



COMPARATIVE EVALUATION OF PERIODONTAL HEALTH IN PRIMARY MOLARS RESTORED WITH ZIRCONIA CROWNS AND FIGARO CROWNS - A RANDOMISED CONTROLLED TRIAL

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Abstract: Background: The esthetic lag in the full coverage restoration of preformed stainless steel crowns led to the development and use of open-face techniques, pre veneered crowns, and zirconia crowns. Fibreglass crowns (Figaro Crowns, Inc.; USA) were recently introduced which required lesser crown reduction when compared to Zirconia crowns and also satisfied the esthetic needs. The periodontal health at the vicinity is still unaddressed. **Aim:** To evaluate the periodontal health status of primary molars restored with PSSCs and Figaro crowns. **Materials and Methods:** This split mouth randomised clinical trial involved 25 children requiring bilateral pulp therapy in primary mandibular second molars between 6-9 years of age. Following pulp therapy, the teeth were randomly allocated into either NuSmile ZR or Figaro crown group. A single operator performed the treatment procedures for all the children to avoid operator variability. The children were recalled at 3, 6, 9 and 12 month intervals for assessment of periodontium. A research scholar who was not involved in the treatment procedure performed the periodontal assessments in the followup visits. Plaque accumulation was recorded using the Loe and Sillness Index. The collected data were subjected to statistical analysis. **Results:** At 3 months, 6 months, 9 months and 12 months follow ups, the mean PI scores and mean GI scores of the participants for Zirconia crowns were slightly lower than Figaro crowns but had statistically significance. ($p > 0.05$). **Conclusion:** Within the limitations of the present study, both Zirconia crowns and Figaro crowns had reasonable amounts of plaque accumulation scores during the 12 month periodical follow ups.

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INTRODUCTION

Preformed stainless steel crowns (PSSCs), introduced decades ago, were recommended by American Academy of Pediatric Dentistry and British Society of Pediatric

Dentistry for restoring primary molars with severe carious lesions and with pulpal treatment (1)(2,3). Although the advantages of PSSCs were numerous, it lacked the esthetic component (4–7). Modifications like open-face techniques (8) and pre veneered crowns (9) could help with the esthetic concerns, but they cannot replace the conventional PSSCs completely in terms of lack of retention of the esthetical build-up (10).

Zirconia crowns created a paradigm shift in pediatric esthetic dentistry since its introduction in 1991. Zirconia crowns exhibited high parental satisfaction, high strength, minimal gingival inflammation with no recurrent caries or opposing tooth wear (11–13). Although the metallic appearance was replaced, the reduction of tooth structure was comparatively very high when compared to PSSCs (14). Also there was a passive fit of the Zirconia crowns, while PSSCs showed active fit. Fibreglass crowns i.e. Figaro crowns (Figaro Crowns, Inc.; USA) entered the market in 2018 with the idea to overcome the odds of both PSSCs and Zirconia crowns (15). They were made of fiberglass, titanium oxide and ferrous oxide providing the strength similar to PSSCs with no compromise in the esthetical component. An in-vitro study demonstrated that Figaro crowns needed lesser crown reduction when compared to Zirconia crowns (16). Whilst results from a recent randomised controlled trial has shown that Figaro

crowns lacked the strength and were not esthetically durable by the end of 6-month follow up (17).

Preserving the hard tissue regions of primary dentition is as important as maintaining the soft tissue components i.e. the periodontium. A recently published in-vivo study showed that gingival and periodontal health were better with teeth restored with Zirconia crowns when compared to PSSCs (18). The periodontal health around the newly introduced fibreglass crowns were not yet reported. Hence this study was aimed to evaluate the periodontal health status of primary molars restored with PSSCs and Figaro crowns.

MATERIALS AND METHODS

This split mouth randomised clinical trial was conducted in a university setting. The study protocol was approved by the institutional ethical committee and provided clearance for this human clinical trial (SRB/2020/013). Children attending the out-patient department of Pediatric and Preventive Dentistry from January 2019 to January 2020 were taken for the clinical trial.

Inclusion criteria were healthy children with ASA physical status I between the age group of 6-9 years of age, children who required bilateral pulp therapy in primary mandibular second molars, children with no recent preventive dental treatments like topical fluoride applications, children not under antibiotic coverage for at least 1 month prior to the study and children without regular usage of mouthrinses. Exclusion criteria were uncooperative children, children with poor oral hygiene maintenance, children with decayed primary mandibular second molars indicated for extraction and presence of any periodontal disease or internal resorption or dentoalveolar abscess. Parent(s) or caretaker(s) or legal guardian was explained in their local language about the protocols of the clinical trial and if they agreed to comply, informed consent was obtained from them.

The sample size was calculated based on our pilot study with 5 children. With a significance level of 5%, a test power of 80% and 15% loss to followup, a sample size of 50 teeth were obtained. So 25 children who met the inclusion criteria were recruited for the study. Following pulp therapy of both the mandibular primary second molars, teeth were randomly allocated into either NuSmile ZR (NSZ; Orthodontic Technologies, Houston, Texas, USA) or Figaro crown group (Figaro Crowns, Inc.; USA). Randomisation was done by coin toss method after completion of the first pulp therapy. During the second pulp therapy visit, the other crown was placed.

A single operator performed the treatment procedures for all the children to avoid operator variability. The operator performed the tooth reduction as per the proposed manufacturer instructions. For placement of NuSmile ZR crowns, 1.5-2.0 mm of occlusal reduction was done followed by 0.5-1.25 mm of circumferential axial reduction. Any cervical shoulders were removed to obtain a feather

edge finish line, 1-2 mm below the marginal gingiva. Line angles and point angles were rounded. Try-in crowns were placed and additional reduction was done if passive fit was not obtained. For placement of Figaro crowns, 1.0-2.0 mm of occlusal reduction was done followed by 1.0-1.5 mm of circumferential axial reduction. 1-1.5 mm subgingival preparation was done to provide a feather margin circumferentially. Line angles and point angles were rounded. Slightly active fit of the crown was obtained due to the Flex-fit nature of the crowns. All the crowns were luted using glass ionomer cement (Ketac, 3M ESPE). All the children were given post operative instructions and also were taught Fone's brushing technique. The children were recalled at 3, 6, 9 and 12 month intervals for assessment of periodontium.

A research scholar who was not involved in the treatment procedure performed the periodontal assessments in the followup visits. Plaque accumulation was recorded using the criteria provided by Sillness and Loe (PI)(19), and gingival inflammation was recorded using Loe and Sillness Index (GI) (20). Neither the patient, nor the operator, nor the research scholar, were blinded as the appearance of the crowns cannot be hidden.

STATISTICAL ANALYSIS

The tabulated data (mean values of GI and PI) that were obtained were subjected to statistical analysis using SPSS (version 23, Illinois, Chicago). Within-group assessment over the four follow-ups until 12 months was performed using repeated measures ANOVA, and between-group assessment was performed using independent T test. The level of significance was set at 5%.

RESULTS

This split mouth clinical trial was conducted among 25 children. The mean age of children in the Zirconia crowns group was 6 ±1.6 years while in the Figaro crowns group was 7 ±0.8 years. Among 25 children who received Zirconia crowns, 11 were males and 14 were females. At baseline, the mean PI score was 1.2 ±0.7 and the mean GI score was 0.68 ±0.7. Among 25 children who received Figaro Crowns, 13 were males and 12 were females. At baseline, the mean PI score was 1.24 ±0.5 and the mean GI score was 0.76 ±0.6. (Table 1) There was no significant difference at baseline between the groups ensuring effective baseline randomization.

At 3 months, 6 months, 9 months and 12 months follow ups, the mean PI scores and mean GI scores of the participants for Zirconia crowns were slightly lower than Figaro crowns. However this difference was not statistically significant. ($p>0.05$)(Table 2)

Table 1: Baseline characteristics of children included in the study

	Zirconia Crowns		Figaro Crowns	
	Mean PI (SD)	Mean GI (SD)	Mean PI (SD)	Mean GI (SD)
Baseline	1.2 (0.7)	0.68 (0.7)	1.24 (0.5)	0.76 (0.6)
Mean Age	6 ± 1.6 years		7 ± 0.8 years	
Gender	Male	11	Male	13
	Female	14	Female	12

Table 2: Mean PI and GI with intergroup comparison between Zirconia Crowns and Figaro Crowns analyzed using student t-test

		Mean PI (SD)	p-value	Mean GI (SD)	p-value	
		3 months	Zirconia Crowns	1.44 (0.6)	0.68	Zirconia Crowns
	Figaro Crowns	1.5 (0.8)	Figaro Crowns	0.8 (0.6)		
6 months	Zirconia Crowns	1.56 (0.7)	0.82	Zirconia Crowns	0.8 (0.6)	0.31
	Figaro Crowns	1.6 (0.7)		Figaro Crowns	0.96 (0.5)	
9 months	Zirconia Crowns	1.64 (0.8)	0.73	Zirconia Crowns	1.16 (0.6)	0.61
	Figaro Crowns	1.56 (0.9)		Figaro Crowns	1.08 (0.6)	
12 months	Zirconia Crowns	1.72 (0.6)	0.83	Zirconia Crowns	1.4 (0.6)	0.73
	Figaro Crowns	1.76 (0.7)		Figaro Crowns	1.48 (0.9)	

p<0.05 - Significant

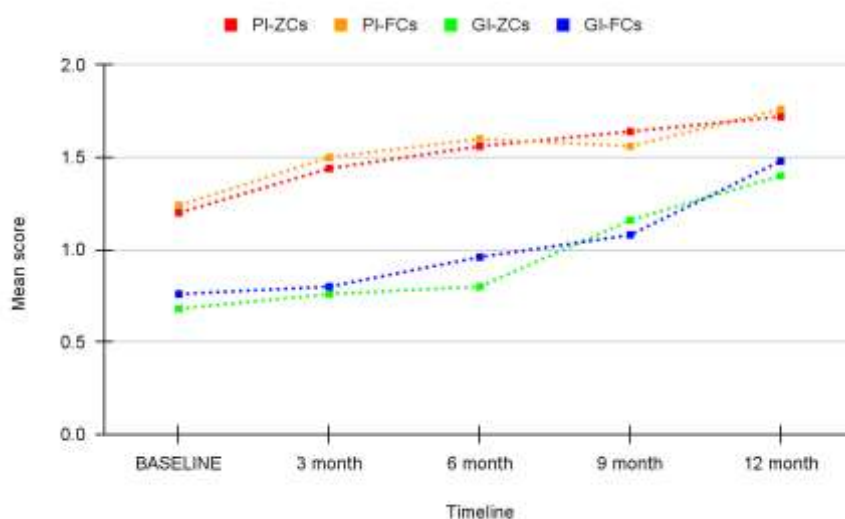


Figure.1: Mean scores of Plaque index and Gingival index of participants receiving Zirconia crowns and Figaro crowns

DISCUSSION

Early childhood caries have been a worldwide pandemic affecting the majority of infants and toddlers. (21). Pediatric dental Practitioners 'major role in this pandemic is its preservation until physiological exfoliation. (22). Pulp therapy is the last resort of managing carious destruction which eventually reduces the strength of the dentition which would require the need of a full coverage restoration. (23). PSSCs had been the gold standard in performing this function for decades. Although the strength cannot be replaced by any other material, the esthetic requirements aren't met.

Parental esthetic demands for their children have been constantly increasing in the recent decades. This has driven the pediatric dental practitioners to shift from the vintage stainless steel crowns to the tooth colored crowns like pre-

veneered crowns, zirconia crowns and recently the Figaro crowns (11,24). But the long term success is still an unresolved question which needs to be assessed. The measurement of success is not only the restoration but also the periodontal health. Our study compared the plaque and gingival scores of the periodontium around pulpctomised mandibular primary second molars restored with PSSCs and Figaro crowns.

The present study showed that pulpctomised mandibular primary second molars restored with Zirconia crowns showed slightly lower PI and GI scores compared to those restored with Figaro crowns. This was in accordance with the studies conducted earlier (25,26). During the 9 month follow-up there was a slight reduction in mean PI score in children with Figaro crowns while there was slight increase in mean GI score in children with Zirconia crowns. This was not a significant difference as the change was not

noticed in the following visit. Although there was an increase in the PI and GI scores during the 12 month follow up compared to baseline in both the groups, there was no significant difference noticed.

Gradual increase in the PI and GI scores in both the groups can be attributed to the change in the environment around the natural periodontium due to the subgingival adaptation of the crowns. Subgingival preparations are encouraged in primary molars as they yield higher retention of the crowns due to the presence of height of contour in the gingival third of the tooth. Trimming of the crowns for good adaptation can also lead to roughened surfaces which could increase the chances of biofilm formation leading to higher PI and GI scores. Zirconia crowns weren't trimmed as the tooth structure was reduced to adapt to the crowns. So the finish of the crowns were polished and glossy which minimises the surface roughness thereby lesser chances for plaque accumulation rendering lower PI and GI scores (25), (27).

One of the strengths of the present study was there were no drop-outs in the sample size. The participants were properly tracked and a regular follow-up was made possible with the parents' cooperative nature towards the study protocols. Crowns were placed by a single operator to avoid inter-operator variability, thus increasing the reliability and validity of the results of the present study. Limitation of the present study was, blinding was not possible due to the color of the crowns. The participants would have taken extra care on the oral hygiene measures when they received the more esthetically plausible restoration compared to metallic ones. This could also have an influence in the maintenance of oral hygiene. Further studies need to be done for long term evaluation of success of the crowns, radiographic evaluation of the periodontium, microscopic evaluation of crown margins which can cause an effect of plaque accumulation.

CONCLUSION

Within the limitations of the present study, both Zirconia crowns and Figaro crowns had reasonable amounts of plaque accumulation scores during the 12 month periodical follow ups. The results of Zirconia crowns were comparable to Figaro crowns with no significant differences statistically and clinically.

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