

Microbial Evaluation of Plaque on 3M ESPE and Kids Stainless Steel Crown in Primary Molars

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Abstract

Introduction: This study aims to evaluate the oral hygiene and microbial adhesion on the 3M stainless steel crown (SSC) and Kids crown in primary molars. **Materials and Methods:** Seven children aged 4–8 years were selected from the Department of Pediatric and Preventive Dentistry. Children included in the study had lower right or left both first and second primary molars that required SSC. The tooth was restored with 3M crown and Kids crown. The swabs were collected before and immediately after the cementation of crowns and after 1 week. Oral hygiene index (OHI) was also evaluated. The swabs were incubated in mitis salivarius bacitracin agar, and the total number of *Streptococcus mutans* was counted and expressed in colony forming units. **Results:** There was no statistically significant difference seen in the microbial count and OHI-simplified between the 3M and Kids crown and natural teeth. **Conclusion:** The microbial adhesion of plaque and *S. mutans* was seen higher on the Kids crown. However, there was no significant difference between 3M ESPE and Kids crown.

Key words: 3M ESPE crown, Kids crown, microbial adhesion

INTRODUCTION

Stainless steel crown (SSC) was introduced by Humphrey in 1950.^[1] Since 1950, SSCs have been widely used for the restoration of grossly destructed carious primary teeth and those teeth requiring pulp therapy or where other restorative materials are likely to fail. The SSC is easy to place, economical and it has the excellent durability.^[2] Braff *et al.* stated that SSCs were significantly superior to multisurface amalgams in the restoration of primary molars.^[3] In spite of its poor esthetics, it has been widely used due to its high strength than preveneered crowns. Microbial plaque adhesion is considered the major factor causing dental caries and periodontal disease in primary teeth.^[4] *Streptococcus mutans* is one of the main causative agents for the initiation of carious process.^[5] Different surface properties of the restorative materials have a direct role in the level of bacterial adhesion and aggregation.^[6] The microbial colonization of plaque on the foreign restorative materials depends on its surface characteristics such as surface texture, surface area, surface smoothness, and its surface microstructure.^[7] SSCs are available under different brands in the market such as 3M ESPE, Unitek, Rocky Mountain, ION Ni-Chro. The most commonly used is the 3M ESPE

crown. Marginal adaptation is required to inhibit the ingress of oral bacteria which can cause secondary caries and gingival inflammation.^[8] These preformed crowns are well contoured and are available in different sizes for primary teeth. Alternative SSCs such as Kids crown are introduced, which have thin cervical margin and are soft, which makes trimming and contouring simple and convenient.^[9] However, the microbial plaque adhesion on these type of crowns is unknown. Hence, this study aims to evaluate the oral hygiene and microbial adhesion on the 3M SSC and Kids crown in primary molars.

MATERIALS AND METHODS

Approval was obtained from the Institute Scientific Review Board. The materials used in this study were SSC (3M ESPE, St. Paul, Minnesota, USA) and Kids crown. Seven children aged 4–8 years were selected from the Department of Pediatric and Preventive Dentistry. The inclusion criteria were the

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presence of right or left both first and second primary molar that required SSC. The consent was taken from parents or guardian. Tooth was restored with 3M crown and Kids crown [Figure 1]. The swabs were taken from the occlusal and buccal surface before and immediately after cementation of crowns and after 1 week [Figure 2]. The oral hygiene index-simplified (OHI-S) was measured at initial visit and after 1 week [Figure 3]. The collected swabs were spread onto the surface of mitis salivarius bacitracin agar (MSBA). MSBA plates were incubated aerobically in 37°C. After 48 h incubation, the total number of *S. mutans* was counted and viable count was expressed in colony forming unit [Figure 4].^[10]

RESULTS

S. mutans counts

Microbial count immediately after the placement of crown was nil for both 3M ESPE and Kids crown. When the microbial count and OHI-S were seen on the crowns between the initial placement and first week, there was no statistically significant difference seen in the microbial count [Table 1] and OHI-S [Table 2] between the 3M and Kids crown. However, the *S. mutans* count on the Kids crown was more than that observed on 3M crown and natural teeth.

DISCUSSION

Restoration of severely decayed primary teeth is always a challenge to the clinician. The ideal requisites for a restoration to be successful is its durability, ease of placement, cost-effectiveness, and natural appearance.^[11] Preformed SSCs have better success rate than large multisurfaced amalgam restorations, which has been reviewed in the literature.^[3,12] The SSC is cost-effective as they are durable, inexpensive, and less technique sensitive and has high longevity than large multisurfaced restorations.^[13] Children with the presence of primary first and second molars which needed pulp therapy followed by SSC were selected for the placement of crown. Any history of intake of antibiotics was excluded from the study as it can change the oral ecosystem.^[14] A parallel arm study design was used since variation in the direction and

force of brushing in different side of the mouth can affect the results.

Many SSCs are available in the market. In the last few decades, esthetic solution was found to replace the conventional SSC which has poor esthetic appearance.^[15]



Figure 1: 3M ESPE and Kids stainless steel crown after cementation.



Figure 2: Swab collection on crowns.



Figure 3: Sterile swab culture collecting tubes.

Table 1: *Streptococcus mutans* count on normal teeth, 3M ESPE and kids crown

Period	Normal teeth 3M ESPE crown kids crown			P
	Mean±SD	Mean±SD	Mean±SD	
1 week	36.40±29.77	45.40±42.31	72.00±58.9	0.457

Table 2: Oral hygiene index-simplified on normal teeth, 3M ESPE and Kids crown

Period	Normal teeth 3M ESPE crown kids crown			P
	Mean±SD	Mean±SD	Mean±SD	
1 week	1.28±0.42	1.42±0.53	1.57±0.52	0.324

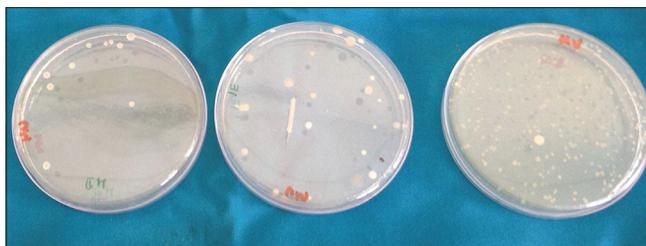


Figure 4: *Streptococcus mutans* colony forming units.

In this regard, open-faced SSCs, preveneered crowns, and resin-bonded composite facings are introduced. However, a study by Reeves has shown that the esthetic crowns are more thick and bulky, which favored the adhesion of microbes causing periodontal breakdown.^[16] Berg and Lin stated that there is maximum mechanical retention of the SSCs if there is a snap on effect.^[17] The success of the restoration also depends on the gingival health in relation to the restoration. However, the study has reported that inflammation of the gingiva varies based on different forms and contour of the SSC.^[18] Myers *et al.* in their study have shown that gingivitis occurs more around inaccurately fitted crowns than well-adapted crowns.^[19] *S. mutans* is the principle microbe causing dental caries. The initial stage of for developing secondary caries is due to the capability of *S. mutans* to adhere to the surface of the restoration.^[20,21] In this study, swabs were collected from the occlusal and buccal surface as it harbors more microbes and more prone to caries.^[22] MSBA agar was used to isolate *S. mutans* as it is the selective media for *Streptococcus* due to the addition of bacitracin and sucrose.^[23,24] When the microbial count and OHI-S were seen on the crowns between the initial placement and first week, there was no statistically significant difference seen [Tables 1 and 2] between the 3M and Kids crown. However, the *S. mutans* count on the Kids crown was more than that observed on 3M crown and natural teeth. The surface of the restoration is highly colonized than natural tooth surfaces.^[25,26] Pedrini *et al.* said that the substances released by the dental material can directly influence the bacterial growth.^[27] On all exposed surfaces in the oral cavity, biofilm forms readily. When the microbial count and OHI-S were seen on the crowns between the initial placement and first week, there was no statistically significant difference seen [Tables 1 and 2] between the 3M and Kids crown. However, the *S. mutans* count on the Kids crown was more than that observed on 3M crown and natural teeth. Physicochemical interaction between the surface of the restoration and microorganisms occurs by electrostatic and van der Waals forces.^[28] The characteristics of SSCs such as surface roughness and surface energy influence the microbial growth.^[29] Higher the surface area and surface roughness of the restoration, higher the occurrence of bacterial adhesion. In this study, there was minimal follow-up. Further studies with long-term follow-up and scanning electron microscopic studies are needed to evaluate the microbial adhesion of plaque and *S. mutans* on Kids crown.

CONCLUSION

The microbial adhesion of plaque and the *S. mutans* was seen higher on the Kids crown. However, there was no significant difference between 3M ESPE and Kids crown.

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Conflicts of interest

There are no conflicts of interest.

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