

ORIGINAL RESEARCH

Assessing clinical outcomes of Zirconia crowns versus Figaro crowns in Primary anterior teeth: A 12-month follow-up investigation

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Received Date: 29 January, 2024

Acceptance date: 12 February, 2024

ABSTRACT

Introduction: Early childhood caries (ECC) is a common childhood disease causing early involvement and gross destruction of the maxillary anterior teeth, thereby leading to difficulty in speech, mastication, development of abnormal tongue habits, malocclusion and psychological problems. The management of carious primary incisors presents a special challenge to pediatric dentists.

Aim: The study was conducted with the aim of evaluating and comparing the clinical performance of Figaro crowns and Zirconia crowns in Primary anterior teeth.

Method: The study design was a randomized split-mouth, conducted in 15 patients. The primary maxillary central incisors on one side were restored with zirconia crown and the primary maxillary central incisors on the other side were restored with figaro crown. Crowns were examined for retention, gingival health, colour match, and opposing tooth wear at follow up period of 6months and 12 months.

Results: Thirty crowns were evaluated in 15 patients. After examining crowns at 6 months and 12 months, the loss of retention was observed in 13.3% of Zirconia Crowns and 33.3% of Figaro crowns at 12 months which was statistically insignificant. For Gingival health, no statistically significant difference was observed between the groups at baselines, 6 months, and 12 months. Colour change was observed in 6.7 % of Zirconia Crowns and 33.3% of Figaro Crowns at 12 months which was statistically insignificant. Wear was observed in 20% of Zirconia Crowns at 12 months.

Conclusion: Preformed Zirconia crowns and Figaro crowns in pediatric dentistry are a better esthetic and highly acceptable, restorative option for primary anterior teeth with the results being better for zirconia crowns.

Keywords: Zirconia Crown, Figaro Crown, Early Childhood Caries, Primary anterior teeth.

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INTRODUCTION

According to AAPD, Early childhood caries is defined as “as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in child at ≤71 months of age”.¹ Severe early childhood caries (S-ECC) is a progressive carious form in children and is defined as “any sign of smooth-surface caries in a child younger than three years of age, and from ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of greater than or equal to four (age 3), greater than or equal to five (age 4), or greater than or equal to six (age

5)”.² The prevalence of Early Childhood Caries is 1-17% in developed countries and 70% in under-developed countries.³ In India, prevalence of this disease among children between 8-48 months was reported as 44%.⁶ It most affects the age group of 3-4 years, with prevalence being more in boys than girls, aged between 8 months and 7 years.⁴ Restoration of carious primary teeth is mandatory to preserve their integrity until the eruption of permanent teeth as tooth destruction leads to compromise in esthetics, development of parafunctional habits, psychological problems, reduced masticatory efficiency and loss of vertical dimension.⁵ To restore carious primary anterior teeth is a challenging procedure due to their small size,

close proximity to pulp, relatively thin enamel that leads to a reduced surface area for bonding.⁶Also, the parents have become more demanding of esthetic restorations and are more engaged in the clinical decision-making process making the esthetic management of primary teeth a fundamental need.⁷There are various types of esthetic restorations for complete crown coverage in primary teeth which include acrylic crowns, polycarbonate crowns, acid etched crown, open-faced stainless steel crown, pre-veneered stainless steel crown, zirconia crown, Figaro crown etc. Zirconia is a crystal-like dioxide of zirconium with metal like mechanical properties, a tooth like colour and the preformed zirconia crowns available for primary teeth provide a more durable, less technique sensitive and esthetic alternative for the management of dental caries.⁸Figaro crowns are strongest all white, metal & BPA-free, pre-formed crowns and they utilize 25-85% fibers embedded in an outer cosmetic composite resin material. The advantage of Figaro crowns is their excellent esthetics, adjustability, strength and biocompatibility with a degree of flexibility which is much closer to tooth structure.⁵The purpose of this study is to clinically evaluate the performance of figaro crowns versus zirconia crowns in primary anterior maxillary teeth.

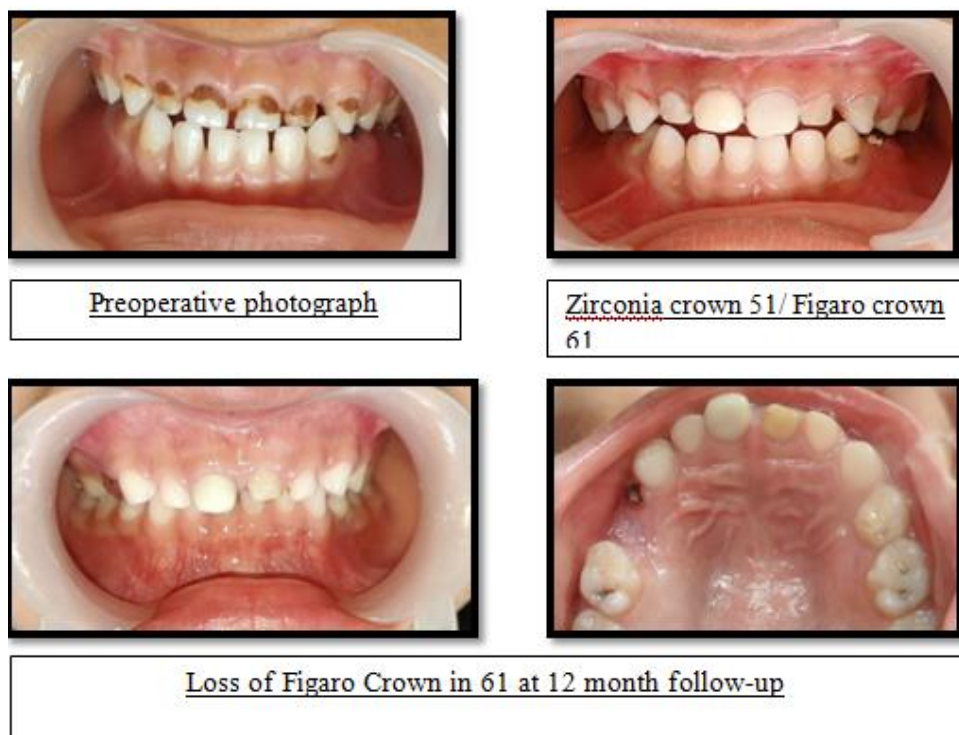
MATERIALS AND METHODS

A randomized, split-mouth designed study was carried out by random selection of healthy children presenting with carious involvement of more than one surface of primary maxillary anterior teeth. Using GPOWER

software (Version 3.0.10), the sample size was determined to be 15. The inclusion criteria for the study were: Healthy 4-5 years old cooperative children, Patients having opposing anterior teeth present, Caries involving at least two surfaces with no signs of pulpal exposure. Excluded were the children with teeth in proximity to exfoliation, children with systemic illness and special needs. The patients were screened and healthy patients fulfilling the inclusion criteria were taken up for the study. The primary maxillary central incisor on one side were restored with zirconia crown and the primary maxillary central incisors on the other side were restored with figaro crown. After making the patient to sit comfortably on dental chair, evaluation of preoperative occlusion was done and the correct sized crown was selected for the patient. Following the incisal plane, incisal reduction of about 1.5- 2 mm was done and in the tight contacts, tapered bur was used to break the contact. This was followed by supragingival and subgingival preparation on all four sides to make a feather edge finish line. The passive fit for the selected crowns was checked. After controlling bleeding, the selected crowns were cemented on the respective teeth using glass ionomer cement. The excess cement was removed and flossing was done to remove cement from interproximal areas. The crowns were rechecked from all sides for any discrepancy and after making sure that the patient was comfortable, the patient was discharged.

Evaluation of Clinical Success: Clinical evaluations were done at Baseline, Six months, Twelve months and the following criteria were used⁹

Criteria	Score	Description
Gingival Health	0	No gingival bleeding
	1	Bleeding with probe
	2	Spontaneous bleeding
Crown Retention	0	Present
	1	Absent
Colour match	0	No noticeable difference from adjacent teeth
	1	Slight shade mismatch
	2	Obvious shade mismatch
Opposing tooth wear	0	No wear
	1	wear

Table No.1: Clinical evaluations**RESULTS**

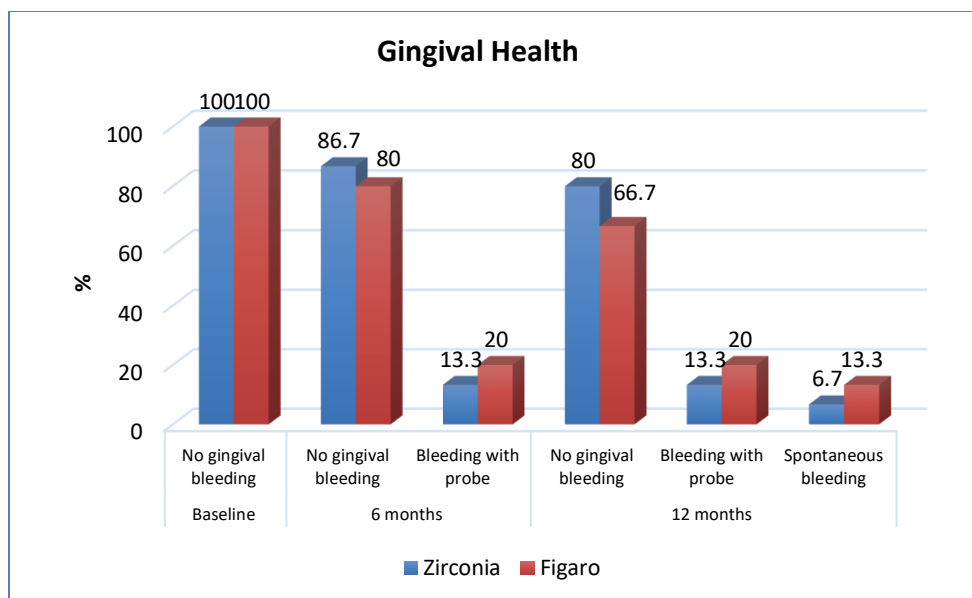
As illustrated in table 1, clinical outcomes were reported as frequencies. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. Results on categorical measurement are presented as frequency (percentage). Comparison between groups is done using

the Chi-square test/ Fisher exact test. A p-value less than 0.05 was considered statistically significant.

Gingival Health: For Gingival health, no statistically significant difference was observed between the groups at baselines, 6 months, and 12 months.

Gingival health	Zirconia N(%)	Figaro N(%)	P value
Baseline			
No gingival bleeding (0)	15(100)	15(100)	1.00
6 months			
No gingival bleeding (0)	13(86.7)	12(80)	1.00
Bleeding with probe (1)	2(13.3)	3(20)	
12 months			
No gingival bleeding (0)	12(80)	10(66.7)	0.727
Bleeding with probe (1)	2(13.3)	3(20)	
Spontaneous bleeding (2)	1(6.7)	2(13.3)	

Table No.2: Gingival health



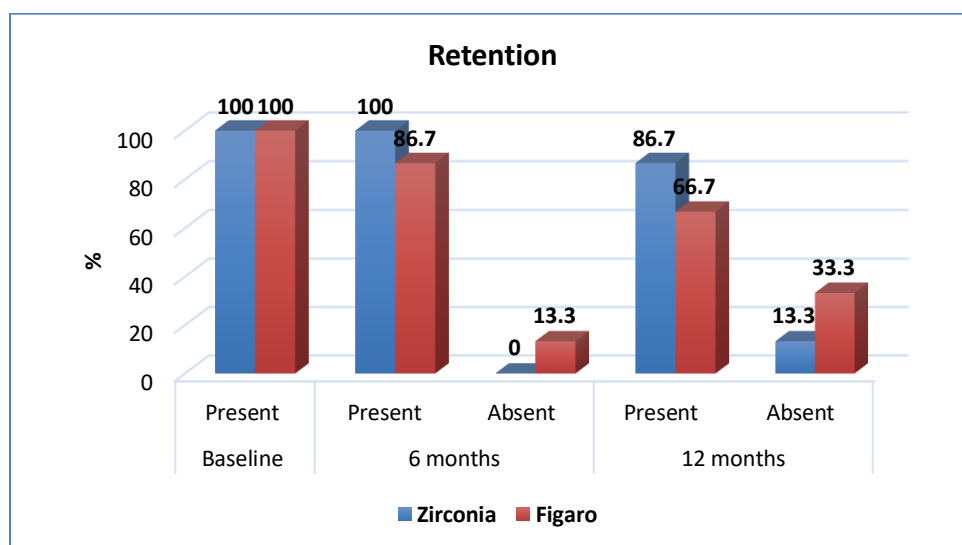
Graph No. 1: Gingival health

RETENTION

Loss of retention was observed in 13.3% of zirconia crowns and 33.3% of figaro crowns at 12 months which was statistically insignificant.

Retention	Zirconia N(%)	Figaro N(%)	P value
Baseline			
Present (0)	15(100)	15(100)	1.00
6 months			
Present (0)	15(100)	13(86.7)	0.483
Absent (1)	0	2(13.3)	
12 months			
Present (0)	13(86.7)	10(66.7)	0.390
Absent (1)	2(13.3)	5(33.3)	

Table No.3: Retention

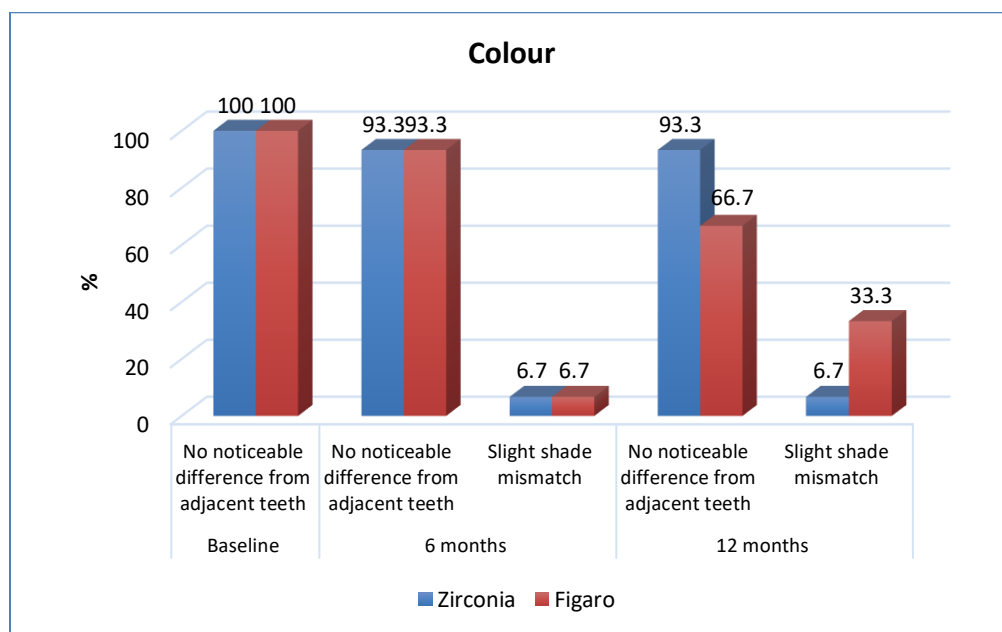


Graph No. 2: Retention

COLOUR

Colour change was observed in 6.7 % of zirconia crowns and 33.3% of figaro crowns at 12 months which was statistically insignificant

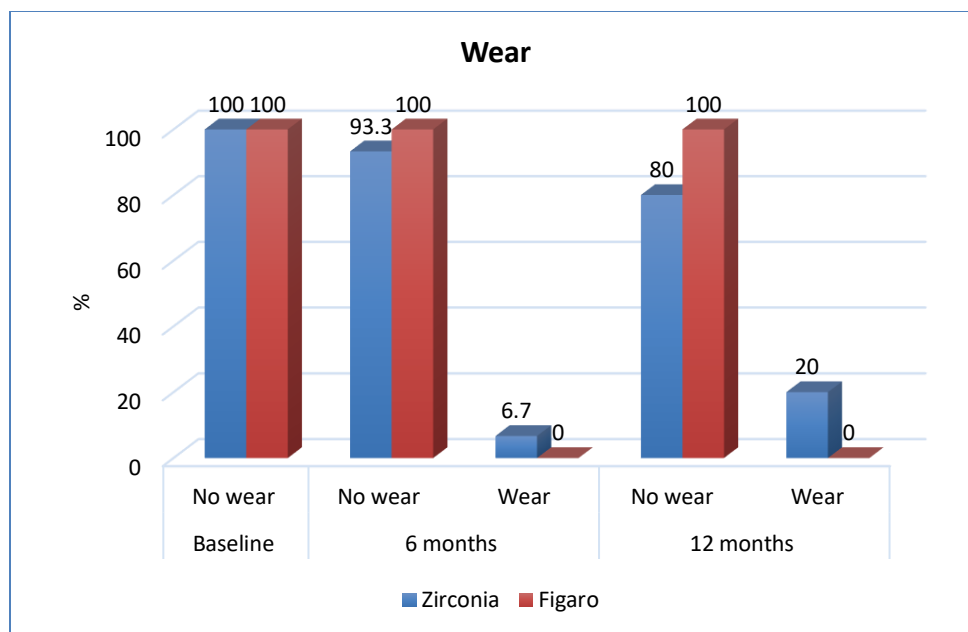
Colour	Zirconia N(%)	Figaro N(%)	P value
Baseline			
No noticeable difference from adjacent teeth (0)	15(100)	15(100)	1.00
6 months			
No noticeable difference from adjacent teeth (0)	14(93.3)	14(93.3)	1.00
Slight shade mismatch (1)	1(6.7)	1(6.7)	
12 months			
No noticeable difference from adjacent teeth (0)	14(93.3)	10(66.7)	0.169
Slight shade mismatch (1)	1(6.7)	5(33.3)	

Table No.4: Colour**Graph No. 3: Colour Change Wear**

Wear was observed in 20% of zirconia crowns at 12 months which was statistically insignificant.

Wear	Zirconia N(%)	Figaro N(%)	P value
Baseline			
No wear (0)	15(100)	15(100)	1.00
6 months			
No wear (0)	14(93.3)	15(100)	1.00
Wear (1)	1(6.7)	0	
12 months			
No wear (0)	12(80)	15(100)	0.224
Wear (1)	3(20)	0	

Table No.5: Wear



Graph No. 4: Wear

DISCUSSION

Severe early childhood caries (S-ECC) is defined as “any sign of smooth-surface caries in a child younger than three years of age, and from ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of greater than or equal to four (age 3), greater than or equal to five (age 4), or greater than or equal to six (age 5)”.² In the management of ECC, a major determining factor is the “triangle of agreement” between the clinician, parent and child (when able). In the present cosmetically oriented society both parents and children do care about the esthetics of their teeth.¹⁰ So it becomes mandatory to restore the teeth to a healthy state in both function and appearance as the defacement of oral structures can alter a child’s psychological development negatively, thereby leading to emotional and behavioural difficulties which may lead to diminished self-esteem.⁹ There are various types of esthetic restorations for complete crown coverage in primary teeth which include acrylic crowns, polycarbonate crowns, acid etched crown, open-faced stainless-steel crown, pre-veneered stainless-steel crown, zirconia crown, figaro crowns, edelweiss crowns. Zirconia crowns were introduced to pediatric dentistry as full coverage restorative option in 2008 and are made up of crystalline dioxide of zirconium that has metal like mechanical properties and tooth like esthetic colour. The advantages of the pediatric zirconia crowns include excellent esthetics, resistance to fracture, biocompatibility, reduced plaque accumulation, colour stability, and potentially less technique

sensitivity.¹¹ Figaro crowns are strongest all white, metal & BPA-free, preformed crowns with an outer surface that provides an excellent lifelike colour and pleasant esthetic feel. Figaro crowns have the advantage of replication of the true anatomy of natural teeth and also provide the feature of adjustability for cosmetic, grinding and eccentric occlusion purposes.⁵ In this study, Bleeding with probe was found in 13.3% of Zirconia crowns and 20% of Figaro Crowns at 6 months, and spontaneous bleeding was observed in 6.7% of Zirconia crowns and 13.3% of Figaro crowns at 12 months which was statistically insignificant. Similar results were seen in study by Salama AA where no gingival inflammation was seen with zirconia crowns.⁹ In the studies by Geduk N et al, Alamoudi RA et al, it was concluded that Zirconia crowns had a lower plaque accumulation and better gingival health and were consistently associated with mild gingival inflammation.^{12,13} In the study by El-Habashy LM et al on Figaro crowns, there was no statistically significant association between type of crown and Plaque Index.¹⁴ The loss of retention was observed in 13.3% figaro crowns at six months, and 13.3% of zirconia crowns and 33.3% of figaro crowns at 12 months which was statistically insignificant. The studies by Salama AA et al, Alamoudi RA et al concluded that Zirconia crowns have long-term survival rates with good retention and marginal integrity, indirectly preventing secondary caries.^{9, 13} In the study by Mohammadzadeh et al on clinically custom-made fiberglass-reinforced composite (FRC) crowns and pre-formed metal crowns (PMCs) on primary molars, only one FRC crown showed fracture after a follow-up period of 12

months.¹⁵ In the study by El-Habashy LM et al on Figaro crowns, there was a significant statistical change from the intact crown at 3 months to either chipped or large loss at 6 months.¹⁴ The difference in the results between the studies can be attributed to the different techniques in tooth preparation as in present study preformed Figaro crowns were used. Figaro crowns are very thin and require minimal tooth preparation as compared to custom-made FRC crowns which demand a shoulder finish line and removal of all undercuts from all surfaces allowing for more bulk of the material. The colour change was observed in 6.7 % of Zirconia crowns and 33.3% of Figaro crowns at 12 months which was statistically insignificant. Similar results were seen in study by Salama AA where Zirconia crowns did not show any colour change⁹. In the study by El-Habashy LM on Figaro crowns, six Figaro crowns (38%) showed statistically significant discoloration at the 6-month follow-up. El-Habashy LM et al have attributed the discoloration to the nature of the FRC material or to the wear and roughness on crown surface that enhanced discoloration. The wear on the opposing tooth is one of the functional parameters and is part of the criteria defined by the World Dental Federation for the evaluation of direct and indirect restorations.¹⁶ In the current study, the wear in opposing tooth was observed in 20% of Zirconia Crowns at 12 months. The results were similar to studies by Salama AA et al, Walia et al who reported an increased wear on the antagonist natural teeth after 6 months for zirconia crowns.^{9,17} In addition to the possible wear on opposing teeth, other disadvantages of zirconia crowns for primary teeth include the requirement for more aggressive tooth reduction, expensiveness and the inability to be altered in colour, trimmed, or crimped.¹⁸

CONCLUSION

Based on the results of the study, it can be concluded that both Zirconia and Figaro crowns can be used in pediatric dentistry for esthetic rehabilitation of anterior teeth. The Zirconia crowns were seen to be more durable, retentive and esthetic than Figaro crowns after 12 months. Figaro crowns were easy crowns in terms of preparation and insertion as they depend on flex-fit technology that needed minimal tooth reduction and had excellent marginal integrity. However, there is a need for more clinical studies with longer follow-up periods for assessing the various clinical aspects of primary teeth crown performance.

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