The Effect of Fixed Orthodontic Treatment on Salivary Component

(Efek Perawatan Ortodonti Cekat Terhadap Komponen Saliva)

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Abstract

Saliva is a complex oral fluid that has an important role on maintaining oral health. Mechanical stimulation such as fixed orthodontic appliance can alter saliva characteristics. The objective of this study is to recognize the components of saliva in a fixed orthodontic treatment. This study in an observational analytic study with a cross sectional approach, the sample is stimulated saliva of 44 subjects (18-25 years of age) consisting of subjects without orthodontic appliance and subjects with orthodontic appliances. Sample is obtained by purposive sampling based on inclusion and exclusion criteria. The result of this study is to understand significant differences in salivary flow, pH, buffer capacity and calcium between subjects between subjects with and without orthodontic appliances (p=0,001). The conclusion in this study is that fixed orthodontic appliance can increase salivary flow, pH, buffer capacity and calcium.

Key words: Effect, fixed orthodontics, salivary component

Abstrak

Saliva merupakan cairan kompleks rongga mulut yang memiliki peranan penting dalam menjaga kesehatan rongga mulut. Rangsangan mekanisme mpengaruhi perubahan karakteristik pada saliva seperti pemakaian piranti ortodonti. Tujuan penelitian ini adalah untuk mengetahui komponen saliva pada perawatan ortodonti cekat. Penelitian ini merupakan penelitian analitik obervasional dengan pendekatan *cross sectional* dengan sampel berupa saliva yang distimulasi berjumlah 44 subjek (18-25 tahun) yang terdiri dari subjek tanpa piranti ortodonti, dan subjek dengan piranti ortodonti. Pengambilan sampel dilakukan dengan metode purposive sampling berdasarkan kriteria inklusi dan eksklusi. Hasil penelitian ini menunjukkan adanya perbedaan yang bermakna pada laju alir saliva, pH, kapasitas *buffer* dan kalsium saliva antara subjek dengan piranti ortodonti dan subjek tanpa piranti ortodonti (p=0.001) .Kesimpulan pada penelitian ini adalah perawatan ortodonti cekat meningkatkan laju alir, pH kapasitas *buffer* dan kalsium saliva.

Kata kunci:Effect, ortodonti cekat, komponen saliva

INTRODUCTION

Saliva is a complex oral fluid produced inside the oral cavity by salivary glands and consists of water and other ingredients. 99% of salivary content is water and 1% is organic and inorganic molecule. Based on its function saliva has properties such as lubricating, cleaning, digestion, neutralizing acid or base, protection from demineralization and as an antibacterial, a storage for calcium and phosphate ion that are important for remineralization on the early onset of a decay, this is why saliva has an important role on an individual's oral health. This protective use is heavily influenced by changes involving composition, flow, pH, buffer capacity, and ion arrangement as much as salivary protein.[1,2]

Orthodontic treatment can cause alteration in the environmental state of an oral cavity, like changes in bacterial concentration, saliva buffer capacity, acidity level (pH), and salivary flow. Fixed orthodontic appliance is an orthodontic appliance that is fixed on the tooth and is not possible to take it of personally by the patient wanting to treat oral functions as mastication, speech, esthetic and correcting and also preventing a more severe malocclusion.[3,5]

Fixed orthodontic treatment can be done in several techniques including Begg, Edgewise, straight wire

and Bio progressive.[6] Different types of techniques in the management of fixed orthodontic appliances is continually being developed to overcome the disadvantages of the techniques before. Installation of fixed orthodontic appliance on subjects increases stimulation process mechanically on the oral cavity that it causes an increase in buffer capacity, salivary pH and also flow.[4]

On a study by Carillo et al, it is found that a significant increase of stimulated salivary flow, pH and salivary buffer capacity 1 month post fixed orthodontic installation.[3] However, Peros et al found that stimulated salivary flow and pH increases signifycantly after 18 months of fixed orthodontic appliance installation while buffer capacity almost never changes.[7] On a similar study by Bhaysardkk, about salivary calcium on subjects with fixed orthodontic appliances also shows a significant increase on Salivary calcium.[1]

Based on the argument above, we are interested in doing a study about salivary component on fixed orthodontic treatments.

MATERIALS AND METHODS

This study is an analytical study with using cross sectional approach done at the clinic of Orthodontics Postgraduate Program at the Faculty of Dentistry, North Sumatra University and Research Laboratory at Faculty of Pharmacy, University Of North Sumatera. This research is done at April – September 2018. The population on this study is clinical subjects of the Orthodontics Postgraduate Program undergoing fixed orthodontics treatment and as control groups, there are subjects without orthodontic appliances.

Sample is obtained by purposive sampling method based one inclusion and exclusion criteria, there are 44 subjects in total. General inclusion criteria: female and male aged 15 to 25 years old, and is willing on participating in this study. Control Group Criteria: subjects without fixed orthodontic appliances. Inclusion criteria for the case group: subjects with fixed orthodontic appliance, moderately crowded (in need of 4-6mm space). Exclusion criteria includes subjects that smokes, is an alcoholic, consuming drugs, systemically compromised, wearing denture, women on their menstruation period, pregnant, and breastfeeding, has cavities and radix.

The study is done at 09.00-11.00 WIB, subjects are asked to not eat or drink 1 hour prior to sample taking to prevent salivary pH changes. Subjects are asked to chew on paraffin wax. Spitting method was used to collect saliva, by holding saliva inside the mouth in the position where subjects have their head looking down, not moving tongue around, and having their lips stay closed, also not doing any swallowing for 1 minute. Subjects are then asked to spit saliva that has been collected inside the mouth by still looking down on a given labelled pot every one minute. Salivary collection is done in a total of 5 minutes and salivary flow is recorded. Salivary pH is measured using pH strips that are available on the GC saliva check-buffer by dipping the strip inside salivary sample for 10 seconds. Color changes in the strip are compared to the pH indicator available in GC saliva check-buffer. Salivary buffer is measured using buffer strip inside the GC saliva check-buffer. One drop of saliva is applied on each pad (1 strip contains 3 pads). Assessment is done right when color changes occur, and they are recorded.

The result is summed by adding points according to the last color of each pad: green 4 points; greenish blue 3 points; blue 2 points; bluish red 1 points; red for 0 point. 0-5 points is very low, 6-9 low, and 10-12 is normal. Salivary samples are taken to the research laboratory at Faculty of Pharmacy, Universitas Sumatera Utara to measure salivary calcium ion in less than one hour after sample collecting. This is done to prevent any damage on the saliva. Salivary calcium ion measurement is done by pipetting 1 ml of saliva and it is inserted in a 25ml LABU TAKAR, diluted with aqua up to am line and the liquid is homogenized. Sample liquid is then being poured through 42 Whatman shift paper inside the pot. Calcium ion measurement is done by SSA method.

Appliances used are calibrated by the laboratory worker by: 1 ml calcium liquid (1000 µg/ml) pipetted and inserted to a 100 ml LABU TAKAR and then diluted with aqua dm up to a line. This liquid (10µg/ml) is pipetted for 2; 4; 6; 8; 10 ml, which each is inserted in concentrated LABU TAKAR 1,2, 3,4,5 µg/ml. these liquid measured by SSA on maximum absorbency wavelength 422,7 nm and a calibration curve is made for standard calcium liquid.

RESULT

This study is done to see salivary components on fixed orthodontic treatments compared to non orthodontic treatment. Data are processed and analyzed by computerizing system.

Table 1. Difference in salivary flow rate

Subjects	Salivary Flow Rate (ml/minute)			*P*
	Min	Max	Median	
Non orthodontic appliance	0,60	2,00	1,00	0,001*
Fixed orthodontic Appliance	1,00	4,40	2,00	

*Mann-Whitney test

Table 2. Difference in salivary pH.

Subjects	Salivary pH			*P*
	Min	Max	Median	
Non orthodontic appliance	6,90	7,60	7,20	0,001*
Fixed orthodontic appliance	7,00	7,80	7,70	

*Mann-Whitney test

Table 3. Difference in salivary buffer capacity

Subjects	Salivary Buffer Capacity			*P*
	Min	Max	Median	
Non Orthodontic appliance	5,00	12,0	8,50	0,001*
Fixed Orthodontic Appliance	9,00	12,0	12,0	

*Mann-Whitney test

Table 4. Difference in salivary calcium

Subjects	Salivary calcium (mmol/l)			*P*
	Min	Max	Median	
Non Orthodontic appliance	0,00	0,90	0,60	0,001*
Fixed Orthodontic Appliance	0,60	4,30	1,35	

*Mann-Whitney test

DISCUSSION

In this study, a total sample of 44 individuals, with 22 subjects without orthodontic appliances and 22 subjects with fixed orthodontic appliances. Sampe is obtained with fixed orthodontic is done while orthodontic treatment control appointment (activation).

On table 1,2,3, and 4 result and differences of salivary flow, pH, buffer capacity and calcium on subjects without orthodontic appliance and with fixed orthodontic appliances. Based on statistical analysis shows significant differences ($p<0,05$) on salivary flow, pH, buffer capacity and calcium in each study group. Study results shows that subjects with fixed orthodontic appliances has higher salivary flow, pH, buffer capacity and calcium than subjects without orthodontic appliances. Installation of fixed orthodontic appliances on malocclusion subjects increases stimulation process mechanically inside the oral cavity. This study result agrees with the study done by Carillo et al, which states that fixed orthodontic appliances can increase salivary flow, pH, and buffer capacity in one month as a physiological respond that considers fixed orthodontic appliance as an unidentified object.[4] On the study of Carillo et al about the measurement of stimulated salivary flow, pH and buffer capacity on six stages of control (activation) is different after orthodontic appliances installation, is stable on the six steps of the study.[8] In Sarapur's study of the salivary component of removable orthodontic appliance users in children with systemic abnormalities compared to control samples with either orthodontic appliances without orthodontic appliances showed that the pH of saliva at the time of use of the removable orthodontic appliance was within normal limits.[9]

Orthodontic treatment is designed to move teeth to the expected location. Changes that occur in the oral cavity are considered as physiological responses to mechanical stimulation due to pressure and friction forces on the teeth caused by techniques in fixed orthodontic treatment. In subjects with fixed orthodontic appliances the sampling was carried out after routine control treatment so that there was an increase in salivary flow rate due to pain stimulation caused by activating orthodontic appliances in the oral cavity. This is in line with the study conducted by Kavaliauskiene et al., 72% of patients reported that they complained of pain after one day the instrument had been included, but the percentage of respondents decreased significantly for one month.[10]

Pain stimulation such as pain when using a fixed orthodontic appliance is a pressure that causes pain because of the high intensity of the pressure, excessive contraction due to the wire that pulls the teeth. Saliva caused by pain stimulation makes salivary flow rate increase because of the physiological response of the body.[4,10]

Mechanical stimulation induces the parasympathetic nervous system and the parasympathetic nervous system releases the neurotransmitter acetylcholine, causing vasodilatation of the salivary gland ducts to stimulate the salivary glands to produce secretions that are liquid rich but low in protein.[11] Increased salivary flow rate contributes to the cleaning process in the oral cavity and modifies the compo-

sition saliva so that an increase in bicarbonate ions, therefore the pH of saliva also increases. pH and salivary buffer capacity contribute to the ability of saliva to fight acids produced by microorganisms in the oral cavity.[8] Increased salivary flow also plays a role in increasing salivary buffer capacity. The oral environment has the ability to adjust to foreign bodies by increasing the salivary flow rate, which has implications for increasing buffer capacity and salivary pH.[4]

In this study salivary calcium also increased in groups using fixed orthodontic appliances. The results of this study are in line with the research conducted by Bhavsar et al., Stating that salivary calcium is affected by changes in the oral environment due to the presence of orthodontic appliances in the oral cavity.[1] Calcium in saliva plays an important role in maintaining tooth integrity, body fluid balance and plays an important role in activating the secretory gland cells and plays an important role in the remineralization process. This is in line with the research conducted by Indriana concluding that an increase in the flow rate of saliva can affect the amount of calcium ion concentration in saliva.[13]

There are several limitations in this study, namely the difficulty of researchers finding male subjects and fulfilling inclusion and exclusion criteria in the clinic of Orthodontics Postgraduate Program at the Faculty of Dentistry, North Sumatra University. Therefore the researchers did not describe differences based on sex. Another disadvantage in this study was that sampling in subjects with fixed orthodontics was carried out after the control at the clinic of Orthodontics Postgraduate Program at the Faculty of Dentistry, North Sumatra University and different treatment phases in the study sample.

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