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Effect of fixed orthodontic treatment on salivary pH

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ABSTRACT:
Background: To evaluate change in pH in patients undergoing fixed orthodontic treatment. **Materials & methods:** A total of 20 subjects were enrolled. Patients were diagnosed with class I and class II malocclusion. The pH values were measured with portable pH meter strips at the same four time points. The data were analyzed using SPSS software. **Results:** A pH value decreased from 7.25 in T1 to 6.84 in T18. This decrease in pH value was statistically significant. **Conclusion:** There are changes in salivary pH in patients undergoing orthodontic treatment.
Keywords: Orthodontics, Salivary pH.

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INTRODUCTION

Malocclusion is one of the most common dental disorders and is capable of increasing the risk of periodontal disease and dental caries. [1] Orthodontic treatment of malocclusions can often resolve them, or at least prevent their progression. [2] However, complex design of fixed orthodontic appliances can affect the oral hygiene by influencing several parameters including the saliva properties and microbial count. [3] Changes in the saliva parameters such as decrease in pH, flow rate and buffering capacity of the saliva may contribute to enamel demineralization and increase the susceptibility to dental caries. [4]

Saliva plays an important part in sustaining oral hygiene. [5] Saliva composition varies from person to person and does not show a clear relation to the composition of blood. Low levels of salivary buffering ability, calcium, and phosphate show a connection to caries. Saliva contains a limited proportion of electrolytes and proteins, but they play vital roles in maintaining oral health and integrity of teeth. [6] Orthodontic appliances are often associated with dietary changes because of discomfort from masticatory movements. The conventional metal stents are routinely prescribed for patients with extreme narrowing. Orthodontic treatment involves fitting or inserting orthodontic wires to correct an irregular bite. The incidence of orthodontic treatment varies from 10% to 35% in the developing countries. It is evident from the given evidence that fixed orthodontic appliances are harmful to oral hygiene. [7] Orthodontic biomaterials influence the oral environment and have a complex interaction with different components. In

addition, their impact on various salivary parameters is not yet elucidated in a tangible way, despite the current innovations of orthodontic biomaterials and the characterization of tissue-material interactions. [8] Previous investigations did not determine the specific correlation between the placement of orthodontic appliances and biological and clinical outcomes. [9] Hence, this study was conducted to evaluate change in pH in patients undergoing fixed orthodontic treatment.

Materials & methods

A total of 20 subjects were enrolled. Patients were diagnosed with class I and class II malocclusion. Fixed orthodontic treatment was done. For the measurement of pH, saliva was collected between 10 and 12 a.m. The whole saliva was collected by spitting into a sterile test tube for 10 minutes. The pH values were measured with portable pH meter strips at the same four time points. P<0.05 was considered statistically significant. The data were analyzed using SPSS software.

Results

A total of 20 subjects were enrolled. A pH value decreased from 7.25 in T1 to 6.84 in T18. This decrease in pH value was statistically significant. The pH value at T6 was 6.82 and p- value was significant as with a value of 0.001.

Table: The pH values of whole saliva after six, 12 and 18 weeks of treatment

Time	pH	P- value
0	7.25	-
6	6.82	0.001
12	6.80	0.001
18	6.84	0.001

Discussion

Saliva acts as a salivary antiseptic and is a potential partner in the development and prevention of dental caries. [10,11] Even one month after the placement of orthodontic appliances was a substantial rise in salivary flow rate discovered. [10] A study findings are consistent with the findings of early studies by [11,12] who discovered a substantial increase in salivary flow rate after 3 months relative to the baseline. According to these authors, a transient increase in this salivary parameter was observed after the placement of orthodontic appliances due to the mechanical stimulation offered by the orthodontic appliances. However, no change in this salivary parameter was observed in the subsequent phases of the study, presumably because the salivary flow rate returned to its initial rate after the patient's adaptation to orthodontic appliances. [10] Increased salivary flow also contributes to increased salivary buffer capability. The oral environment can adapt to foreign bodies by increasing salivary flow rate, which has implications for buffer capacity and salivary Ph. [13] Increased salivary flow rate leads to the cleaning process in the oral cavity and modifies the composition of saliva, increasing bicarbonate ions and, as a result, an increase in saliva pH. Saliva's ability to combat acids formed by microorganisms in the oral cavity is influenced by pH and salivary buffer energy. Hence, this study was conducted to evaluate change in pH in patients undergoing fixed orthodontic treatment.

In the present study, a total of 20 subjects were enrolled. A pH value decreased from 7.25 in T1 to 6.84 in T18. This decrease in pH value was statistically significant. A study by Arab S et al, 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. The changes in oral microflora and saliva properties show the importance of caries preventive measures during orthodontic treatment. [13]

In the present study, the pH value at T6 was 6.82 and p- value was significant as with a value of 0.001. Another study by Dallel I et al, a cohort study was conducted with 112 healthy patients. Salivary samples were taken at baseline, 1 month, and 9 months after placement of the orthodontic appliances used in treatment. A statistically significant difference was observed in certain examined salivary parameters, including enzymes, electrolytes, and oxidative stress markers. The use of aligners had a lower prevalence of disturbing salivary parameters. Orthodontist must consider these changes to prevent the occurrence of white spot lesions. [14] AlHudaithi FS et al, saliva samples were collected from 35 patients before de-bonding (T0) and after 4 to 5 weeks of de-bonding or on retention period (T1). The biochemical parameters such as calcium, phosphorous and alkaline phosphatase levels were measured with saliva samples. Additionally, flow-rate, buffering capacity, pH and OHI levels was also measured. Results showed reduction in calcium, alkaline phosphatase, pH, flow-rate and OHI levels during T1 ($p < 0.05$). However, phosphorous and buffering capacity levels were increased at T1. The phosphorous levels showed non statistically significant difference when compared between T0 and T1 ($p = 0.42$). The remaining salivary parameters showed statistically significant difference when compared between T0 and T1 ($p < 0.05$). [15] According to the literature, orthodontic appliances enhanced the salivary flow rate, thus increasing the protective effect against white spot lesions (WSLs). The increase of salivary flow rate is considered a physiological response to the mechanical stimulation caused by the introduction of new appliances. WSLs can form due to salivary pH, flow rate and buffer capacity decline associated with poor oral hygiene. [16,17] Additionally, the results showed a modification in several electrolyte rates, which may have been due to a disturbance in the ionic balance on tooth surfaces leading to WSLs. Orthodontic treatment can also produce gingival complications and aggravate existing

lesions, which would affect salivary electrolytes. Previous studies revealed that electrolyte concentrations increased in severe periodontal disease. Sodium concentrations in saliva decreased as a result of the increased adrenocorticotropic hormone. Consequently, the change in sodium and potassium levels could be considered stress-response indicators.[18] The presence of fixed orthodontic appliances on teeth might be the likely reason for this observation. Based on the study performed by Kanaya et al, [19] the main bacterial isolates identified during orthodontic therapy were mutans Streptococci. In another study, it was indicated that Streptococcus mutans was strongly implicated in the initiation and progression of dental caries, and its presence was significantly associated with dental plaque. [12] Recently, it was also shown that during orthodontic procedures, Mutans streptococci are among the most important causes of bacterial endocarditis. [20]

Conclusion

There are changes in salivary pH in patients undergoing orthodontic treatment.

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