

## Extra Coronal Esthetic Restorations: Clinical Predictability in Pediatric Dentistry

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### Abstract

*A variety of esthetic restorative materials has been introduced in the past decades for restoring primary incisors. However, knowledge of the specific strengths weakness and properties of each material will enhance the clinician's ability to make the relevant choice of selection for each individual personalized treatment plan. The objective of this review was to discuss the advancements in esthetic restorations for restoring primary incisors in a clinical situation. Individualized treatment planning and optimum professional judgement is essential for selecting the extra coronal restorations for primary dentition. Nevertheless, CAD/CAM crowns can be promising alternative options for full-coronal coverage. Moreover, long-term follow-ups and further clinical trials are required to support the evidence.*

**Keywords:** SSC Crown, CAD/CAM crowns, Primary molars, Primary teeth, Porcelain crowns

### Introduction

A variety of esthetic restorative materials has been introduced in the past decades for restoring primary incisors. However, knowledge of the specific strengths weakness and properties of each material will enhance the clinician's ability to make the relevant choice of selection for each individual personalized treatment plan. Therefore, resin composites glass ionomers cements, resin-modified ionomers or polyacid-modified resins can be used as intra coronal restorations of primary teeth. Extra coronal restorations that are available for restoration of primary incisors include those that are directly bonded onto the tooth, which are a resin material in general, and those crowns that are lusted onto the tooth and are some type of stainless steel crown. Each restoration category whether intracoronal or extracoronal has distinct advantages and disadvantages and the clinical conditions of placement might be a strong deciding factor as to which material can be utilized. However, due to lack of supporting evidence and the clinical data none of the crowns can be considered superior to others under all clinical scenarios. Though the prevalence of caries lesion in the mandibular region is rare, restorative treatments for mandibular incisors are required. Neither stainless steel crowns nor celluloid crown forms are made for providing an effective restorative solution for mandibular incisors. Although several options exist to repair carious primary incisors but there is insufficient, controlled, clinical data to suggest that one particular type of restoration is superior to another. Moreover, Dentists have been using many types of these crowns for years with predictable clinical results. There are variables such as operator preferences esthetic demands by parents, the child's behavior and moisture, hemorrhage control might affect the decision, and ultimate outcome of whatever restorative treatment is chosen [1,2].

The objectives of this review were to discuss the advancements in esthetic restorations for restoring primary incisors.

### Overview

It is evident from the literature that there is no single ideal restoration exists that can provide long-term clinical predictability. However, several studies discussed the recent advancement in esthetic restorations for restoring primary teeth that can enhance better treatment outcome. A study by Kratunova E, et al. was conducted to compare the clinical and radiographic success of veneered posterior NuSmile® and Kinder Crown's® over one year and to assess the level of parental satisfaction with their esthetics. Three trained operators placed 120 crowns in a split-mouth design with a random allocation for 36 participants (mean age: 5.8 years) who received two, four, six, or eight crowns respectively. After one year, four calibrated examiners performed blind assessment of the clinical and radiographic performance of the restorations. Results were analyzed carefully and it was concluded that all crowns with the exception of one were retained, and the majority of crowns (83 percent) had no facing fractures. Parental satisfaction was high on visual analog scale VAS (9.4/10 on the VAS). Primary maxillary first molar crowns had more occlusal facing fractures than their mandibular counterparts (P=.02). Primary mandibular second molar crowns showed more facing fractures than their maxillary counterparts (P=.008). Both types of crowns showed no statistical difference in most categories, but Kinder Crown's had more facing fractures (P<.02). Hence, it was stated that Posterior veneered crowns have predictable durability at 12 months while offering natural appearance to restored teeth. Moreover, long-term follow-ups are required to predict the longevity of these restorations [3].

Nevertheless, another study was aimed to evaluate the clinical performance of posterior veneered stainless steel crowns after three years. NuSmile crowns and Kinder Crown's were randomly

allocated on paired molars using a split-mouth design. Variables such as fracture, wear, gingival health, and esthetics were recorded ( $P < .05$ ). After three years, 53 percent of crowns were fracture free in comparison to 81 percent at one year. There was minimal esthetic impact for most fractures due to the location of the veneer fracture, but five crowns had extensive fracture. Moreover, no difference was reported in the clinical performance between the two types of crowns. Fracture was more likely to occur where the adjacent tooth was missing. Parents reported a satisfaction rating of 8.3 out of 10. Clinical performance of both crown types was similar and successful for three years. Facing fracture occurred in 47 percent of crowns but had minimal impact on the esthetic value or parental satisfaction in the majority of cases. Hence, these crowns offer an esthetic alternative to the traditional stainless steel crown, but parents should be alerted to the possibility of veneer loss over time [4].

Another study was conducted to evaluate the parental satisfaction and the clinical success of prefabricated resin-faced stainless steel crowns (SSCs; Kinder Crown's, Mayclin Dental Studios, Minneapolis, Minn) on anterior primary teeth.

Patients treated with Kinder Crown's 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. Hence, 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. Therefore, Kinder Crown prefabricated resin-faced SSCs showed a low failure rate, and the parental satisfaction with treatment was positive [5].

Nevertheless, the extensive plaque formation on dental restorations might be a contributing factor to secondary caries or periodontal inflammation. Moreover certain types of dental restorations may prevent or promote the accumulation of microorganisms. An *in vivo* study by Bin AlShaibah WM, et al. was aimed to evaluate the adhesion of *Streptococcus mutans* to preveneered and stainless steel crowns (SSCs) and to evaluate the effects of these restorations on the gingival health and oral hygiene. Total 20 patients (age 3-5 years) were selected. The selected patients had (dmf) index for primary dentition  $\leq 4$ , including lower right and left first primary molars. Each tooth was pulpotomy-treated and restored with either type of crowns (split-mouth technique). Then, ten swabs from the buccal mucosa, preveneered crown, and SSC surfaces were taken from each patient. Also, the gingival index (GI) and oral hygiene index (OHI-S) were measured at different times during the study. MitisSalivarius Bacitracin Agar (MSBA) was used as a selective medium for *S. mutans* growth. MSBA plates were taken in candle jar and incubated aerobically in 37°C for 48 h. Finally, bacteria were counted and expressed in colony forming unit (CFU). After 1, 2, and 4 weeks, mucosa and crown swabs of preveneered crown showed statistically significant higher mean CFU counts than SSC. Through the whole study period, the two restorations revealed a

statistically significant decrease in mean CFU counts. Also, there was a statistically significant positive (direct) correlation between OHI-S, GI, and *S. mutans* counts on both restorations. Hence it was found that the adhesion of *S. mutans* to preveneered crowns was higher than to SSC. Full mouth rehabilitation led to significant decrease in *S. mutans* count in the short term. An increase in *S. mutans* counts is associated with an increase in OHI-S and GI. Therefore, parents are advised to supervise oral hygiene care habits for children under the age of 6 [6].

A study was conducted to evaluate the effects of full-coverage all-ceramic zirconia, lithium disilicate glass-ceramic, leucite glass-ceramic, or stainless steel crowns on antagonistic primary tooth wear. There were four study groups: the stainless steel (Steel) group, the leucite glass-ceramic (Leucite) group, the lithium disilicate glass-ceramic (Lithium) group, and the monolithic zirconia (Zirconia) group. Ten flat crown specimens were prepared per group; opposing teeth were prepared using primary canines. A wear test was conducted over 100,000 chewing cycles using a dual-axis chewing simulator and a 50 N masticating force, and wear losses of antagonistic teeth and restorative materials were calculated using a three-dimensional profiling system and an electronic scale, respectively. The Leucite group ( $2.670 \pm 1.471$  mm(3)) showed the greatest amount of antagonist tooth wear, followed by in decreasing order by the Lithium ( $2.042 \pm 0.696$  mm(3)), Zirconia ( $1.426 \pm 0.477$  mm(3)), and Steel groups ( $0.397 \pm 0.192$  mm(3)). Mean volume losses in the Leucite and Lithium groups were significantly greater than in the Steel group ( $P < .05$ ). No significant difference was observed between mean volume losses in the Zirconia and Steel groups ( $P > .05$ ). Leucite glass-ceramic and lithium disilicate glass-ceramic cause more primary tooth wear than stainless steel or zirconia [7]. Stainless steel crowns (SSCs) were introduced by Dr Humphrey into the pediatric dentistry as an indirect restorative resolution in 1950[1]. Over time, clinicians and manufacturers attempted to make some esthetic modifications such as open faced SSC, chairside veneered SSC, and preveneered SSC to provide esthetic solutions for their metallic gray colored appearances [2 4]. In common, the esthetic approaches comprise SSCs and esthetic resin material combinations. The combinations have raised not only some concerns in terms of both human health and environment but also have sometimes provided unsatisfactory resolutions for parents [5,6]. Thus, researches have inclined the development of metal free esthetic restorations. In the early 1980s, new-invented computer-aided design/computer-assisted manufacture (CAD-CAM) technology was introduced to produce metal-free esthetic restorations[7]. Esthetic restorations are constructed with lab side (dental lab-based, dental laboratory production-based, network or open-concept-based model) or chairside (in-office system model) CAD/CAM technologies and milled with alumina, zirconia, and porcelain-based ceramic blocks, metal alloy blocks, and various composite resin blocks [8]. Chairside CAD/CAM technology is more advantageous than lab side technology, since both restorations are prepared in a single appointment and also no temporary restorations are used [8]. Glass-ceramic material that is widely used with CAD/CAM technologies has both advantages such as the esthetic appearance, color stability, biocompatibility, and life-long durability and disadvantages such as brittleness, tendency to fracturing, and attrition on the enamel of the antagonist tooth. To overcome its disadvantages, resin nanoceramic (RNC), modified polymethylmethacrylate (PMMA), or PMMA based polymeric resins have been developed under high temperature and pressure. The polymeric materials have some advantages: they are less worn by

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the antagonist tooth enamel, their low modulus of elasticity enables them to absorb the functional stresses, they have a higher degree of conversion due to lower rate of residual monomer, and they require less invasive chamfer and bevel preparation types.

Within the limitation of this study, CAD/CAM crowns milled for the primary molars promised to be used as an alternative for the full-coronal coverage. However, clinical studies are needed to support their use in the primary molar teeth restorations [8].

### Conclusion

Individualized treatment planning and optimum professional judgement is essential for selecting the extra coronal restorations for primary dentition. Nevertheless, CAD/CAM crowns can be promising alternative options for full-coronal coverage. Moreover, long-term follow ups and further clinical trials are required to support the evidence.

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