AJDS ALAZHAR Al-Azhar Journal of Dental Science
Vol. 22- No. 2- 165:169- April 2019
Record 1110-2624 | the ISSN Portal
portal.issn.org

ASSESSMENT OF MICROBIAL ADHESION TO ZIRCONIA AND STAINLESS-STEEL CROWNS IN PRIMARY MOLARS.

Mohamed A Wakwak *, Samy Y. El Bayoumy**, Ibrahim F. Barakat***, Amany M. Tawfik ****

ABSTRACT

Purpose: Assessment of streptococcus mutans and lactobacillus adhesion to zirconia and stainless-steel crowns in primary molars **Methods:** One hundred and twenty randomly selected Egyptian children received bilateral crowns to first or second primary molars, one side was restored by stainless steel crowns (group A) and the other side was restored by zirconia crowns (group B). swabs were collected before preparation of crowns, 1 month and 3 months after cementation Results**:** There was no significant difference in the count of streptococcus mutans and lactobacillus before preparation of zirconia crowns, after 1 month and after 3 months. There was significant difference in the count of streptococcus mutans and lactobacillus before preparation of SSCs, after 1 month and after 3 months **Conclusions**: Zirconia crowns presented to be an excellent choice for primary posterior teeth full coverage restorations. Zirconia crowns performed better than SSCs in the aspect of prevention of plaque adhesion.

INTRODUCTION

Primary teeth play an important role in growth and development of children. Attempts to maintain the primary teeth until the eruption of their permanent successors have resulted in the introduction of many restorative materials and techniques (1). The stainless-steel crowns are often the first choice for the repair of severely damaged primary teeth and have been one of the most effective and efficient methods of tooth restoration in pediatric dentistry since Humphrey first used them in pediatric patients in 1950 (2). They are used to restore primary or permanent teeth with extensive or multisurface cavities, cervical decalcification and/or developmental defects (3). The stainless-steel crowns have many advantages over other crown types and dental restorative materials (4). First, their life span is the same as that of an intact primary tooth. Second, they provide protection to the residual tooth structure that may have been weakened after excessive caries removal. Third, the technique sensitivity or the risk of making errors during their application is low. Fourth, their cost is low (5). Despite many advantages, the metal appearance of these crowns is unpleasant to the parents and children and they prefer tooth-colored restorations to silver-colored fillings regardless of location of restorations (6). Inflammation of the surrounding gingival tissue is problem frequently associated with stainless steel crowns. The incidence of gingivitis has been reported to be higher around poorly fitting crowns than around the crowns considered to be well adapted (7). Considering the increasing demand for esthetic restorations, several treatment options have been proposed for primary teeth to overcome this problem such as strip crowns, pre-veneered stainless-steel crowns and zirconia crowns (8). Zirconia crowns are the most recent type of esthetic crowns for primary teeth. Zirconia, also known as

* Assistant Lecturer, Pedodontics and Oral Health Department, Faculty of Dental Medicine, Al-Azhar University (Assuit Branch).
** Professor, Pedodontics and Oral Health Department, Faculty of Dental Medicine, Boys, Cairo, Al-Azhar University
*** Assistant Professor, Pedodontics and Oral Health Department, Faculty of Dental Medicine, Boys, Cairo, Al-Azhar University.
*** Assistant Professor, Microbiology Department, Faculty of Medicine, Girls, Cairo, Al- Azhar University

"ceramic steel", has reasonable aesthetics and has excellent mechanical properties[9]. Streptococcus mutans is the main factor that initiates dental caries and lactobacillus are important in further caries development especially in the dentin. In vivo and in vitro studies have shown that streptococcus mutans is one of the bacteria isolated in plaque samples from natural and artificial surfaces during early stages of caries development. However, it is well known that the first stage of colonization by an organism involves adherence of the organism to a host surface [10]. From this viewpoint, evaluation of streptococcus mutans and lactobacillus adhesion to restorative materials is one of most importance issues for their success.

MATERIALS AND METHODS

The study was randomized clinical trial. The study approval was taken from parents or guardians by consent form. Parents were informed about the purpose of the study. This study was carried out on one hundred and twenty randomly selected Egyptian children from the Pedodontics Outpatients Clinic, Faculty of Dental Medicine, Al-Azhar University. Their age was ranged from 4 to 9 years. All children received bilateral crowns to first or second primary molars, one side was restored by stainless steel crowns (group A) and the other side was restored by zirconia crowns (group B).

FIG (1) Zirconia and st.sl. crowns

Microbiological analysis:

The swabs were collected before preparation of crowns, 1 month and 3 months after cementation[11]. Swabs were taken from occlusal and buccal surface by means of the tips of sterile cottons[12,13]. Samples were preserved in a tube containing 9ml thioglycolate broth medium as transfer medium to keep the viability of the aerobic and anaerobic micro-organisms under complete aseptic condition. All specimens were transported as soon as possible to microbiological lab at microbiology department, faculty of medicine, girls, Al-Azhar University for culture on selective media. For determining Streptococcus mutans count, mitis salivary with bacitracin agar was used according to the manufacturer's instructions. Normal saline containing the specimens was dispersed by agitation in a vortex mixer at maximum speed for 60 seconds. Homogenized specimens were serially diluted down to10^6 in sterile normal saline. The inoculated plates were then placed in anaerobic jar containing gas pack and incubated for 3 days at 37°C. The same procedure was used to determine Lactobacillus count but using selective MRS Agar.

Statistical analysis

The mean and standard deviation values were calculated. Viable counts of antibacterial activity were transformed to their log10 values. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests, data for microbial evaluation showed parametric (normal) distribution. For parametric data; Repeated measure ANOVA was used to compare between more than two groups in related samples. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

RESULTS

Streptococcus mutans results:

Before preparation: There was no statistically significant difference between (Zirconia) and (Stainless steel) where (p=0.265). The highest mean value was found in (Stainless steel) while the least mean value was found in (Zirconia). After 1 month: There was a statistically significant difference between (Zirconia) and (Stainless steel) where (p=0.007). The highest mean value was found in (Stainless steel) while the least mean value was found in (Zirconia). After 3 months: There was a statistically significant difference between (Zirconia) and (Stainless steel) where (p=0.002). The highest mean value was found in (Stainless steel) while the least mean value was found in (Zirconia).

TABLE (1): Comparison between two groups regarding streptococcus mutans count.

Variables	Streptococcus mutans count				
	Zirconia		Stainless steel		p-value
	Mean	SD (±)	Mean	SD (±)	
Before preparation	4.37 ^{a}	0.16	4.37^{bA}	0.15	**0.265ns**
After 1 month	4.37 ^{aB}	0.16	4.38^{bA}	0.14	**0.007***
After 3 months	4.37 ^{aB}	0.15	4.39 ^{aA}	0.14	**0.002***
p-value	**0.104ns**		**<0.001***		

*Means with different small letters in the same column indicate statistically significance difference, means with different capital letters in the same raw indicate statistically significance difference *; significant (p<0.05) ns; non-significant (p>0.05)*

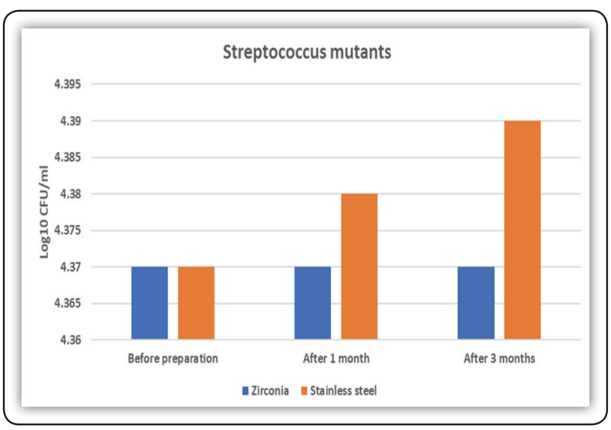

FIG (2) Bar chart representing comparison mean values between s. mutants counts of different groups

Lactobacillus results: Before preparation: There was no statistically significant difference between (Zirconia) and (Stainless steel) where (p=0.758). The highest mean value was found in (Stainless steel) while the least mean value was found in (Zirconia). After 1 month: There was a statistically significant difference between (Zirconia) and (Stainless steel) where (p=0.022). The highest mean value was found in (Stainless steel) while the least mean value was found in (Zirconia). After 3 months: There was a statistically significant difference between (Zirconia) and (Stainless steel) where (p<0.001). The highest mean value was found in (Stainless steel) while the least mean value was found in (Zirconia).

TABLE (2): Comparison between two groups regarding lactobacillus count.

Variables	Lactobacillus				
	Zirconia		Stainless steel		p-value
	Mean	SD (±)	Mean	SD (±)	
Before preparation	4.375^{aA}	0.137	4.392^{cA}	0.127	**0.758ns**
After 1 month	4.375^{aB}	0.136	4.474^{bA}	0.049	**0.022***
After 3 months	4.377 ^{aB}	0.137	4.539^{aA}	0.037	**<0.001***
p-value	**0.551ns**		**0.002***		

*Means with different small letters in the same column indicate statistically significance difference, means with different capital letters in the same row indicate statistically significance difference *; significant (p<0.05) ns; non-significant (p>0.05)*

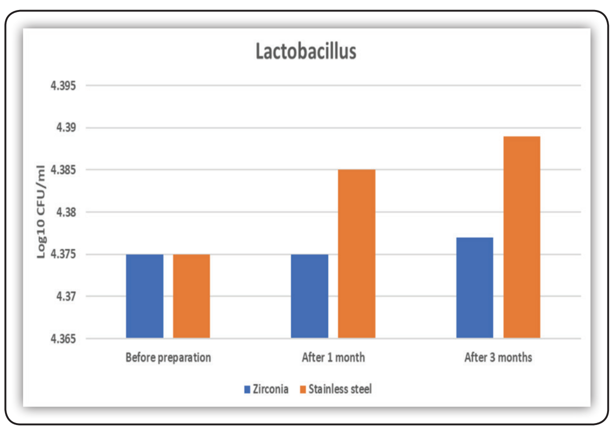

FIG (3) Bar chart representing comparison mean values between lactobacillus counts of different groups

DISCUSSION

Stainless steel crowns have been recommended to restore badly broken teeth and are considered to be superior to large multi surface amalgam restorations**.** Although SSCs are considered as the best treatment modality for teeth with extensive caries lesions or pulpotomized tooth, their use fails to meet the esthetic demands of the patient and the parents because of its unsightly metallic appearance [14]. The demand for esthetics has grown significantly for adults and children alike[9]. Due to their excellent properties, white color and superior biocompatibility; preformed zirconia crowns are being evaluated as an alternative to preformed SCCs. The analysis of newly developed dental materials with regard to the accumulation of dental plaque is commonly used in dental material science[15]. S. mutans and lactobacillus have been chosen as a representative oral bacterium as it is considered as one of the most abundant microorganisms in the oral cavity[16]. S. mutans is the principle microbe causing dental caries also, the initial stage of for developing secondary caries is due to the capability of S. mutans to adhere to the surface of the restoration and lactobacillus are important in further caries development especially in the dentin[17]. Regarding to results of microbial adhesion to crowns, In the present study there was no significant difference in the count of streptococcus mutans and lactobacillus before preparation of zirconia crowns, after 1 month and after 3 months. Also, in the present study there was significant difference in the count of streptococcus mutans and lactobacillus before preparation of SSCs, after 1 month and after 3 months. These results may be due to chemical composition of the surface of the materials which is important for bacterial colonization. The chemical stability and biocompatibility of zirconia produce a negligible rate of component release from this material. On the other hand, the characteristics of SSCs such as chemical composition and surface energy enhance the microbial adhesion. These results in agreement with Jalalian E. et al. [18] who evaluate In-vitro adhesion of streptococcus mutans to zirconia, porcelain, titanium alloy and indirect composite resin and concluded that zirconia showed the lowest bacterial adhesion in comparison to other tested materials and enamel. Also, these results supported by Abbas I. et al. [19] who reported that zirconia crowns adhere less streptococcus colonies compared to lithium disilicate and gold crowns and attributed these results due to higher biocompatibility of zirconia. On the other hand, these results disagree with Subramanyam D, et al.[13] when evaluate microbial adhesion between two commercially types of SSCs in primary molars and concluded that There was no statistically significant difference seen in the microbial count between the 3M and Kids crown and natural teeth however the drawback of this study was short duration of follow up (1 week). According to Bin AlShaibah W. et al. [11] who evaluate the adhesion of Streptococcus mutans to preveneered and stainless-steel crowns and reported that adhesion of S. mutans to preveneered crowns was higher than to SSC and attributed these results due to surface properties of composite which used as veneer such as chemical composition, surface free energy, and surface roughness enhance microbial adhesion.

CONCLUSION

Streptococcus mutans and lactobacillus adhesion to SSC was significantly higher than to zirconia crowns.

RECOMMENDATION

Longer follow up periods are recommended to observe microbial adhesion to SSCs

REFERENCES

1. Afshar H, Sabeti A &Shahrabi M. Comparison of primary molar crown dimensions with stainless steel crowns in a sample of Iranian children JODDD.2015;9(2):87-91
2. Cheo J, Bae I &Noh T. Wear of primary teeth caused by opposed all ceramic or stainless-steel crowns. J Adv Prosthodont. 2016; 8:43-52

3. Sonmez D&Duruturk L. Success rate of calcium hydroxide pulpotomy in primary molars restored with amalgam and stainless-steel crowns. Br Dent J. 2010; 9:18-22

4. Randall R. Preformed metal crowns for primary and permanent molar teeth: review of the literature. Pediatr Dent. 2002; 24: 489-500

5. Santamaria R, Innes N& Machuliskene V. Caries Management Strategies for Primary Molars 1-Yr Randomized Control Trial. JDR. 2014;93(11):13-8

6. Leith R&Connell A. Clinical study evaluating success of 2 commercially available preveneered primary molar stainless-steel crowns. Pediatr Dent. 2011;33 (4):300-6.

7. Padbury A, Eber R&Wang H. Interactions between the gingiva and the margin of restorations. J Clin Periodontol. 2003; 30:379-85

8. Zimmerman J, Feigal R, Till M&Hodges J. Parental attitudes on restorative materials as factors influencing current use in pediatric dentistry. Pediatr Dent. 2009; 31:63-70.

9. Dhar V, Hsu K, Coll J, Ginsberg E&Ball B. Evidence-based update of pediatric dental restorative procedures: dental materials. J Clin Pediatr Dent. 2015 ;39(4):303–10.

10. Auswin M, Ramesh S, Gayathri R&Priya V. Inhibition of superoxide dismutase using herbal compounds to treat oral diseases caused by Streptococcus mutans. J Adv Pharm Edu Res. 2017;7(2):146-9.

11. AlShaibah W, El-Shehaby F, El-Dokky N& Reda A. Comparative study on the microbial adhesion to preveneered and stainless-steel crowns. J Indian Soc Pedod Prev Dent. 2012;30: 206-11.

12. Motisuki C, Lima L, Spolidorio D & Santos L. Influence of sample type and collection method on streptococcus mutans and Lactobacillus spp. counts in the oral cavity. Arch Oral Biol. 2005; 50:341-5.

13. Subramanyam D& Guru Nathan D. Microbial evaluation of plaque on 3M ESPE and kids stainless steel crown in primary molars. Int J Pedod Relabel. 2016; 1:60-3

14. Atieh M. Stainless steel crown versus modified open-sandwich restorations for primary molars: A 2-year randomized clinical trial. Ped Dent. 2008;18: 325-32.

15. Tanner J, Vallittu P & Soderling E. Adherence of Streptococcus mutans to an E-glass fiber-reinforced composite and conventional restorative materials used in prosthetic dentistry. J Biomed Mater Res. 2000; 49:250-6

16. Kawashima M, Hanada N, Hamada T&Tagami H. Real-time interaction of oral streptococci with human salivary components. Oral Micro Immuno. 2003; 18:220-5.

17. Montanaro L, Campoccia D, Rizzi S, Donati M, Breschi L, Prati C, et al. Evaluation of bacterial adhesion of streptococcus mutans on dental restorative materials. Biomaterials. 2004; 25:457-63.

18. Jalalian E, Mostofi S, Shafiee E, Nourizadeh A& Nargesi R. Adhesion of streptococcus mutans to zirconia, titanium alloy and some other restorative materials: “An in-vitro study”. AIAC. 2014;3(2):13-9

19. Abbas I, Sara H& Zuryati G. Bacterial adhesion on zirconia, lithium desilicated and gold crowns-in vivo study. Adv Dent & Oral Health. 2016; 1(5):1-3