



## Pediatric Deciduous Molar Full Coverage Restorations: A Comparative Study of Stainless-Steel, Zirconia, and Fibreglass Crowns

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### ABSTRACT

**Background:** Dental caries is a common condition that needs to be treated; the desire for durable and esthetic restorations in primary teeth continues to grow. This study aimed to assess the clinical performance and the gingival health status of stainless Steel (SSCs), zirconia (ZRC), and fiberglass crowns (FIGC) in children. **Patients and Methods:** This a randomized controlled clinical trial on 44 children aged from 4 to 8 years old with mean age  $\pm 5.85$ . The selected children were divided randomly into two main groups, each group was subdivided into two subgroups according to the type of restorative crowns for primary molars. A total of 88 crowns were placed in 44 children who had 88 bilateral mandibular primary molars. **Results:** The highest scores for resistance to dislodgement before cement were recorded for SSCs followed by FIGC then the ZRC was the lowest one with statistically highly significant differences between the three treated groups of crowns. The highest scores for retention after cementation were recorded for SSC as it has a snap-fit and ZRC which have micromechanical locks present on the cementing surface within crowns that increases the surface area for cementation despite the greater tooth reduction while FIGC was the lowest group which showed complete loss of 10 crowns at the end of evaluation this seemed to be related to occlusal wear. The better gingival health was recorded for ZRCs followed by SSCs while the worst one was FIGCs with statistically highly significant differences between the three types of crowns according to the Gingival index (GI) at different time intervals. **Conclusion:** Stainless steel crowns are still the “Gold Standard” for posterior full coverage restorations in primary molars followed by zirconia and fiber-glass crowns.

**Keywords:** Stainless steel Crowns; Zirconia; Fiber-Glass Crowns; Molars; Children

## **Introduction**

Full-coverage crowns are preferred for the restoration of teeth with extensive, multi-surface and subgingival carious lesions, as well as for the restoration of endodontically treated teeth in the primary dentition and developmentally defective teeth (1). The placement of a preformed crown is intended to provide a more durable restoration than other fillings (2). The choice of a crown is the longest-lasting primary tooth restoration and it is superior to any other restoration (3).

The current study used stainless steel crowns (SSCs) as it has been considered the gold standard full coverage restoration for deciduous molars and they have been used successfully in the practice of pediatric dentistry to restore badly broken down primary molars for more than six decades and have presented little in the way of adverse events while the major drawback is poor aesthetics due to the metallic appearance which has been poorly received by patients and parents (4,5).

The desire for durable and esthetic restorations in primary teeth continues to grow. This study used zirconia crowns (ZRCs) as they are durable, esthetic restorations that appear to show positive clinical results but have some limitations, such as the need for more tooth reduction and a higher per-unit cost and the inability to crimp or shape the crown (6).

Also, fiberglass crowns were used in this study as the concept they are tooth-coloured and approximately two-thirds the cost of a ZRC. Additionally, they require generally less preparation than ZRCs and can be handled like SSCs during fitting and placement (7).

Therefore, this study aimed to assess the clinical performance of three crown types using the modified United States Public Health Service criteria (USPHS) in terms of resistance to dislodgement, retention after cementation, occlusal wear, color match, and staining of the crown. Evaluation of the gingival health status by measuring the gingival index (GI) for crowned teeth and their opposing natural teeth.

## **Patients and Methods**

This a randomized controlled clinical trial using the split-mouth technique, 88 crowns were placed in 44 children who had 88 mandibular primary molars indicated for crown restoration according to sample size calculation:

The sample size had a power of 80% and confidence of 95%. sample calculated to be 88 primary molars, 44 primary molars in each group and the data were recorded at baseline and after six time intervals week,1, 3, 6, 9 and 12 months by using [www.clinicalcalc.com](http://www.clinicalcalc.com) (8).

$$K = \frac{n_2}{n_1} = 1 \quad n_1 = \frac{(\sigma_1^2 + \sigma_2^2 / k) (z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2}{\Delta^2} \quad n_1 = \frac{(0.2^2 + 0.2^2 / 1) (1.96 + 0.84)^2}{0.24^2}$$

Where:  $n_1 = 11$ ;  $n_2 = k * n_1 = 11$ ;  $\Delta = [\mu_2 - \mu_1]$  = absolute difference between two means;  $\sigma_1, \sigma_2$ , = variance pf means # 1 and #2 ;  $n1$ = sample size for group # 1;  $n2$ = sample size for group # 2;  $\alpha$  = probability of type I error (usually 0.05);  $\beta$  =

*probability of type II error (usually 0.2); Z= critical z value for a given  $\alpha$  or  $\beta$ ; K=ratio of sample size for group # 2 to group #1*

### **Ethical Approval:**

The present study was conducted in the Out-patient Dental Clinic, Pediatric Dentistry Department, Faculty of Dentistry, Suez Canal University after the approval of the Research Ethical Committee (REC) of the Faculty of Dentistry, Suez Canal University (No. 286/2020). All clinical procedures were performed under its guidelines and regulations.

### **Selection criteria:**

All the children who participated in this study were selected according to the following criteria (4):

- a) **Patient's Inclusion Criteria:** Healthy children were free from any systemic diseases. Cooperative patients within the age group of 4 to 8 years old of both sexes. Patients with at least two bilateral lower primary molars.
- b) **Teeth Inclusion Criteria:** Badly decayed teeth with more than two surfaces caries. Pulp therapy treated primary molars. Developmental defects on the tooth surface. Root resorption is less than/ equal to 1/3rd of root length.
- c) **Patient's Exclusion Criteria:** Children with hypersensitivity to any type of materials used, and children could not complete the follow-up periods. Failures of any of the crowns used.
- d) **Teeth Exclusion criteria:** Teeth with acute infection; infra-occlusion; mobility; internal root resorption; and exfoliation imminent.

### **Sample Grouping:**

A total of 88 crowns were placed in 44 children had 88 mandibular primary molars were included in this study using the split-mouth technique to ensure equalizing variables for both groups. The selected patients were divided randomly into two main groups according to different treatments. Each group had (44) mandibular primary molars subdivided into two subgroups according to the types of crowns. Each one had (22) mandibular primary molars that were used as follows:

**Group I (SSCs& ZRCs):** 44 mandibular primary molars that were subdivided into:

- **Subgroup IA (SSCs):** 22 mandibular primary molars restored by stainless steel crowns.
- **Subgroup IB (ZRCs):** 22 mandibular primary molars that restored by zirconia crowns.

**Group II (SSCs & FIGCs):** 44 mandibular primary molars that subdivided into:

- **Subgroup IIA (SSCs):** 22 mandibular primary molars restored by stainless steel crowns.
- **Subgroup IIB (FIGCs):** 22 mandibular primary molars restored by fiberglass crowns.

### **Clinical procedures:**

A total number of 88 bilateral mandibular primary molars in 44 children were indicated for using steel crowns, zirconia crowns or fiberglass crowns according to different treatment modalities.

Topical anaesthetic Gel 20 %Benzocaine (I-Gel) was applied on the injection site using a cotton swab and left for 2 minutes before administrating local anaesthesia. Local nerve block anaesthesia was achieved using articaine hydrochloride 4% with epinephrine 1:100,000.

### **Tooth preparation:**

Tooth preparations were performed on each tooth according to the manufacturer's instructions for each crown type.

#### **I. Stainless steel Crown preparation (9):**

The proper size of the crown measured by a digital calliper was selected using mesiodistal width. 1.0-1.5 mm of occlusal reduction was done by using a wheel diamond stone. 1 mm of proximal reduction was done by using a fine tapered diamond stone. The proximal contact points were clear and smooth taper surfaces from the occlusal surface to the gingival margin. Any cervical shoulders were removed to obtain a feather edge finish line, 0.5mm below the marginal gingiva. No reduction was needed on the buccal or lingual surfaces unless that excessive prominent buccal bulge of mandibular first primary molars. Round off all line angles. Crimping and contouring of the SSCs were done with crown contouring pliers until the proper active fit of the crown was obtained.

#### **II. Zirconia crown preparation (4):**

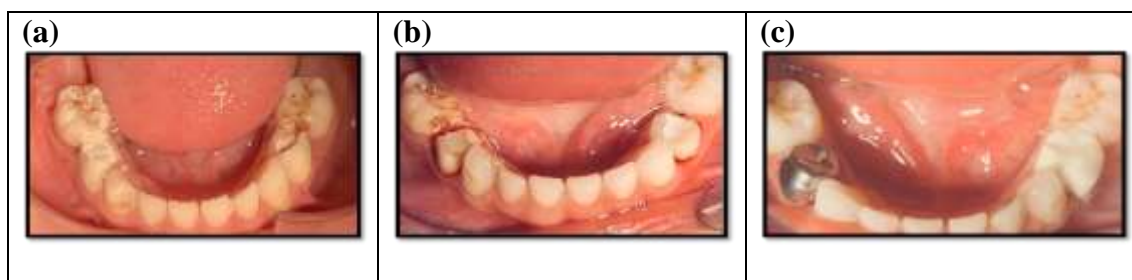
The proper size of the crown measured by digital calliper was selected using mesiodistal width. 1.5 to 2 mm occlusal reduction was done and kept preparation flat by using a football diamond stone. A chamfer margin was created, all around the tooth by reducing 0.5 -1mm by using a flat tapered diamond stone. Chamfer margin was removed and extended 2mm sub-gingivally without ledge formation by using the fine tapered diamond stone. Round off all line angles, crown was passive fit (**Figures 1**).



**Figure (1): Clinical procedures for group I (SSCs & ZRCs): (a) pre-operative photo, (b) Bilateral molars: lower right first primary molar was prepared for SSC & lower left first primary molar was prepared for ZRC; (c): Cemented crowns: lower right first primary molar restored by SSC & lower left first primary molar restored by ZRC.**

### **III. Fiberglass Crown Preparation (10):**

The proper size of the crown measured by a digital calliper was selected. Approximate the original size of the tooth before cavities or damage. 1.0-2.0 mm of occlusal reduction was done by using a wheel diamond bur. The circumferential length of the tooth was reduced by 1-1.5 mm and opened the interproximal contact using a tapered diamond stone. A feather edge preparation 1-1.5 mm subgingival preparation was done to provide a feather margin circumferentially using the fine tapered diamond stone. Next, the occlusal surface of the tooth was bevelled. A flame diamond stone was used. Round off all line angles. A slightly active fit of the crown was obtained due to the Flex-fit nature of the crown (**Figures 2**).



**Figure (2): Clinical procedures for group II (SSCs & FIGCs):(a) pre-operative photo, (b) Bilateral mandibular first primary molars: lower right first primary molar was prepared for SSC & lower left first primary molar was prepared for FIGC and (c): Cemented crowns: lower right first primary molar restored by SSC & lower left first primary molar restored by FIGC.**

#### **Crown Cementation:**

All crowns were cemented using Glass Ionomer cement (Medicem Promedica Dental Material GmbH Mad in Germany) by light finger pressure and then residual cement was removed. First by wet cotton then by a probe after complete setting.

#### **Methods of evaluation and follow-up:**

Each crown was assessed clinically at the baseline which was the same day of the procedure immediately after placement and after one week, 1, 3, 6, 9 and 12 months of follow-up by using the following method (**4,11,12**):

1. Modified United States Public Health Service (USPHS) criteria.
2. Measuring of gingival health status according to Gingival index (GI) scoring criteria by **Löe, (13)** for restored molars and their opposing natural teeth.

#### **Statistical analysis:**

Data analyzed using Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. Differences between quantitative independent multiple by ANOVA. P value was set at  $<0.05$  for significant results &  $<0.001$  for high significant result.

## **RESULTS**

From 55 enrolled patients and 110 teeth. 44 patients, with 88 teeth were included in the study. The flow chart of the patients through the study following the CONSORT flow diagram (**Figure 3**).

A total of 88 crowns were placed in 44 children who had 88 bilateral mandibular primary molars. There were 40(45.5%) mandibular first primary molars 18 (20.5%) boys and 22 (25%) girls) and 48(54.5%) mandibular second primary molars 22 (25%) boys and 26 (29.5%) girls). From 22 FIG crowns, there was a complete loss of 10 crowns (45.5%) (four crowns (18.2%) at 6, and 9 months and six crowns (27.3%) at 12 months) these were replaced with SSCs (**Table 1**).

The comparison between three types of crowns Stainless-Steel, Zirconia and Fiberglass on retention after cementation at different time intervals showed that: SSCs and ZRCs had the highest scores showing (100%) alpha score, all crowns were retained at all-time intervals of evaluation (baseline, one week,1,3,6,9 and 12 months) while FIGCs were the lowest one showing bravo score (63.6 %,54.5 %,63.6% and 45.5 %) crowns were partially lost/chipped at 3,6,9 and 12 months of evaluation and charlie score a Complete loss of crown (18.2 %,18.2 % and 45.5 %) at the 6,9 and 12 months of evaluation. The results showed there were highly significant differences ( $P=0.00016$ ) between the three types of crowns at different time intervals using the chi-square test (**Figure 4**).

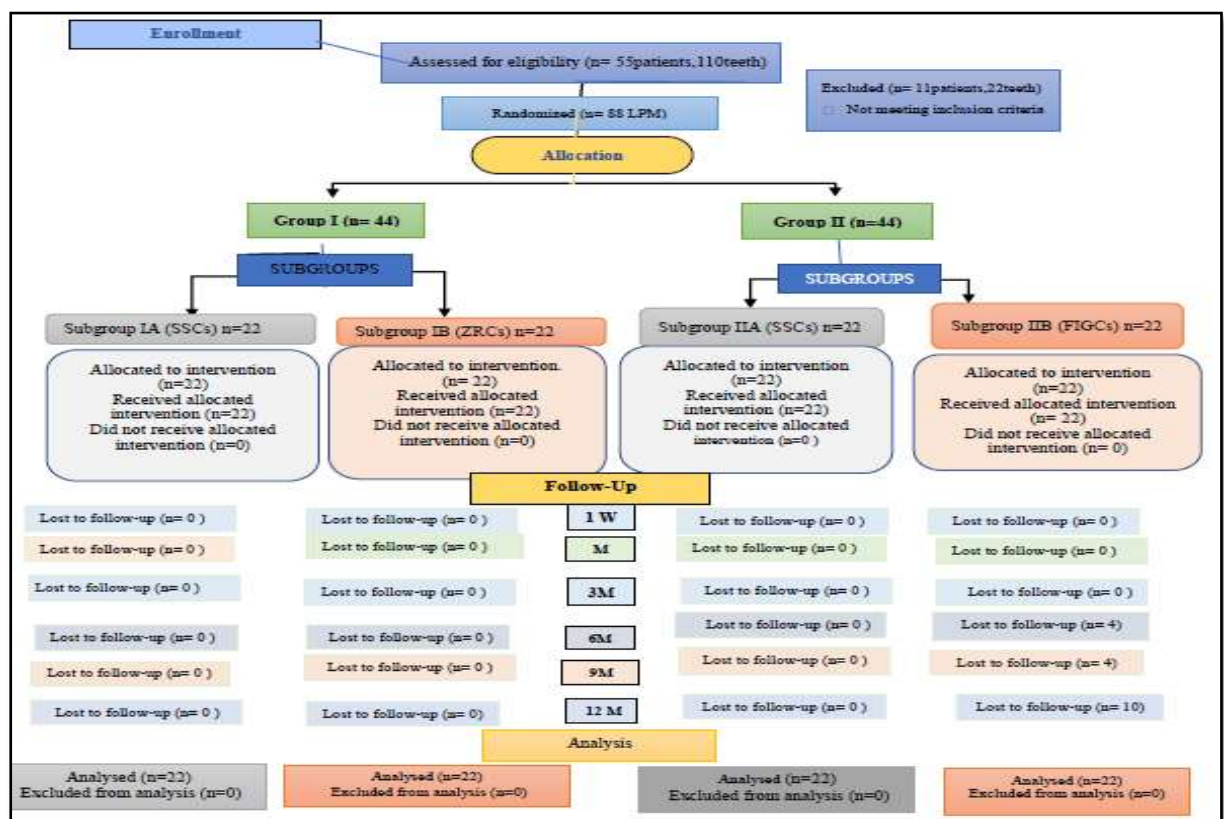
The comparison between three types of crowns Stainless-Steel, Zirconia and Fiberglass on occlusal wear at different time intervals of the evaluation showed that: SSCs and ZRCs had no occlusal wear showing alpha scores (100%) all crowns had occlusal surface intact at all-time intervals of the evaluation while FIGCs had high occlusal wear showing bravo score ( 63.6 %,45.5%,27.3%,36.4 % and18.2%) of crowns had worn of the occlusal surface with tooth surface exposure at1,3,6,9 and 12 months of evaluation periods and Charlie score (72.3%,36.4%,36.4% and 27.3%) of crowns had worn of the occlusal surface with tooth surface exposure at the 3,6,9and 12 months of evaluation periods. From 22 FIG crowns, there was a complete loss of 10 crowns (45.5%). These were replaced with SSCs and excluded from occlusal wear evaluation. There were highly significant differences ( $P=0.000000156^{**}$ ) between the three types of crowns (**Figure 5**).

The comparison between three types of crowns Stainless-Steel, Zirconia and Fiberglass for the staining of the crown at different time intervals showed that: the SSC and ZRC crowns had no stain showing alpha score (100%) for all crowns at all time intervals of evaluation, While FIGCs had heavy staining and showing bravo scores (18.2%, 63.6 %,63.6%,54.5%,36.4 % and 36.4%) that crowns had staining which could be polished away at1 week,1,3,6,9 and 12 months of evaluation periods and Charlie score (18.2%,27.3% and18.2% ) that crowns had heavy staining that could not be polished away at 6,9 and 12 months of evaluation periods. From 22 FIG crowns, there was a complete loss of 10 crowns (45.5%). These were replaced with SSCs and excluded from the crown staining evaluation. There were statistically significant differences ( $P=0.000176$ ) between the three types of crowns (**Figure 6**).

The natural teeth had better gingival health than the crowned teeth and there were highly significant differences ( $P=0.00000143$ ) between SSCs and their opposing

natural teeth according to (GI). Also, there were highly significant differences ( $P=0.00000143$ ) between ZRCs and their opposing natural teeth at baseline, one week and one month, while there were non-significant differences ( $P=1.00$ ) at 3,6,9 and 12 months (**Table 2**).

The comparison between SSCs and ZRCs according to the gingival index at different time intervals. In subgroup IA (SSCs); The score-0 was the most frequent at one week, 1,3,6,9, and 12 months, while the score-1 was the most frequent at baseline, also in subgroup IB (ZRCs); The score-0 was the most frequent at one week, 1,3,6,9, and 12 months, while the score-1 was the most frequent at baseline. The results showed there were significant differences at the baseline only ( $P=0.0223$ ) while there was a non-significant difference ( $P=1.00$ ) at one week, 1, 3, 6, 9 and 12 months between SSCs and ZRCs (**Figure 7**).

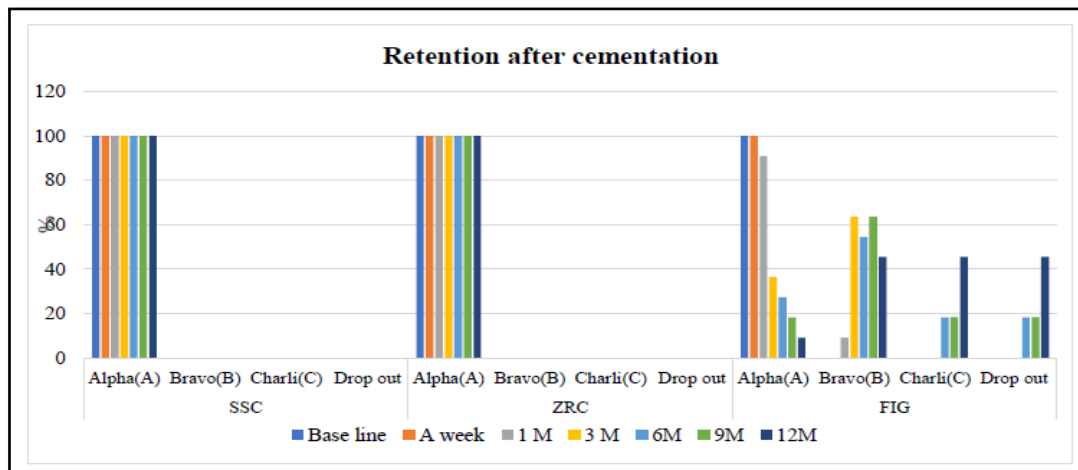


**Figure (3): CONSORT flow diagram of the study.**

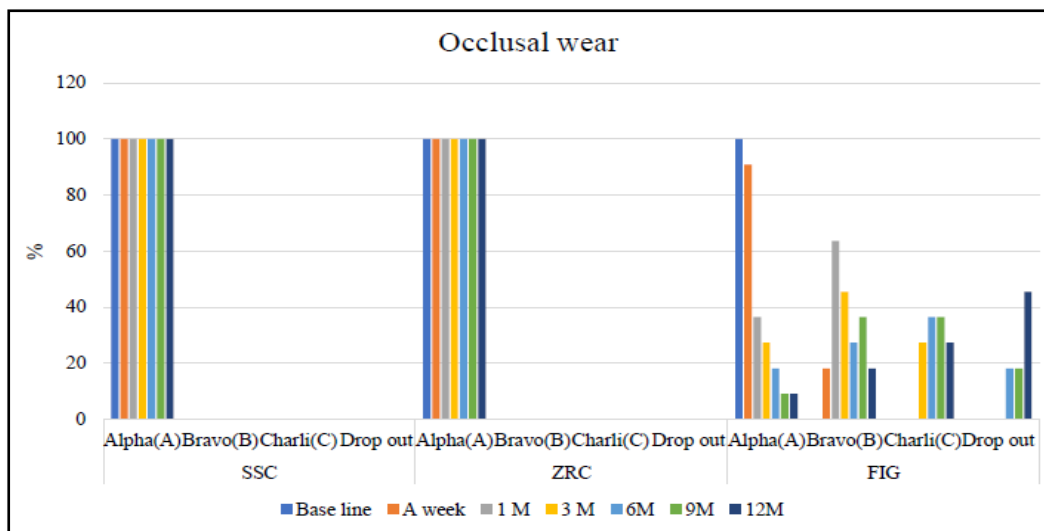
**Table (1): Descriptive analytics data of the study sample**

	Number		Total	Age Range	Mean	SD
	Male	Female				
	20(45.5) %	24(54.5) %	44(100) %	4-8	±5.85	1.59
primary molars	40(45.5) %	48(54.5) %	88(100) %			
mandibular first primary molars	18 (20.5) %	22 (25) %	40 (45.5) %			
mandibular	22	26	48			

second primary molars	(25) %	(29.5) %	(54.5) %
SSCs	20(22.7) %	24(27.3) %	44(50) %
ZRCs	8(9.1)	14(15.9) %	22(25) %
FIGCs	12(13.6) %	10(11.4) %	22(25) %



**Figure (4):** The percentage of between three types of crowns Stainless-Steel, Zirconia and Fibreglass for Retention after cementation at different time intervals.



**Figure (5):** Comparison between three types of crowns Stainless-Steel, Zirconia and Fibreglass for Occlusal wear at different time intervals of evaluation.



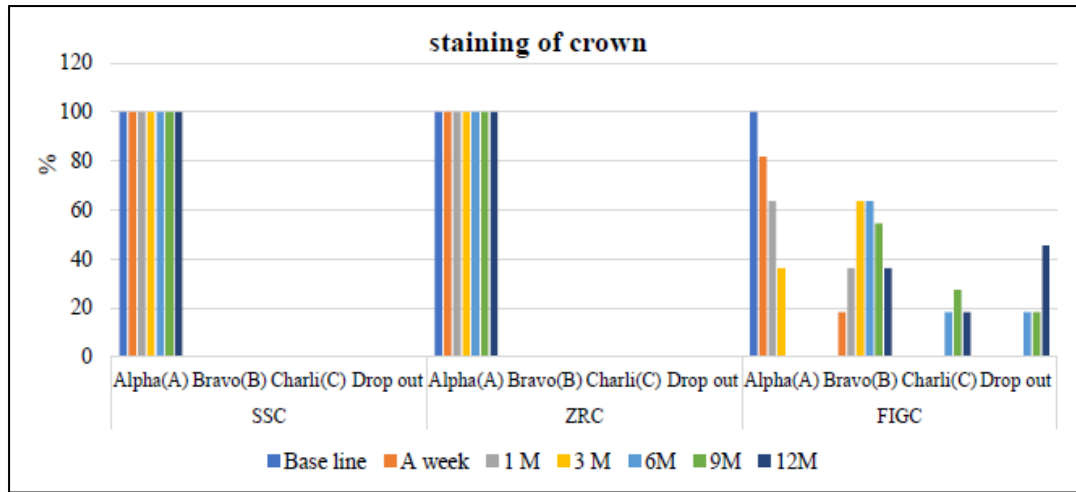
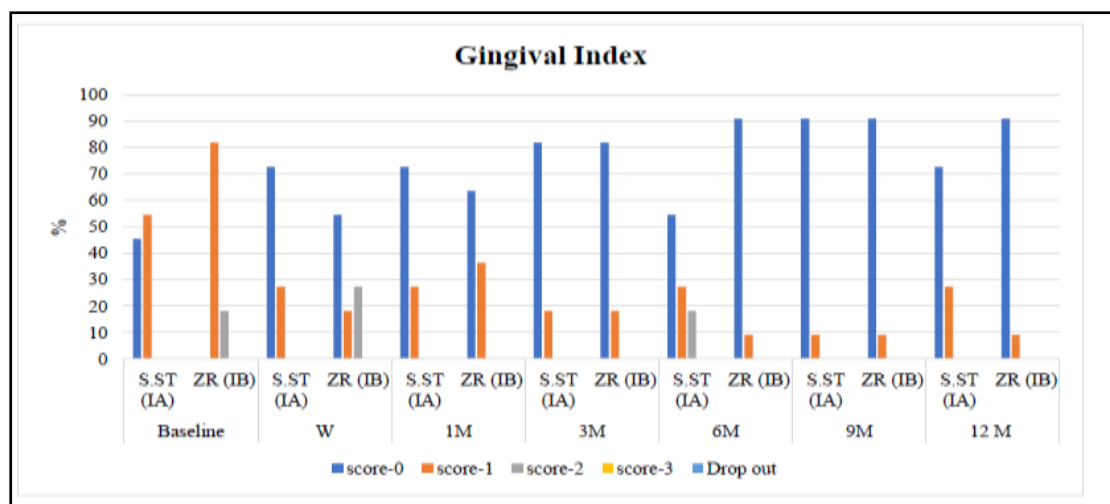


Figure (6): Bar chart representing the percentage % of between three types of crowns Stainless-Steel, Zirconia and Fibreglass for Staining of the crown.

Table (2): Comparison between IA (SSCs) vs their natural opposing teeth and IB (ZRCs) vs their natural opposing teeth according to Gingival index scores at different time intervals of evaluation:

score	IA(SSCs)					Opposing IA (SSCs)					p	IB(ZRCs)					p	Opposing IB(ZRCs)					p
	0	1	2	3	Drop out	0	1	2	3			0	1	2	3	Drop out		0	1	2	3		
Base line	10 (45.5) %	12 (54.5) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	0.0000052**	0 (0.0) %	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	0.000000016**			
w	16 (72.7) %	6 (27.3) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0.0000042**	12 (54.5) %	4 (18.2) %	6 (27.3) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0.0000009**			
1M	16 (72.7) %	6 (27.3) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0.00000042**	14 (63.6) %	8 (36.4) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0.000000063**			
3M	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	1.00	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	18 (81.8) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	1.00			
6M	12 (54.5) %	6 (27.3) %	4 (18.2) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0.0000014**	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	1.00			
9M	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	1.00	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	1.00			
12M	16 (72.7) %	6 (27.3) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0.0000042**	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	0 (0.0) %	20 (90.9) %	2 (9.1) %	0 (0.0) %	0 (0.0) %	1.00			
P value	0.000162**					0.866						0.00000000416**					0.8666						
	0.00000143**											0.00000165**											

%; means significant difference at P<0.05  
 \*\*; means highly significant difference at P<0.001



**Figure (7): Bar chart representing percentage % comparison between the Gingival index scores<sup>(13)</sup> (GI) subgroup [IA (SSCs)] vs subgroup [IB (ZRCs)] at different time intervals.**

## DISCUSSION:

Until the beginning of the study (according to our knowledge) there is nearly no study was conducted to compare and evaluate stainless steel crowns versus zirconia crowns and fibreglass crowns as full coverage restorations for primary molars clinically and experimentally.

In this study patients were carefully chosen according to the inclusion criteria, to standardize the clinical situation, healthy patients with no history of medical conditions were enrolled in the study, to avoid any complications in the prognosis and the success rate of the treated teeth and Children were selected with an age range of 4-8 yrs old as children younger than 4 years were excluded due to possible lack of cooperation and children older than 8 years were excluded due to expected physiological resorption of primary molar roots that might have affected the parameters tested. This is in agreement with **Abdulhadi et al. (4)**.

In the current study, Patients were selected with at least two bilateral lower primary molars (a split-mouth design) as the split-mouth design was employed to equalize the oral environment, health and hygiene habits of the three treated groups and also minimize the sample size. This is in agreement with **Talekar et al. (12)**.

The teeth were selected in this study according to the following inclusion criteria: Badly decayed primary molars were indicated for pulp therapy, teeth had more than two surfaces caries, pulp therapy treated primary molars and teeth had developmental defects on the crown surface. All these criteria are indicated for crown restorations. This is agreed with with **Abdulhadi et al. (4)**.

In this study, the three types of crowns were evaluated and assessed using the Modified United States Public Health Service (USPHS) criteria, in terms of (resistance to dislodgement, retention after cementation, occlusal wear, staining of

crown and color match) since these criteria are simple and representative for use. this is in accordance with **Talekar et al. (12)**.

Gingival health status was evaluated in this study for both the crowned tooth and its opposing natural tooth to evaluate the oral health status of the same patient either to improve or deteriorate. this is in agreement with **Taran and Kaya (11)**. also, patient and parental satisfaction were evaluated in this study because the target of any treatment is to be satisfied to parents and their children. this is in accordance with **Subramanian et al. (14)**.

In the present study, the three types of crowns were evaluated and assessed at the baseline which was the same day of the procedure immediately after placement. this is to document the quality of treatment and help determine prognosis during all evaluation periods. All patients were recalled after one week, 1, 3, 6, 9, and 12 months of follow-up. this is in accordance to **Abdulhadi et al. (4)**. However, this finding differs from **Alamoudi et al. (15)** who evaluated the clinical performance of NuSmile primary Zirconia crowns on 232 pulp-treated primary teeth and used evaluation criteria of the United States Public Health Service for plaque index, restorative failure and marginal integrity at 6, 12, 18, and 24 months.

In this study, Teeth preparations were done according to the manufacturer's instructions, the minimum reduction of the crown was done for SSCs followed by FIGCs and then ZRCs which showed that the fast operation time taken was for SSCs followed by FIGCs and then ZRCs this is similar to those **Mohammadzadeh et al. (9)**; **Taran and Kaya (11)** and **Talekar et al. (12)**. Also, teeth preparations for ZCRCs were performed according to the manufacturer's instructions (Kids-e-crown, India). A one- to two-mm occlusal reduction and a 0.5- to 1.25-mm circumferential reduction were performed. The finishing line was established one to two mm subgingivally using a tapered bur. This is similar to **Suguna and Gurunathan (16)** and **Agrawal et al. (17)**.

Also, teeth preparations for fiberglass crowns were performed according to the manufacturer's instructions (Figaro Crowns INC. USA) Occlusal reduction using a wheel or flamed bur to achieve occlusal clearance by 1 to 2mm. Proximal reduction using plane medium-flamed diamond bur giving a feather-end finish line 1 mm below the gingival margin. Buccal and lingual reductions were made by the same bur but to a lesser extent. This was followed by beveling of all line angles to remove any sharp edges. This is similar to **El-Habashy and El Meligy (10)**.

On the other hand, this is inconsistent with **Mohammadzadeh et al. (9)** who prepared the tooth as a shoulder finish line and removed all undercuts from all surfaces, which allowed for more bulk of the material. They compared clinically custom-made fibre-glass-reinforced composite (FRC) crowns and PMCs on primary molars, using custom-made FRC crowns.

In this study, the three treated crowns groups were cemented using type I Glass Ionomer Cement (according to the manufacturer's instructions), while not using resin cement which needs to light cure. This agreed with **Abbas (18)** and **Agrawal et al. (17)** who used the same type of cement (type 1 GIC )when evaluating SSCs and ZRCs for retentivity of the crown, temporomandibular joint (TMJ) problem, gingival

response, plaque accumulation, and tooth wear in opposing teeth after 1st and 3rd-month follow-up.

The results of the present study revealed that the highest scores for resistance to dislodgement before cement were recorded for SSCs followed by FIGC then the ZRC was the lowest one with statistically highly significant differences between the three treated groups of crowns. This is maybe due to the SSCs having a snap-fit and the FIGCs having a flex fit which showed more resistance to dislodgement while ZRC required a passive fit which offered little to no resistance to dislodgement. This agreement with **Talekar et al. (12)** who assessed the clinical performance of ZRCs with FIGCs in primary molar teeth and observed a statistically significant relation between ZRCs and FIGCs.

Moreover, the results of the present study revealed that the highest scores for retention after cementation were recorded for SSC as it has a snap-fit and ZRC (Kids-e-crown) which have micromechanical locks present on the cementing surface within crowns that increases the surface area for cementation despite the greater tooth reduction while FIGC was the lowest group which showed complete loss of 10 crowns at the end of evaluation this seemed to be related to occlusal wear. there were statistically highly significant differences between the three types of crowns. This is in agreement with **Abdulhadi et al. (4)**, and **Mathew et al. (19)** who found that all crowns (SSC and ZRC) 100 % crowns were retained till the end of the study and also agreed with **El-Habashy and El Meligy (10)**.

Moreover, the results of the present study revealed that the highest scores for occlusal wear resistance were recorded for SSC and ZRC this may be due to the microhardness of stainless steel and zirconia crowns being higher than primary enamel while FIGC was the lowest group which showed occlusal wear started from one week which led to complete loss of crowns at the end of the study. This wear in FIGC may be due to the Fiberglass crown being very thin and as the manufacturer recommended a minimal tooth preparation was required with a feather-end finish line. it could be assumed that Fiberglass crown thickness may not be enough to provide a strong material that withstands the forces of mastication. There were statistically highly significant differences between the three types of crowns. This is in agreement with **Abdulhadi et al. (4)**; (**, 2011**); **Mathew et al. (19)**; **Yilmaz et al. (20)**; and **Sripetchdanond and Leevailoj (21)** who evaluated and compared the clinical performance of SSCs and ZRCs and found that all crowns had 100% success rate as appeared healthy with no chips, cracks, or fractures.

On the other hand, the results of the current study disagreed with **Agrawal et al. (17)** and **Murali et al. (22)** who compared the clinical performance of posterior preformed zirconia with Stainless Steel crowns. who showed a loss of stainless steel crowns 3.2% during the 9th month following up and 3.2% of zirconia crowns at the 3rd-month follow-up and found 3.2% chipping of zirconia crowns at the 3rd-month follow-up. They explained the chipping of the crown to the occlusal forces during the seating of the crown or mild occlusal disharmony. also, the complete loss of crowns may be due to poor adaptation of luting cement as zirconia crowns were a passive fit depending on cement for retention.

The results of the present study revealed that better gingival health was recorded for ZRCs followed by SSCs while the worst one was FIGCs with statistically highly significant differences between the three types of crowns according to the Gingival index (GI) at different time intervals. This could be explained by the glazed and polished surface of the zirconia crowns decreasing plaque accumulation and maintaining good gingival health whereas the shaping of metal borders improperly as well as adhesive residues in the sulcus that cause gingival problems in the stainless steel restored teeth, while the cause of deteriorating of the gingival health around the FIGCs may be due to the resin material in the Fiberglass crown and also, over time, the FIGC surface became rough and less polished which led to plaque accumulation and hence more gingival irritation and bleeding. This is in agreement with **Abdulhadi et al. (4)** ; **Taran and Kaya (11)** and **Suguna and Gurunathan (16)** who found that gingival health was better in teeth restored with ZRCs than those restored with SSCs during 3 and 6 months follow-up, but later 12 months follow-up two groups were had healthy gingiva.

Also, this study result is agreed with **Murali et al. (22)** who found that in ZRC the gingival response showed mild marginal gingivitis in the 1st month and then reduced at the 3<sup>rd</sup>-month follow-up, whereas SSC had healthy gingiva and also showed a statistically significant difference for both groups. SSCs came out to be better than zirconia crowns. He explained this by traumatic and painful ZRC preparation to the child, so child would have to avoid touching that area even with the toothbrush for the first few weeks following its placement.

## **CONCLUSION:**

Stainless steel crowns are still the “Gold Standard” for posterior full coverage restorations in primary molars. Zirconia crowns proved excellent clinical performance and parental satisfaction over 12 months. Fiber-glass crowns showed significantly more occlusal wear, staining, and partial loss of crown structure, complete loss of crown, plaque retention, and poorer gingival health after 6months.

Based on the clinical results achieved in the current stud recommended that:

1. The current most popular choice for the restoration of primary molars stays the SSCs.
2. Zirconia crowns are a good choice as aesthetics full coverage restoration for primary molars.
3. Fiber-glass crowns cannot be recommended for clinical use for periods greater than 6 months.

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