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COMPARATIVE STUDY ON PH ANALYSIS BETWEEN REMOVABLE AND FIXED ORTHODONTIC APPLIANCES

Running title: PH change analysis between removable and fixed appliances

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ABSTRACT

Introduction:

A saliva of PH 7.0 usually indicates a healthy dental and periodontal situation. At this pH, there is a low incidence of dental decay combined and little or no calculus. Therefore, stable conditions should basically be found in this environment. Fixed orthodontic appliances can affect oral hygiene by influencing several parameters including the salivary PH and microbial count. Wearing fixed appliances can lead to various changes such as decrease in pH, flow rate and buffering capacity.

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The main aim of this study is to compare the PH of the salivary samples of both removable and fixed orthodontic appliance patients.

Materials And Methods:

For this study 10 salivary samples of fixed appliance patients and 10 salivary samples of removable appliance patients have been collected from the department of orthodontics at Saveetha dental college and hospitals and was analyzed in the research lab with the help of salivary analyzer.

Results:

According to the present study we have found a slight increase in salivary PH of fixed appliances compared to removable appliances. This may be due to accumulation of food particles in the appliance which forms a favorable environment for pathogens which leads to the decrease in salivary PH.

Conclusion:

In the present study we have found that the salivary PH of fixed appliance patients have increased PH compared to removable appliance patients

Key words: Fixed appliance; Orthodontics; pH ;Innovative technology; Removable appliance.

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INTRODUCTION

Orthodontic treatment has gained increasing popularity owing to increased self-awareness of oral health -related quality of life and facial esthetics. However, using fixed appliances increases the probability of biofilm formation which may affect oral hygiene and may lead to enamel demineralization and gingival inflammation. In order to avoid biofilm formation, brushing and cleansing of teeth has to be done. Furthermore, introducing foreign objects, such as orthodontic appliances can alter the normal functioning of the oral cavity(1). It is well known that saliva is produced and secreted by the salivary glands. It consists mainly of water (99%) and other organic and inorganic components that contribute to the major functions of the salivary glands. In addition, saliva contains antibacterial, antiviral, and antifungal components that help in maintaining the normal oral flora. Saliva plays a vital role in maintaining oral health by performing several functions such as lubrication, antimicrobial activity, maintenance of homeostasis, and control of demineralization/remineralization of the teeth(2). It is said that when parameters such as salivary flow rate, PH, electrolytes, fluorides and calcium are reduced in the oral cavity of the person, it is carcinogenic in nature(3). Saliva also has one more important advantage that is, the protein present in the saliva adsorb onto the surface of the enamel and form a protective layer called the pellicle, which regulates remineralization of the enamel in conjunction with calcium and phosphate ions in saliva(4).

In recent years orthodontic appliances are used to treat a wide range of malocclusion types from mild to severe, which helps to improve the periodontal status of the patient. Orthodontic appliances are broadly classified into two types that are removable and fixed appliances(5). Previous studies have reported that fixed orthodontic appliances can stimulate the growth of subgingival plaques, which triggers adverse reactions and increases discomfort to patients(6)&(7). Therefore, the use of an alternate removable orthodontic appliance is expected to improve comfort and induce better healing of patients.(8) & (9)

Several studies have been performed on PH change analysis in saliva on removable and fixed appliances (10),(11)]. According to the previous studies done, we come to know that orthodontic appliances can bring changes to the salivary PH of the oral cavity. Whether the PH increases or decreases depends on the patient's health[(12),(13). Removable orthodontic appliances are used in mild rotation of a single tooth and used to maintain the changes achieved with fixed treatment. Limitations of removable orthodontic appliances are that multiple teeth rotation cannot be treated,

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bodily movements cannot be done and only simple malocclusions can be corrected(14). Fixed orthodontic appliances are used in severe dentofacial deformities and it has the ability to splint severely malpositioned teeth. The main aim of this study is to analyze the PH change of the salivary samples collected from both fixed and removable orthodontic appliance patients.

MATERIALS AND METHODS

For this study 10 salivary samples of fixed appliance patients and 10 salivary samples of removable appliance patients have been collected from the department of orthodontics at Saveetha dental college and hospitals and was analyzed in the research lab with the help of salivary analyzer. In order to perform this, experiment a small amount of the collected salivary sample is taken in a beaker and mixed with 10ml of distilled water and was analyzed using a PH analyzer (Figs 1 and 2). The PH rod has to be cleaned with a tissue paper before and after use. The results obtained from the PH analyzer were then generated into a comparative bar graph with the help of a software known as SPSS Version 23 (Figure 3).

Figure 1:Shows the image of analyzing the salivary PH of patients wearing removable appliances.

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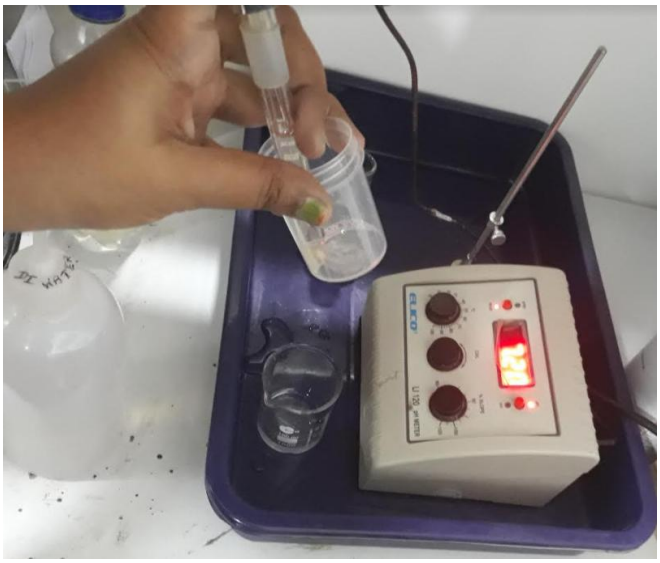

Figure 2: Shows the image of analyzing the salivary PH of patients wearing fixed appliances.

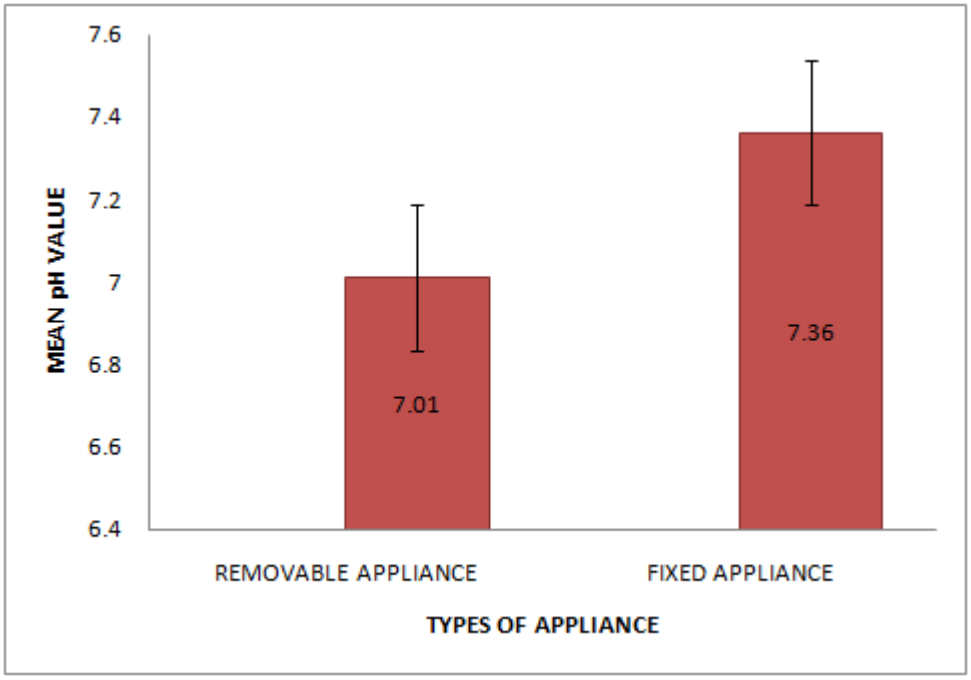

Figure 3: Shows the correlation between types of appliance and mean salivary PH. The mean salivary PH in fixed partial appliance patients are 7.36 and the mean salivary PH of removable appliance patients are 7.01. The X -axis represents the mean PH value and the Y-axis represents the type of appliance used. Chi square value=16, df=9 and P value=0.067

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RESULTS

According to the results obtained we can clearly say that there was an increase in the salivary PH in patients wearing fixed appliances compared to people wearing removable appliances (Table 1). The P value that was obtained in our study was 0.067.

Table 1- shows the type of appliance used and salivary PH values.

S. No	Type of appliance	PH of saliva sample
1.	Removable	PH 7.0
2.	Removable	PH 7.0
3.	Removable	PH 7.0
4.	Removable	PH 7.0
5.	Removable	PH 7.0
6.	Removable	PH 7.0
7.	Removable	PH 7.11
8.	Removable	PH 7.0
9.	Fixed	PH 7.10
10.	fixed	PH 7.23
11.	Fixed	PH 7.20
12.	Fixed	PH 7.50
13.	Fixed	PH 7.25
14.	Fixed	PH 7.36
15.	Fixed	PH 7. 46
16.	Fixed	PH 7.8

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DISCUSSION

Fixed orthodontic appliances are devices or equipment that are attached to the teeth, cannot be removed by the patient and are capable of causing tooth movement. These appliances are found to induce plaque retention and thereby constitute risk for white spot enamel lesion. Favorable changes in the salivary parameters such as stimulated and unstimulated salivary flow rate, pH and buffering capacity might help in maintaining the oral equilibrium. In a study done by Wu KP et al 2008 , stated that PH showed no significant statistical changes. Increased salivary flow is followed by increased PH(15).

In a study done by Sepideh Arab et al 2016, stated that PH showed a significant decrease after the beginning of orthodontic therapy. The salivary PH decreased from 7.18±0.35 to 6.81±0.31(16). Whereas in our study the pH. showed significant increase after wearing fixed orthodontic appliances. In a study done by Chang et al 1997, stated that PH significantly increased after 3 months of active orthodontic treatment.(17). Similar results were also stated by Lara- Carrillo et al 2009. In a study done by Matheus Melo Python et al,2015 stated that the level of oral PH of patients decreased with the time of use of orthodontic appliances which is contradictory to our results. The PH varied from 6.7 in the beginning to 5.9 at the end of treatment. The variation in the PH is due to dietary products or the conversion of sugar into acid by dental biofilm (18).

Analyzing PH helps the dentist to find the susceptibility of caries in a patient. According to the PH obtained, the dental treatment is planned. If the salivary PH is low then there is high probability for dental caries to be formed, so removable appliances are given to avoid plaque deposition and bacterial growth which may lead to tooth decay. This study has been performed only on 20 subjects who are relative to Tamil Nadu, India which is considered to be the major drawback of this study because our study comprises a very small sample size. The result of the study would have changed if the study was done on a broader classification because the salivary PH mainly depends on dietary intake, lifestyle, economic status, oral health and source of information. Our team has extensive knowledge and research experience that has translated into high quality publications (19-26).

CONCLUSION

In this study, the salivary PH of fixed appliance patients are higher compared to salivary PH of removable appliance patients. The main reason for this result is due to the microbial activity on the surface of the tooth structure. In the future we can use this salivary analysis method for

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measuring the amount of microbes in the oral cavity and to decide the type of orthodontic treatment given to the patient.

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