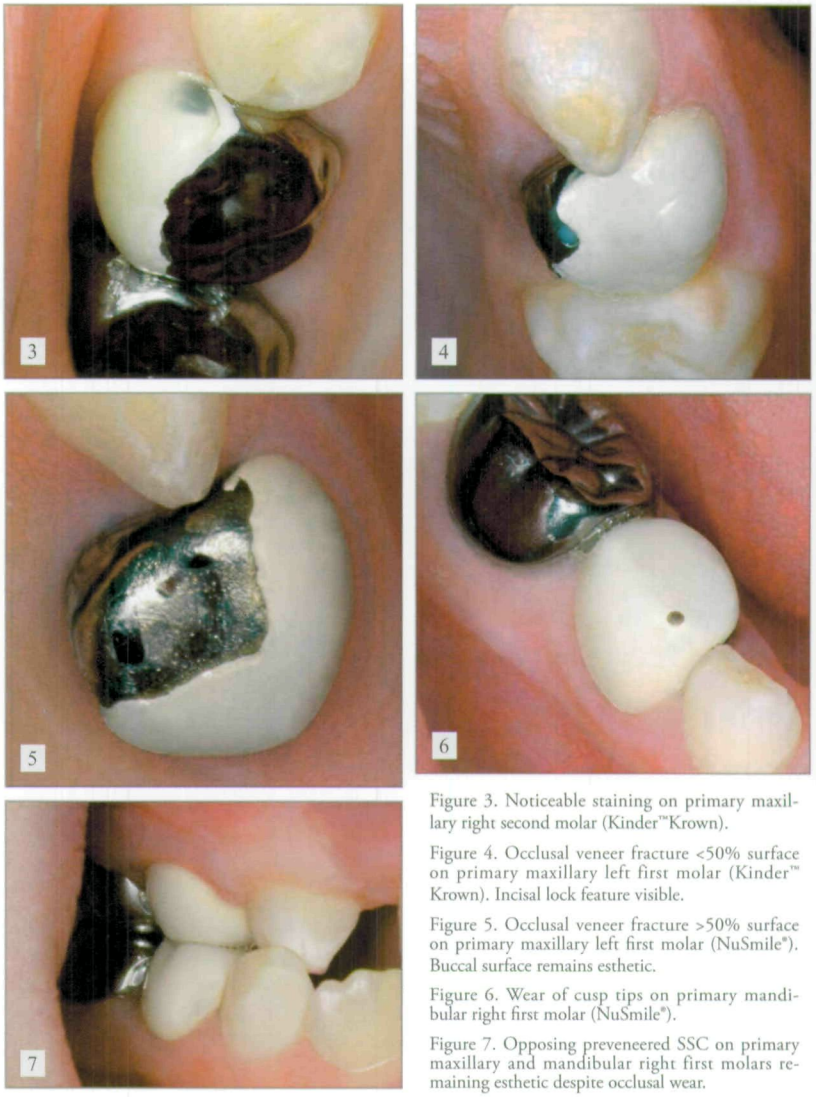

Figure 3. Noticeable staining on primary maxillary right second molar (Kinder™Krown).

Figure 4. Occlusal veneer fracture <50% surface on primary maxillary left first molar (Kinder™ Krown). Incisal lock feature visible.

Figure 5. Occlusal veneer fracture >50% surface on primary maxillary left first molar (NuSmile®). Buccal surface remains esthetic.

Figure 6. Wear of cusp tips on primary mandibular right first molar (NuSmile®).

Figure 7. Opposing preveneered SSC on primary maxillary and mandibular right first molars remaining esthetic despite occlusal wear.

Participants were recalled for examination at 3-month intervals for 12 months. Two other blinded examiners alternatively reassessed crowns at review visits. These examiners were trained twice and then calibrated on four separate occasions. The final two sessions were used to test examiners on intra-examiner and inter-examiner agreement. Variables for clinical outcome were scored using a designated scoring system (modified from those used in similar clinical studies) or specified indices (where suitable) (Table 2). Clinical success was determined by retention of the crown, absence of facing fracture and no adverse effects on gingival health. Bitewing radiographs were exposed at the 1-year review visit in a standardized manner. Following training and calibration, one examiner was asked to blindly evaluate radiographic crown adequacy based on the presence of a horizontal overhang. Assessment was based on visual inspection using an illuminated light box under lens magnification (X2, Lysta AS, Denmark). The crowns were subsequently scored as either radiographically adequate or inadequate.

A visual analogue scale (VAS) was used to score levels of parental satisfaction at the 1-year review visit[9]. Parents were presented with a horizontal VAS by an independent person and were asked to consider the size, shape and shade of the crowns in their overall assessment. Data was recorded on Microsoft® Excel 2007 (Microsoft Inc., Redmond, Wash, USA). Statistical analysis was carried out using SPSS version 14.0 for Windows® statistical software (SPSS Inc. Headquarters, Chicago, Ill, USA). Inter- and intraexaminer agreement was analysed using the Cohen's kappa test. Clinical data with categorical variables was collapsed to produce dichotomous values from which contingency tables were generated (Table 2 & 3). Fisher's Exact test was used to test for statistical significance, with the level of significance set at $P<.05$.

Results

Final analysis included 48 crowns in 18 patients following 12 months in service (Table 3). The mean age was 5 years with a range of 2-9 years. The number of crowns received by each participant varied from a minimum of 2 (67%) to a maximum of 4 (33%). No patient received 4 second primary molar crowns. The majority of participants (79%) received crowns on first primary molar pairs and 21% on second. The most common crown size used was size 3 for first primary molars and size 2 for second primary molars for both crown types.

Table 3. DICHOTOMOUS CLINICAL OUTCOME DATA AT 12 MONTHS

	Retention		Plaque index		Modified gingival index		Staining		Buccal fracture		Occlusal fracture		Wear	
	Yes (0)	No (1)	Yes (1,2,3)	No (0)	Yes (1,2,3)	No (0)	Yes (1,2)	No (0)	Yes* (1,2,3)	No (0)	Yes* (1,2,3)	No (0)	Yes (1,2)	No (0)
NuSmile crowns	24	0	16	8	3	21	4	20	1	23	2	17	6	18
Kinder Krowns	24	0	19	5	5	19	2	22	1	23	6	13	2	22
Total	48		48		48		48		48		38		48	

* One crown had both buccal and occlusal fracture. Total no. of fractured crowns=9/48.

Overall clinical success showed 100% crown retention, 81% intact veneer facings and 83% free of gingival inflammation. Cohen's kappa score for interexaminer agreement of clinical variables ranged from 0.67 (substantial agreement) to 1 (perfect agreement). There were no significant differences between the plaque index and gingival inflammation scores of NuSmile® and Kinder™ crowns at 6 months or 12 months. Eleven NuSmile® crowns displayed inflammation at 6 months and 3 at 12 months; this improvement over time was statistically significant (P=.02). The number of Kinder™Krowns with inflammation had an insignificant decrease from 12 at 6 months to 5 at 12 months. There were no significant differences in staining of either crown at 6 months or 12 months. At 6 months, 2 of the 24 NuSmile® crowns displayed minor staining; at 12 months this number had increased to 4. Two Kinder™Krowns had staining at 6 months (1 minor and 1 noticeable) with no new cases at 12 months (Figure 3).

Only one of each crown type displayed buccal facing fracture with <50% of the facing surface involved in both cases, with no significant differences between the crown types and no time effect noted. Fracture of the occlusal surface was only scored for the first primary molar crowns (N=38). Overall, 8 crowns had occlusal facing fracture at 12 months (Figure 4). Of these, only one (NuSmile®) displayed fracture involving >50% of the occlusal surface (Figure 5). There was no significant difference between NuSmile® and Kinder™Krowns in terms of occlusal facing fracture at 6 months (P=.60) or at 12 months (P=.23). Furthermore, there was no significant difference detected between occlusal facing fracture over time for either crown type.

Overall, 3 of the 48 crowns placed showed wear on the occlusal surfaces at 6 months and 8 at 12 months (Figure 6). Only NuSmile® crowns displayed facing wear such that the area of metal exposed was greater than the cuspal dimension. Statistical analysis found no significant differences in wear between NuSmile® and Kinder™Krowns at 6 months. The number of NuSmile® crowns displaying facing wear increased from one at 6 months to 6 at 12 months, but this was not significant (P=.09). Although more NuSmile® than Kinder™Krowns showed wear at 12 months, this difference was not significant (P=.25). There was no difference in the number of Kinder™ crowns with facing wear at 6 and 12 months. Overall, 47/48 crown margins were scored as subgingival at 6 and 12 months. All crowns were found to be in occlusion after 6 months. At 12 months it was noted that 3 crowns (2 first and 1 second primary molar) in 2 patients had developed infraocclusion relative to the adjacent teeth. All of the remaining 45 non-infraoccluded crowns maintained their occlusal contacts in maximum intercuspal position at 12 months.

It was noted that half of all 48 crowns were opposed by another esthetic SSC (Figure 7). Seven of the 8 first primary molar crowns that displayed occlusal veneer fracture at 12 months were opposing another esthetic SSC. Analysis failed to show any statistical significance for this finding (P=.22). Interestingly, all 8 crowns displaying wear of the occlusal facing at 12 months were crowns opposing another esthetic SSC, and this association was statistically significant (P=.02). Four of the 6 patients with opposing esthetic SSC had some or all of their second primary molars extracted. All the crowns except one (Kinder™) were scored as having normal alignment at 6 and 12 months, with no statistical difference between crown types. Nineteen crowns had an adjacent tooth extracted and were therefore excluded from assessment of proximal contact. Of the remaining crowns evaluated (N=29), only 1 crown (Kinder™) displayed a poor proximal contact between the primary molars at 12 months.

Following training of one radiographic examiner, a calibration test determined the level of agreement to be substantial (Cohen's kappa score = 0.84). Forty-two of the 48 images were of sufficient radiographic quality to include in the final radiographic analysis. The presence of an overhang determined crown adequacy, and 81% were determined to be adequate and a radiographic success, with 19% (8 crowns) scored as radiographic failures. No significant correlation between the presence of radiographic overhang and modified gingival index scores at 12 months was evident for either crown type. All parents expressed high levels of satisfaction with the appearance of the esthetic crowns despite some facing fracture and wear (Figure 4, 5 & 6). The results of the parental VAS ranged from 6.7 to 10 with a mean score of 9.3.

Discussion

Parents are increasingly requesting esthetic restorations for their children's teeth[10,11]. The vast majority of the literature regarding preveneered esthetic SSC focuses on anterior crowns, which have been successfully used[12,13]. This study is the first to evaluate clinically two different types of posterior preveneered SSC in a split mouth design.

Overall, patient and parent satisfaction with the esthetic crowns was found to be excellent. The results of the VAS ranged from 6.7 to 10 with a mean score of 9.3. Questioning revealed that on the whole, parents could not tell the

difference between the crown types and expressed no individual preference for NuSmile® or Kinder™Krowns. Although this study did not specifically record the children's opinion due to the varying age range, the majority of children who had both a preveneered esthetic SSC and a conventional SSC placed expressed a preference for the esthetic variety. This result is unsurprising since the evidence suggests that children prefer white over silver fillings regardless of age or gender[10,14]. It was observed that the color of the crowns used matched well with the adjacent teeth, and was more natural than previously reported for anterior teeth[12,13].

The results indicated that overall there was no significant difference in the clinical and radiographic performance of posterior NuSmile® Primary crowns and Kinder™Krowns after 12 months. All study crowns maintained an adequate coronal seal and remained free of adverse pulpal sequelae. These clinical variables are comparable to the expected performance of conventional SSCs as evidenced by the literature[15,16,17]. This led us to accept that there was no difference in durability of NuSmile®, Kinder™Krowns and conventional SSCs after 12 months.

All crowns were successfully retained after 12 months, as expected from previous studies[3,12,13,18,19]. This finding indicates that the limited crimping ability does not appear to affect crown retention. Overall, 81% of both NuSmile® and Kinder™Krowns were clinically successful with an intact veneer facing. Ram et al. (2003) previously reported that all of the 10 NuSmile® crowns studied had partial chipping after 4 years in service. It was not specified whether this finding affected the patient or parent satisfaction levels. Furthermore, there was no evidence of training or calibrating of the examiners, and given the obvious differences between the crown types, a blind assessment was not possible. The corresponding result for absence of adverse effects on gingival health in our study was 83%, with a decrease in inflammation seen over time.

Radiographic success was 81% for 42 crowns, although it is notable that the presence of a radiographic overhang was not associated with an increase in gingival inflammation and may therefore be considered a 'failure' for academic purposes only. Ram et al. (2003) found all crowns to be radiographically adequate in terms of bone resorption, however only 10 crowns were evaluated, and the presence of an overhang was not specifically investigated.

The majority of crowns in this study were placed on lower first primary molars. Usually these teeth are highly visible during function, and parents reportedly dislike metal restorations most on this particular tooth[17]. The buccal surface is the main visible surface of a second primary molar; therefore it was decided to restore these teeth with crowns incorporating a preveneered buccal surface only. To the author's knowledge, these crowns have never been studied clinically. The crown manufacturers propose that less tooth reduction is required to fit an esthetic SSC with only one veneered surface. However, experience gained during this study proved that the amount of tooth reduction required to passively fit these crowns was almost equivalent to that for full coverage esthetic SSCs, yet without the full esthetic benefit.

It has been reported by the manufacturers that a learning curve is required for technical placement of these crowns. This was indeed found to be the case during the preparatory phase of this study, and the operators considered pre-operative training to be useful. Once mastered however, the technique itself was found to be very manageable and did not influence the behaviour management options used. This is of great clinical importance in pediatric dentistry, as any technique carried out on young children must be able to be executed under varying circumstances in order to be clinically useful. It was possible to place an esthetic SSC just as easily under LA alone as under GA. In fact some patients who had an esthetic SSC placed using only LA in this study were as young as 5 years of age. Although the majority of patients in this study (15/18: 83%) were treated under GA, the decision to choose this behaviour management option was based on other issues related to patient management. The operators found no difference in the ease of placement between the two crown types; however the crown identification system of NuSmile® was considered more operator friendly (NuSmile® print crown size and type on the external crown surface while Kinder™Krowns use a colour coded index system on the internal aspect of the crown).

The investigators perceived difficulties in placing adjacent posterior esthetic SSCs due to space constrictions. Placement of adjacent preveneered SSCs is likely to require excessive tooth preparation and should be approached with caution. In a situation where adjacent primary molars require full coverage, it is recommended that the esthetic variety be chosen for the first primary molar and a conventional SSC for second primary molar (Figure 6 and 7). This situation was achieved in a number of study patients and led to an acceptable esthetic result. Another clinical situation where placement of these crowns may be restricted is where space loss occurs between primary molars. This is a relatively common consequence of long standing interproximal carious lesions. While orthodontic tooth separation can be used to regain some space, when severe space loss occurs even the smallest preveneered crown size cannot be utilized. In this situation a conventional SSC is more appropriate, as there is an unrestricted crimping ability, a phenomenon that is limited on all preveneered SSCs.

It has been suggested that a pulpotomy procedure may be required due to the likelihood of pulpal exposure following the extensive occlusal tooth preparation. In this study almost 90% of teeth were crowned without pulpal exposure or invasive pulp therapy. The remaining 10% required a pulpotomy procedure due to extensive caries and not due to crown preparation, which did not encroach on the pulpal space in any circumstance. This was a welcome finding, as it suggests that the tooth preparation required for an esthetic SSC is somewhat more conservative than previously thought.

Although differences were noted between the clinical performance of Kinder™ and NuSmile® crowns, these were not statistically significant. Only 8 crowns displayed occlusal veneer fracture at 12 months, and of these, Kinder™ Krowns outnumbered NuSmile® by a factor of 3, although the most severe fracture magnitude was detected in a NuSmile® crown (Figure 5). With regard to wear, the situation was reversed with NuSmile® outnumbering Kinder™Krowns by a factor of 3 (Figure 6). No significant differences were detected between the success rates of upper and lower preveneered SSCs, although more upper crowns displayed both occlusal veneer

fracture and facing wear. This finding was contrary to another study which reported that veneered crowns in the maxillary arch had a higher success rate[20].

Six crowns had staining after 12 months. Twice as many NuSmile® crowns were stained, but the only crown with severe staining was a Kinder™ Krown (Figure 3). This crown had internalised staining within the veneer surface, which may have been due to the introduction of micro fractures into the material during crown placement. This finding highlights the importance of using gentle digital pressure to seat these crowns and of ensuring a passive fit. Overall, staining was an infrequent finding and where present, was exclusively localized with no cases of generalized staining or colour change noted. This colour stability over time was also reported by other studies [3,13].

No significant difference was found in the pre-operative gingival inflammation scores when compared with those after 12 months. While some crowns displayed a firm rolling of the cervical gingiva after crown placement, it was without redness or swelling. This implies that although esthetic preveneered crowns are bulky and placed 2 mm subgingivally, they do not adversely affect the gingival health of primary molars. In fact, many more teeth were scored as having gingival inflammation pre-operatively than at 12 months post-treatment. It is probable that this improvement in gingival health is related to the absence of plaque retaining carious lesions post-operatively and an improvement in oral hygiene procedures following encouragement and instruction at multiple review visits. Kinder™Krowns displayed more cases of inflammation and more severe scores at 12 months. This difference was not found to be significant. Both NuSmile® and Kinder™Krowns showed an improvement in gingival health over time, consistent with the existing literature[2,3]. A significant reduction in the number of NuSmile® crowns with inflammation occurred between 6 and 12 months (P=.02). A corresponding significance for Kinder™ Krown was not established in the present study (P=.07). The results for the other clinical variables assessed (crown retention, gingival margin extension, occlusion, alignment and proximal contact) failed to show any significant differences between NuSmile® and Kinder™ Krown. These variables appear to be primarily related to appropriate crown placement and not due to individual differences between the crown types.

A further statistically significant finding was in relation to the effect of the opposing tooth on occlusal facing wear. Opposing esthetic SSCs were statistically more likely to display facing wear than an esthetic SSC opposing another surface type (P=.02). A possible explanation for this relates to the occlusion. Many patients with opposing esthetic SSCs occluded only on these molar pairs, having had other unrestorable primary molars extracted. It is plausible that the full burden of the occlusal load focused exclusively on opposing esthetic SSCs accelerated veneer wear and fracture. This theory was further substantiated by the fact that the most severe wear and fracture scores were found in two patients with a limited posterior occlusal support.

A number of findings of clinical importance were realized during the course of this study. A total of 19% of 48 crowns displayed some type of fracture leading to the conclusion that the veneer strength is not always greater than the average bite force of a child as reported in the literature[21,22,23]. However, the vast majority of crowns with fractures remained esthetic in the patient's smile, and the occurrence of chipping did not detract from the parental satisfaction scores as evidenced by the VAS results. The investigators observed that certain design features slightly compromised the overall esthetic value of these crowns. The mesial composite metal interface was visible from the buccal side on some crowns. This phenomenon was more commonly seen with Kinder™ Krowns, because the composite veneer commences more buccal to the contact point. However, this feature may enable more conservative tooth preparation in this area, as suggested by the manufacturer. An interesting observation was noted when examining the performance of Kinder™Krowns. The veneer of one of these crowns was noted to be fractured down to metal exposing this subsurface perforation (Figure 4). It is of concern that further wear may lead to micro leakage through this perforation thus compromising the coronal seal, a situation that does not exist with NuSmile® crowns given their intact metal base. On the other hand, it is possible that these perforations aid repair procedures, as suggested by the manufacturers. It has been reported that it was possible to repair NuSmile® posterior crowns *in vitro* to produce a shear bond strength that is equivalent to the original veneer material[4]. Such a procedure could render fractured crowns esthetic and assessment of this repair technique *in vivo* would be a useful area for further research. However, in our study, crowns that displayed facing loss were still considered esthetic by the parents, and at no time was a request for veneer repair made.

Posterior preveneered SSCs offer a potential solution to the ongoing challenge pediatric dentists' face in achieving an esthetically pleasing and durable restoration for primary molars. The present study was undertaken due to the lack of literature regarding clinical use of posterior preveneered SSCs. Limitations exist in terms of the relatively small sample size and short follow up time; however, a continuation of this study is already underway.

Conclusions

Preveneered SSCs possess a major advantage over conventional SSCs due to their superior esthetics, and based on this study's results, the following conclusions can be made:

1. Both posterior NuSmile® and Kinder™Krowns can be successfully used with no significant differences in their clinical performance after 12 months. While a minority of crowns displayed facing loss, they remained esthetic in the patients smile.
2. Parental satisfaction with these crowns was found to be excellent; however it is recommended that parents be informed of the possibility of veneer failure.

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