

Determination of Changes in Oral Flora After Fixed And Removable Appliances Using Saliva Test - A Research

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Abstract

Introduction : The presence of fixed appliances in the oral cavity of orthodontic patients could alter the nature of dental plaque. The structure, metabolism and composition of dental plaque would change, leading to an increase in microbial population. Moreover fixed appliances might even hamper effective oral hygiene and cause high cariogenic challenge. Furthermore, based on the difficulty of maintaining oral hygiene, the subgingival microbiota may also be influenced by orthodontic appliances, since orthodontic accessories would favour bacterial plaque retention. These variables would lead to pathogenic bacteria colonisation, which are responsible for gingival inflammation, periodontal support destruction and changes in enamel surface. Hence this research is done to assess the causes for changes in oral flora due to fixed and removable appliances.

Materials And Methods : Thirty patients attended to the department of orthodontics at saveetha dental college, their age ranged from 15-30 years and they were in good general health. Those patients were divided into 3 groups. The subjects were asked to spit and the samples were collected from each group using sterile urico containers, the patient is atleast asked to spit two times, and then it's streaked on different types of media such as Blood agar, Chocolate agar, MacConkey agar and Sabouraud media then incubated aerobically for 24 hours at 37 C in order to be examined under light microscope and biochemical tests. Finally the colony count of the organisms were noted.

Conclusion: Based on the findings of the study, it is concluded that normal patients without any orthodontic treatment, showed 40% lower colony count than that of the patients with removable appliance and 60% lower than that of the patients with fixed appliance. These Results clearly showed that an orthodontic appliance increases colonisation of bacteria in oral cavity during orthodontic treatment.

Keywords: fixed appliance, removable appliance, oral hygiene, microflora, periodontal health

INTRODUCTION:

The normal flora of humans is the mixture of organisms regularly found at any anatomical site and it is exceedingly complex and consists of more than 200 species of bacteria. The make up of the normal flora

depends upon various factors, including genetics, age, sex, stress, nutrition and diet of the individual (1). The removable orthodontic appliance is an appliance removable from the mouth consisting of wire and acrylic components. It may be active or passive and is used almost exclusively in the upper arch (2). The placement of orthodontic appliances creates a favourable environment for the accumulation of microbiota and food residues, which, in time, may cause caries or exacerbate any pre-existing periodontal disease (3). The appliances may interfere with oral hygiene practice and cover considerable parts of the tooth surfaces, so an increase of the total microbial population as well as an altered microflora have been reported in relation to orthodontic treatment (4). Patients need to understand and be aware of the implications for their oral health, while accepting recommended orthodontic treatment. On the other hand, accepting removable appliance orthodontic therapy has important implications for patients' home care. Acceptance of orthodontic treatment means patient commitment to a regimen of increased attention to oral hygiene and oral health (5). The normal flora of humans is the mixture of organisms regularly found at any anatomical site and it is exceedingly complex and consists of more than 200 species of bacteria. The makeup of the normal flora depends upon various factors, including genetics, age, sex, stress, nutrition and diet of the individual. The purpose of the present study was to compare microbiological status between patients with and without fixed and removable orthodontic appliances. Scientific publications have demonstrated that the presence of fixed appliances in the oral cavity of orthodontic patients could alter the nature of dental plaque (6). The structure, metabolism and composition of dental plaque would change, leading to an increase in microbial population, especially *Streptococcus* and *Lactobacillus*. (7) Some authors have observed that fixed appliances might hamper effective oral hygiene and cause high cariogenic challenge. (8) Furthermore, based on the difficulty of maintaining oral hygiene, the subgingival microbiota may also be influenced by orthodontic appliances since orthodontic accessories would favour bacterial plaque retention. These variables would possibly lead to pathogenic bacteria colonisation, which are responsible for gingival inflammation, periodontal support destruction (9) and changes in enamel surface. Published literature has shown that conditions favouring microbial colonisation and establishment of, fungi and periodontal pathogens increase microbial population growth and plaque accumulation. Hence this study is done to determine the changes in Oral flora after fixed and removable appliances using saliva test.

MATERIALS AND METHODS :

Thirty patients attended to the department of orthodontics at saveetha dental college, their age ranged from 15-30 years and they were in good general health. Those patients were divided into 3 groups:

Group1: consists of 10 patients without any removable or fixed orthodontic appliance was taken as the control group.

Group2: consists of 10 patients wearing fixed orthodontic appliance for 1 month - 2 years

Group3: consists of 10 patients wearing removable orthodontic appliance and any prosthesis, and dentures for 2 months- 2 years

The subjects were asked to spit and the samples were collected from each group using sterile urico containers, the patient is atleast asked to spit two times, and then it's streaked on different types of media such as Blood agar, Chocolate agar, MacConkey agar and Sabouraud media then incubated aerobically for 24 hours at 37 C in order to be examined under light microscope and biochemical tests. Finally the colony count of the organisms were noted.

RESULTS :

S.No	Clinically healthy persons without any orthodontic appliance	Patients with removable appliance	Patients with fixed appliance
1	110 CFU	195 CFU	239 CFU
2	166 CFU	232 CFU	221 CFU
3	147 CFU	178 CFU	236 CFU
4	155 CFU	191 CFU	208 CFU
5	146 CFU	211 CFU	240 CFU
6	131 CFU	186CFU	234 CFU
7	152 CFU	203 CFU	229 CFU
8	145 CFU	216 CFU	237 CFU
9	141 CFU	188 CFU	209 CFU
10	149 CFU	171 CFU	223 CFU
Mean value	144.2 CFU	197.1 CFU	227.6 CFU

Table 1 indicates bacterial colony count among control group, patients with fixed and removable appliance.

The saliva samples for this study were collected from 30 people out of which 10 were healthy persons without any prosthesis, 10 of them had fixed appliance and the remaining 10 had removable appliance. From the table it's seen that the Mean bacterial colony count were higher in case of patients with fixed appliance (Mean value = 227 CFU) as expected as it's really difficult to maintain oral hygiene with the prosthesis inside, it was comparatively lower in case of patients with removable appliance (Mean value = 197.1 CFU) and the patients without any prosthesis/appliance had significantly lower bacterial colony count (Mean value = 144 CFU) compared to the other two groups as it was easier for the patients to maintain proper oral hygiene.

Discussion :

In this study the bacterial colony count among normal adolescents i.e. among subjects without any appliance or prior to application of any appliance / prosthesis was found to be 40% lower than that of the patients with removable appliance and 60% lower than that of the patients with fixed appliance. This difference in colony count between the control group and patients with removable and fixed appliance is quite significant which is worrisome. This difference is mainly due to the hindrance which these appliances exhibit to maintain normal oral hygiene.

Dental caries and periodontal diseases are recognised as consequences of inadequate oral hygiene during orthodontic treatment.(10) Fixed and removable appliances and rough-surfaced adhesives in the oral cavity create new retentive sites favourable to plaque accumulation and inflammatory response (11)(12). Although new appliances as well as new bonding techniques and material have been developed, it has not yet been possible to decrease dental plaque retention.(13)(14) Therefore, plaque retention is considered a real problem in Corrective Orthodontics.(15) Difficulties in maintaining oral hygiene around the appliances may result in hyperplastic marginal gingivitis which can advance to periodontitis.(16) There is a consensus that oral microorganisms are the primary etiologic agents of periodontal diseases, and their different species are responsible for the different forms of the disease. Periodontal health is associated with supra-gingival gram-positive microbiota that consists mainly of diverse species of Streptococci and Actinomyces. They are also predominant in gingivitis, however, the amount of gram-negative bacteria increases. On the other hand, in periodontitis, the microflora is dominated by gram-negative facultative anaerobes. The pathogenic potential of these micro-organisms is related to their virulence and capacity to act in gingival tissues. Moreover, the virulence of bacteria depends on many factors, especially bacterial serotype and individual host susceptibility.

According to Yan Zheng et al, the incidence of bacterial colonies in the oral cavity among normal adolescents prior to the application of fixed orthodontic appliance was 14%, lower than the patients with fixed orthodontic appliance (17) This result is in accordance with our study where the variation between normal and patients with fixed appliance was found to be 60%. This may be attributed to the fact that the patients without any appliance can brush their teeth properly without any hindrance which helps greatly in maintaining proper oral hygiene and helps reducing the number of microbes in the oral cavity. Regional differences may also contribute to the variations observed.

Within 3 months of the installation of Fixed orthodontic appliances, the rate of pathogenesis and number of colonies of oral bacteria increased compared with those prior to treatment, particularly at 2 months after Fixed orthodontic appliance installation; these values then gradually decreased over time. These findings may be due to the FOAs resulting in a lowering of the local defence mechanism of oral mucosal cells. Oral mucosal cells, which act as mechanical barriers, and metabolism play important roles in increasing the resistance of the mouth to infection. Thus bacteria can't easily adhere to any damage in the oral epithelia.(18) Lip buccal mucosal damage was observed in many patients shortly after the application of Fixed orthodontic appliances. Varying degrees of oral ulcers or gum inflammation, both of which can decrease local defence mechanisms, were also observed.

According to oral micro-ecological theory, an ecological balance exists between the microorganisms in the mouth and the host. When the host conditions change, the type, number, and proportion of mouth microbes also change. A fixed orthodontic appliance can change the original ecological balance of the oral cavity and oral microbial plexus. Studies have shown that the oral cavity of patients with FOAs have more *Bacteroides melaninogenicus* and intermediate *Bacillus*. Moreover, the proportion of anaerobic bacteria to facultative anaerobic bacteria also increased.(19).

Adhesion of Bacteria to parts of the Fixed orthodontic appliance, during which the bacteria adheres to different dental metal material surfaces, may also affect colony formation. The extent of adhesion is dependent on the

surface roughness and type of material used. The adhesion of different substances to the surface of metal or ceramic orthodontic appliances should be studied further.

There is also a relationship between Bacteria and the resistance of patients, where an increase in the bacterial population may cause a temporary weakening of the resistance of the body during the adaptive phase after the application of the FOA. The amount of bacteria gradually declined 3 months after treatment, which may be due to the gradual adaptation of the patients to the new oral environment. Moreover, full recoveries of systemic and local resistance were also observed. The increase in the number of bacterial colonies may be associated with an increase in the amount of plaque and microbes in the oral cavity of patients shortly after Fixed orthodontic appliance start to be worn.

The increase in the population of other strains and in mixed bacteria, may be related to differences in adhesion and interaction between bacteria and fungi. Our results reveal that the rate of carrying bacteria is significantly high. However, the increase in the possibility of infection due to FOAs require further study.

The increase in the number of bacterial colonies in patients may be due to differences in the living conditions of the bacterial strains. After the application of Fixed orthodontic appliance, the pH of plaque and the strain and number of microorganisms in the oral cavity changed. Increase in bacterial strains causes them to aggregate and adhere more easily to Fixed orthodontic appliances. The adhesive force of the bacterial colonies to the surface of nonliving substrates is very strong. Some of the bacterial strains can also attach to and reproduce on the surface of nonliving substrates via cell surface hydrophobicity.(20) Similar features of this behaviour in Fixed orthodontic appliances require further research.

Fixed and removable orthodontic appliance can change the carrying rates of bacteria in the oral cavities of adolescents. The carrying rates, total number of bacterial colonies, and strains of bacteria all changed prior to and after the application of fixed orthodontic appliances .

Conclusion :

Based on the findings of the study, it is concluded that normal patients without any orthodontic treatment ,showed 40% lower colony count than that of the patients with removable appliance and 60% lower than that of the patients with fixed appliance .These Results clearly showed that an orthodontic appliance increases colonisation of bacteria in oral cavity during orthodontic treatment.

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