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Clinical performance of three types of crowns as esthetic alternatives to stainless steel crowns for primary molars

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Aim: Esthetic dentistry is currently an essential component of dental practice. This study was conducted to compare clinical performance of three types of crowns as esthetic alternatives to stainless steel crowns for primary molars.
Materials and methods: Eighty lower second primary molars of children aged 4-8 years old were allocated into 4 groups: Group 1 (n = 20): received stainless steel crowns; group 2 (n = 20): received the prefabricated commercially available zirconia crowns (NuSmile®); group 3 (n = 20): received the locally manufactured zirconia crowns created via CAD/CAM system; and group 4 (n = 20): received the locally manufactured hybrid ceramic (Vita Enamic®) crowns created via CAD/CAM system. All crowns were cemented using resin modified glass ionomer cement. The Clinical Performance of four crowns in terms of gingival health (gingival index (GI) and plaque index (PI)), crown integrity and color stability were followed-up at 3, 6, 9 and 12 months.
Results: There was a significant difference as zirconia crowns had better gingival health and color stability than stainless steel crowns and hybrid crowns. There was no significant difference between NZCs and CCZCs regarding gingival health, crown integrity and color stability.
Conclusion: The SSCs had the best crown integrity while zirconia crowns had the best gingival health and color. The prefabricated CCZCs offers a new satisfactory cost effective esthetic option.

Keywords: Primary molar; NuSmile; CAD CAM; Zirconia; Hybrid; Stainless steel; Gingival health; Crown integrity; Color stability.

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Introduction

Crowns are the best definitive restorations for primary teeth due to their high sealing abilities.[1] Stainless steel crowns (SSCs) have many advantages as they are functional, durable, and cost effective but they are the least attractive to the child or their parents due to their silver metal color.[2] The field of dentistry has shown a rapid development especially in the area of esthetic dentistry. This esthetic approach seems to give the child a sense of self-esteem, health and safety. Zirconia crowns are highly esthetic, biocompatible, durable, and functional.[3, 4] However, the high cost and abrasiveness of zirconia can be considered significant drawbacks.[5-7] The commercially available prefabricated zirconia crowns are such as Cheng Crowns®, EZ Pedo®, Kinder®, and NuSmile®.

At present, the most active area in the dental industry is the development of new computer-aided design/ computer-aided manufacturing (CAD/CAM) materials.[8, 9] The locally manufactured zirconia crowns via CAD/CAM technology offer a satisfactory, cost-effective esthetic restorative option.[10] Ceramics account for the majority of CAD/CAM materials, but significant advancements have been made in CAD/CAM hybrid ceramic materials, which combine the advantages of ceramics and resin-based materials. The hybrid materials have many advantages as their modulus of elasticity is very similar to that of dentin, and they can be easily fabricated and repaired than ceramics.[11] However, they are not as good as ceramics in other terms like mechanical properties, biocompatibility, and material loss.[12, 13]

Esthetic problems in childhood have a significant effect on psychological development and social interaction with peers.[1] No enough researches had been conducted in the field of CAD/CAM crowns for primary molars compared to the traditional stainless steel crowns. This research focused on CAD/CAM technology offering a new satisfactory cost effective esthetic option as the locally manufactured zirconia crown created via CAD/CAM system and another esthetic option as the locally manufactured hybrid ceramic crown created via CAD/CAM system which combines the advantages of ceramics and resin-based materials.

The purpose of this study was to assess the clinical performance of three types of crowns as esthetic alternatives to stainless steel crown for primary molars: the prefabricated commercially available zirconia crowns (NuSmile®) (NZC), the locally manufactured zirconia crowns created via CAD/CAM technology (CCZC), and locally manufactured hybrid ceramic crowns created via CAD/CAM technology (CCHC).

Materials and methods

Patients' selection

This study was a randomized controlled clinical trial and the protocol followed the recommendations of the Consort Statement. Ethical approval for all study protocol steps was obtained from Mansoura Research Ethics Committee, Faculty of Dentistry, Mansoura University, Mansoura, Egypt (M01010222). Written informed consents were signed by the parents prior to examination and treatment of their children. ClinicalTrials.gov Identifier: NCT06456879. Eighty children were selected from Faculty of Dentistry (the Pediatric Dental Clinic), Mansoura University.

Randomization

Simple randomization was carried out via the randomization formula in Excel (Microsoft, Wash, USA). Printing random numbers on papers then folding them, and all papers were collected in a box to ensure concealment of allocation. The child was allowed to choose a paper from the box then allocated to the matching group. Eighty lower

second primary molars were allocated randomly into 4 groups: Group 1 (n = 20): receive 3M™ ESPE™ SSCs for Primary Molars, group 2 (n = 20): receive the commercially available prefabricated zirconia crowns (NuSmile®) (NZC), group 3 (n = 20): receive the locally manufactured zirconia crowns using CAD/CAM technology (CCZC), and group 4 (n = 20): receive the locally manufactured hybrid ceramic crowns using CAD/CAM technology (CCHC).

Inclusion criteria

1) Children between 4-8 years old.
2) Definitely positive or positive behavior according to Frankl behavior rating scale.
3) The lower second primary molar with one or more indications for crown restoration.
4) The child did not have occlusal problems or periodontal diseases and did not take medications that lead to symptoms of them.

Materials

1. A kit of 3M™ ESPE™ Stainless Steel Primary Molar Crowns.
2. The prefabricated commercially available zirconia crowns (NuSmile®).
3. The locally manufactured zirconia crowns created via (CAD/CAM) system (CCZC).
4. The locally manufactured hybrid ceramic crowns created via (CAD/CAM) system (CCHC).
5. Resin modified Glass ionomer cement.

Machine

CAD-CAM milling machine (Amann Girrbach Ceramill Motion 2).

Methods

The Laboratory work of CAD/CAM crowns: A dental technical lab was used to design CAD/CAM crowns. The milling of zirconia crowns was done using dry processing mode, while hybrid ceramic crowns were milled using wet processing mode in the CAD-CAM milling machine (Amann Girrbach Ceramill Motion 2) to produce different sizes of prefabricated crowns for the second primary molars.

NuSmile® crowns were used to design the locally manufactured CAD/CAM crowns to produce different crown sizes. Using an Open Technologies Optical 3D Scanner, the inner and outer faces of the NuSmile crown were scanned after being sprayed with the digital scanner's spray marker. (4) The CAD CAM crowns were designed with the same inner and outer surface with the same thickness of NuSmile crowns.

For fabrication, the CAM device received the STL file. Each milled crown was separated from the CAD/CAM blocks then polished. This procedure was repeated for every crown size. Finally, crowns were encoded in various sizes, then collected in a special box with separators to produce a complete set of locally manufactured prefabricated crowns using CAD/CAM technology.

The Clinical work: To ensure compliance of the primary molar with the study criteria, clinical and radiographic examinations were done. Both the child and parents received oral health instructions before the local anesthetic was administered.

1) Stainless steel crowns:

A flame-shaped diamond was used to reduce the occlusal surface uniformly by about 1.5 mm. A long and tapered diamond bur was used for the proximal reduction bur to allow the probe to pass through the contact area. The suitable size of the crown was selected according to the mesio-distal dimension of the prepared tooth. Before cementation, a trial fit was carried out as the crown should not extend subgingivally more than 1 mm.[14]

2) Zirconia and hybrid ceramic crowns:

Reduction of the occlusal surface by 1–2 mm using a flame bur, followed by opening the interproximal areas. Reduction of the crown dimensions by 0.5–1.25 mm using a tapered diamond bur making the contour of the prepared tooth consistent with the natural contour. A pointed tapered diamond bur was used to make a 1–2 mm subgingival feather-edge preparation.

The selected crown was tested for appropriate fit before the final cementation. The prepared tooth should be cleaned from blood, saliva and preparation remnants to be ready for cementation.[10]

The appropriate size of the crown was selected (figure 1). Then, it was cleaned, filled with cement and applied passively on the tooth till it was fully seated (passive fit). This prevents the formation of micro-cracks in the structure of zirconia when a crown is forced into place. A probe and floss were used to remove any excess cement. Resin modified Glass ionomer cement was used for the cementation of all crowns.

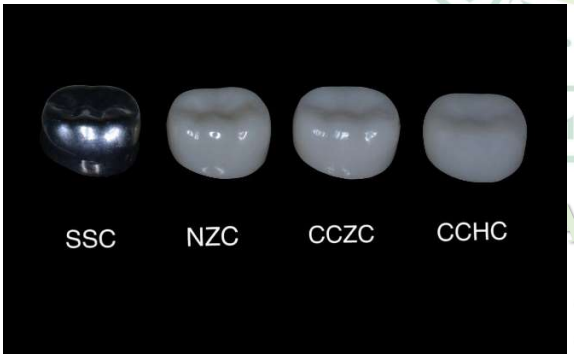

Figure 1: The four types of crowns from the buccal aspect.

Clinical evaluation

Evaluation criteria concerning the clinical performance:

- Gingival health (gingival index and plaque index).
- Crown integrity.
- Color stability.

All crowns were evaluated at baseline and at 3rd, 6th, 9th and 12th months.

The gingival health around the crowned teeth was recorded using the following parameters:

I. The Gingival Index (GI)[15] was measured by the William Gingival Probe with a blunt-ended instrument gently placed within the gingival gutter around each tooth to be crowned/previously crowned, and the values will be as follows:

0 = normal gingiva
1 = mild inflammation: a slight change in color, slight edema, no bleeding on probing
2 = moderate inflammation: redness, edema, and glazing, or bleeding on probing
3 =severe inflammation: marked redness and edema, a tendency toward spontaneous bleeding, ulceration.

II. Plaque Index (PI)[15] was measured by passing the gingival probe around each tooth to be crowned/previously crowned, and the values will be as follows:

0 = no plaque
1= film at the gingival margin and adjacent tooth
2 = moderate accumulation of plaque
3 = abundance of plaque.

The plaque was measured on the four surfaces of the tooth and then divided by four.

Crown integrity[16] was measured as follows:

0 = intact.
1 = crack present.
2 = fracture present.
3 = crown lost.

Color stability[17] was measured as follows:

0 = Unchanged.
1 = Minor deviation from original.
2 = Unacceptable discoloration.

Color stability was assessed using one crown from the original kit as a standard

compared to each individual restoration for color comparison.

Statistical analysis

Chi-Square and Monte Carlo tests were used to compare qualitative data between groups while Cochrane test was used to compare more than 2 follow up readings within same group for qualitative data with Pairwise comparison by MCNemar and Stuart Maxwell test.

Results

Clinical Evaluation

1. **Gingival health (gingival and plaque index)**

gingival index:

The results of gingival index of the four groups were revealed in table (1). **Gingival index after 3 months illustrates:** NZCs, CCZCs and CCHCs had higher gingival index scores than SSCs. No statistically significant difference between studied groups (overall p =0.07), post Hoc pairwise comparison demonstrates statistically significant difference between the following groups; SSCs & NZCs group (p=0.04), between SSCs & CCHCs group (p=0.02).

Gingival index after 6, 9 and 12 months illustrates: SSCs and CCHCs had higher scores of gingival index than zirconia crowns. A statistically significant difference between studied groups, post Hoc pairwise comparison demonstrates statistically significant difference between the following groups; SSCs & NZCs group, between SSCs & CCZCs group, between CCHCs & NZCs group and between CCHCs.

plaque index:

Plaque index after 3, 6, 9 and 12 months illustrates:

The results of gingival index of the four groups were revealed in table (2). SSCs and CCHCs had higher scores of plaque index than zirconia crowns. A statistically significant difference between studied groups (overall p =0.001) , post Hoc pairwise comparison demonstrates statistically significant difference between the following groups ; SSCS & NZCS group, between SSCS & CCZCS group, between NZCS and CCHCS group and between CCZCS and CCHCS group.

2. **Crown integrity**

Crown integrity at baseline illustrates: All cases studied in 4 groups demonstrates score 0.

Crown integrity after 3 months illustrates: All cases studied in 4 groups demonstrates score 0.

Crown integrity after 6 months illustrates: 1 CCZC and 1 CCHC had fractured. No statistically significant difference between studied groups (overall p =0.562).

Crown integrity after 9 months illustrates: 1 CCHC had fractured, and 2 CCHCs and 1 NZC had lost. No statistically significant difference between studied groups (overall p =0.301). Post Hoc pairwise comparison demonstrates statistically significant difference between the following groups; difference between SSCS and CCHCS group (p=0.03) and difference between CCZCS and CCHCS group (p=0.036).

Crown integrity after 12 months illustrates: (figure 2) 1 NZC and 1 CCZC had lost. No statistically significant difference between studied groups (overall p =0.594).

3. **Color stability:**

SSCs and CCHCs had a statistically significant increase in color stability score during follow up with overall p value <0.001. At 1 year, 100% of NZCs and CCZCs had score 0, while 100% of SSCs and 93.8 CCHCs had sore 1.

Table (1): Comparison of gingival index change during follow up between studied groups.

	Time of assessment	Score	SSCS group	NZCS group	CCZCS group	CCHCS Group	Test of significance	Within group significance#
			N=20	N=20	N=20	N=20		
Gingival index	Baseline	0 1 2	12(60.0) 7(35.0) 1(5.0)	10(50.0) 10(50.0) 0	11(55.0) 7(35.0) 2(10.0)	12(60.0) 7(35.0) 1(5.0)	χ^{2MC}=3.12 P=0.794	P1=0.795 P2=0.603 P3=1.0 P4=0.795 P5=0.795 P6=0.603
			0.45±0.60	0.50±0.51	0.55±0.68	0.45±0.61		
	After 3 months	0 1 2	14(70.0) 6(30.0) 0	7(35.0) 13(65.0) 0	9(45.0) 11(55.0) 0	8(40.0) 10(50.0) 2(10.0)	χ^{2MC}=11.65 P=0.07	P1=0.043* P2=0.145 P3=0.021* P4=0.558 P5=0.769 P6=0.380
			0.30±0.47	0.65±0.48	0.55±0.51	0.70±0.66		
	After6 months	0 1 2 3	6(30) 12(60) 2(10) 0	16(80) 4(20) 0 0	13(65) 7(35) 0 0	5(25) 11(55) 3(15) 1(5)	χ^{2MC}=21.82 P=0.009*	P1=0.002* P2=0.019* P3=0.292 P4=0.428 P5=0.001* P6=0.001*
			0.80±0.61	0.20±0.41	0.35±0.48	1.0±0.78		
	After 9 months	0 1 2 3	N=20 3(15) 9(45) 7(35) 1(5)	N=19 15(78.9) 4(21.1) 0 0	N=19 13(68.4) 6(31.6) 0 0	N=17 0 12(70.6) 5(29.4) 0	χ^{2MC}=41.42 P=0.001*	P1=0.001* P2=0.001* P3=0.975 P4=0.570 P5=0.001* P6=0.001*
			1.30±0.80	0.21±0.41	0.32±0.47	1.29±0.47		
	After 12 months	0 1 2 3	N=20 2(10) 7(35) 9(45) 2(10)	N=19 13(68.4) 6(31.6) 0 0	N=18 10(55.6) 8(44.4) 0 0	N=16 0 6(37.5) 10(62.5) 0	χ^{2MC}=44.09 P=0.001*	P1=0.001* P2=0.001* P3=0.713 P4=0.520 P5=0.001* P6=0.001*
			1.55±0.82	0.32±0.47	0.44±0.51	1.62±0.50		
Cochrane test , p value			χ^2=45.52 P<0.001*	χ^2=19.75 P<0.001*	χ^2=2.14 P=0.710	χ^2=34.46 P<0.001*		

Table (2): Comparison of Plaque index change during follow up between studied groups.

	Time of assessment	Score	SSCs group	NZCs group	CCZCs group	CCHCs Group	Test of significance	Within group significance
			N=20	N=20	N=20	N=20		
Plaque index	Baseline	0 1 2	4(20) 15(75) 1(5)	0 17(85) 3(15)	2(10) 16(80) 2(10)	2(10) 16(80) 2(10)	χ^{2MC}=5.13 P=0.528	P1=0.037* P2=0.291 P3=0.291 P4=0.291 P5=0.291 P6=1.0
			0.85±0.48	1.15±0.36	1.0±0.459	1.0±0.459		
	After 3 months	0 1 2	4(20) 16(80) 0	18(90) 2(10) 0	16(80) 4(20) 0	2(10) 17(85) 1(5)	χ^{2MC}=41.94 P=0.001*	P1=0.001* P2=0.001* P3=0.219 P4=0.412 P5=0.001* P6=0.001*
			0.80±0.41	0.10±0.308	0.20±0.410	0.95±0.394		
	After6 months	0 1 2 3	5(25) 9(45) 5(25) 1(5)	16(80) 4(20) 0 0	15(75) 5(25) 0 0	0 10(50) 9(45) 1(5)	χ^{2MC}=42.22 P=0.001*	P1=0.001* P2=0.001* P3=0.02* P4=0.794 P5=0.001* P6=0.001*
			1.10±0.852	0.20±0.410	0.25±0.444	0.95±0.394		
	After 9 months	0 1 2 3	N=20 3(15) 5(25) 9(45) 3(15)	N=19 12(63.2) 7(36.8) 0 0	N=19 10(52.6) 9(47.4) 0 0	N=17 0 2(11.8) 15(88.2) 0	χ^{2MC}=57.29 P=0.001*	P1=0.001* P2=0.001* P3=0.175 P4=0.605 P5=0.001* P6=0.001*
			1.60±0.94	0.37±0.496	0.47±0.513	1.88±0.332		
	After 12 months	0 1 2 3	N=20 1(5) 4(20) 10(50) 5(25)	N=19 7(36.8) 12(63.2) 0 0	N=18 5(27.8) 13(72.2) 0 0	N=16 0 2(12.5) 14(87.5) 0	χ^{2MC}=62.71 P=0.001*	P1=0.001* P2=0.001* P3=0.698 P4=0.633 P5=0.001* P6=0.001*
			1.95±0.63	0.496±0.72	0.461±0.109	1.88±0.342		
Cochrane test , p value			χ^2=49.66 P<0.001*	χ^2=47.80 P<0.001*	χ^2=36.12 P=0.710	χ^2=42.21 P<0.001*		

Table (3): Comparison of Crown integrity change during follow up between studied groups.

	Time of assessment	Score	SSCs group	NZCs group	CCZCs group	CCHCs Group	Test of significance	Within group significance
			N=20	N=20	N=20	N=20		
Crown integrity	Baseline	0	20(100)	20(100)	20(100)	20(100)	P=1.0	
	After 3 months	0	20(100)	20(100)	20(100)	20(100)	P=1.0	
	After6 months	0 2	20(100) 0	20(100) 0	19(95) 1(5)	19(95) 1(5)	χ^{2MC}=2.05 P=0.562	P1=1.0 P2=0.320 P3=0.320 P4=0.320 P5=0.320 P6=1.0
	After 9 months	0 2 3	N=20 20(100) 0 0	N=20 19(95) 0 1(5.0)	N=19 19(100) 0 0	N=19 16(84.2) 1(5.3) 2(10.5)	χ^{2MC}=7.22 P=0.301	P1=0.436 P2=1.0 P3=0.03* P4=0.442 P5=0.167 P6=0.036*
	After 12 months	0 3	N=20 20(100) 0	N=19 19(95) 1(5)	N=19 18(94.7) 1(5.3)	N=16 16(100) 0	χ^{2MC}=1.89 P=0.594	P1=0.337 P2=0.318 P3=1.0 P4=0.960 P5=0.365 P6=0.346
Cochrane test , p value				p=1.0	χ^2 =4.0 P=0.406	χ^2 =4 0 P=0.406		

Table (4): Comparison of Color stability change during follow up between studied groups.

	Time of assessment	Score	SSCs group	NZCs group	CCZCs group	CCHCs Group	Test of significance	Win group significance
			N=20	N=20	N=20	N=20		
Color stability	Baseline	0	20(100)	20(100)	20(100)	20(100)	P=1.0	
	After 3 months	0 1	18(90) 2(10)	20(100) 0	20(100) 0	18(90) 2(10)	χ^{2MC}=4.21 P=0.240	P1=0.150 P2=0.150 P3=1.0 P4=1.0 P5=0.150 P6=0.150
	After6 months	0 1 2	14(70) 6(30) 0	20(100) 0 0	20(100) 0 0	12(60) 7(35) 1(5.0)	χ^{2MC}=19.25 P=0.004*	P1=0.015* P2=0.015* P3=0.219 P4=1.0 P5=0.001* P6=0.001*
	After 9 months	0 1	N=20 5(25) 15(75)	N=19 19(100) 0	N=19 19(100) 0	N=17 6(35.3) 11(64.7)	χ^{2MC}=41.30 P=0.001*	P1=0.001* P2=0.001* P3=0.344 P4=1.0 P5=0.001* P6=0.001*
	After 12 months	0 1	N=20 0 20(100)	N=19 19(100) 0	N=18 18(100) 0	N=16 1(6.3) 15(93.8)	χ^{2MC}=69.24 P=0.001*	P1=0.001* P2=0.001* P3=0.114 P4=1.0 P5=0.001* P6=0.001*
Cochrane test , p value			P<0.001*	P=1.0	P=1.0	P<0.001*		

Figure 2: The clinical performance of four types of crowns at 12 months follow up

Discussion

The importance of primary teeth should not be overlooked since they have a high susceptibility to caries and healthy teeth in childhood have an important factor in the eruption of healthy permanent teeth.[18] The use of crowns is especially recommended for teeth after pulp therapy procedures and extensive decay damage. Until now, SSCs have been the restoration of choice for severely decayed primary teeth, but the silver color makes them undesirable for parents and their children.[2] To overcome the poor esthetics, new materials were developed like zirconia and hybrid ceramics. At present, the development of new Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) materials is the most active field in dental industries.

The effect of the crown on the gingival health is one of the important parameters to assess. The placement of a crown in the oral cavity generates a new niche for microorganisms adhesion which plays an important role in determining the success of the restored tooth in the long term as it affects secondary caries development on the cemented tooth.[19] In evaluation of gingival health, all the esthetic crowns showed mild gingival inflammation at 3rd month follow-up, while SSCs showed better gingival response. This can be justified as the preparation of the esthetic crowns is traumatic and painful to the child, so patient would have to avoid touching that area even with the toothbrush for first few weeks following its placement.[20]

By the end of the 12 months follow up, the CCCHCs and SSCs have higher scores of gingival and plaque index than zirconia crowns. The gingival health around zirconia crowns was better than stainless steel crowns which came in accordance with many studies.[3, 21-23] This is in contrary with a study done by Agrawal et al.[20] who stated that SSCs performed better in terms of gingival response and plaque accumulation than zirconia crowns. The best gingival health of zirconia crowns is due to many factors including the great biocompatibility of zirconia,[21] the superior hardness of the surface which makes zirconia crowns resistant to scratches and zirconia have a shiny, smooth polished surface. Also, the low surface energy of zirconia crowns may lead to low plaque and bacterial adhesion. [19, 24]

Regarding the results, there was a statistically significant increase in plaque index score in SSC group was detected during follow up as the smooth polished surface of the SSC is less susceptible to plaque accumulation, but the surface is prone to scratches with time which make plaque removal more difficult which came in accordance with Kara et al.[25] who stated that gingival health around a primary tooth restored with an SSC deteriorate with time. Additionally, CCHC group had a statistically significant increase in plaque index score during follow up as the amount of resin matrix positively correlates with biofilm growth rather than the amount of filler particles and it is scientifically evident that some released monomers induce bacterial adhesion.[26]

Regarding crown integrity at 1 year follow up, SSC group had the best crown integrity as there were no cracked, fractured or lost crowns. On the other hand, NZC group had 2 lost crowns ,CCZC group had 1 fractured crown and 1 lost crown, and CCHC group had 2 fractured crowns and 2 lost crowns. Stainless steel crowns showed better results regarding retentivity of crown than esthetic crowns which came in accordance with Kayal et al.[27] and Mohie et al.[28] The esthetic crowns have passive fit, so crowns require more tooth structure reduction to ccomplish better adaptation and they largely depend on cements for retention, while SSCs have snap fit, so minimal tooth reduction is needed.[29] The current study was consistent with the results of Louay Hanafi and Mohamed Altinawi[10] which also reported no cracks or fractures after 12 months follow up with sixty posterior NZC. Abushanan et al.[30] reported that the zirconia crowns showed optimum mechanical properties to withstand the masticatory forces.[30] The fracture of esthetic crowns may be due to the occlusal forces during crown seating or high occlusion that induce stresses which can potentially lead to fracture.

Zirconia crowns had a high degree of color stability as their color remained unchanged during follow up which came in accordance with Pate et al.[31] who concluded that prefabricated zirconia crowns had no clinically significant difference in color. Dabash et al. 2020,[32] reported that choosing type of material must be the interest regarding to smoothness to achieve color stability. Zirconia crowns have a shiny, smooth polished surface. On the other hand, both SSCs and CCHCs showed statistically significant increase in color stability score (minor deviation from original color) during follow up. The SSC lost its luster as the surface is prone to scratches with time. The color stability of resin matrix ceramics is critical as composites have a far higher discoloration potential when compared to ceramics.[33] This is in accordance with results of Mahrous et al.[34] who concluded that Vita Enamic restorations presented higher color change at 12 months follow-up.

Limitation of the study

The limitations of this study are a relatively short follow up period and the prefabricated

CAD CAM crowns are not available in the market and need special laboratory work.

Conclusions

The SSCs had the best crown integrity as there were no cracked, fractured or lost crowns after 1 year. Zirconia crowns had better gingival health and color stability than stainless steel crowns and hybrid crowns. When esthetics is of prime concern for the parent and child, zirconia crowns can be the best option for restoring primary molars. There was no significant difference between NZCs and CCZCs. The prefabricated CCZC offers a new satisfactory cost effective esthetic option.

Conflict of interest

All authors deny any financial or non-financial conflict of interest.

Funding

No funding was obtained for this study.

Availability of data and materials

Upon reasonable request, all of the datasets utilized and analyzed in this study are accessible from the corresponding author.

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from Mansoura Research Ethics Committee, Faculty of Dentistry, Mansoura University with the code number: M01010222. Written informed consents were signed by the parents prior to examination and treatment of their children. The ClinicalTrials.gov Protocol Registration and Results System (PRS) has this RCT registered as (NCT06456879).

Competing interests

The authors declare no competing interests.

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