MARGINAL ADAPTATION AND DISCREPANCY OF FIGARO CROWNS - AN IN VITRO STUDY

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Abstract: Aim: The increase demand for a cost effective aesthetic replacement to stainless steel crowns invites various aesthetic alternatives to paediatric dental practice, one among it is the Figaro crowns. Identifying the marginal fit of the new alternate crown is equally important, for the crown to serve its purpose. Hence, The rationale of the present study was to assess the marginal adaptation and discrepancy of the Figaro crowns between the mesial, distal, buccal and lingual surfaces in the primary teeth. **Materials and method:** A typhodont tooth was prepared for placement of Figaro crowns and 15 duplicates of the prepared typhodont tooth was made. The Figaro crowns were then cemented on the 15 duplicates using Type 1 Glass Ionomer Cement. The duplicated teeth with Figaro crowns were then stored for 48 hours at room temperature and was assessed for the marginal adaptation and discrepancy using stereomicroscope at 100x magnification. The measurements were then recorded in milli metres around the circumference of each specimen. **Results:** The marginal adaptation of the Figaro crowns was found to be the best on the mesial surface of the primary teeth followed by distal, lingual and buccal surfaces and the difference was also found to be statistically significant (p=0.001). Only the lingual margins of the Figaro crowns extended beyond the cemento-enamel -junction, whereas all other margins of the Figaro crowns relatively had supra Cemento-enamel junction level with statistical significance.
Conclusion: Figaro crowns for primary teeth have a good marginal adaptation and minimal marginal discrepancy, thus serving as a reliable aesthetic replacement for Stainless steel crowns.

Keywords: Figaro crowns, marginal adaptation, Marginal discrepancy, Primary teeth

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INTRODUCTION

Stainless steel crowns served as the choice of restoring primary teeth with multi-surface carious lesions and proximal caries, thus retaining them in its place until the physiological exfoliation of the primary teeth. [1] The American Academy of Pediatric Dentistry also recommended Stainless Steel Crowns for restoration of the posterior primary teeth with extensive carious lesion.[2] Since then Stainless steel crowns outperformed the other restorative materials for posterior primary teeth in terms of cost, durability and longevity. [3-5] Despite the numerous advantages of the Stainless Steel Crowns, the focal area of concern for both the parents and the children was its metallic appearance.[6-8]

The rational search for aesthetic full coverage restorations in primary teeth provided options like open faced stainless steel crowns, pre-veneered stainless steel crowns and polycarbonate crowns for posterior primary teeth. However, these crowns presented with various disadvantages and did not serve the purpose.[9,10] With continual hunt for an acceptable aesthetic alternative, Zirconia crowns were introduced into paediatric dental practice in 1991. However, placing Zirconia crowns in primary teeth required more reduction of the tooth, thus necessitating pulp therapy in primary teeth. Also these crowns cannot be crimped, thus hampering the marginal adaptability and increasing the risk of marginal leakage. High cost, low grade of abrasion of the opposing natural dentition are the other factors that cannot be neglected.[11,12] Despite various pitfalls, Zirconia crowns remains as the only viable aesthetic alternative in primary teeth.

With increase in the demand for an alternate cost-effective aesthetic crown for primary tooth instigated Fiber re-inforced glass crowns - FIGARO into paediatric dentistry. Figaro crowns are composed of quartz in the form of fibre mesh sheets embedded in a resin. These crowns are proclaimed to be metal free, bisphenol free and are also autoclavable which is an added advantage. [13] A recent systematic review that evaluated the clinical success of the preformed aesthetic crowns in primary molars proclaimed Figaro crowns as a promising replacement to Stainless steel crowns in primary teeth. [14]

Limited studies have evaluated various factors such as the retention rate, marginal leakage for Figaro crowns, however the most important elements that still needs to be appraised are the marginal adaptation and discrepancy. Maintaining an ideal marginal fit is essential to declare the success of the crown as it

helps in preventing micro leakage, recurrent caries formation and also protects the restored tooth from any sort of chemical, physical and bacterial impact.[15] With this rationale, the present study was carried out to assess the marginal adaptation and discrepancy of the Figaro crowns between the mesial, distal, buccal and lingual surfaces.

MATERIALS AND METHOD

The present study was designed as an in-vitro study and was conducted on a typhodont tooth - mandibular primary second molar on a phantom head with maxillary and mandibular jaw so that the tooth preparation simulated the intra-oral clinical situation. A convenience sample size of 15 was taken up for the present study.

Tooth preparation was initiated on a single typhodont primary mandibular second molar tooth. The tooth preparation for Figaro crowns was performed similar to the tooth preparation for stainless steel crowns. The occlusal reduction of 1mm was done followed by preparation of the proximal surfaces to featheredge without any ledges. At the level of the Cemento-enamel-junction, a reference line was made as a demarcation using the bur to a thickness and depth of 1mm. This served as the reference line to measure the crown adaptation and discrepancy at the margins. Further differentiation of the 4 surfaces - medial, distal, buccal and lingual was done with the grooves that was marked with reference to a line was drawn from each cusp on the long axis of the tooth toward the apex.

An additional silicone mold of the prepared typhodont tooth was made to duplicate 15 specimens in polyester resin for the study. In the duplicated specimen, the prepared cemento-enamel-junction was again re-demarcated by filling the groove with gingival barrier. The excess material was removed before curing and measures were taken to make it smooth so that it doesn't affect the marginal adaptation.

The Figaro crowns for the 15 duplicated specimens were selected by measuring the mesio-distal width of the typhodont tooth. The 15 selected Figaro crowns were then adapted on the 15 duplicated teeth in the phantom head simulating the clinical procedure. The Figaro crowns were then cemented. The cementation was done using Type 1 Glass Ionomer Cement. Excess flushed out cement was then removed. All of these duplicated teeth with Figaro crowns were then stored for 48 hours at room temperature.

The marginal adaptation and discrepancy of the Figaro crowns was measured using stereomicroscope. Each of the prepared specimen was placed under the stereomicrscope at 100x magnification and the measurements were recorded in milli metres around the circumference of each specimen.

RESULTS

Table 1. Marginal adaptation per surface of the Figaro crowns

	Mean ± SD	P value
Mesial	0.165 ± 0.014	0.001
Distal	0.180 ± 0.021	
Buccal	0.323 ± 0.041	
Lingual	0.220 ± 0.020	

Table 2. Marginal discrepancy per surface of the Figaro crowns

	Mean ± SD	P value
Mesial	0.154 ± 0.141	0.001
Distal	0.163 ± 0.121	
Buccal	0.124 ± 0.122	
Lingual	- 0.232 ± 0.110	

A good marginal adaptation to the primary teeth was noticed with Figaro crowns in all the surfaces with the highest recorded on the mesial surface (0.165 mm) and the least recorded in the buccal surface (0.323 mm) with statistical significance as depicted in Table 1. A minimal marginal discrepancy was noticed on the mesial, distal and buccal surfaces of the primary teeth with Figaro crowns. In other words, the extension of the margins of the Figaro crowns were slightly above the cemento-enamel- junction of the primary teeth on the mesial, distal and buccal surfaces. Whereas, the extension of the margins of the Figaro crowns were recorded to be beyond the cemento-enamel-junction on the lingual side of the primary teeth, which is indicated with the negative value in Table 2. This discrepancy was also found to be statistically significant with p value of 0.001.

DISCUSSION

Aesthetic paediatric dental options has become increasingly demanded by the children and the parents. Figaro crowns being one such aesthetic option is new to paediatric dentistry, hence, assessing its adaptation and fit to the primary teeth plays a critical role for declaring it as an effective aesthetic alternative to Stainless steel crowns. Croll et al have stated that the longevity and the success of the crowns depends on the adequate marginal adaptation.[16] Similarly marginal discrepancy is the extension of the margins of the crown around the circumference of the teeth. Over- extension of the crowns can invade the biological width of the periodontium of the primary teeth resulting in gingival bleeding, discomfort and alveolar bone resorption.[17] Thus, evaluating the marginal adaptation and marginal discrepancy of the Figaro crowns is of utmost importance to support its use in paediatric dental practice.

Marginal adaptation is the perpendicular distance from the internal surface of the restoration to the finish line of the tooth preparation. In the present study, the marginal adaptation of the Figaro crowns was found to the best on the mesial surface of the primary teeth followed by distal, lingual and buccal surfaces and the difference was also found to be statistically significant (p=0.001). Improper adaptation of the crown on the proximal surfaces of the primary teeth can result in food lodgement, microleakage and secondary caries formation. Better adaptation of the Figaro crowns on the proximal surfaces (medial and distal) of the primary teeth throws a promising light to support the use of Figaro crowns in primary teeth. However, the buccal surface of the Figaro crowns shows the least adaptation and this could be attributed to the morphology of the primary teeth. The gold standard Stainless steel crowns have also shown a poor marginal adaptation on the buccal surface of the primary teeth.[18] The marginal adaptation of the Figaro crowns to the buccal surface of the primary teeth could be improvised by

modifying the tooth preparation procedure. Studies in the literature have supported the reduction of buccal bulge during tooth preparation stating that this reduction can reduce the degree of microleakage.[19] The buccal bulge present on the primary teeth should be reduced during the tooth preparation, which will make the primary tooth straighter improving the marginal adaptation of the Figaro crowns to the buccal surfaces of the primary teeth.

Marginal discrepancy is the vertical discrepancy between the margins of the crown to the abutment teeth. The Ideal extension of the crown should be till the cemento-enamel junction or slightly above it. With regards to the marginal discrepancy, the Figaro crowns were found to extend beyond the Cemento-enamel-junction only on the lingual surface, which is represented by the negative value. The mesial, distal and the buccal surfaces of the Figaro crowns did not extend beyond the cemento-enamel-junction and this marginal discrepancy was also found to statistically significant (p=0.001). In the other words, only the lingual surface of the Figaro crowns extended sub-gingivally, whereas the margins of the Figaro crowns on the buccal, mesial and the distal surfaces were at the level of cement-enamel junction or slightly above it. Clinically, this can be seen as a blanching on the gingiva on the lingual surface and thus this discrepancy can be subdued by precise trimming of the lingual margins of the Figaro crowns using an abrasive stone after trying the crown on the intended tooth. But as the present study was conducted as an in-vitro study on a typhodont mounted in a phantom head, the gingival portion was hard and thus blanching was not possible and the lingual surfaces were not trimmed. A study done by Mulder et al, to evaluate the marginal discrepancy of Stainless steel crowns showed that except for the buccal surface, the remaining 3 surfaces extended beyond the Cements-enamel- junction. Thus, comparing to stainless steel crowns, Figaro crowns seems to require less trimming and modifications. This in turn not only reduces the chain side time required for the procedure but also increases the patients co-operation.

The potential limitation of the present in-vitro study is that it cannot completely simulate the intra -oral conditions. The gingiva clinically is firm and resilient and hence any over-extensions can be easily detected via balancing of the gingiva and the Figaro crowns can be trimmed accordingly. Hence, the present study was done on a phantom head, the extension was not evident and hence modifications were not made to the Figaro crowns prior to cementation. Further, In vivo studies should be conducted to confirm the findings of the present study. Another important factor that should not be neglected in terms of crown cementation is the type of luting cement used. In the present study Glass ionomer cement was used for luting. Further studies should be conducted comparing glass ionomer cements with resin modified glass ionomer cements (RMGIC) and resin cements to declare the ideal luting cement for Figaro crowns which would in turn increase the success of Figaro crowns for primary teeth in children.

CONCLUSION

The present study concluded that the Figaro crowns for primary teeth have a good marginal adaptation and minimal marginal discrepancy. Minor alterations in the tooth preparation and trimming of the crowns can overcome the limitations and increase the success of Figaro crowns in paediatric dental practice.

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