

Comparison of Parental Satisfaction with Three Tooth-Colored Full-Coronal Restorations in Primary Maxillary Incisors

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Objectives: To evaluate and compare the parental satisfaction among resin composite strip crown, pre-veneered stainless steel crown (PVSSC) and the newly introduced pre-fabricated primary zirconia crown for restoring maxillary primary incisors. **Study design:** A prospective clinical study on 39 children with carious or traumatized primary maxillary incisors. They were randomly and equally distributed in three groups and received one of the full-coronal restorations. Children were recalled to evaluate and compare parental satisfaction about performance of crowns after one year through a questionnaire. **Results:** Parents were satisfied with all three tooth colored full-coronal restoration techniques. A significant relationship was found between colour of PVSSC ($p=0.003$) and durability of resin strip crowns ($p=0.009$) with the overall parental satisfaction levels. Parents who gave poor ratings in these two variables however rated their overall acceptance levels as being satisfied. **Conclusion:** Parental overall satisfaction was highest for zirconia primary crowns followed by resin composite strip crowns and lowest satisfaction was reported for pre-veneered SSCs. Parents were least satisfied with durability of resin composite strip crowns and colour of pre-veneered stainless steel crowns. However, this did not affect their overall satisfaction with these crowns.

Key Words: Tooth colored, full coronal, restorations, primary incisors, parental satisfaction

INTRODUCTION

Loss of clinical crown structure in primary maxillary incisors is quite common following oro-dental trauma and early childhood caries (ECC)¹. Numerous esthetic restorative approaches have been proposed to restore these structurally weakened teeth. Intra-coronal tooth-colored restorations have been used with materials like resin-modified glass ionomers (RMGI), compomers or resin composites¹. Full-coronal esthetic restorations are also being advocated; such as resin composite strip crowns², ready-made crowns like pre-veneered stainless steel crowns (PVSSC)³ and the recently introduced pre-fabricated primary zirconia crowns⁴.

Dental professionals treating children often experience parental influence in selection of dental restorations and the parents are getting keenly involved in clinical decision-making than ever before⁵. Management of carious/traumatized primary teeth has gradually shifted from extraction to restoration⁶. Over the last two decades, a higher esthetic standard is expected by parents that have resulted in an increased request for tooth colored pediatric dental restorations. To fulfill the parental expectations has become one of the most important deciding parameter in selection of dental restoration in children. Esthetics, toxicity, durability and cost are common factors that parents consider before they give their consent for any restoration technique⁷.

There are reports in literature that have evaluated parental satisfaction levels with either PVSSC or resin composite strip crowns^{8,9}. However, there has been no study that compared parental satisfaction of various tooth-colored full-coronal restorations in primary maxillary incisors. A study by Kupietzky and Waggoner⁸ on bonded resin composite strip crowns for the treatment of primary incisors has reported that parental dissatisfaction was most often related to the color of restoration. Another study conducted by Roberts *et al*¹⁰ found lowest parental responses for appearance and color of resin-faced stainless steel crowns in primary maxillary incisors.

The purpose of present study was to compare parental satisfaction level with resin composite strip crown, pre-veneered SSC and the newly introduced pre-fabricated primary zirconia crown in treatment of carious and/or traumatized maxillary primary incisors after a period of 1 year. This study was a part of randomized controlled trial undertaken to clinically evaluate and compare full-coronal aesthetic restorations in primary incisors and has been discussed in a previous article⁴.

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MATERIALS AND METHOD

The study was approved by the Research Ethics Committee of College of Dentistry, Ajman University of Science and Technology (AUST), U.A.E. Each parent/guardian received and signed an informed consent form which contained all information regarding risks and benefits of full coverage esthetic crowns in primary teeth. Parents were not involved in decision making about the type of restoration to be used in their children.

Sample size: was calculated based on the primary outcome of study i.e. restoration failure while separate power test was not calculated for parental satisfaction. In order to look for a clinically important difference in proportion of restoration failures of 25% between groups (2-tailed alpha=0.05 and power of 0.80), a minimum of 35 crowns were required in each group, totaling 105 teeth. Given the possibility of 10% attrition in subsequent follow-ups, an additional 24 teeth were included in the study ensuring 43 primary incisors in each group. Therefore, total sample size of 129 teeth/39 children was selected; which met the inclusion/exclusion criteria described in the Figure 1. Since durability of a full coverage crown, especially in primary incisors depends upon remaining clinical

crown/tooth structure, it was imperative that at least 2/3rd clinical crown structure was available after caries removal and it was almost similar in all groups. Baseline and follow up sample characteristics are presented in Table 1.

The subjects were allocated randomly to one of the following groups:-

- *Group A:* Resin composite strip crowns (Pedoform strip crowns, 3M®)
- *Group B:* Pre-veneered stainless steel crowns (NuSmile LTD. Houston, TX®)
- *Group C:* Pre-fabricated primary Zirconia crowns (Zirkiz crowns, Hass, South Korea®)

Randomization was done by a statistician using permuted block randomization technique. This was conducted on children rather than individual teeth. Block sizes of three individuals were used. Each block consisted of children who required similar number of full coronal restorations. Therefore, a child who required multiple restorations was only entered into the study when two other children with same number of restorations were available. Similarly, a child

Figure 1. Inclusion & exclusion criteria

Inclusion criteria	Exclusion criteria
1. Good general health and with dmft of ≥3 (WHO Index) ¹¹	1. Teeth requiring pulp therapy or already pulp treated
2. Mandibular primary incisors must be present	2. Presence of single surface caries not involving proximal surfaces
3. Carious primary maxillary incisors with involvement of minimum two surfaces, out of which one must be palatal caries and atleast 2/3 rd clinical crown remains after caries removal	3. Teeth requiring full coronal restoration following trauma reaching the pulp
4. Primary maxillary incisors which required full coronal restoration due to trauma, involving enamel or enamel and dentin only	4. Anxious, uncooperative children who require sedation or general anesthesia
5. Children with behavior scale of 3 & 4 (Wright's modification of Frankl's rating) ¹² that can be managed by behavioral management techniques only	5. Presence of root/periapical resorption in pre-operative x-ray
6. Primary maxillary incisors with at least two third of the root length	6. Children with bruxism or deep-bite
7. Patients who signed the consent to come for the follow-up	7. Children with special needs
8. Teeth that were expected to survive for two years	8. Presence of tooth wear (abrasion/attrition) on the opposing lower incisors or absence of those teeth
9. Adequate root support with no mobility	

Table 1: Sample Data at Baseline and follow up at 1 year

DATA	GROUPS		
	Strip Crowns	PVSCC	Zirconia crowns
Mean Age - Baseline	4.5	4.2	4.5
Gender (M/F) – Baseline (Total No. of Children)	7/7 14	6/6 12	8/5 13
Gender (M/F) – 1 Year (Total No. of Children)	6/7 13	6/6 12	8/5 13
Total No. of Crowns – Baseline	43	43	43
Total No. of Crowns – 1 Year	39	43	43
Behaviour Rating – Baseline*	4	3.5	4

* Wright's modification of Frankl's Rating Scale:

Frankl 1 (Wright's --) behavior; Frankl 2 (Wright's -) behavior; Frankl 3 (Wright's +) behavior; Frankl 4 (Wright's ++) behavior

Figure 2. Parents overall very satisfied with zirconia primary crowns in terms of color, shape and durability



Figure 3. Composite strip crown restorations rated by the parent as successful in overall satisfaction, yet low in durability



Figure 4. An example of a PVSCC rated by the parents as successful in overall satisfaction but low in color



requiring multiple numbers of crowns got same kind of restorations on all of the involved teeth in his mouth. Children were assigned randomly as per the permutation within each group; however they could not be randomized on the basis of their dmft status, as it was difficult to find permuted blocks with similar number of children having the same dmft and number of teeth to be replaced. Age of children could not be adjusted in three groups although children in the age range of 3-5 years were only included. Similarly, it was very difficult to select children with similar behavior to match the three groups, although children with Wright's modification of Frankl's behavior rating scale of 3 and 4 were only selected in order to minimize the variation.

Standardization

Crown Placement: Prior to study initiation, three intern trainees were calibrated on tooth preparation and crown placement on 10 children (total of 21 crowns, 7 crowns for each group). In order to maintain consistency in restoration methods, each intern was evaluated by two specialists with regards to their clinical technique, and rated for each restoration prepared on a Likert scale from 1-5; 1 being not acceptable, and 5 being highly acceptable. The consistency in ratings between specialists for each trainee was also tested for consistency using the Kappa test. During the calibration for consistency in restoration methods, specialists consistently scored high ratings for the restorations by each intern, emphasized by a high Kappa score of 0.93. Each intern prepared only one type of crown. Children in each group were treated with one of the above mentioned full-coronal restoration technique. The treatment was done completely free of cost as a part of the trial and followed-up over a period of 1 year.

Parental Survey: It was conducted on 38 parents at the recall examination to determine their satisfaction on these three full-coronal restorations with the help of pretested questionnaire. The questionnaire was piloted for ease of understanding on ten parents who attended the pediatric dentistry clinics in college of dentistry, AUST, UAE. Minor modifications as required were done, and for few questions the response alternatives were expanded to include more possible options.

A trained dental practitioner explained the questionnaire to the accompanying parent. It was not possible to blind parents about the types of crowns. However, the dental practitioner who recorded parental responses on the survey form was not aware about the restoration type, as treated children were not present during the interview time. The dentists who placed the crowns were not present during the evaluation and parents were reassured that their answers would be anonymous to the dentist. The parents evaluated their child's restoration directly and not from a photograph. Four parents had shifted their residences and were not able to attend the follow up visit personally. Questionnaires were emailed and if responses were not clear, they were then contacted personally and doubts clarified.

Parents were asked to rate parameters such as the crown's shape, size, color, durability, and their overall satisfaction using a 5-point Likert-type scale; with 1 being "very unsatisfied" and 5 being "very satisfied". Durability was defined as the ability of the crown to be retained on the tooth without fracture and ability to function well. In addition, one "Yes/No" Dichotomous questions were included in the questionnaire asking about the future treatment choice. This questionnaire was made similar to one used by Kupietzky and Waggoner⁸ and Roberts *et al*¹⁰ in their studies on parental satisfaction with bonded resin composite strip crowns and resin coated steel crowns, respectively. Parents were also asked to define the level of pain and discomfort their child ever complained during one year of the crown placement by using a visual analogue scale (VAS) consisting of equal units from 0 to 10 (a line of 10 cm). On this scale, 0 and 10 represented "no pain/discomfort" and "worst pain/discomfort imaginable" respectively.

Descriptive statistics were computed for the data, including averages & percentages. Data were analyzed using t test and chi-square test. Data was also submitted for statistical analysis to determine the relationship between the variables using the Wilcoxon rank-sum test. Variables were tested and compared at a p=0.05 level of significance. Analyses were performed using the Statistical Package for Social Sciences (SPSS, versions 20.0.0 for Windows).

RESULTS

To assess satisfaction or dissatisfaction, answers were collapsed: 1 and 2 were combined and renamed “satisfied”; 4 and 5 were combined and renamed “dissatisfied”; neutral responses are mentioned in Table 2, but were discarded for statistical purposes.

Parents were highly satisfied with the color, size and shape of the composite strip crowns while majority of parents whose children received PVSCC were satisfied with size but 33% of them didn’t like the color of these crowns. Parents were very satisfied with zirconia primary crowns with reference to the 3 parameters (i.e. color, shape and size). Twenty three percent and 17% of parents considered composite strip crowns and PVSSC respectively not durable, while all parents found zirconia crowns highly durable.

However, parental overall satisfaction for strip crown increased as compared to their durability from 54% to 84% , while for PVSSC’s, their overall satisfaction slightly dropped in comparison to their durability from 83% to 75% (Table 2).

Parents were asked to point on the 10cm line between the faces at the ends of VAS to indicate how much pain & discomfort their child ever complained related to the placed crowns. The mean of VAS was highest (2.25) in case of resin composite strip crowns followed by zirconia crowns (1.95); and least pain was reported in case of PVSSCs (1.65) (Table 3). 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, similar number of parents answered yes for both strip crowns and PVSSCs (n=10), while all parents whose children were treated with zirconia primary crowns, would choose similar crowns again in future if restoration of other teeth are required (Table 4).

The variables such as size, color, shape and durability were compared to the overall parental satisfaction within each group to find out the significant relationships between the selected variable and overall satisfaction. Only two variables among all three groups were found to be statistically significant. The level of parental satisfaction was significantly related to the durability (the crown fracture or complete loss) of the resin composite strip crowns (p=0.009) and color of the PVSSCs. (p=.003) Parents who reported lower satisfaction levels with the durability of strip crowns and color of PVSSCs, generally rated their overall satisfaction with these crowns as positive (Table 5). Other variables did not show any significant relationship with the overall satisfaction scores in all THE THREE GROUPS.

Table 2- Parental Satisfaction results for each variable for all three groups

Group No of parents	Strip Crown (N=13)			PVSSC (N=12)			Zirconia Crown (N=13)		
	Dissatisfied n (%)	Neutral n (%)	Satisfied n (%)	Dissatisfied n (%)	Neutral n (%)	Satisfied n (%)	Dissatisfied n (%)	Neutral n (%)	Satisfied n (%)
Response									
Size	0 (0)	1 (8)	12 (92)	0 (0)	1 (8)	11 (92)	0 (0)	2 (15)	11 (85)
Color	0 (0)	0 (0)	13 (100)	4 (33)	1 (8)	7 (59)	1 (8)	1 (8)	11 (84)
Shape	0 (0)	1 (8)	12 (92)	1 (8)	1 (8)	10 (84)	0 (0)	1 (8)	12 (92)
Durability	3 (23)	3 (23)	7 (54)	2 (17)	0 (0)	10 (83)	0 (0)	0 (0)	13 (100)
Overall Satisfaction	1 (8)	1 (8)	11 (84)	3 (25)	0 (0)	9 (75)	0 (0)	0 (0)	13 (100)

*Neutral responses are mentioned, however, were discarded for statistical purposes

Table 3. Parental Acceptance (Mean)

Category	Strip Crown	PVSSC	Zirconia Crown
Size *	4.3	4	4.2
Color *	4.3	3	4.1
Shape *	4.2	4	4.3
Durability *	3.1	3.9	4.7
Overall Satisfaction *	4.0	3.8	4.6
Pain & Discomfort **	2.25	1.65	1.95

* 1-5 scale was used with 1=very dissatisfied and 5=very satisfied (over 1 year)

** 0-10 VA scale was used with 0=no pain and 10=worst pain ever (over 1 year)

Table 4. Future treatment choice

Category	Strip Crown (N=13)		PVSSC (N=12)		Zirconia Crown (N=13)	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
	10 (77)	3 (23)	10 (83)	2 (17)	13 (100)	0 (0)

DISCUSSION

The vast majority of literature has evaluated parental satisfaction of either composite strip crowns or PVSS crowns individually, but there has been no comparative evaluation regarding parental satisfaction with various aesthetic full coverage crowns for primary maxillary incisors.

In the present study, similar number of parents was satisfied with size and shape of all three types of crowns. However, with reference to color of PVSS crowns, parental acceptance levels were much lower in comparison to strip crowns and zirconia primary crowns. Shah et al have also concluded that appearance and color of PVSSC play a significant role in parental overall satisfaction and they were most satisfied with size of these crowns⁹.

Zirconia primary crowns in our study were found to be highly durable by parents followed by PVSSC's and composite strip crowns. Similar results have also been seen in previous studies. Kupietzky and Waggoner showed poor durability with bonded composite strip crowns which negatively reflected in the parental satisfaction⁸ while Shah et al reported that facial fracture of composite material from PVSS crowns affects the durability and it resulted in negative effect on total parental satisfaction⁹.

Overall parental acceptance levels were maximum for zirconia crowns (100%, mean=4.7) followed by resin composite strip crowns (84%, mean=4.0) and the pre-veneered SSCs (75%, mean=3.8) were rated the least. This is inferred in higher parental satisfaction with zirconia crowns in terms of its aesthetics and durability (Fig 2). From above results, it can be stated that in today's society apart from dental aesthetics, parents are highly concerned about the retention of any restoration.

Post-operative pain and discomfort was seen maximum with composite strip crowns and this could be due to the loss of the restorations itself. However, pain and discomfort in case of primary zirconia crowns could be due to their thickness that necessitates greater tooth reduction during placement. Parents whose children complained of pain and discomfort with pre-veneered stainless steel crowns also reported lower scores for overall satisfaction and requested a different restoration for future treatment. This result is somewhat similar to another study conducted by Champagne *et al* that evaluated parental satisfaction with pre-veneered SSCs for primary anterior teeth¹³. They found that 22 out of 54 children who complained of pain after PVSSC's placement, only 5 parents requested subsequent treatment to alleviate discomfort, while 49 (91%) would still choose the PVSS crowns.

There was significant relationship ($p=0.003$) between color and the overall parental dissatisfaction with PVSS crowns. It could be due to metal visibility around margin, and also these crowns

are available in only two shades – light and very light which can sometime mismatch with the natural tooth color. In a study examining prefabricated resin-faced SSCs¹⁰, although an overall high level of parental satisfaction was reported, the lowest satisfaction was for the crown's aesthetics. Although, zirconia primary crowns are also available in two shades, but they have much superior life like aesthetics and are highly match-able to the natural teeth. Strip crowns are easy to match with the adjacent natural teeth due to availability of different shades for resin composites.

Significant relationship was also found between durability of strip crowns and the overall dissatisfaction ($p=0.009$). Since composite materials rely highly on the remaining tooth structure for bonding, the amount of clinical tooth structure after caries removal and crown preparation is critical to their retention rate. Secondly, resin composites are moisture sensitive and lack of child cooperation can compromise its bonding although a proper isolation technique and rubber dam application was performed in all the cases. Similar results were found by Kupietzky and Waggoner who concluded that the durability or retention of resin strip crowns was the single most important factor affecting parental satisfaction. They were willing to compromise with color, shape, and appearance of these crowns, but their overall satisfaction was affected by failure of the restoration⁸. This limitation of bonding was certainly not a factor in the retention of PVSSC and zirconia crowns. Closer adaptation of palatal metal margins in NuSmile[®] preveneered crowns helps in better retention; however, fracture of facial composite veneer affects their overall durability. While with Zirkiz[®] primary zirconia crowns there is no chance of facial veneer fracture as they are monolithic - made up of solid zirconia and have no facial upper structure.¹⁴ In our study all the crowns were placed free of charge. Although zirconia primary crowns had the greatest parental acceptance; it is costlier than the other two options which can definitely influence their decision.

It is interesting to note that in our study, parents who were very dissatisfied with the color of pre-veneered SSCs and durability of composite strip crowns rated their overall acceptance levels for these two types of crowns as satisfied (Figs 3 and 4). When parents state their overall satisfaction, they often include many dimensions of treatment that the clinical evaluation may not include. Parents may cognitively construct their experience with their child's treatment in 3 distinct ways: (1) psychosocial outcomes; (2) clinical outcomes; and (3) the treatment process¹⁵. Therefore durability and psychosocial benefits outweighed the visible clinical outcome.

Table 5. Variables and overall level of parental satisfaction with each group – P-Values

Variable	Strip Crown	PVSSC	Zirconia Crown
Size vs overall satisfaction	.12	.18	.28
Color vs overall satisfaction	.21	.003	.13
Shape vs overall satisfaction	.27	.09	.25
Durability vs overall satisfaction	.009	.08	.31
Future treatment choice vs overall satisfaction	.16	.06	.22

CONCLUSION

1. Parental overall satisfaction was highest for zirconia primary crowns followed by resin composite strip crowns and lowest satisfaction was reported for pre-veneered SSCs.
2. Parents rated size, color, shape and durability with primary zirconia crowns as very high.
3. Parents were least satisfied with durability of resin composite strip crowns and color of pre-veneered stainless steel crowns. However, this did not affect parental overall satisfaction with these crowns.

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