Original Research

Assessment of effect of fixed orthodontic treatment on salivary pH

Tushar Abrol[1], Karan Duvedi[2], Kusha Thakur[3], Yashika Bali[4]

[1]MDS (Orthodontics and Dentofacial orthopedics), Private practitioner Jammu and Kashmir
[2]Senior Lecturer, Department of Prosthodontics, Crown & Bridge and Implantology, Himachal Dental College, Sundernagar
[3]MDS (Prosthodontics and Crown and Bridge), Associate dentist, Dental life Fortis C-Doc, New Delhi
[4]Senior Lecturer, Department of Prosthodontics, Crown & Bridge, Baba Jaswant Singh Dental College, Ludhiana

ABSTRACT:
Background: Areas around metal brackets are difficult to clean and are prone to the adhesion of bacteria and debris, whereas in the case of orthodontic bands, biofilm formation occurs mostly at the gingival margin, leading to periodontal inflammation. Decreased pH and higher lactobacillus and Streptococcus mutans count increase the susceptibility to caries. Hence; the present study was undertaken for assessing the effect of fixed orthodontic treatment on salivary pH. **Materials & methods:** A total of 20 patients scheduled to undergo orthodontic treatment were enrolled. Complete demographic details of all the patients were obtained. Clinical and radiographic details were also recorded separately. The pH values were measured with portable pH meter strips at the same four time points. Measurement of pH was done at baseline, 6 weeks post initiation of fixed orthodontic treatment, 12 weeks post initiation of fixed orthodontic treatment, and 18 weeks post initiation of fixed orthodontic treatment. **Results:** Mean pH at baseline, 6 weeks post initiation of fixed orthodontic treatment, 12 weeks post initiation of fixed orthodontic treatment, and 18 weeks post initiation of fixed orthodontic treatment was found to be 7.22, 6.79, 6.71 and 6.68 respectively. While analyzing statistically, significant results were obtained. **Conclusion:** There is a decrease in salivary pH during the course of fixed orthodontic treatment predisposing for the development of dental caries.
Key words: Orthodontic treatment, pH

INTRODUCTION:

Orthodontic treatment has gained increasing popularity owing to increased self-awareness of oral health-related quality of life and facial esthetics. However, treatments using fixed appliances may induce the formation of bacterial biofilms in healthy oral cavities, and these can compromise oral hygiene and lead to enamel demineralization and gingival inflammation.[1]

Areas around metal brackets are difficult to clean and are prone to the adhesion of bacteria and debris, whereas in the case of orthodontic bands, biofilm formation occurs mostly at the gingival margin, leading to periodontal inflammation. Several studies have demonstrated the development of white spot lesions on the tooth surface following orthodontic treatment.[2-4]

The effects of acidic foods, acidic and alcoholic beverages, herbal teas and different chemical solvents on the bond strength of orthodontic brackets have been investigated by researchers. Aside from increasing the risk of bond failure, these substances may increase the incidence of caries and periodontal problems and can lead to patient dissatisfaction. Decreased pH and higher lactobacillus and Streptococcus mutans count increase the susceptibility to caries.[5-7] Hence; the present study was undertaken for assessing the effect of fixed orthodontic treatment on salivary pH.

155

MATERIALS & METHODS

The present study was conducted with the aim of assessing effect of fixed orthodontic treatment on salivary pH. A total of 20 patients scheduled to undergo orthodontic treatment were enrolled. Complete demographic details of all the patients were obtained. Clinical and radiographic details were also recorded separately. The pH values were measured with portable pH meter strips at the same four time points. Measurement of pH was done at baseline, 6 weeks post initiation of fixed orthodontic treatment, 12 weeks post initiation of fixed orthodontic treatment, and 18 weeks post initiation of fixed orthodontic treatment. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Student t test and one way ANOVA were used for evaluation of level of significance.

RESULTS

In the present study, a total of 20 patients scheduled to undergo fixed orthodontic treatment were analyzed. Mean age of the patients was found to be 14.2 years. There were 14 males and 6 females. Mean pH at baseline, 6 weeks post initiation of fixed orthodontic treatment, 12 weeks post initiation of fixed orthodontic treatment, and 18 weeks post initiation of fixed orthodontic treatment was found to be 7.22, 6.79, 6.71 and 6.68 respectively. While analyzing statistically, significant results were obtained.

Table 1: Demographic data

Parameter		n	%
Age group (years)	Less than 15	12	60
	More than 15	8	40
Gender	Males	14	70
	Females	6	30

Table 2: Change in pH with time

Time (weeks)	pH	p- value
Zero	7.22	0.00 (Significant)
Six	6.79	
Twelve	6.71	
Eighteen	6.68	

DISCUSSION

Malocclusion is one of the most common dental disorders and is capable of increasing the risk of periodontal disease and dental caries. Orthodontic treatment of malocclusions can often resolve them, or at least prevent their progression. However, complex design of fixed orthodontic appliances can affect the oral hygiene by influencing several parameters including the saliva properties and microbial count. Saliva is involved in myriad functions, such as mechanical cleansing, demineralization and remineralization of the enamel, protection against oral microbial flora, and buffering of acids in the oral cavity. Maintenance of oral hygiene is difficult in individuals with fixed orthodontic appliances, and this leads to plaque accumulation, gingival inflammation, dental caries, and other periodontal conditions. White spot lesions usually develop within a month of starting fixed orthodontic treatment.[6-9] Hence; the present study was undertaken for assessing the effect of fixed orthodontic treatment on salivary pH.

In the present study, a total of 20 patients scheduled to undergo fixed orthodontic treatment were analyzed. Mean age of the patients was found to be 14.2 years. There were 14 males and 6 females. Arab S et al evaluated the changes in saliva properties and oral microbial flora in patients undergoing fixed orthodontic treatment. Two important saliva properties namely the salivary flow rate and pH as well as oral microbial flora were assessed in 30 orthodontic patients before starting fixed orthodontic treatment and after six, 12 and 18 weeks of treatment. Selective media, Sabouraud dextrose agar, Mitis salivarius agar and Rogosa agar were used for isolation of Candida albicans, Streptococcus mutans and Lactobacillus acidophilus, respectively. After six, 12 and 18 weeks of commencing fixed orthodontic treatment, the total colony counts of Candida albicans, Streptococcus mutans and Lactobacillus acidophilus showed a significant increase. The saliva pH decreased during the orthodontic treatment ($P< 0.05$) while the salivary flow did not change significantly. Fixed orthodontic treatment causes major changes in the saliva properties.[10]

In the present study, mean pH at baseline, 6 weeks post initiation of fixed orthodontic treatment, 12 weeks post initiation of fixed orthodontic treatment, and 18 weeks post initiation of fixed orthodontic treatment was found to be 7.22, 6.79, 6.71 and 6.68 respectively. While analyzing statistically, significant results were obtained. Toodehzaeim MH et al evaluated the effect of salivary pH on the shear bond strength (SBS) of orthodontic brackets to tooth surface. Eighty intact premolars were randomly divided into four groups of 20. After bonding a bracket on each tooth, the groups one to four were stored in artificial saliva at a pH of 3.8, 4.8, 5.8, and 6.8, respectively for two months. The artificial saliva solutions were refreshed weekly. Each tooth was then embedded in an acrylic block so that the crown was exposed and its buccal surface was parallel to the direction of the force during SBS testing. The mean SBS value in group one (pH 3.8) was significantly lower than that in other groups ($P<0.05$). The differences between other groups were not significant ($P>0.05$). Decreased salivary pH due to poor oral hygiene and/or frequent consumption of acidic beverages may be responsible for orthodontic bracket bond failure.[11] Alshahrani I et al evaluated the changes in essential salivary parameters in patients undergoing fixed orthodontic treatment. Their

156

findings indicated that the biochemical properties of saliva are altered after introducing fixed orthodontic appliances into the oral cavity, thereby promoting plaque retention and increasing the susceptibility to tooth demineralization and gingival inflammation.[12] Asli Topaloglu-Ak et al investigated the effect of fixed and removable orthodontic appliances among children on salivary Streptococcus mutans, Lactobacillus sp. and Candida albicans. The study was conducted on 69 patients aged between 6-17 years who used fixed or removable orthodontic appliances. Five ml samples of unstimulated saliva from each patient were collected at baseline and at the 1, 3 and 6 month periodic controls. Samples were diluted and plated on Mitis Salivarus Agar (MSA), Man Rogosa Sharp Agar (MRS) and Saboroud Dextrose Agar (SDA). The growths on the plates were examined under a stereomicroscope. Numbers of colony forming units (CFU) per plate were counted. For statistical analysis, the paired t test and Chi-Square were used. S mutans and Lactobacillus sp counts increased significantly 6 months after the insertion of fixed/removable orthodontic appliances in the oral cavity. A significant increase for C albicans presence was noted after 3 months compared with baseline for fixed appliances. Long-term utilization of orthodontic appliances may have a negative effect on microbial flora and increase the risk of new carious lesions and periodontal problems.[13]

CONCLUSION

From the above results, the authors concluded that there is a decrease in salivary pH during the course of fixed orthodontic treatment predisposing for the development of dental caries. However; further studies are recommended.

REFERENCES

1. Glans R, Larsson E, Øgaard B. Longitudinal changes in gingival condition in crowded and non-crowded dentitions subjected to fixed orthodontic treatment. Am J Orthod Dentofacial Orthop. 2003. December; 124 (6): 679– 82.
2. Larmour CJ, McCabe JF, Gordon PH. An ex vivo investigation into the effects of chemical solvents on the debond behaviour of ceramic orthodontic brackets. Br J Orthod. 1998. February; 25 (1): 35– 9.
3. Diedrich P, Rudzki-Janson I, Wehrbein H, Fritz U. Effects of orthodontic bands on marginal periodontal tissues: A histologic study on two human specimens. J Orofac Orthop. 2001. March; 62 (2): 146– 56.
4. Bollen AM, Cunha-Cruz J, Bakko DW, Huang GJ, Hujoel PP. The effects of orthodontic therapy on periodontal health: a systematic review of controlled evidence. J Am Dent Assoc. 2008. April; 139 (4): 413– 22.
5. Smiech-Slomkowska G, Jablonska-Zrobek J. The effect of oral health education on dental plaque development and the level of caries-related Streptococcus mutans and Lactobacillus spp. Eur J Orthod. 2007. April; 29 (2): 157– 60.
6. Hobson RS, McCabe JF, Hogg SD. The effect of food simulants on enamel-composite bond strength. J Orthod. 2000. March; 27 (1): 55– 9.
7. Vizitiu TC, Ionescu E. Microbiological changes in orthodontically treated patients. Therapeutics, Pharmacology and Clinical Toxicology. 2010. December; 14 (4): 283– 6.
8. Kumar Goje S, Bhavsar A, Patel J. Comparative evaluation of salivary parameters before and during orthodontic treatment. Int J Recent Sci Res 2017;8:18630-4.
9. Prabhakar A, Dodawad R, Os R. Evaluation of flow rate, pH, buffering capacity, calcium, total protein and total antioxidant levels of saliva in caries free and caries active children-an In Vivo study. Int J Clin Pediatr Dent 2009;2:9-12.
10. Arab S, Nouhzadeh Malekshah S, Abouei Mehrizi E, Ebrahimi Khanghah A, Naseh R, Imani MM. Effect of Fixed Orthodontic Treatment on Salivary Flow, pH and Microbial Count. J Dent (Tehran). 2016;13(1):18-22.
11. Toodehzaeim MH, Khanpayeh E. Effect of Saliva pH on Shear Bond Strength of Orthodontic Brackets. J Dent (Tehran). 2015;12(4):257-262.
12. Alshahrani I, Hameed M S, Syed S, Amanullah M, Togoo R A, Kaleem S. Changes in essential salivary parameters in patients undergoing fixed orthodontic treatment: A longitudinal study. Niger J Clin Pract 2019;22:707-12
13. Asli Topaloglu-Ak 1, Fahinur Ertugrul, Ece Eden, Mustafa Ates, Hakan Bulut Effect of Orthodontic Appliances on Oral microbiota--6 Month Follow-Up. J Clin Pediatr Dent. Summer 2011;35(4):433-6. doi: 10.17796/jcpd.35.4.61114412637mt661.