

## PARENTAL SATISFACTION, COST EFFECTIVENESS AND LONGEVITY OF PREFABRICATED ZIRCON CROWNS VERSUS STAINLESS STEEL CROWNS: (A CROSS SECTIONAL STUDY)

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### ABSTRACT

**Introduction:** Prefabricated zirconia crowns have many merits when compared to Stainless Steel Crowns (SSCs). The high cost and duration of the crowns are among the most prominent disadvantages that hinder the wide range of use of zirconia crowns.

**Methods:** This cross sectional study included a questionnaire sent to pediatric dentists to request the parents of their child patients to fill in via email. The questionnaire consisted of six sections: Type of Crown, Personal Data and Sociodemographic, Parental Satisfaction, Cost Effectiveness, Longevity and Potential Difficulty Experienced.

**Results:** There was no difference in the overall satisfaction between the groups in terms of gender distribution and parent/guardian occupation and education. Regarding color, SSCs showed lower satisfaction compared to zirconia crowns. Crown shape showed same level of satisfaction in both groups. For size and number of visits, SSCs showed higher satisfaction than zirconia crown. Higher percentage of parents reported that SSCs have reasonable price while zirconia crowns are expensive. Higher stability was observed with SSCs for less than 6 months and from 6-12 months while for zirconia crowns stability was more than 12 months. Zirconia crowns showed higher prevalence of bleeding and food accumulation compared to SSCs. There was no difference between the two groups regarding tooth sensitivity.

**Conclusion:** There is increasing demand for aesthetic restoration of deciduous teeth in the field of pediatric dentistry. Most parents prefer zirconia crowns when compared to SSCs, and they recommend this type for others despite its high cost.

**KEY WORDS:** Zirconium, Stainless Steel Crowns, Costs and Cost Analysis, Parents / psychology

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## INTRODUCTION

Early Childhood Caries (ECC) is the most common disease that affects preschool children. <sup>(1,2)</sup> Parents as well as children are concerned about aesthetics not only in anterior teeth, but also in posterior ones <sup>(3)</sup>. This increases the demand for aesthetic management of ECC, <sup>(4)</sup> and decreases the parental acceptance of Stainless Steel Crowns (SSCs) despite the simplicity of procedures, its long durability and low cost. <sup>(5,6)</sup>

Zirconia crowns nowadays have become an excellent aesthetic and durable alternative restoration for both anterior and posterior primary teeth <sup>(7-9)</sup> since the introduction of a commercially wide range of aesthetic crowns such as veneered SSC, NuSmile (Houston, TX, USA), Kinder Krowns (St Louis Park, MN, USA), Ez Crowns (Sprig Oral Health Technologies) and Cheng Crown (Exton, PA, USA). <sup>(10,11)</sup>

Prefabricated zirconia crowns have many advantages such as their high fracture resistance <sup>(12)</sup>, low thermal conducting properties <sup>(10,13)</sup>, low technique sensitive cementation, <sup>(1)</sup> and of course better aesthetics. Their disadvantages, on the other hand, include inability to be crimped to increase its mechanical retention, change of colour, inadaptability, <sup>(14)</sup> their high cost <sup>(1)</sup>, and the fact that they need more reduction of tooth structure than in the case of the conventional SSCs by about 20-30% <sup>(10,14)</sup>.

Due to the limitation in research worldwide regarding the comparison between prefabricated zirconia crowns and SSCs, the current study was done to evaluate the parental satisfaction, cost effectiveness and longevity of prefabricated zirconia crowns versus SSCs among pediatric dental patients.

## SUBJECTS AND METHODS

### Ethical considerations

The study was reviewed and approved by the Institutional Review Board in Misr International University, IRB Number: MIU-IRB-2223-179.

### Study Setting:

The questionnaire was sent by email to parents of children visiting private pediatric dental clinics in Egypt.

### Inclusion Criteria:

1. Both genders.
2. Age: 2-6-years-old.
3. Patients with past dental history of prefabricated zircon crowns or SSCs.
4. Parents or guardians willing to participate in the questionnaire.
5. Patients with history of delivery from 6 months to 2 years.

### Exclusion Criteria:

1. Parents or guardians with mental or psychological disturbances.
2. Parents or guardians who cannot read or write.

To be able to answer the questionnaire. <sup>(15)</sup>

### Methodology

A pilot study was carried out first on randomly selected (50) child patients. The two researchers approached a number of pediatric dentists and requested them to send a questionnaire to subjects via email. Upon gaining the approval of the dentists, the questionnaire was sent to them and then they forwarded it to the parents of their child patients. The responses were sent back to the investigators via email. The informed consent of the parents to participate in the study was obtained automatically by answering the questionnaire.

Results of the pilot study was used to modify the questionnaire but were not used in the analysis of the study results. The validity of the questionnaire was reviewed by two experts for validity and was modified in light of their comments. After finalizing the questionnaire, the same procedures were carried out throughout the study.

The questionnaire was designed specially to tailor the purpose of this study. It consisted of six sections:

- The first section asked the parent to select the type of the crown which has been already delivered to their child.
- The second section focused on the sociodemographic characteristics of the respondents such as gender, occupation, and education level.
- The third section assessed the parental satisfaction by using five variables, namely, appearance, colour matching, shape, size and treatment duration/number of visits on a 5 point Likert scale: 1= very dissatisfied, 2= dissatisfied, 3= neutral, 4= satisfied and 5= very satisfied.
- The fourth section assessed the cost effectiveness and was sub-divided into two parts: the first part focused on the price on a 3 point Likert scale: 1= expensive, 2= reasonable and 3= cheap, while the second part assessed whether or not the parents wish to recommend a certain crown type on a 5 points Likert scale: 1= highly don't recommend, 2= don't recommend, 3= neutral, 4= recommend and 5= highly recommend.
- The fifth section assessed the longevity of the crown regarding retention on a 3 points Likert scale: 1= Less than 6 months, 2= from 6-12 months and 3= more than 12 months.
- The sixth section assessed the potential difficulty experienced during treatment by using five variables, namely bleeding around the gum when brushing, food lodging in-between crowns, and sensitivity to hot and cold foods/drinks on a 5 points Likert scale: 1= not at all, 2= rarely, 3= occasionally, 4= infrequently, 5= regularly.
- An Arabic version of the questionnaire was sent to the pediatric dentists to be sent to the parents to be easier to answer.

- The questionnaire was designed by using google forms and was sent to the pediatric dentists to be sent to the parents via email through a link created and shared by investigators.

### Statistical Analysis

Qualitative data were presented as frequencies and percentages. Chi-square test or Fisher's Exact test was used for comparisons regarding qualitative variables. Questionnaire scores were presented as median, range, mean and standard deviation values. Scores are non-parametric data, so Mann-Whitney U test was used to compare between the two groups. The significance level was set at  $P \leq 0.05$ . Statistical analysis was performed with IBM SPSS Statistics for Windows, version 23.0. Armonk, NY: IBM Corp.

## RESULTS

### Demographic data of children and parents: (Table 1)

There were no statistically significant differences between children's gender distribution, parent/guardian occupation, and education in the two groups.

### Parental satisfaction with the crowns: (Table 2)

As regards color, SSCs showed statistically significant lower satisfaction score than Zirconia crown ( $P$ -value  $< 0.001$ , Effect size = 0.891).

There was no statistically significant difference in satisfaction with crown shape scores in the two groups ( $P$ -value = 0.174, Effect size = 0.238).

As for the duration and number of visits, SSCs showed statistically significant higher satisfaction scores than Zirconia crown ( $P$ -value = 0.002, Effect size = 0.518) and ( $P$ -value  $< 0.001$ , Effect size = 0.889), respectively.

Generally, there was no statistically significant difference between the two groups ( $P$ -value = 0.978, Effect size = 0.005).

TABLE (1) Descriptive statistics and results of Chi-square test and Fisher's Exact test for comparison between demographic data of children and parents in the two groups

Demographic data		SSCs (n = 54)		Zirconia crown (n = 54)		P-value
		n	%	n	%	
Child gender	Boy	27	50	21	38.9	0.245
	Girl	27	50	33	61.1	
Parent/Guardian occupation	White collar	29	53.7	38	70	0.137
	Housewife	12	22.2	10	18.5	
	Unemployed	13	24.1	6	11.1	
Parent/Guardian education	Primary	11	20.4	7	13	0.412
	University	39	72.2	45	83.3	
	Post Graduate	4	7.4	2	3.7	

: Significant at  $P \leq 0.05$

TABLE (2) Descriptive statistics and results of Mann-Whitney U test for comparison between parental satisfaction scores with the two crown types

Parental satisfaction	SSCs (n = 54)		Zirconia crown (n = 54)		P-value	Effect size (d)
	Mean (SD)	Median (Range)	Mean (SD)	Median (Range)		
Color	3.13 (1.21)	3 (1-5)	4.09 (0.59)	4 (2-5)	<0.001	0.891
Form	4.07 (1.04)	4 (2-5)	4.04 (0.64)	4 (2-5)	0.174	0.238
Size	4.46 (0.54)	4 (3-5)	4.17 (0.42)	4 (3-5)	0.002	0.518
Number of visits	4.57 (0.84)	5 (2-5)	3.93 (0.82)	4 (2-5)	<0.001	0.889
Overall	4.07 (0.61)	4.2 (2.6-4.8)	4.11 (0.44)	4 (3.4-5)	0.978	0.005

: Significant at  $P \leq 0.05$

### Price and recommendation: (Table 3)

Regarding the price, there was a statistically significant difference between the two groups ( $P$ -value = 0.020, Effect size = 0.269). Higher percentage of parents believed that SSCs have reasonable price while Zirconia crowns are

expensive. Consequently, when responding to the question of which crown type to recommend, the percentage of the parents who did not recommend SSCs was higher than those who recommended Zirconia crowns. Thus, there was a statistically significant difference between the two groups ( $P$ -value <0.001, Effect size = 0.471).

TABLE (3) Descriptive statistics and results of Fisher’s Exact test for comparison between price and recommendation of the two crown types

Price and recommendation		SSCs (n = 54)		Zirconia crown (n = 54)		P-value	Effect size (v)
		n	%	n	%		
Price	Cheap	0	0	5	9.3	0.020	0.269
	Reasonable	40	74.1	29	53.7		
	Expensive	14	25.9	20	37		
Recommendation of crown	Don’t recommend	21	38.9	1	1.9	<0.001	0.471
	Neutral	1	1.9	1	1.9		
	Recommend	22	40.7	41	75.9		
	Highly recommend	10	18.5	11	20.4		

: Significant at  $P \leq 0.05$

**Follow up and complications(table4)**

There was a statistically significant difference between the two groups ( $P$ -value = 0.048, Effect size = 0.243). SSCs showed statistically significant higher prevalence of stability for less than 6 months and 6-12 months, while zirconia crowns showed higher prevalence of stability for more than 12 months.

Gingival bleeding was another aspect that the respondents were asked to comment on in the questionnaire. There was a statistically significant difference between the two groups ( $P$ -value = 0.001,

Effect size = 0.372). Zirconia crown, unlike SSCs, was reported to have higher prevalence of bleeding.

Again, there was a statistically significant difference between the two groups ( $P$ -value = 0.003, Effect size = 0.332) in terms of food accumulation. According to the answers, food accumulation is more common in the case of Zirconia crown than in SSCs.

Tooth sensitivity was another area that showed no statistically significant difference between the two groups ( $P$ -value = 0.054, Effect size = 0.232) according to the respondents.

TABLE (4) Descriptive statistics and results of Chi-square test and Fisher’s Exact test for comparison between follow up and complications after using the two crown types

Follow up and complications		SSCs (n = 54)		Zirconia crown (n = 54)		P-value	Effect size (v)
		n	%	n	%		
Stability	Less than 6 months	4	7.4	2	3.7	0.048	0.243
	6 – 12 months	11	20.4	3	5.6		
	>12 months	39	72.2	49	90.7		
Gingival bleeding	Sometimes	19	35.2	20	37	0.001	0.372
	Often	1	1.9	14	25.9		
	Never	34	63	20	37		
Food accumulation	Sometimes	9	16.7	22	40.7	0.003	0.332
	Often	12	22.2	16	29.6		
	Never	33	61.1	16	29.6		
Tooth sensitivity	Sometimes	4	7.4	9	16.7	0.054	0.232
	Often	18	33.3	25	46.3		
	Never	32	59.3	20	37		

: Significant at  $P \leq 0.05$

## DISCUSSION

Dental caries in children is considered a major concern in pediatric dentistry. Various methods of full coverage restoration have been adopted for deciduous teeth, each with its own advantages and disadvantages.<sup>(10)</sup>

Nowadays, there is an increasing demand in pediatric dentistry for aesthetic solutions, mainly for psychological reasons<sup>(16)</sup>. This has given rise to many aesthetic prefabricated crowns for deciduous teeth as an excellent alternative for SSCs.<sup>(17)</sup>

There is a wide range of aesthetic prefabricated crowns available in the market, which have gained parents' satisfaction and approval regarding both function and appearance.<sup>(15)</sup> Despite the important role of aesthetics in improving the psychological well-being of the child, research is still limited in pediatric dentistry concerning the parental perception about the aesthetics of primary posterior area.<sup>(18)</sup>

The current study utilized a five-point and three-point Likert scales questionnaire to calculate a score for each criterion and to calculate a total score to make a statistical comparison between the prefabricated zircon crowns and stainless-steel crowns.

The results of the study reflected the parents' demand for aesthetics regardless of their occupation, educational level, or the gender of their children. The natural look and good translucency of zirconia crowns may play a crucial role in this issue<sup>(10)</sup> though it is relatively more expensive compared to SSCs, which may hinder its dominance over the later.<sup>(15)</sup>

Concerning colour, SSCs showed statistically significant lower satisfaction score than zirconia crown, which is consistent with the results of Salman et al. and Holsinger et al. There was no statistically significant difference between satisfaction with crown shape scores in the two groups, which may be due to the fact that both are anatomical crowns.

As for the duration and number of visits, SSCs showed statistically significant higher satisfaction scores than zirconia crown, which may be justified by the simple and easy clinical steps of SSCs crowns compared to zirconia crowns that require more tooth structure reduction.<sup>(14)</sup> As regards the overall satisfaction, there was no statistically significant difference between the two groups, which reveals that the poor aesthetics of SSCs is not an obstacle for its wide usage.

Respondents' choices regarding the price showed a statistically significant difference between the two types of crowns. Most of the parents agreed that SSCs have reasonable price while zirconia crowns are expensive. This may agree with the findings by Holsinger et al.<sup>(15)</sup> Furthermore, there was a statistically significant difference between the two groups concerning recommendations. The percentage of the parents who did not recommend SSCs was high, probably due to the excellent color, shape and size of zirconia crowns when compared to SSCs. These results are consistent with the results found by Salami et al<sup>(19)</sup> and Mathew et al.<sup>(9)</sup>

When assessing the stability of crowns, there was a statistically significant difference between the two groups. SSCs showed stability for less than 6 months as well as from 6-12 months due to its ability to be crimped to aid in retention. Zirconia crowns, on the other hand, showed higher stability for more than 12 months. The latter technique is known to be lower in sensitivity and highly tolerant to moisture contamination though it depends on the strength of the luting cement for retention.<sup>(15)</sup> The findings of the current study were in conformity with the previous findings by Salami et al<sup>(20)</sup> and Yanover et al.<sup>(21)</sup>

Zirconia crowns showed higher prevalence of bleeding and food accumulation than SSCs. The findings of this study disagree with the results of Walia et al<sup>(9)</sup> which proved a significant reduction in the gingival index after using zirconia crowns due to its biocompatibility and highly polished

surface. However, the negligence of home care and lack of oral hygiene are most likely the main causes of food accumulation, which results in gingival inflammation and hence bleeding.

As regards tooth sensitivity, there was no statistically significant difference between the two groups, as most of zirconia crowns exhibit a closed margin<sup>(15)</sup>, which favors absence of tooth sensitivity.

Future studies should include assessment of oral hygiene performance and scoring of plaque to examine the actual effect of crowns on health of the gingiva.

## CONCLUSION

- There is an increasing demand for esthetic restoration of deciduous teeth in the field of pediatric dentistry.
- Zirconia crowns fulfil the esthetic requirements of the parents when compared to SSCs.
- Parents prefer zirconia crowns to SSCs and recommend them for others despite their high cost.

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