

<https://doi.org/10.33472/AFJBS.6.9.2024.120-124>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Comparative evaluation of changes in salivary flow rate, pH, and Streptococcus mutans levels in children undergoing fixed and removable space maintainer therapy.

¹Dr. Prudhvi Kumar Bellapukonda, ²Dr. PVM Uday Mohan A, ³Dr. Navaneet Babu Senapathi, ⁴Dr. KVK Santosh Kumar, ⁵Dr. Kuruva Sharvani, ⁶Dr. Akhila Sirin Koyyalamudi

¹PG 3rd Year, Department of Pediatric and Preventive Dentistry, Anil Neerukonda Institute Of Dental Sciences, Visakhapatnam, Andhra Pradesh.

²Assistant Professor, Department of Pediatric and Preventive Dentistry, Anil Neerukonda Institute Of Dental Sciences, Visakhapatnam, Andhrapradesh.

³Associate Professor, Department of Pediatric and Preventive Dentistry, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhra Pradesh.

⁴Assistant Professor, Department of Pediatric and Preventive Dentistry, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhra Pradesh.

⁵PG 3rd Year, Department of Pediatric and Preventive Dentistry, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhrapradesh.

⁶PG 2nd Year, Department of Pediatric and Preventive Dentistry, Anil Neerukonda Institute of Dental Sciences, Visakhapatnam, Andhra Pradesh.

Article History

Volume 6, Issue 9, 2024

Received: 11 Mar 2024

Accepted : 04 Apr 2024

doi: 10.33472/AFJBS.6.9.2024.120-124

Abstract

Background: To evaluate changes in salivary flow rate, pH, and Streptococcus mutans levels in children undergoing fixed and removable space maintainer therapy. **Materials & methods:** Thirty individuals, aged five to twelve, of both sexes, were included in the study who needed an appliance (space maintainers, habit-breaking appliances) fixed or detachable. Data for the two groups were compared. The results were analysed using SPSS software. The p value less than 0.05 was considered significant. **Results:** Among the fixed space maintainer group, salivary flow rate and Streptococcus mutans level showed significant rise at 3 months follow-up. Similar pattern was seen among patients of the removable space maintainer group. They also showed significant rise in salivary flow rate and Streptococcus mutans level at 3 months follow-up. However; while comparing the baseline to 3 months mean difference of different variables among fixed space maintainer group and removable space maintainer group, only streptococcus levels showed significant difference. **Conclusion:** Positive and negative changes in salivary parameters were associated with SM therapy, highlighting the significance of patient and parent education regarding maintaining good oral hygiene throughout SM therapy.

Keywords: space maintainers, Saliva, Streptococcus mutans.

Introduction

Space maintainers (SM) are commonly used in the case of early loss of primary teeth to maintain the space required for the eruption of permanent successors. Fixed space maintainer (FSM) and removable space maintainer (RSM) are routinely used in children. FSMs often include a band, which is placed over the tooth crown and sometimes slightly invades the gingival sulcus. Depending on the type of space maintainer, wires of different shapes may be welded to the band. RSMs include an acrylic body with wires for retention when placed on teeth. These wires sometimes invade the gingival sulcus to provide more retention. These appliances and their band and wires change the contour of the teeth and often result in plaque accumulation. Also, they complicate oral hygiene practice by children. The use of FSMs and RSMs can also cause some periodontal changes due to impaired oral hygiene practice and, further, plaque accumulation following the placement of these appliances, and gingival inflammation may occur.¹ A previous study compared the effects of bands and other orthodontic appliances on the periodontium and showed that bands had a more destructive effect.² Alstad and Zachrisson² stated that orthodontic treatments may initiate periodontal disease. An increase in probing pocket depth (PPD) has also been reported following orthodontic treatment in patients with poor oral hygiene. However, these pockets can be pseudo-pockets (due to inflammatory conditions) without attachment loss.³ Freitas et al.⁴ discussed that treatment with fixed appliances affects the oral microbiota qualitatively and quantitatively. Arikani et al.⁵ reported that both FSMs and RSMs may cause gingivitis in children. In a more recent study, the same group of authors discussed that space maintainers should be considered as a source of infection and oral hygiene must be strictly practiced during the use of these appliances.⁶ Development of primary, mixed, and permanent dentition along with guidance of eruption is a fundamental part of comprehensive oral healthcare for all pediatric dental patients. This guidance should contribute to the development of a stable, functional, and esthetically acceptable permanent dentition. Timely diagnosis and effective management of the developing malocclusion can have long-term benefits along with maintenance of occlusal harmony, function, and dental esthetics.⁷ The rationale behind giving space maintainers or appliances is to guide the erupting permanent teeth, increasing the masticatory efficiency, and enhancement of the esthetics of the individual.⁸ The etiology for various malocclusions in the developing dentition is varied and so are the treatment options available for the same. Both fixed and removable orthodontic appliances are used for the correction of developing and already established malocclusions in primary, mixed, and permanent dentitions.⁸ *S. mutans* is an aciduric Gram-positive coccus which may be naturally found in dental plaque and saliva. In this study, high proportions of *S. mutans* were seen in the saliva and subgingival plaque samples of chronic periodontitis. This is in contradiction to studies by Koll-Klais et al. who found high proportions of these species in healthy individuals, indicating that they help in maintaining a micro-ecological balance in the oral cavity.⁹ Hence, this study was conducted to evaluate changes in salivary flow rate, pH, and *Streptococcus mutans* levels in children undergoing fixed and removable space maintainer therapy.

Materials & methods

Thirty individuals, aged five to twelve, of both sexes, were included in the study who needed an appliance (space maintainers, habit-breaking appliances) fixed or detachable. Two groups of subjects were formed as follows: Group I: 15 participants will receive fixed appliance treatment (space maintainers with banded teeth and fixed appliances designed to break bad habits). Group II: Fifteen patients receiving treatment with removable appliances (functional and nonfunctional space maintainers, appliances that disrupt habits). The patients had to finish all of their general dentistry operations, and a comprehensive case history, clinical examination, and radiographic investigations were documented. Shortly before and three months after the SMs were placed, measurements of the salivary flow rate, pH, and *S. mutans* levels were made. Data for the two groups were compared. The results were analysed using SPSS software. The p value less than 0.05 was considered significant.

Results

Among the fixed space maintainer group, salivary flow rate and *Streptococcus mutans* level showed significant rise at 3 months follow-up. Similar pattern was seen among patients of the removable space maintainer group. They also showed significant rise in salivary flow rate and *Streptococcus mutans* level at 3 months follow-up. However; while comparing the baseline to 3 months mean difference of different variables among fixed space maintainer group and removable space maintainer group, only streptococcus levels showed significant difference.

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Table 1: Comparison of change in variables within fixed space maintainer group

Variable	Baseline	3 months	p-value
Flow rate	0.31	0.39	0.001*
pH	6.56	6.55	0.112
Streptococcus mutans level (CFU/mL) x 10 ³	13.81	17.13	0.001*

*: Significant

Table 2: Comparison of change in variables within removable space maintainer group

Variable	Baseline	3 months	p-value
Flow rate	0.29	0.39	0.000*
pH	6.78	6.61	0.098
Streptococcus mutans level (CFU/mL) x 10 ³	12.31	14.85	0.000*

*: Significant

Table 3: Comparison of baseline to 3 months mean difference of variable among fixed space maintainer group and removable space maintainer group

Variable	Fixed space maintainer	Removable space maintainer	p-value
Flow rate	-0.08	-0.10	0.646
pH	0.01	0.17	0.774
Streptococcus mutans level (CFU/mL) x 10 ³	-3.32	-2.54	0.000*

*: Significant

Discussion

The bacterial microflora, present in the oral cavity, contributes to the health of the host and prevents infections by potentially pathogenic exogenous microorganisms, thus providing resistance to the colonization of these parasitic species, and by regulating the inflammatory response towards the commensal bacteria that host in the buccal cavity.

¹⁰ Two literature reviews ^{11,12} showed that there is moderate-to-high evidence that orthodontic appliances are able to significantly influence the concentration of oral microbiota, causing an alteration of the quantity of Streptococcus mutans (*S. mutans*) and Lactobacilli that can basically affect the process of tooth enamel demineralization, due to their acid production and tooth adhesive properties. This statement is confirmed both for removable and fixed orthodontic appliances. ^{13,14} Hence, this study was conducted to evaluate changes in salivary flow rate, pH, and Streptococcus mutans levels in children undergoing fixed and removable space maintainer therapy.

In the present study, Among the fixed space maintainer group, salivary flow rate and Streptococcus mutans level showed significant rise at 3 months follow-up. Similar pattern was seen among patients of the removable space maintainer group. They also showed significant rise in salivary flow rate and Streptococcus mutans level at 3 months follow-up. However; while comparing the baseline to 3 months mean difference of different variables among fixed space maintainer group and removable space maintainer group, only streptococcus levels showed significant difference. A study by Bahurupi MP et al, compared and evaluated the changes in salivary flow rate, pH, and Streptococcus mutans levels in children undergoing fixed and removable SM therapy. The study participants comprised 40 children aged 4-10 years divided into two groups of 20 each. Children undergoing fixed (Group I = 20) and removable SM therapy (Group II = 20). Salivary flow rate, pH, and *S. mutans* levels were recorded just before and 3 months after the placement of SMs. Data were compared for both groups. A significant increase in salivary flow rate (<0.05) and *S. mutans* level (<0.05) was evident, however, no significant difference in pH was found in both the groups from baseline to 3 months after appliance placement. Group I showed a significant increase (<0.05) in *S. mutans* level as compared to Group II. SM therapy allied both favorable and unfavorable changes in salivary parameters, thus emphasizing the importance of parent and patient education about maintaining proper oral hygiene during SM therapy. ¹⁵

Another study by Sharma M et al, conducted a clinical study was undertaken to evaluate and compare the efficacy of toothbrushing, fluoride varnish, chlorhexidine mouthwash, and a probiotic (Yakult) in reducing the *S. mutans* counts in the saliva using Dentocult SM Strip Mutans kit in children. A total of 40 school students between the age group of 4 and 8 years were selected for the study and *S. mutans* count was taken on the first dental visit using Dentocult SM Strip Mutans test kit. After the initial scores of *S. mutans* were obtained, the children were divided into four groups and provided with different caries preventive regimen for 2 weeks. After 2 weeks, the scores of *S. mutans* were

reevaluated for reduction in their counts, if any. The data thus collected were tabulated and statistically analyzed. All the groups showed a significant reduction in *S. mutans* counts with the highest reduction from the Fluor Protector varnish followed by chlorhexidine mouthwash, probiotic (Yakult), and toothbrushing.¹⁶ Kukreja P et al, evaluated and compared the effect of fixed and removable space maintainers or appliances on salivary factors (“salivary flow rate,” pH, and buffering capacity of saliva) in children aged 5–12 years over a period of 3 months. Sixty children were selected for the study and equally alienated into two groups as group I for fixed appliances and group II for removable appliances). Unstimulated saliva was collected from children wearing fixed and removable space maintainers or appliances at baseline, 1, 2, and 3 months. At the end of 3 months, there was a slight decrease in the buffering capacity and pH of saliva, which was not statistically significant in both the groups. An increase in unstimulated salivary flow rate was also seen in both the groups at the end of 3 months. Fixed and removable space maintainers or appliances act as opportunistic plaque retentive sites in children, necessitating appropriate oral hygiene maintenance and its reinforcement. Failure to adhere to a strict oral hygiene regimen can cause considerable enamel decalcification and plaque retention leading to alteration in oral microflora which has detrimental effects. The study paves way for provision of incorporating practice guideline information for both dentists and children undergoing long-term space maintainer or appliance therapy in children.¹⁷ Quantitative and qualitative salivary changes allied with local or systemic disorders are not always easily netted or valued by clinicians and scientists owing to the dearth of calibration in saliva collection techniques. Saliva composition can be termed as “whole” (mixed or total) which is secretions from three pairs of major salivary glands and abundant minor ones (labial, buccal, lingual, and palatal) or “gland specific.” Diverse sources (mixed vs individual glands) and techniques (unstimulated vs stimulated) of collection significantly affect the looked-for qualitative or quantitative changes being evaluated.^{18,19} Chang et al. and Ulukapi et al. which state a prolonged stimulatory effect of treatment with fixed orthodontic appliances on salivary flow.^{20,21} Also, the increase in salivary flow rate with the use of orthodontic appliances is beneficial as it offers mechanical cleaning and buffered pH.²²

Conclusion

Positive and negative changes in salivary parameters were associated with SM therapy, highlighting the significance of patient and parent education regarding maintaining good oral hygiene throughout SM therapy.

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