



## A comparative Cross-Sectional study of Two Aesthetic Restorative options for class III caries in primary Anterior Teeth

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### Article History:

Received on: 22 Jun 2020  
Revised on: 26 Jul 2020  
Accepted on: 03 Aug 2020

### Keywords:

Composite restoration,  
strip crown,  
class III caries,  
primary anterior teeth

### ABSTRACT

Early childhood caries shows its first signs of manifestation in maxillary anterior teeth which poses as a hindrance to esthetics and may induce psychological complications in young children. Though esthetic restoration of anteriors in the primary teeth is challenging, all efforts must be taken to restore the tooth to its normal form and function. This study aims to infer a suitable treatment option exclusively for class III caries in primary teeth by comparing two restorative techniques, namely direct composite restoration and strip crowns. The database searched was Dental Information Archiving Systems and a total of 297 restorative procedures were analyzed using descriptive statistics on SPSS Software. Among 297 treatment procedures, 76.1% of the anterior teeth were restored as direct composite resin restoration and 23.9% were restored with strip crowns. Direct composite resin restoration was considerably used to restore class III caries in primary teeth. However, owing to recent trends in esthetics, strip crown restoration may be an ideal choice.



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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11iSPL3.2894>

Production and Hosted by

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### INTRODUCTION

Early childhood caries is a major public health problem being the most common chronic infectious childhood disease which is difficult to control (Katiyar, 2010) and is greatly influenced by parental attitude and behaviour (Gurunathan and Shanmugaavel, 2016). According to American Association of Pediatric Dentistry, early childhood caries (ECC) is defined 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 a child 71 months of age or younger affecting 1.76 billion children worldwide (Huang and Xu, 2016). The initiation and progression of caries is altered by immunological defence mechanisms present in saliva. Hence saliva has been used as a biomarker for the detection of free radicals and subsequent caries formation (Subramanyam, 2018).

Similarly, salivary duct obstruction due to various pathology (Packiri, 2017) can promote the inception of caries. In early childhood caries, there is prompt and rapid involvement of maxillary anterior teeth. Primary maxillary anterior teeth dominate the physical appearance of a person (Grewal and Seth, 2008) and its destruction due to caries or trauma (Ravikumar et al., 2017) may compromise esthetics and lead to psychological problems. It can interfere with normal nutrition intake and speech. (Christabel, 2015) Management of ECC by invasive, (Govindaraju et al., 2017c,a,b) non-invasive and preventive methods (Somasundaram, 2015; Gurunathan and Shanmugaavel, 2016) is mandatory to improve the quality of life in such affected children.

The esthetic restoration of primary anterior teeth has long been a challenge for a pediatric dentist and most difficult goals to achieve. The reasons include lack of available materials and techniques; children who require such restorations are usually among the youngest and least manageable group of patients (Ravikumar *et al.*, 2017). The primary teeth have short and narrow crowns. Thus, only a small surface area is available for bonding, the pulp chamber is inherently large, enamel is difficult to etch due to its prismatic nature (Govindaraju *et al.*, 2017b; Jeevanandan, 2017).

In the past, the commonly followed treatment protocol was extraction (Grewal and Seth (2008). However, with advancements in materials and techniques, preparation designs and adhesive protocols coupled with growing awareness among patients and parents, it's become prudent to restore a carious tooth to its form and function (Jeevanandan and Govindaraju, 2018; Nair, 2018). Development in restorative materials includes direct composite resin restorations, strip crowns, and bond reinforced composite, polycarbonate crowns, and veneered stainless steel crown for primary anterior teeth. Various in-vitro studies and clinical studies (Grewal and Seth, 2008) have compared the efficacy of the different restorative materials for all aspects of primary anterior teeth rehabilitation (Panchal *et al.*, 2019).

In our study, the composite resin was utilized in two techniques, namely, as a direct restoration or bulk filled in the form of strip crowns. Composite resin is a commendable restorative material though technique-sensitive and highly cumbersome in children, exhibits worthy physical properties, has a higher polishing ability, which enhances esthetics (Ramakrishnan and Shukri, 2018).

Therefore, this study aims to infer a suitable treatment option exclusively for class III caries in primary teeth by comparing two restorative techniques, namely direct composite restoration and strip crowns.

## METHODOLOGY

The cross-sectional study was conducted in the Department of Pediatric and Preventive Dentistry in a private dental institute in Chennai during the period of June 2019 to March 2020. The ethical clearance for the study was obtained from the Institutional Ethical Committee, Saveetha Institute of Medical and Technical Review Board.

Composite restoration procedures performed on children aged 2-5 years with Class III caries accord-

ing to G.V black's classification were included in the study. Those procedures performed on children with pre-existing medical conditions and those with special needs were excluded from the study. The two methods by which composite resin was employed is by direct restoration and in the form of strip crowns.

The restorative procedures were carried out by postgraduate students. After an appropriate diagnosis of class III caries without pulpal involvement, caries removal and suitable cavity preparation was carried out using No.69 carbide bur. This was followed by etching, bonding, placement of matching shade of composite resin using a Mylar strip and curing of the composite using visible light cure unit followed by finishing and polishing. In the case of strip crowns, subgingival tooth preparation was done after local anaesthetic administration. The celluloid strip crown forms were then checked for size and cut according to the suitable length. A relief hole was punched in the strip crown forms in order to avoid air entrapment during composite filling. Pedoshade was used to fill the form. The tooth surfaces were then etched, bonded and the strip crowns were placed and cured in a similar manner. After sufficient curing for 30 sec, the celluloid form is removed using an explorer. If required, trimming and polishing was carried out. In every step, sufficient care was taken to impart a fluid free environment. The concerned data associated with these treatment procedures was fed into the Dental Information Archiving System from which data was extracted for the purpose of this study.

The data verification, collection, and analysis were carried out by two persons. Cross verification of the included data was done through photographic verification. In order to avoid sampling bias, only those data which are custom to the eligibility criteria were included. The internal validity was high as it was a representative sample and the external validity was high as the study results may be generalized to the Chennai population.

The extracted data was tabulated into Excel sheets and was imported into SPSS Software by IBM for data analysis. A total of 297 treatment procedures were included for data analysis. Any incomplete data was excluded. The obtained data was analyzed using descriptive statistics on SPSS software and the results were represented graphically.

## RESULTS AND DISCUSSION

A total of 297 treatment procedures were analyzed using Descriptive Statistics on SPSS Software Version 23.0 based on methods of placement of com-

posite resin for Class III caries on the primary anterior tooth. The study samples included treatment procedures performed on 170 boys (57.6%) and 125 girls (42.4%) [Figure 1]. 57.6% of the children were boys and 42.4% were girls.

The percentage of participants in each age group included 6.1% belonging to 2 years of age, 24.6% belonging to 3 years of age, 36% and 33.3% of children belonging to 4 and 5 years of age respectively. [Figure 2]. 6.1% belonged to 2 years of age, 24.6% belonged to 3 years of age, 36% and 33.3% of children belonged to 4 and 5 years of age respectively.

Out of 297 teeth, 253 anterior teeth had Class III mesial caries (85.2%) and 44 were Class III distal caries (14.8%) [Figure 3] of which maxillary central incisors were commonly involved (44.8%). 85.2% of the participants had class III mesial caries and 14.8% had class III distal caries.

[Figure 4] Among 297 procedures, 226 teeth were restored as direct composite resin restoration (76.1%) and 71 teeth were restored with strip crowns (23.9%). According to tooth involved-maxillary central incisors (44.8%), maxillary lateral incisors(27.9%), maxillary canines (9.4%), mandibular central incisors (5.4%) ,mandibular lateral incisors (4.4%) and mandibular canines (8.1%)

[Figure 5] Direct placement of composite restoration was the treatment of choice irrespective of gender and age with a slight increase in strip crown usage in 4-year-old children. 76.1% had undergone direct composite resin restoration whereas 23.9% had strip crowns. Figure 6 The graph shows that direct composite resin restorations are the aesthetic restoration of choice in both genders.  $\chi^2$ -value = 0.23. Figure 7 The graph shows that direct composite resin restorations are the aesthetic restoration of choice in all age groups.  $\chi^2$ -value = 0.06. Figure 8 The graph shows that direct composite resin restorations are the aesthetic restoration of choice in all anterior teeth. Figure 9 Direct composite resin restorations are the aesthetic restoration of choice in both Class III mesial and distal caries.

[Figures 6 and 7] It was also the most common technique used for composite restoration irrespective of the location of class III caries and anterior teeth involved [Figures 8 and 9].

Esthetics by definition is the science of beauty, that particular detail of an animate and inanimate object that makes it appealing to the eye. Primary maxillary anterior teeth are responsible for a distinguished physical appearance (Grewal and Seth, 2008). Hence, it is important to restore the crown

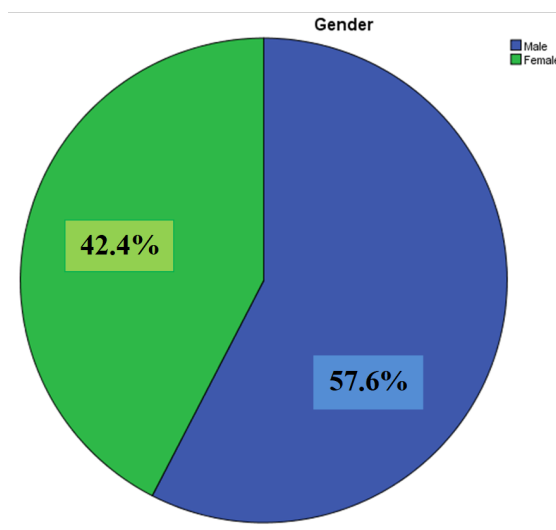


Figure 1: The pie chart represents the distribution of the study participants according to gender

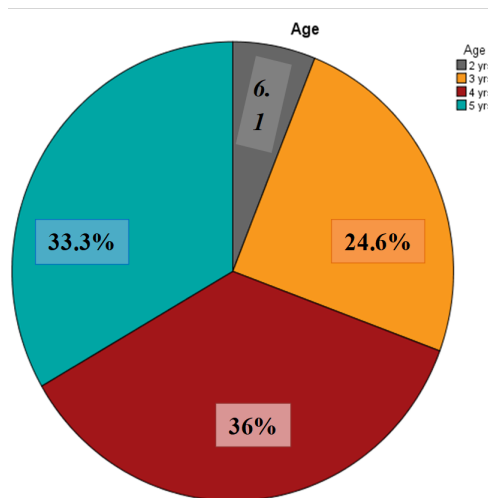


Figure 2: The pie chart represents the distribution of the study participants according to age

structure lost due to caries to preserve the integrity of primary dentition until it's exfoliation and eruption of permanent teeth.

The resin-based composite restoration was introduced in dentistry about half a century ago as an esthetic restorative material and covers a paramount position among restorative materials as they offer an impeccable esthetic potential and acceptable endurance. Composites consist of a resin matrix and chemically bonded fillers. These fillers contribute to its esthetics, polymerization depth, shrinkage and physical properties. It is a focus of attention that composite resins shrink during polymerization leading to adhesive and cohesive

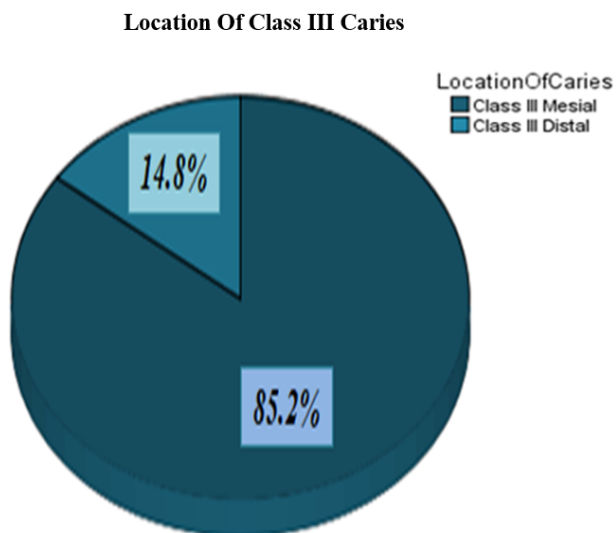


Figure 3: The pie chart represents the distribution of the study participants according to the location of Class III caries

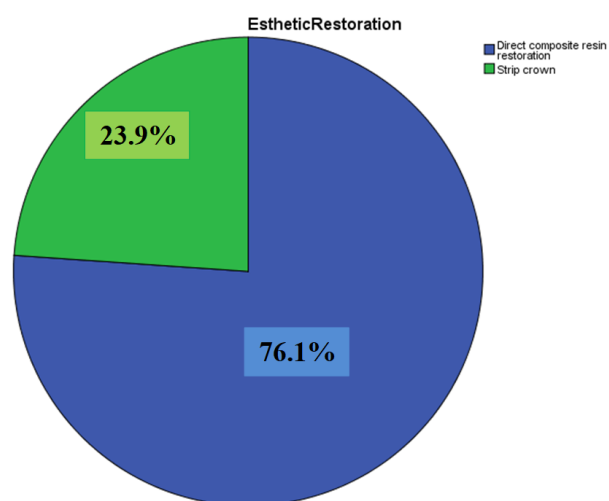


Figure 5: The pie chart represents the distribution of the study participants according to the aesthetic restorations done

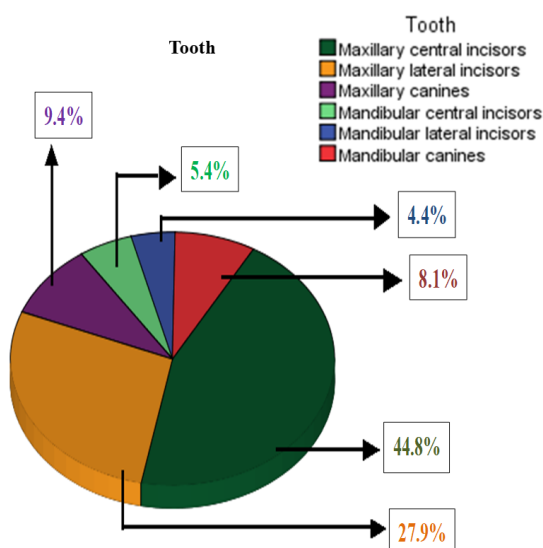


Figure 4: The pie chart represents the distribution of the study participants

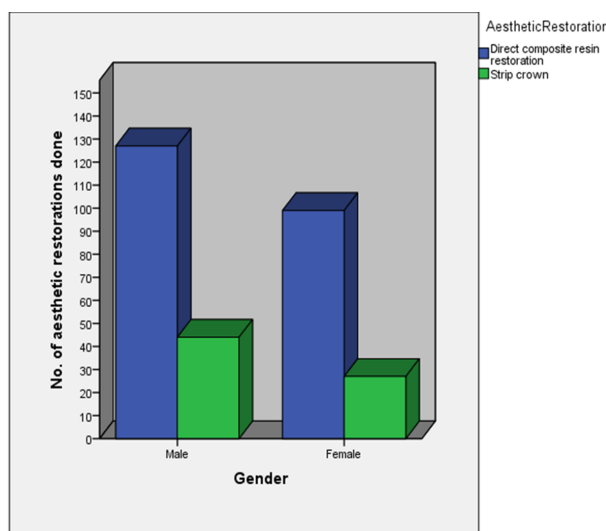
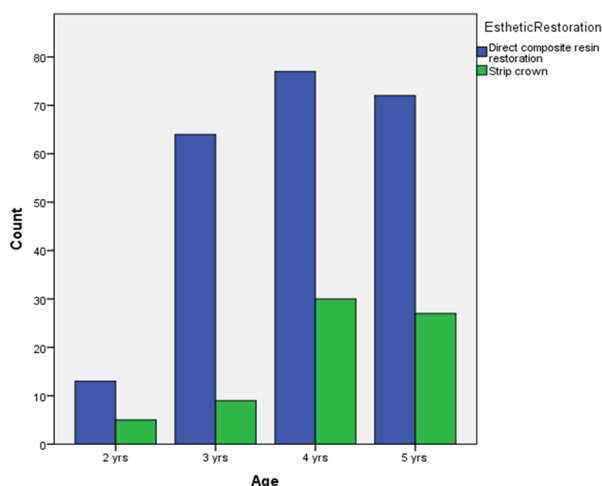


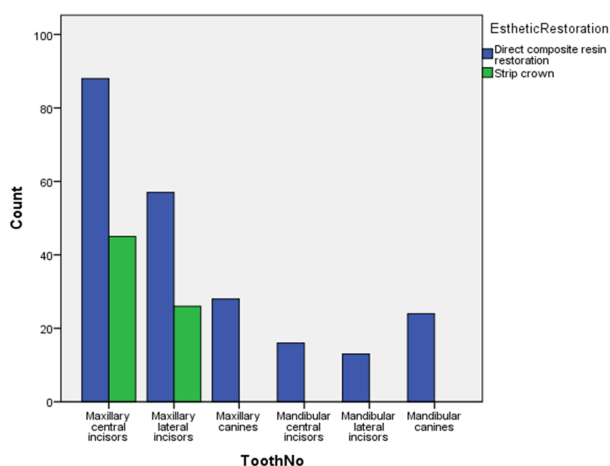
Figure 6: The graph represents the correlation between gender and aesthetic restorations done for class III caries on primary anterior teeth

failure. It is now acknowledged that incremental filling decreases shrinkage stress as a result of reduced polymerization material volume. Hybrid resin combines different particle sizes for strength as well as esthetics. Flowable resin materials have been proposed for restoration under hybrid composites in recent times. This is because their viscosity eases material placement, and adaptation to cavity walls is enhanced. Several *in vitro* studies showed that flowable resin composites reduced microleakage. Visible light curing activates photoinitiators that are present in the composite which are sensitive to visible light in the wavelength region of around 470 nm (blue region). It has a

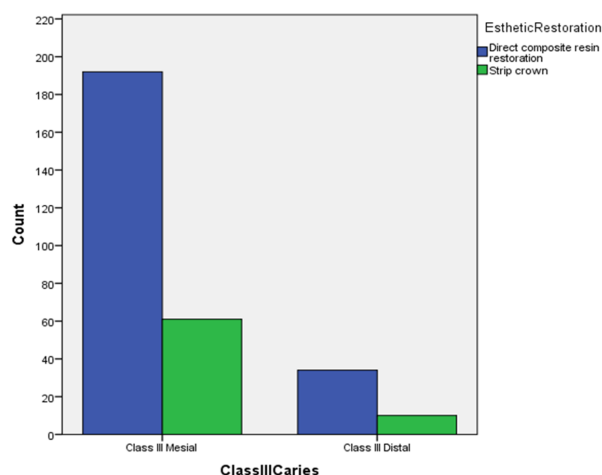
short setting time, namely 20-40 seconds. The working time is longer and the material does not set until exposure to the polymerizing light. The factors that contribute to the longevity of composite resin includes operator experience, restoration size and tooth position (Bernardo, 2007). The procedure is technique sensitive requiring longer placements time compared to other materials. Resin-based composites are appropriate restorations for anterior when sufficiently isolated from saliva and blood. This allows for true dentin bonding to occur and alleviates restoration micro leakage. Compared to permanent dentin, the inorganic content of intrabular primary dentin is less, and the number



**Figure 7: The graph represents the correlation between age and aesthetic restorations done for class III caries on primary anterior teeth**



**Figure 8: The graph represents the correlation between the teeth involved and aesthetic restorations done for class III caries on primary anterior teeth**



**Figure 9: The graph represents the correlation between the location of class III caries on primary anterior teeth and aesthetic restorations done**

of dentinal tubules is lower resulting in less surface moisture and increases the primary dentin to decalcification which may hinder bonding. The prismless enamel structure of primary teeth makes etching difficult.

In this study, the study participants included 57.6% males and 42.9 % females. The teeth restored with the greatest frequency to the least were maxillary central incisors (44.8%) followed by maxillary canines (9.4%), mandibular canines (8.1%) and mandibular lateral incisors (4.4%). The order was concurrent with the manifestations of ECC.

Nearly 76.1% of the teeth were restored by the direct method of composite restoration and this was independent of gender, age, the tooth involved and location of Class III caries. In spite of the technical difficulties associated with composites, especially in young children, the reason for direct placement may be primarily due to the painless procedure of caries removal. Also, unnecessary tooth preparation need not be done for simple carious lesions and painful anaesthetic administrations involved in tooth preparation for strip crowns can be avoided, all of which may upset an otherwise cooperative child. However, Class III cavities must be prepared with labial and lingual dovetails to incorporate a large surface area for bonding to enhance retention and the procedure must be completed in a short time.

The use of strip crowns had a slight inclination among 4-5-year-old children. This may be due to the esthetics being of greater concern in school-going children (Grewal and Seth, 2008). However, there is limited information on the potential psychological impact of anterior caries or unesthetic restoration in primary teeth.

Strip crowns are prefabricated transparent celluloid crown forms for anterior teeth first introduced by Webber. They are specifically made only for primary upper central and lateral incisors. This may be one of the confounding factors in the study results as multiple surface carious canines could only be restored with direct composites. One of the main advantages according to (Kupietzky et al., 2005) is that it is highly esthetic and easily matches natural dentition, leaves a smooth surface, hence polishing is not required and it is easy to fit and trim. Ram et al. 2003 described the disadvantage that moisture contamination may disturb the bond and hemorrhage produced during tooth preparation may alter the shade of the material.

Full coronal restoration of primary incisors may be indicated when (i) caries are present on multiple surfaces (ii) extensive decalcification of tooth

(iii) poor hygiene (iv) child's behaviour makes the procedure difficult. A retrospective study showed 80% of strip crowns were completely retained after three years, 20% were partially retained with none being lost (Kupietzky *et al.*, 2005). When comparing composite resin and strip crown, there was some degree of discolouration caused by the formation of coloured degenerated products and changes in surface morphology in both groups. However, another study found that colour and texture of restoration using strip crowns remained acceptable with no pitting and discolouration.

Nowadays, strip crowns are the preferred choice for clinicians and parents alike because of its super esthetics and the ease of repair in the event of fractures. However, there is little scientific support for any of the clinical techniques that clinicians have utilized for many years to restore primary anterior teeth and most of the evidence is regarded as an expert opinion. The limitations of the study include the lack of comparison with other restorative options such as RMGIC or other luted/ bonded full coronal crowns. Also, no follow-up evaluation of the physical properties (or) retention of the materials was done.

Hence, there is a strong need for well-designed prospective clinical studies to validate the use of these techniques and materials.

## CONCLUSION

Within the limits of the study, direct restoration with composite resin has been commonly employed for the restoration of Class III caries in primary teeth. However, owing to the prevailing concerns with esthetics, strip crowns can be a better restorative option for primary anterior teeth.

## ACKNOWLEDGEMENT

The authors of this study acknowledge the institute, for their help towards collecting all the patient case records and other datas in relevance to the current study.

## Conflict of Interest

The authors declare that there are no conflicts of interest for this study.

## Funding Support

The authors declare that they have no funding support for this study.

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