EGYPTIAN DENTAL JOURNAL

VOL. 64, 977:989, APRIL, 2018

I.S.S.N 0070-9484

ORTHODONTICS, PEDIATRIC AND PREVENTIVE DENTISTRY

www.eda-egypt.org • Codex : 228/1804

CLINICAL AND RADIOGRAPHIC EVALUATION OF STAINLESS STEEL VERSUS ZIRCONIA CROWNS ON PRIMARY MOLARS: RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Aim or purpose: To evaluate clinical and radiographic success of Stainless steel crowns versus zirconia crowns on primary molars.

Materials and methods: Two hundred and forty vital mandibular primary molars in sixty medically free patients were pulpotomized under general anaesthesia. The patients with an age range 4-6 years. After pulp therapy, molars were restored and divided into two equal groups, group (1) stainless steel crowns(control) and group (2) Zirconia crowns. Clinical and radiographic evaluation were conducted at baseline,3,6,9 and 12 months intervals utilizing Scoring system. Data were collected and analysed statistically.

Results: There was no statistically significant difference between GI and OHI scores in the two groups at base line, 3 ,6 months. Stainless Steel crown group showed statistically significantly higher mean GI and OHI scores than Zirconia crown group at 9 and 12 months. After 12 months, 75.8% of the Stainless-Steel crowns showed acceptable clinical and radiographic criteria compared to 80.8% of the Zirconia crowns. The drop out were 5 cases in Stainless Steel crown group comprising 20 molars and 4 cases in Zirconia group comprising 16 molars. However, there was no statistically significant difference between the two groups. After 12 months, 9.2% of the SSC group showed inter-proximal bone resorption compared to 7.5% of the Zirconia crowns. However, there was no statistically significant difference between the two groups.

Conclusions: Regarding to the results of the current study, Zirconia crowns proved acceptable clinical and radiographic success compared to stainless steel crowns with an advantage of better esthetics.

INTRODUCTION

Early Childhood Caries is considered a public health problem, which entails the early carious involvement of the primary maxillary incisors followed by the maxillary and mandibular first primary molars and the mandibular cuspids [1].

In primary dentition, large, multi-surface carious lesions indicate the use of a full-coverage

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restoration. It is also indicated in deep unilateral or bilateral proximal cavities, circumferential caries and history of pulp therapy [2].

In 1950 Stainless Steel Crowns were introduced by Dr William Humphrey. These were the most reliable restoration in terms of full coverage. After pulpectomy or pulpotomy SSC were the treatment of choice due to less microleakage when compared to amalgam restoration[3].

SSCs do not require complete isolation for bonding like crowns made of composite resin and they do not require a preparation incorporating mechanical retention into the design, as do amalgam restorations. After two years of clinical use, the rate of perforations of SSCs was only 12% [4].

However, the parents need for lifelike restorations that looks like natural teeth leads to development of metal free coverage. This is represented through the use of zirconia crowns which are considered cosmetic treatment compared to other alternative crowns [5].

By increasing the translucency of zirconia ceramics which were made of one single material by aid of computer assistant design (CAD) and computer assistant machining (CAM) it showed excellent mechanical properties and perfect aesthetics crowns [6,7].

Numerous studies have focused on the gingival health of primary molars restored with SSC. Good- to moderate-fitting crowns and well-contoured margins led to healthy gingivae, and less plaque accumulation [8].

Another study reported that interproximal bone resorption after placement of an SSC was not adversely affected by (a) an extension or adaptation of the crown's margin, (b) a tight proximal contact, (c) the level of oral hygiene, or (d)the duration of crown's presence [9]. Discrepancies of the sub-gingival margins of the SSC, however, have been implicated by some investigators as one of the causes of gingival inflammation after restoring a primary molar with a SSC [8].

The Debates about SSCs and Zirconia crowns necessitated the investigation of their clinical and radiographic performance as a final restoration of pulpotomized primary molars.

SUBJECTS AND METHODS

Study design and ethical approval

The study was a randomized, non-blinded prospective controlled clinical trial. The children and their parents were informed about the purpose of the study, and an informed consent document prior to participation was also signed. The study was performed according to the principles of the Declaration of Helsinki and was approved by the Ethics Committee, Faculty of Dentistry, Cairo University.

Sample size calculation:

Sample size determination was based upon the results of Kara NB and Yilmaz Y (2014). Using alpha level of 0.05 (5%) and β level of 0.20 (20%) i.e. power = 80%; the estimated minimum required sample size (n) was 56 crowns per group giving a total of 112 crowns. To compensate for 20% drop-out rate, the minimum required sample size could be increased to a minimum of 134 Sample size determination was based upon the results of Kara NB and Yilmaz Y (2014). Using alpha level of 0.05 (5%) and β level of 0.20 (20%) i.e. power = 80%; the estimated minimum required sample size (n) was 56 crowns per group giving a total of 112 crowns. To compensate for 20% drop-out rate, the minimum required sample size could be increased to a minimum of 134 crowns.

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total of 112 crowns. To compensate for 20% drop-out rate, the minimum required sample size could be increased to a minimum of 134.

Study Subjects

Two hundred and forty vital mandibular primary molars in sixty medically free children (34 boys and 26 girls), with an age range between 4–6 years presented to the Department of Pediatric Dentistry, Faculty of Dentistry, Cairo University for general anaesthesia.

Inclusion criteria

For inclusion in the study, mandibular molars that required restoration on both sides met one of the following criteria:

- patients presented with deep carious lesions including the first and second primary molars bilaterally
- No evidence of any clinical pathology
- No mobility and had no tenderness to percussion
- A normal or non-resorbed interproximal bone level, in which the distance between the crest of interdental bone and cement–enamel junction was not greater than 2 mm on radiographic evaluation
- No more than one-third root resorption detected.

Exclusion criteria

Children who had one of the following were excluded from the study:

- Systemic disease
- An allergy to any drug, such as a local anaesthetic agent
- Extremely poor oral hygiene
- Periodontal disease,
- Malocclusion.

Pateints were treated under general anaesthesia. After local anaesthesia administrated, all caries was removed and coronal access was gained using a sterile No. 330 high speed bur with water spray to expose the pulp chamber. A sterile spoon excavator was used for coronal pulp amputation. Sterile cotton pellet moistened with distilled water was placed over the pulp stumps, and light pressure was applied for 5 minutes for obtaining haemostasis. If bleeding did not stop after 5 minutes, the molar was excluded from the study. Formocresol was applied (formocresol, Dentsply, Surrey, UK) using a sterile cotton pellet for 3–5 mins. After removal of the cotton pellet, a reinforced zinc oxide eugenol base covered the pulp stumps. After the completion of pulp therapy, molars were restored and divided into two equal groups:

Group (1) Stainless steel crowns (control): one hundred and twenty mandibular primary molars (first and second molars) in thirty patients (18 boys and 12 girls) bilaterally restored with stainless steel crowns (3M, ESPE, USA).

Reduction of the occlusal surface by about 1.5 mm using a flame shapeddiamond bur to produce uniform occlusal reduction. Using long, and tapered diamond bur, adhered marginally convergent to cut interproximal slices mesially and distally. The reduction should allow the probe to pass through the contact area. An appropriate size was chosen according to mesiodistal width of the prepared tooth and trail fit carried out before cementation. The crown should remain no more than 1 mm subgingivally. Contoured and trimmed SSCs were cemented.

Group (2) NuSmile Zirconia crowns: one hundred and twenty mandibular primary molars (first and second molars) in thirty patients (16 boys and 14 girls) bilaterally restored by Zirconia crowns (NuSmile ZR, Houston, TX, USA).

Suitable crown size cauld be identified using NuSmile Try-In Crowns and should always be selected before startingmolar reduction.Reduction of the occlusal surface next to the natural occlusal

profile by 1-1.5 mm. Interproximal contacts were opened. The proximal space should be enough to permit the chosen crown to fit passively. The molar should be trimmed down circumferentially 0.5-1.25 mm as needed with the use of tapered diamond burs. For reduction of the occlusal area, coarse football shaped diamond bur cauld be utilized.

Sub gingival reduction:

The anticipated edge should be polished to a feather-edge so that no undercuts or subgingival ridges stay roughly 1-2 mm subgingivally on every area. A slim, narrowed diamond bur should be utilized to prevent the breaking up of tissue during subgingival tooth modifications. Finally, elimination of line and point angles to allowall areasof the prepartion to be marginally rounded was done.

Clinical and radiographic evaluation were conducted for both groups at baseline, 3,6,9 and 12 months intervals utilizing Scoring system.

Evaluation of the gingival health by:

1. Gingival index (GI) (Machen et al,1980) [10]:

The GI was measured by passing an explorer tip gently within the sulcus mesial, distal, buccal, and lingual surface of each crowned molarit was scored on a scale of 0 to 3

0= no bleeding

1= only one bleeding point appearing some seconds after probing

2=bleeding points appearing immediately after probing

3=profuse bleeding appearing immediately after probing spreading towards the marginal gingiva

2. Oral hygiene index (Greene and vermillion,1964) [11]:

The OHI-S was estimated by running the side of an explorer over the buccal surface of the treated molars. Oral hygiene index = Debris index+ Calculus index

TABLE (1) Criteria for classifying debris

Scores	Criteria
0	No debris or stain present
1	Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered
2	Soft debris covering more than one third, but not more than two thirds, of the tooth surface.
3	Soft debris covering more than two thirds of the tooth surface.

TABLE (2) Criteria for classifying calculus

Scores	Criteria
0	No calculus present
1	Supragingival calculus covering not more than third of the exposed tooth surface.
2	Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both.
3	Supragingival calculus covering more than two third of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both.

Criteria of clinical success according to (*Sharaf* and *Farsi, 2004)* [9]:

The crowns were evaluated clinically according to the following criteria:

1. Length: the margin is at the gingival crest or is extended to the cemento-enamel junction.
2. Position: crown is not rotated.
3. Polish: no scratches or roughness.
4. Cement: no excess cement remains in the sulcus.

If all criteria fulfilled the crown is considered acceptable clinically, if not it is considered unacceptable.

Radiographic evaluation:

Utilizing periapical parallel technique crowned molars were evaluated radiographically at baseline, 3, 6, 9 and 12 months intervals. Standerdaized technique was achieved by film holder RinnXCP film holder and Kodak pediatric film size 0.

Criteria of radiographic success:

1. Quality of the crown is considered **adequate** when all the margins appear smooth and well adapted covering all dentin. Crowns are considered **inadequate** when crown margins appear too short or extended below the cemento-enamel junction or away from the tooth surface by a distance more than 1mm or when any defects in the crown are detected.

2. The interproximal bone level is considered normal or **non-resorbed** when the distance between the crest of the interdental bone and cemento-enamel junction is 2mm or less and bone is considered **resorbed** when the distance is more than 2mm.

Statistical Analysis

Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). Age data showed parametric distribution while GI and OHI scores were treated as non-parametric data.

Data were presented as mean, median, standard deviation (SD), minimum, maximum and 95% Confidence Interval (95% CI) values.

For parametric data; Student's t-test was used to compare between the two groups.

For non-parametric data, Mann-Whitney U test was used to compare between two groups. Friedman's test was used to study the changes by time in each group. Wilcoxon signed-rank test with Bonferroni's adjustment was used for pair-wise comparisons between the time periods when Friedman's test is significant.

Qualitative data were presented as frequencies (n) and percentages (%). Chi-square 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 Version 20 for Windows.

RESULTS

Demographic data

The mean ± standard deviation values of age were 4.8 ± 0.8 and 5.0 ± 0.8 years in SSC and Zirconia crown groups, respectively. There was no statistically significant difference between mean age values in the two groups (*P*-value = 0.417).

SSC group comprised 18/30 boys (60.0%) while Zirconia crown group comprised 16/30 boys (53.3%). There was no statistically significant difference between gender distribution in the two groups (*P*-value = 0.602).

Gingival Index (GI)

Descriptive statistics of GI scores in the different groups are presented in table (3).

There was no statistically significant difference between GI scores in the two groups at base line, after 3 as well as 6 months. After 9 as well as 12 months; SSC group showed statistically significantly higher mean GI score than Zirconia crown group.

As regards the changes by time in SSC group, there was no statistically significant change in mean GI score from base line to 3 months, 3 months to 6 months as well as from 6 months to 9 months. However, the mean GI score at 9 months showed

® IBM Corporation, NY, USA.
® SPSS, Inc., an IBM Company.

TABLE (3): Descriptive statistics of GI in the different groups

Group	Time	Mean	SD	Median	Minimum	Maximum	95% CI	
							Lower bound	Upper bound
SSC group	Base line	0.00	0.00	0.00	0.00	0.00	Not computed	
	3 months	0.05	0.22	0.00	0.00	1.00	0.00	0.08
	6 months	0.10	0.33	0.00	0.00	2.00	0.03	0.13
	9 months	0.34	0.59	0.00	0.00	2.00	0.20	0.44
	12 months	0.62	0.81	0.00	0.00	3.00	0.46	0.78
Zirconia group	Base line	0.00	0.00	0.00	0.00	0.00	Not computed	
	3 months	0.01	0.09	0.00	0.00	1.00	-0.01	0.03
	6 months	0.06	0.24	0.00	0.00	1.00	0.01	0.10
	9 months	0.18	0.42	0.00	0.00	2.00	0.06	0.21
	12 months	0.37	0.62	0.00	0.00	3.00	0.24	0.49

statistically significantly higher mean value than base line and 3 months scores. There was a statistically significant increase in mean GI scores from 9 months to 12 months. While for Zirconia crown group, there was no statistically significant change in mean GI scores from base line to 3 months, 3 months to 6 months as well as 6 months to 9 months. There was a statistically significant increase in mean GI scores from 9 months to 12 months table (4).

TABLE (4): The mean, standard deviation (SD) values and results of comparison between GI scores in the two groups and changes within each group

Time	SSC group		Zirconia group		*P*-value (Between groups)
	Mean	SD	Mean	SD	
Base line	0.00 ^{C}	0.00	0.00 ^{B}	0.00	1.000
3 months	0.05 ^{C}	0.22	0.01 ^{B}	0.09	0.056
6 months	0.10 ^{BC}	0.33	0.06 ^{B}	0.24	0.321
9 months	0.34 ^{B}	0.59	0.18 ^{B}	0.42	0.016*
12 months	0.62 ^{A}	0.81	0.37 ^{A}	0.62	0.014*
P-value (Within group)	<0.001*		<0.001*		

: Significant at P ≤ 0.05, Different superscripts in the same column are statistically significantly different

Oral Hygiene Index (OHI)

Descriptive statistics of OHI scores in the different groups are presented in table (5).

There was no statistically significant difference between OHI scores in the two groups at base line, after 3 as well as 6 months. After 9 as well as 12 months; St. St. crown group showed statistically significantly higher mean OHI score than Zirconia crown group.

As regards the changes by time in SSC group, there was no statistically significant change in mean OHI score from base line to 3 months, 3 months to 6 months as well as from 6 months to 9 months. However, the mean OHI score at 9 months showed statistically significantly higher mean value than base line and 3 months scores. There was a statistically significant increase in mean OHI scores from 9 months to 12 months. While for Zirconia crown group, there was no statistically significant change in mean OHI scores from base line to 3 months, 3 months to 6 months as well as 6 months to 9 months. There was a statistically significant increase in mean OHI scores from 9 months to 12 months table (6).

TABLE (5): Descriptive statistics of OHI in the different groups

Group	Time	Mean	SD	Median	Minimum	Maximum	95% CI	
							Lower bound	Upper bound
SSC group	Base line	0.00	0.00	0.00	0.00	0.00	Not computed	
	3 months	0.05	0.22	0.00	0.00	1.00	0.00	0.08
	6 months	0.10	0.33	0.00	0.00	2.00	0.03	0.13
	9 months	0.34	0.59	0.00	0.00	2.00	0.20	0.44
	12 months	0.63	0.81	0.00	0.00	3.00	0.47	0.79
Zirconia group	Base line	0.00	0.00	0.00	0.00	0.00	Not computed	
	3 months	0.01	0.09	0.00	0.00	1.00	-0.01	0.03
	6 months	0.06	0.24	0.00	0.00	1.00	0.01	0.10
	9 months	0.18	0.42	0.00	0.00	2.00	0.06	0.21
	12 months	0.41	0.65	0.00	0.00	3.00	0.29	0.54

TABLE (6): The mean, standard deviation (SD) values and results of comparison between OHI scores in the two groups and changes within each group

Time	SSC group		Zirconia group		*P*-value (Between groups)
	Mean	SD	Mean	SD	
Base line	0.00 ^{C}	0.00	0.00 ^{B}	0.00	1.000
3 months	0.05 ^{C}	0.22	0.01 ^{B}	0.09	0.056
6 months	0.10 ^{BC}	0.33	0.06 ^{B}	0.24	0.321
9 months	0.34 ^{B}	0.59	0.18 ^{B}	0.42	0.016*
12 months	0.63 ^{A}	0.81	0.41 ^{A}	0.65	0.045*
P-value (Within group)	<0.001*		<0.001*		

: Significant at P ≤ 0.05, Different superscripts in the same column are statistically significantly different

Criteria of clinical success

At base line, after 3, 6 as well as 9 months; all crowns showed acceptable clinical criteria.

After 12 months, 75.8% of the SSC group showed acceptable clinical criteria compared to 80.8% of the Zirconia crowns. The drop out were 5 cases in SSC group comprising 20 molars and 4 cases in Zirconia group comprising 16 molars. However, there was no statistically significant difference between the two groups. table (7)

Criteria of radiographic success

At base line, after 3. 6 as well as 9 months; all crowns showed adequate radiographic criteria.

TABLE (7): The frequencies, percentages and results of comparison between criteria of clinical success in the two groups

Time	Criteria	SSC group		Zirconia group		*P*-value (Between groups)
		n	%	n	%	
Base line	Acceptable	120	100.0	120	100.0	NC
3 months	Acceptable	120	100.0	120	100.0	NC
6 months	Acceptable	120	100.0	120	100.0	NC
9 months	Acceptable	120	100.0	120	100.0	NC
12 months	Acceptable	91	75.8	97	80.8	0.642
	Unacceptable	9	7.5	7	5.8	
	Drop out	20	16.7	16	13.3	

: Significant at P ≤ 0.05, NC: Not computed because the variable is constant

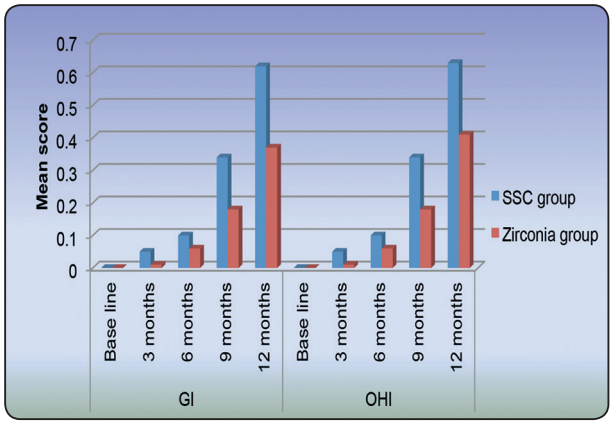


Fig. (1): Mean GI and OHI scores in the two groups

After 12 months, 75.8% of the SSC group showed adequate radiographic criteria compared to 80.8% of the Zirconia crowns. The drop out were 5 cases in SSC group comprising 20 molars and 4 cases in Zirconia group comprising 16 molars. However, there was no statistically significant difference between the two groups table (8).

Assessment of inter-proximal bone level

At base line, after 3. 6 as well as 9 months; all crowns showed no inter-proximal bone resorption.

After 12 months, 9.2% of the SSC group showed inter-proximal bone resorption compared to 7.5% of the Zirconia crowns. The drop out were 5 cases in SSC group comprising 20 molars and 4 cases in Zirconia group comprising 16 molars. However, there was no statistically significant difference between the two groups.

TABLE (8): The frequencies, percentages and results of comparison between criteria of radiographic success in the two groups

Time	Criteria	SSC group		Zirconia group		*P*-value (Between groups)
		n	%	n	%	
Base line	Adequate	120	100.0	120	100.0	NC
3 months	Adequate	120	100.0	120	100.0	NC
6 months	Adequate	120	100.0	120	100.0	NC
9 months	Adequate	120	100.0	120	100.0	NC
12 months	Adequate	91	75.8	97	80.8	0.642
	Inadequate	9	7.5	7	5.8	
	Drop out	20	16.7	16	13.3	

: Significant at P ≤ 0.05, NC: Not computed because the variable is constant

TABLE (9): The frequencies, percentages and results of comparison between inter-proximal bone level in the two groups

Time	Bone level	SSC group		Zirconia group		*P*-value (Between groups)
		n	%	n	%	
Base line	No resorption	120	100.0	120	100.0	NC
3 months	No resorption	120	100.0	120	100.0	NC
6 months	No resorption	120	100.0	120	100.0	NC
9 months	No resorption	120	100.0	120	100.0	NC
12 months	No resorption	89	74.2	95	79.2	0.657
	Resorption	11	9.2	9	7.5	
	Drop out	20	16.7	16	13.3	

: Significant at P ≤ 0.05, NC: Not computed because the variable is constant

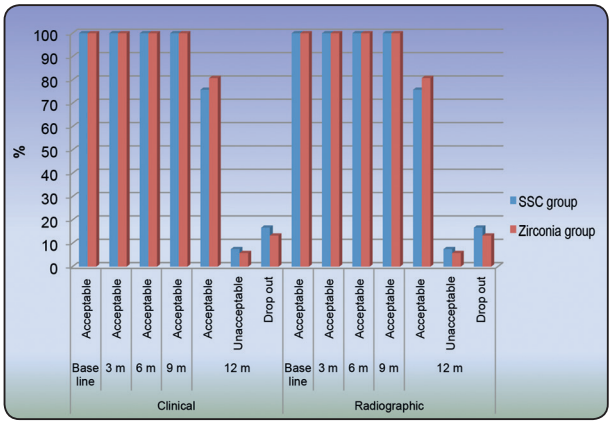


Fig. (2): Clinical and radiographic success in the two groups

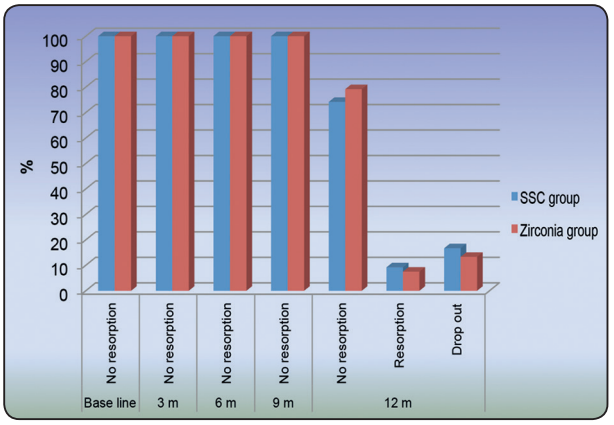
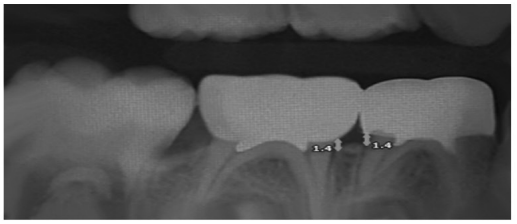
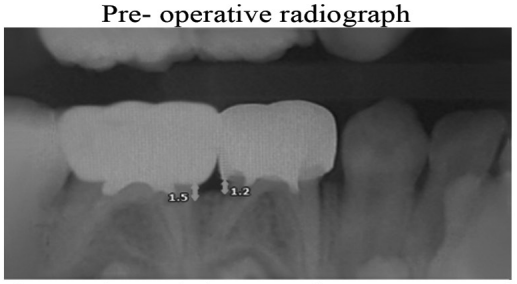


Fig. (3): Inter-proximal bone levels in the two groups

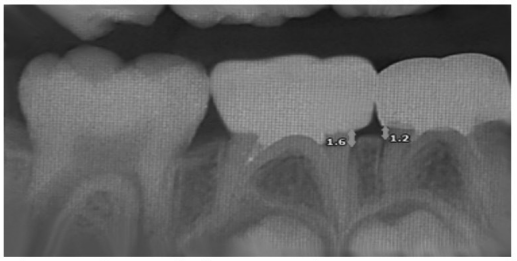
Pre- operative radiograph



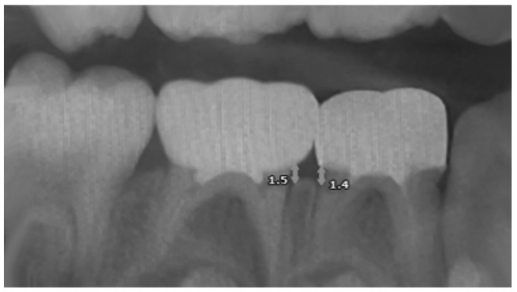
At baseline stainless steel crowns on D&E



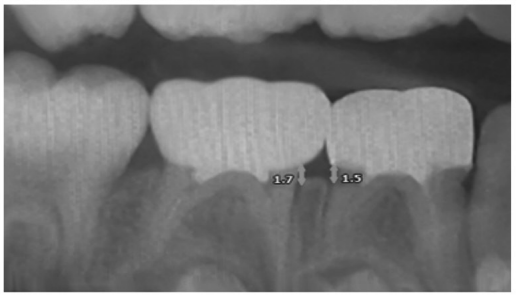
At 3 months stainless steel crowns on D&E



At 6 months stainless steel crowns on D&E



At 9 months stainless steel crowns on D&E



At 12 months stainless steel crowns on D&E

Fig (4) Stainless steel crowns radiographs at different time intervals

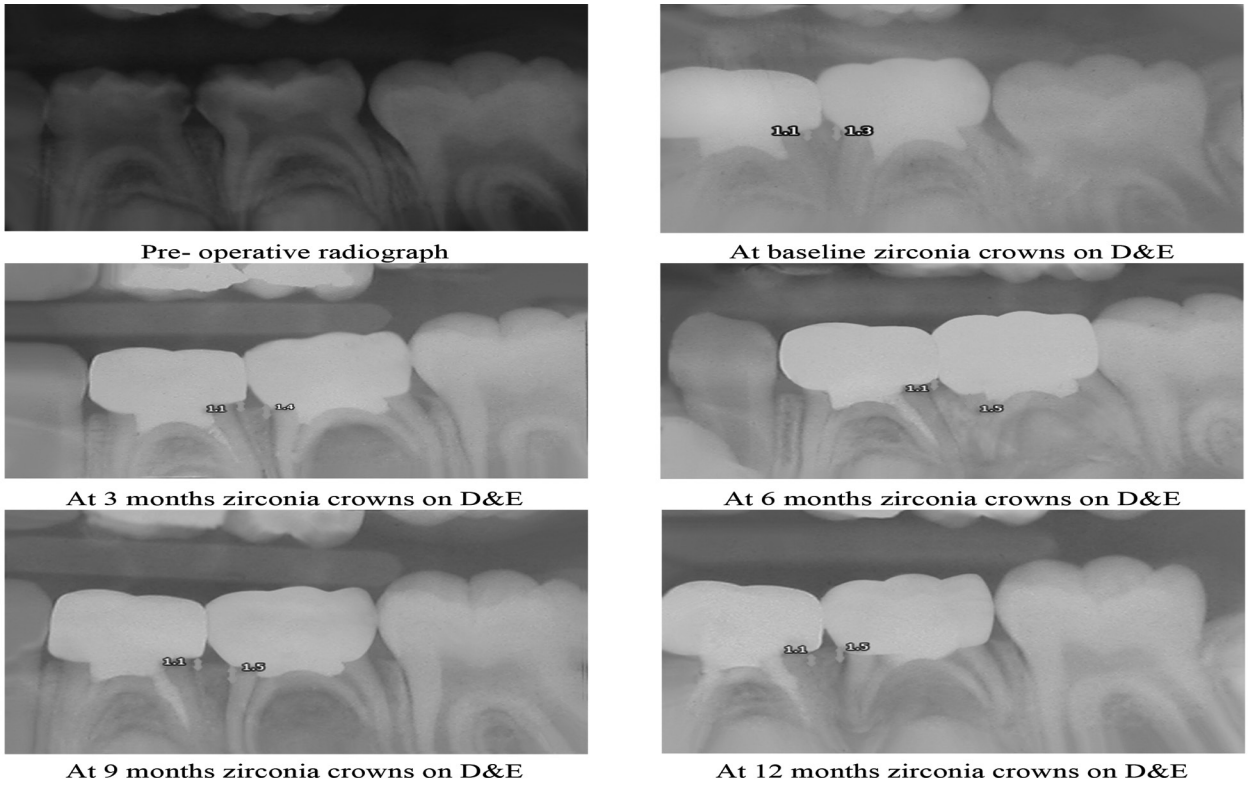


Fig (5) Zirconia crowns radiographs at different time intervals

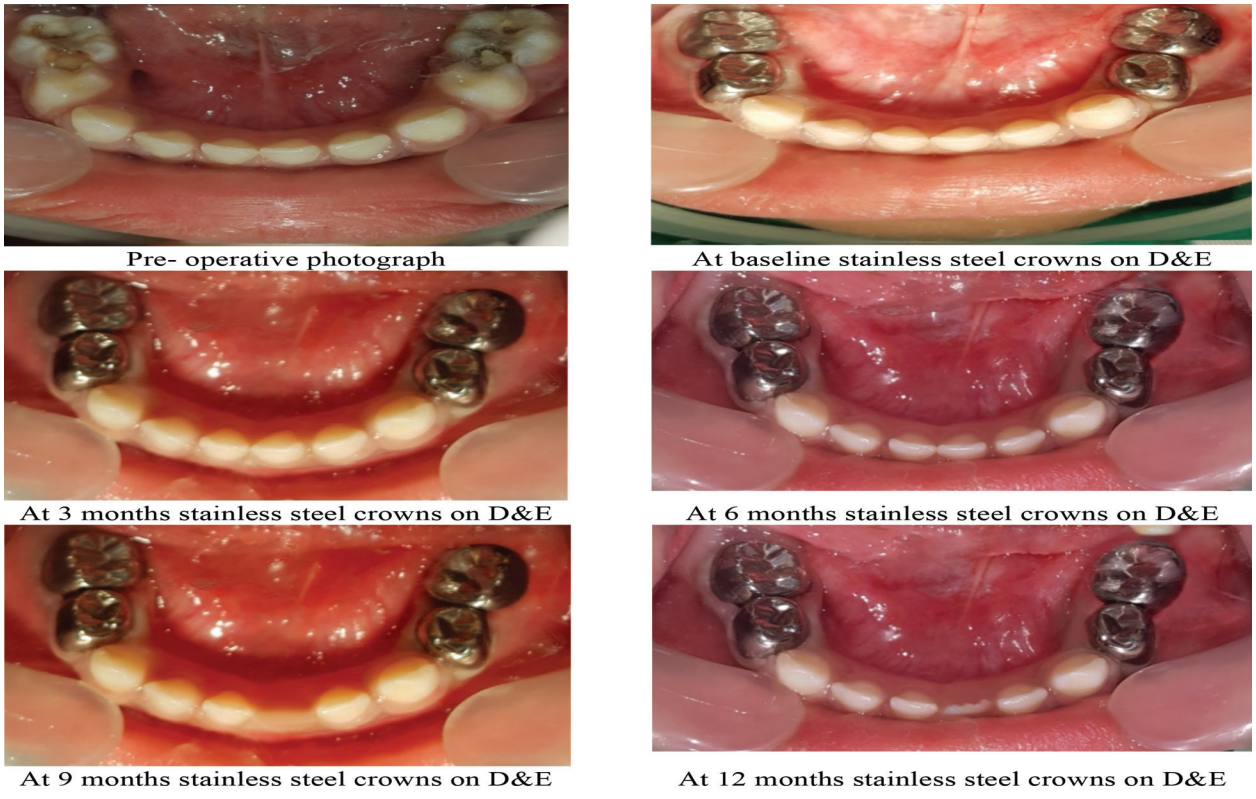


Fig (6) Stainless steel crowns photographs at different time intervals

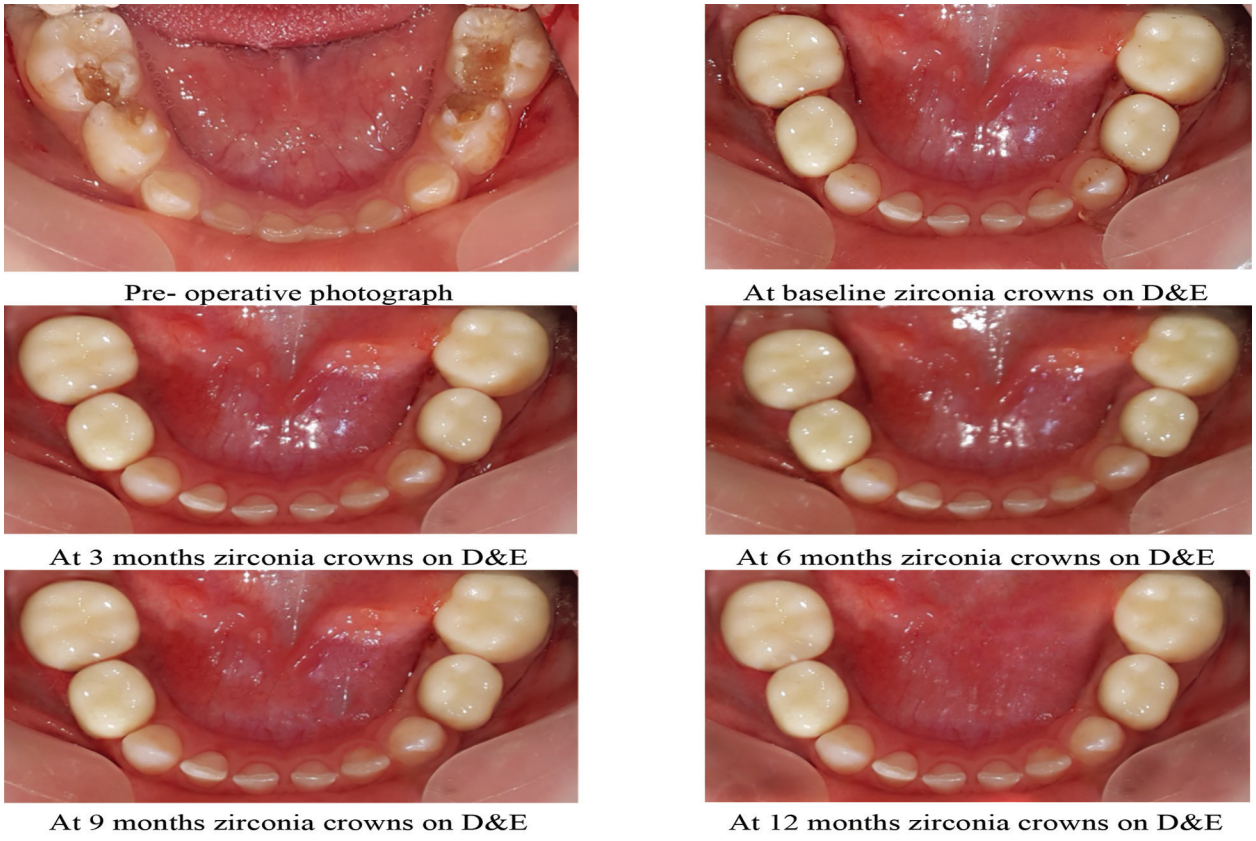


Fig (7) Zirconia crowns photographs at different time intervals

DISCUSSION:

Clinical trials investigating the preformed metal crowns as a final restoration for severely mutilated primary teeth are quite insufficient. Despite their disadvantages such as poor esthetics, previous preparation of the tooth and requirement for good cooperative behaviour, these disadvantages diminish against their advantages [12]. Mechanical durability, protection of the remaining tooth structure after pulp therapy and service longevity compared to filling materials as treatment modality for multisurface caries are advantages provided by preformed metal crowns [13,14].

Recently, demands for esthetic restorations increased by parents as a treatment option for their children. Zirconia ready-made esthetic crowns appeared in the market. Zirconia is a crystalline dioxide of zirconium that possesses mechanical properties similar to metals and superior esthetics comparable to that of teeth [15].

In the present study, no statistical significant difference between GI scores in the two groups at base line, 3 as well as 6 months was shown. At 9 and 12 months; SSC group showed statistically significantly higher mean GI score than Zirconia crown group. This could be explained that Zirconia material is highly biocompatible and possesses a polished and smooth surface leading to less plaque accumulation and hence less gingival irritation and bleeding [16,17].

There was no statistically significant difference between OHI scores in the two groups at base

line, after 3 as well as 6 months. After 9 as well as 12 months; SSC group showed statistically significantly higher mean OHI score than Zirconia crown group. This could be attributed to the highly polished smooth surfaces of Zirconia crowns which led to decrease plaque build-up and subsequent gingival irritation [16,17]. In another study **Walia et al.,** reported that Zirconia crowns on primary anterior teeth showed favorable gingival health [18].

On the other hand, **Maclean et al**; considered shaping of metal borders improperly and adhesive residues in the sulcus in a case of SSCs major causes of irritation to the gingiva, resulting in further plaque accumulations and subsequent gingival inflammation [19].

Despite the Oral hygiene instructions recommended to the patients and their parents. However, plaque accumulations were noticed in follow-up appointments with various degrees between the two groups. In the Zirconia crowns group,less plaque accumulations during the follow-up periods and also improved marginal adaptation to the restored molars were noticed.This reduced the chance of cement washout that may leed to cementation failure or subsequent decay . On the other hand, a statistically significant difference between the two groups presenting higher values of plaque index in SSCs group[19].

In the current study, at base line, after 3, 6 and 9 months; all crowns showed acceptable criteria of clinical success. After 12 months, 75.8% of the SSC group showed acceptable criteria of clinical success compared to 80.8% of the Zirconia crowns.

On the other hand, ***Atieh*** conducted a2-year randomized control trial investigating the restoration of primary teeth. The survival rate for restored teeth with performed metal crowns was 95%. While, no sufficient published data yet available about zirconia crowns success for primary molar teeth except for the studies done by the product company (NuSmile ZR, Houston, TX, USA) [20].

After the 12 months follow-up, another study reported success rate of both crown types tested in this study (Zirconia and SSCs for posterior teeth) showed 100% success rate represented as all crowns appear healthy with no chips, cracks, or fractures till the end of study [15].

At 12 months evaluation interval, 75.8% of the SSC group showed adequate radiographic criteria compared to 80.8% of the Zirconia crowns. The drop out were 5 cases in SSC group comprising 20 molars and 4 cases in Zirconia group comprising 16 molars. However, there was no statistically significant difference between the two groups.

The findings of this study showed that crowns that judged as non-satisfactory radiographically were associated with interproximal bone resorption which agrees with ***Sharaf*** and ***Farsi*** who confirmed that there was a direct correlation between stainless steel crowns and interproximal bone resorption. In addition, ***Bimstein et al***, stated that gingival inflammation and abnormal alveolar bone resorption have been described adjacent to extensive proximal caries and to stainless steel crowns in the primary dentition, especially when inadequate crown crimp, length, contour, position and cement remaining in the gingival sulcus were observed [9,21].

CONCLUSIONS

Regarding to the results of the current study; Zirconia crowns showed favorable gingival health in comparison with SSC group. Furthermore, Zirconia group proved acceptable clinical and radiographic success compared to stainless steel crowns with an advantage of superior esthetics.

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