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ASSESSMENT OF SALIVARY MICROBIAL PARAMETERS WITH TWO TYPES OF FIXED SPACE MAINTAINERS IN CHILDREN

Samadah M*, El Bayoumy S**, El- Mansy T***

ABSTRACT

Purpose: The originality of the present study was to evaluate caries risk factors with salivary microbial parameters in a population of children with two types of fixed space maintainers. **Methods:** The study sample was divided equally into two groups; group A**:** twelve child received EZ space maintainer; group B: twelve child received band and loop space maintainers. The samples were collected before the insertion of the space maintainer and 2 weeks after its insertion. **Results:** There was no statistically significant difference between (EZ/Lacto) ($0.36 \times 10^3 \pm 0.68\times 10^3$) and (Band & Loop /Lacto) ($4.38\times 10^3 \pm 7.78\times 10^3$) where (p=0.165). There was no statistically significant difference between (EZ / Strept) ($1.38 \times 10^3 \pm 3.22\times 10^3$) and (Band & Loop Strept) ($5.42\times 10^3 \pm 12.75\times 10^3$) where (p=0.488). There was no statistically significant difference between (EZ) ($0.87\times 10^3 \pm 1.80\times 10^3$) and (Band & Loop) ($4.90\times 10^3 \pm 7.17\times 10^3$) where (p=0.112). **Conclusions**: Both EZ space maintainer and band and loop space maintainer increase bacteria count insignificantly. EZ space maintainer can be used as alternative to conventional band and loop space maintainer.

INTRODUCTION

Dental caries is the most common chronic disease of childhood.(1) The percentage of children found to be caries-free with regard to primary teeth was 7% however, this proportion would increase to 15.6% if the enamel lesions were excluded.(2) Dental caries is a multifactorial chronic bacterial disease that causes demineralization and destruction of the hard tissues usually by production of acid by bacterial fermentation of the food debris accumulated on the tooth surface.(3)It was reported that microorganisms believed to lead to the occurrence of caries within the oral flora, streptococcus mutans and lactobacilli play major roles in this process. Streptococcus mutans is the main factor that initiates caries and very important factor of enamel decay. The bacteria of the genus lactobacillus are important in further caries development especially in the dentin.(5) Wherever bacteria have niches in which to live, these acidogenic/aciduric bacteria preferentially survive well. Therefore, orthodontic subjects who have brackets or bands are at high risk of caries because the bacteria live well in the surrounding edges of these appliances.(6) The study of the level of streptococcus mutans in saliva is one of the most common methods for identifying subjects at risk of dental caries.(7) Longitudinal studies have shown that groups of individuals with a large amount of S. mutans in their saliva have significantly higher caries activity than those who have lower numbers of these bacteria.(8) A strong correlation has been established between the lactobacillus count and caries , the higher the DMF index, the higher the number of children harboring a high lactobacillus count.(9) Primary teeth play a critical role in the

* B.D.S 2010, Faculty of Dental Medicine, Al-Azhar University (Assuit Branch) Demonstrator, Department of Pedodontics and Dental Public Health (Assuit Branch)
** Professor and Head, Department of Pedodontics and Dental Public Health Faculty of Dental Medicine,Boys,Cairo Al-Azhar University
*** Lecturer, Department of Pedodontics and Dental Public Health Faculty of Dental Medicine, Boys, Cairo Al-Azhar University

growth and development of a child. In addition to their role in esthetics, eating, speech, and to encourage normal function and resultant expected growth, the other main function of a primary tooth is to hold space for the permanent successor until it is ready to erupt.[10,11] However, if premature extraction or loss of tooth is unavoidable due to extensive caries or other reasons, the safest option to maintain arch space is by placing a space maintainer. [12] Space maintainer is an intraoral appliance used to preserve arch length following the premature loss of primary teeth/tooth. This allows the permanent teeth to erupt unhindered into proper alignment and occlusion. [13] Space maintainer appliances may be unilateral or bilateral and fixed or removable. Band and loop space maintainer is the most common type of space maintainer used in the case of premature extraction of a primary molar because it can be produced easily and economically, it requires little chair time for application, it can be used bilaterally and it's well tolerated by children.[14] Band and loop has been used since long as a space maintainer with high success rates but in spite of disintegration of cement, solder failure, caries formation along the margins of the band, long construction time ,the need for a cast or model and the possibility of metal allergy are some of the disadvantages associated with them.[15] EZ space maintainer seems to be a suitable alternative to the conventional fixed space maintainer. EZ space maintainers are easy to apply and require only one visit. There is no need for making impressions and laboratory procedures are eliminated. [16]

MATERIALS AND METHODS

This study was carried out on twenty four selected Egyptian children from the Pediatric Dental Outpatients Clinic, Faculty of Dental Medicine, Al-Azhar University. The age of children was ranged from 4 to 9 years.The study sample was divided equally into two groups according to the type of space maintainer:

Group A: twelve child received EZ space maintainers.

Group B: twelve child received band and loop space maintainers.

Clinical inclusion criteria: [11]

1. Premature loss of a primary molar
2. Presence of teeth on the mesial and distal sides of the extraction space
3. Angle's Class I occlusion
4. Normal primary molar relation

Technique for construction band and loop space maintainer;

Brief history was recorded and a clinical examination was done. Intraoral periapical radiographs were taken in the area of tooth loss. Impressions were made by alginate impression material, study model were prepared, and a space analysis was done for every child. A prefabricated band was selected for the abutment tooth by measuring the mesiodistal diameter of abutment tooth with a caliper and correlating it with the internal diameter of the prefabricated band .The smallest stainless steel band that seats approximately 1 millimeter below the mesial and distal marginal ridges was selected. Impressions were taken with alginate impression material. Each band was then gently removed with a band remover and stabilized in the impression material in the correct position. The impression was then casted using dental stone with the band in place within 30 minutes of impression taking. [17] Loop constructed and soldered to band. The loop was soldered with the band in its middle third. Band and loop space maintainers were cemented onto a clean, dry abutment tooth with glass ionomer cement (Medcem, promedica,Neumunster,Germany) mixed according to manufacturer's instructions. Excess of cement was removed. Low-volume suction and cotton rolls isolation were used to maintain a

dry field during cementation. Space maintainers were checked for gingival Clearance and occlusal interference. Children were instructed not to eat for 30 minutes following cementation. Regular follow up appointments were scheduled at 4-6 months.

FIG (1)

Technique for construction EZ space maintainer;

A brief history was recorded and a clinical examination was done. Intraoral periapical radiograph was taken in the area of tooth loss. Choose the proper E Z Space Maintainer by its color mark and remove the coil spring. **Green** - Upper Right. **Yellow** - Upper left**. Red** - Lower Right. **White** - Lower Left. Adjust the length of the EZ Space Maintainer by squeezing one of the tubes with pliers. Isolation was done using high volume suction and cotton roll, it cannot be applied under rubber dam because it extends to muco buccal fold. Both the abutment teeth (primary canine and second primary molar) etched with 35% phosphoric acid for 60 seconds. Some controversy regarding optimal etching times for deciduous teeth, whose primeless zones have a negative effect on bond strength. Some authors recommend grinding the outer enamel layer to remove prism less enamel, while others suggest increasing the etching time to improve adhesion.[18, 19, 20] The teeth were rinsed, air-dried and wetted with an adhesive (Adper Single Bond-2® 3M) that was light cured for 20 seconds. Thin layer of flowable composite (VLC Flowable Filling composite-Prime Dent) was applied to the buccal surfaces of the abutment teeth. Each appliance was positioned about 2mm away from the gingival tissue to allow proper gingival hygiene. Bond the maintainer with a light cure adhesive according to the manufacturer's instructions. Excess adhesive was removed with finishing burs. Instructions on oral hygiene and appliance maintenance were given to both children and parents.

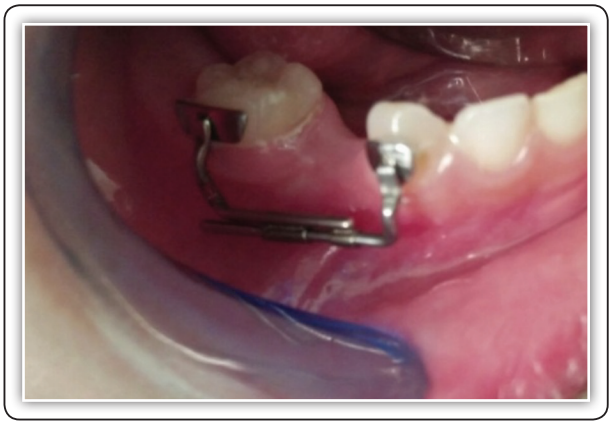

FIG (2)

Microbiological analysis:

The samples were collected before the insertion of the space maintainer and 2 weeks after its insertion. A fresh unstimulated whole saliva sample was collected from each patient by asking each child to spit in a sterile container (1st thing after getting up or at least 2 hours after meal). 1ml of the collected saliva sample was preserved in a tube containing 9 ml thioglycolate broth medium a transfer medium. 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 salivary levels, mitis salivarius with bacitracin agar was used according to the manufacturer's instructions: 1 mL of saliva was put in another sterilized tube and diluted from 10^1 to 10^6 serially with sterilized distilled water. After overtaxing the tubes for 15 seconds, 1 mL of each diluted saliva was put onto the agar.

The inoculated plates were then placed in anaerobic jar containing gas pack at 37ºC for 48 and 96 hours intervals respectively. The number of S. mutans per milliliter of saliva was estimated by comparing the colony density on the growth substrate .[21] The same procedure was used to determine Lactobacillus acidophilus salivary levels but using selective MRS Agar. After these processes, total viable S mutans and Lactobacillus colonies were counted and the numbers of the viable microorganisms were calculated by means of colony-forming units per milliliter of volume (cfu/ ml).

Statistical analysis

The data and the statistics were done according to the 1 mL amount of volume as colony-forming units per milliliter. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests and showed parametric (normal) distribution. Pair-wise t-test was used to compare between different variables (Pre and Post) in same group while independent sample t-test was used to compare between (EZ) and (Band and Loop) groups.

RESULTS

Effect of Space maintainer material on bacterial count:

For Lactobacillus species:

1. For EZ space maintainer:

There was no statistically significant difference between (EZ/Lacto/Pre) ($5.31 \times 10^3 \pm 1.46 \times 10^3$) and (EZ/Lacto/Post) ($5.67 \times 10^3 \pm 1.76 \times 10^3$) where (p=0.094).

2. For Band and Loop space maintainers:

There was no statistically significant difference between (Band & Loop/Lacto/Pre) ($8.88 \times 10^3 \pm 4.65 \times 10^3$) and (Band & Loop /Lacto/Post) ($13.25 \times 10^3 \pm 9.83 \times 10^3$) where (p=0.077).

3. Relation between both materials of space maintainers:

There was no statistically significant difference between (EZ/Lacto) ($0.36 \times 10^3 \pm 0.86 \times 10^3$) and (Band & Loop /Lacto) ($4.38 \times 10^3 \pm 7.78 \times 10^3$) where (p=0.165).

For Streptococcus mutans:

1. ***For EZ space maintainer:***

There was no statistically significant difference between (EZ/Strept/Pre) ($21.42 \times 10^3 \pm 21.42 \times 10^3$) and (EZ/ Strept /Post) ($22.79 \times 10^3 \pm 6.57 \times 10^3$) where (p=0.167).

2. ***For Band and Loop space maintainers:***

There was no statistically significant difference between (Band & Loop/ Strept /Pre) ($35.39 \times 10^3 \pm 8.90 \times 10^3$) and (Band & Loop / Strept / Post) ($40.81 \times 10^3 \pm 9.11 \times 10^3$) where (p=0.169).

3. ***Relation between both materials of space maintainers:***

There was no statistically significant difference between (EZ / Strept) ($1.38 \times 10^3 \pm 3.22 \times 10^3$) and (Band & Loop Strept) ($5.42 \times 10^3 \pm 12.75 \times 10^3$) where (p=0.488).

Effect of Space maintainer material on bacterial count regardless type of bacteria:

There was no statistically significant difference between (EZ) ($0.87 \times 10^3 \pm 1.80 \times 10^3$) and (Band & Loop) ($4.90 \times 10^3 \pm 7.17 \times 10^3$) where (p=0.112).

DISCUSSION

The study of the level of streptococcus mutans in saliva is one of the most common methods for identifying subjects at risk of dental caries.[7] A strong correlation has been established between the Lactobacillus count and caries, the higher caries, the higher the number of children harboring a high Lactobacillus count.[9] In the present study band and loop space maintainer was used because it is the most prevalent. It adjust easily to accommodate

changing dentition.[22] Band and loop has been used since long as a space maintainer with high success rates .[12] Currently, glass ionomer cements (GIC) are more widely accepted for use in the cementation of band and loop. Not only do GICs adhere to both enamel and metal, they also provide fluoride release and uptake. Despite these advantages, the use of GICs has not eliminated the problem of failure at the stainless steel band-tooth interface. Resin-based materials have been developed with a stronger bond to tooth structure than GICs. However this bonding ability represents a disadvantage when removal of appliance is required. For this reason, the present study used GIC to cement bands to teeth. [11] According to(Nayak et al.2004) and (Kulkarni et al.2009), the fabrication of conventional band and loop space maintainer required more laboratory time and needed minimum of two appointments. They concluded that this procedure was time taking and labor intensive, therefore expensive. Also impression making was difficult in young and uncooperative children. [23] Considering this there have been many pilot studies that explain the use of newer adhesive directly bonded EZ as fixed space maintainers. [12]

There are limited literatures available in terms of effect of space maintainers on bacteria. In the present study there was no significant difference in the count of lactobacillus species and streptococcus mutans before insertion of band and loop space maintainer and after 2 weeks from cementation. Also in the present study thre was no significant difference in the count of lactobacillus species and streptococcus mutans before insertion of EZ space maintainer and after 2 weeks.

These results may be due to regular surfaces on band and loop space maintainer, good soldering between band and loop and proper design of space maintainer. In EZ space maintainer these results may be attributed due to good finishing and polishing of composite with finishing burs and sufficient clearance between space maintainer and gingiva. This result in agreement with (Keris E et al 2016) reported that there is no significant difference in gingival index and plaque index after application of two groups of bonded and cemented space maintainers for periods of follow up immediately, 1week and 5weeks.[24] On the other hand according to (Gules.S et al 2014) that had been evaluate E Z space maintainer clinically for period of follow up 1month, 3 months and 2o months after application reported that an increase in plaque index scores 1 month after placement of the EZ Space Maintainer especially around the abutment teeth but relatively low gingival index scores, with only one appliance failure due to periodontal conditions.[25] Also (Maret D et al. 2014), reported that significant increase in S.mutans and lactobacillus in saliva was found after 6 weeks from the start of fixed orthodontic therapy and the highest levels were registered at the 12th week of therapy .when assess the microbial changes in children with fixed orthodontic appliances compared with a control group of children without orthodontic treatment, over a period of six months. [26] This increase in S. mutans following placement of orthodontic devices can be explained by the irregular nature of their surfaces, which promote the growth of these aciduric and acidogenic bacteria that prefer hard surfaces to grow on.

CONCLUSIONS

1. EZ space maintainer can be used as alternative to conventional band and loop space maintainer.
2. Both EZ space maintainer and band and loop space maintainer increase bacteria count insignificantly.

RECOMMENDATIONS

1. EZ space maintainer is a promising appliance but further and long term studies are needed on various designs.
2. Longer follow up periods are recommended to observe long term effect of EZ space maintainer and B & L space maintainers on L. acidophilus and S. mutans in saliva.

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