

Daylong Effect of Tooth Brushing or Combination Tooth Brushing and Tongue Cleaning Using Antiplaque® Toothpaste on Volatile Sulphur Compound Levels

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Abstract

Objective : to determine the daylong effect of Antiplaque® toothpaste active compound and the effect of tooth brushing or combination of tooth brushing and tongue cleaning on Volatile Sulphur Compounds (VSC) levels. **Methods:** Clinical experimental double blinded microbiological and clinical oral examination. Subjects mainly from dental faculty student with or without a chief complain of halitosis. One hundred and twenty subjects were divided into four groups that consist thirty samples each group. Two group are treatment groups using Antiplaque® toothpaste and two groups are control groups using placebo toothpaste. The daylong effects of VSC levels are measured by Halimeter and organoleptic. The intra oral status were measured including periodontal status and tongue index, **Result :** There are a reduction of VSC levels in both treatment and control group, but the reduction only significant in group using Antiplaque® toothpaste (Willcoxon signed rank test, $p < 0,05$). There are a reduction of VSC levels in both treatment using Antiplaque® toothpaste, but the combination of tooth brushing and tongue cleaning reduced VSC levels significantly lower than tooth brushing treatment (Mann Whitney U test, $p < 0,05$). **Conclusion:** Tooth brushing and combination of tooth brushing and tongue cleaning using Antiplaque® toothpaste significantly reduced VSC levels.

Key words : VSC levels, tooth brushing, combination of tooth brushing and tongue cleaning, Antiplaque® toothpaste, daylong effect

Introduction

Oral malodour (breath odour, halitosis, bromopnea, fetor ex ore) are terms used to describe unpleasant or disagreeable odours detectable in the exhaled air.^{1,2} The term halitosis and bad breath can be used interchangeably, with bad breath or other oral malodours recognized as a symptom (sign) and not an actual disease.²

Although the true prevalence is unclear, since objective assessment is difficult, one study in Japan found that up to 25% of the population had Volatile Sulphur Compound (VSC) in the breath in amount above what was regarded as the socially acceptable limit. Another study in USA, involving persons of 60 years old of age and older, found that 24% persons have been told that they had oral malodour.¹ In Cipto Mangunkusumo National Central General Hospital, the prevalence of halitosis patient during year 2001 – 2002 is 3,5%. However, halitosis affects a large proportion of the population and may be the cause of significant social and psychological handicap to those who suffer from it.¹

Many factors can cause halitosis.¹⁻³ Although commonly arising from local causes,

systemic physiological and/or pathological causes may be found.¹² In approximately 85% of cases, halitosis is the result of microbial activity in the mouth.⁵⁴ Many researchers suggested that many VSC were caused halitosis.^{1,4-11} It had formerly been generally assumed that skatole, indole, sulphide, amines, cadaverine and ammonia were the principal compounds responsible for halitosis, but it have been suggested that the major causes were in fact the VSC which predominantly compromise hydrogen sulphide (H_2S) and methyl mercaptan (CH_3SH).^{1-8-10,12,13} VSC can be measured quantitatively in breath by cromoscopy, gas chromatography, industrial sulphide monitor, portable mercaptan / sulphide monitor and semi conductor gas sensors.¹

Cleaning the teeth and tongue can control the major cause of halitosis.¹¹ Some study indicated that combined thorough tooth and tongue brushing effectively reduce methyl mercaptan and hydrogen sulphide levels by more than 50% for 2 – 3 hours.⁵ But the study did not measure the decrease of those compound levels after 8 to 10 hour the cleaning activity of the oral cavity and did not compare the effectiveness between toothpaste which are use

to do the tooth brushing. Therefore, it is important to study that measure methyl mercaptan and hydrogen sulphide levels as the major cause of halitosis at 8 to 10 hours after tooth brushing activity using toothpaste which contain active compound compare to toothpaste which contain no active compound and combined with tongue cleaning.

Aims and Objectives

The aim of this study is to determine the effects of toothpaste's active compound and the effects of few oral cleaning procedures, in order to give an appropriate management in dentistry for those who suffer halitosis.

The objectives of this study are : To determine the daylong effect of tooth brushing and combination of tooth brushing and tongue cleaning using Antiplaque® toothpaste on the VSC levels

Material and Methods

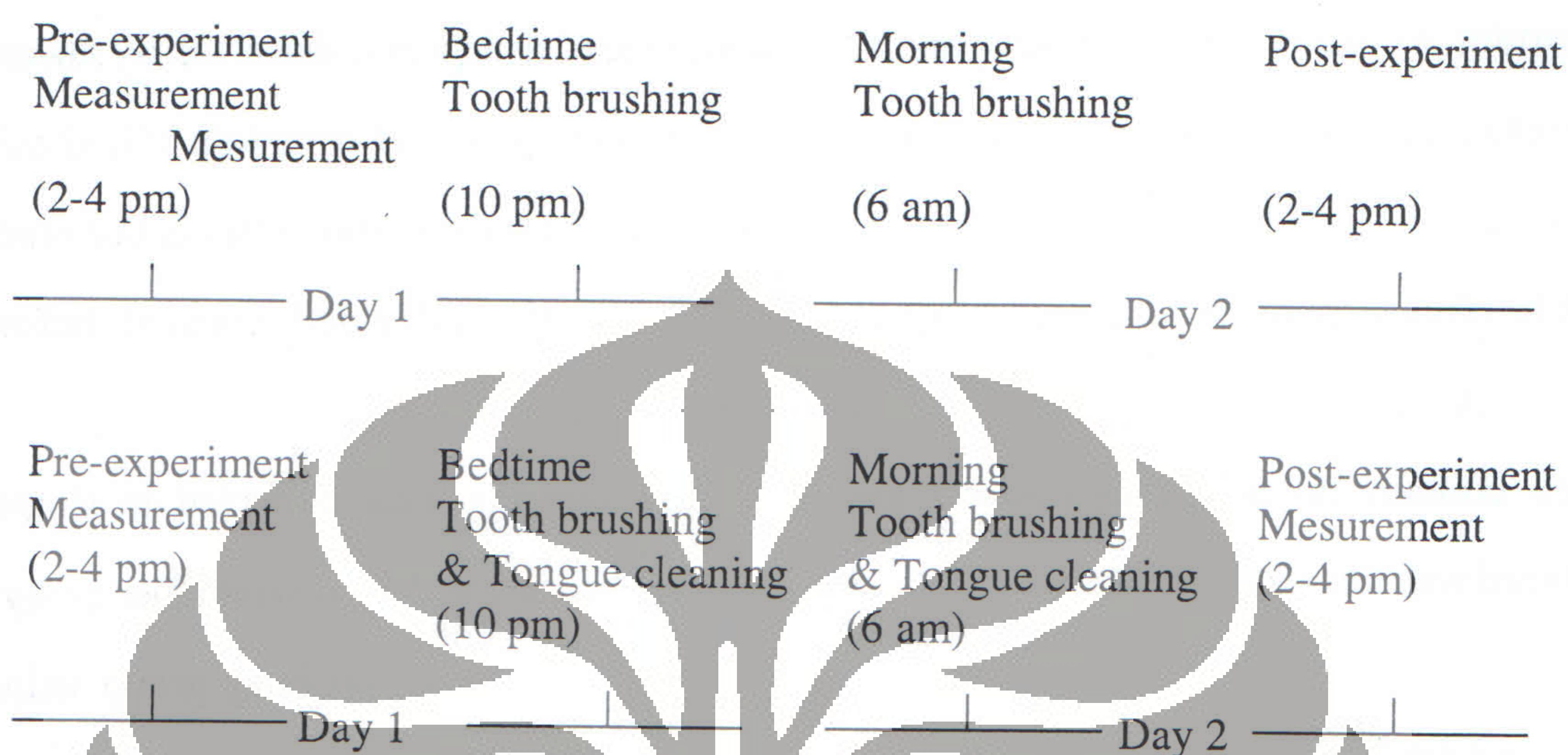
This study has been done by double blind clinical experimental study. Both the subjects and observer did not know which one is

Antiplaque® toothpaste or placebo. Subjects were selected mainly from dental faculty students with or without a chief complain of halitosis. They were invited as volunteers to this study and fulfill the informed consent before participating in the study.

The subjects were collected in simple random sampling and divided into four groups. Group 1 is a tooth brushing group using Antiplaque® toothpaste, group 2 is a tooth brushing group using placebo toothpaste, group 3 is a combination of tooth brushing and tongue cleaning group using Antiplaque® toothpaste, group 4 is a combination of tooth brushing and tongue cleaning group using placebo toothpaste.

The pre-experiment measurement was taken on day one at 2 – 4 pm and the post-experiment measurement was taken on day two at 2 – 4 pm, while the subjects were instructed to do the oral cleaning procedures at 10 pm on day one and at 6 am on day two. The schematic method is figured in picture 1.

Picture 1



The oral hygiene procedure was done by Bass technique of tooth brushing using 1 cm of toothpaste. The tongue cleaning procedures was done by wetting the brush with Antiplaque[®] or placebo self-made mouthrinse (1 centimetres Antiplaque[®] or placebo toothpaste was diluted in mineral water until ± 20 cc) then moving the brush in one direction from posterior to anterior aspect of the tongue for 5 strokes and instructed to repeat the action twice, so that each subject will clean the tongue with 10 strokes of brushing. Each subject was provided with a rounded 1 - 5 centimeters head soft nylon toothbrush with same length of brushes, Antiplaque[®] toothpaste or placebo toothpaste in a blank tube which marked by "X" and "Y".

The inclusion criteria are either female or male between 17 to 30 years old. The exclusion criteria are Smokers ; Those who have systemic diseases such as diabetes mellitus, hepatic cirrhosis, renal failure, upper and lower respiratory diseases, metabolic disorders ; Regular user of antiseptic or non-antiseptic mouthwash or oral rinses ; Those who have professional oral hygiene procedures at least 2 month before the experimental begin ; Those who consume a long-term antibiotic and still consume it at least two weeks before the experimental begin ; Those who regularly consume alcohol ; Those who have a certain eating habits that can cause a very distinct oral malodor, such as garlic, onion and durian ;

Female who is at her period of menstruation. The study was taken place in Oral medicine clinic, faculty of dentistry, university of Indonesia during May – August 2003.

Prior to any measurement, subjects were asked to refrain from taking food or drink that makes distinct oral malodor and refrain from taking any drugs at least 72 hours prior to measurement, refrain from using mouth freshener spray at least 48 hours prior to measurement, instructed to eat at least 2 hours prior to measurement and did not flush or gargle the oral cavity or take any other food, gums and drinks except water until the measurement over, subject may not use any scented cosmetics when taking the measurement and refrain from talking for 3 minutes prior to measurement. The VSC level was measured by industrial portable sulphide monitor (interscan monitor 1170), monitor was zeroed on ambient air prior to each measurement. The measurement was taking between 02.00 pm until 04.00 pm on day 1 and day 2. The measurement performs by inserting a disposable 18.4 centimeters disposable plastic straw approximately 2.5 to 5 centimeters into a partially opened oral cavity. Subject was asked

to breath through the nose during measurement. Result was recorded as peak ppb sulphide equivalent and the measurement was taking three times and the recorded result was an average of the three measurements.

The organoleptic measurement was perform using the privacy screen (50x70 centimeters) of unscented material, this screen will separate subject and the observer in order to prevent subject from seeing the observer sniffing tube. A disposable plastic straw or plastic tube (24 millimeters in diameter and 10 centimeters in length) was inserted through the small hole in the centre of privacy screen, The straw or tube was inserted into subject mouth in about 2.5 – 5 centimeters, and the subject was instructed to exhale slowly to the straw or tube. While the subject exhaling slowly, the observer judges the odor at the other end of straw or tube. For the 1-2 seconds, the judge smells the subject's breathe. After taking away judge's nose away from the straw or tube for 3-4 seconds, the judge re examine the subject breath. Result was recorded base to organoleptic scoring scale, which is 0 = absence of oral malodor (odour can not be detected); 1 = questionable odor (odor is detectable, although the examiner could

not recognize it as malodor) ; 2 = slight malodor (odor is deemed to exceed the threshold of malodor recognition ; 3 = Moderate malodor (Malodor is definitely detected) ; 4 = Strong malodor (strong malodor is detected, but can be tolerated by examiner) ; 5 = Severe halitosis (overwhelming malodor is detected and can be tolerated by examiner / examiner instinctively averts the nose).

The intra oral status was measured under WHO standard, including Decay-missing-filling tooth (DMF-T). The periodontal status were taking by measured the debris index and the calculus index which later be combined to Oral hygiene index-simplified (OHI-S), plaque index by Loe and Silness and The community of periodontal index and treatment needs (CPITN). Tongue index was measured to assess the quantify changes for coating by modification of Yaegaki's method which is determined by looking at coating in the dorsum of the tongue. All the measurement was taking placed in an unscented room. The experimental room is clear from any scented including the dental material scent at least 48 hours prior to measurement. Temperature and humidity of the room was maintain in the optimum state and while taking

the measurement, there is only two people may allowed in the room (subject and observer). The observer may not use any scented cosmetics when taking the measurement, may not smoke on the day of measurement and may not be using mouthwash or mouth freshener spray and taking any food or drink at least 5 minute prior to measurement.

Kolmogorof-Smirnoff test of normality was employed to test the normality of data. Willcoxon test was used to determine significant effects among four groups. Pair comparison between groups were made using Mann-Whitney test, at the P d' 0.05 significance level. Spearman correlation coefficients were employed to test for condition among the results of the different measurement technique.

Result

Total subject who completed the experiment is one hundred and twenty subject which were divided into four group that each consisted of 30 subjects. Most of the subjects were females (76,7%). The average age of all subject is 21,73 ± 2,56 years old.

Most of the subjects have a very low Decay-Missing-Filling Tooth (DMF-T) score as

shown in table 1, which are 33.3%. most of the subjects also have a good OHI-S, even before treatment (76,7%) and after treatment (83,3%), for the tongue index score most subjects are in the categories “no coating” before treatment (50%) and also after treatment (74,2%) while in the debris index shows that most of the subject have a good score of debris index (100%). Those three categories shows an increase in percentage of subject who have good oral hygiene, “no coating” tongue index categories and good categories of debris index after treatment. In the categories of CPITN,

most of the subject did not need a periodontal treatment (55,8%). The result of organoleptic measurement before treatment shows that most of the subject have a “slight noticeable odour” (57,5%) and there are subject who have moderate odour (4,2%) and strong odour (0,8%). After treatment, the organoleptic measurement shows that all subjects are only divided into two group which are some have “no appreciable odour” (55,8%) and some have “Slight noticeable odour” (44,2%).

Tooth Brushing Group (TB)

The assessment for tongue coating index and

Table 1

NO	INTRAORAL STATUS	N	PERCENT (%)
1	DMF-T	120	
	▪ Very low	10	33.3
	▪ Low	6	20.0
	▪ Moderate	4	13.3
	▪ High	5	16.7
2	CPITN	120	
	▪ No treatment needed	67	55.8
	▪ Oral Prophylactics	26	21.7
	▪ Scaling	15	12.5
	▪ Currettage	10	8.3
3	OHI-S (Before Treatment)	120	
	▪ Good	38	76.7
	▪ Fair	28	23.3
4	OHI-S (After Treatment)	120	
	▪ Good	100	83.3
	▪ Fair	20	46.7
5	Debris (Before Treatment)	120	
	▪ Good	115	95.8
	▪ Fair	5	4.2
6	Debris (After Treatment)	120	
	▪ Good	120	100
	▪ Fair	0	0
	▪ Poor	0	0

7	Tongue Index (Before treatment)	120	
	▪ No coating	60	50
	▪ Thin coating	59	49.2
	▪ Moderate coating	1	0.8
	▪ Thick Coating	0	0
8	Tongue Index (After treatment)	120	
	▪ No coating	89	74.2
	▪ Thin coating	31	25.8
	▪ Moderate coating	0	0
	▪ Thick Coating	0	0
9	Organoleptic score (Before treatment)	120	
	▪ No appreciable odour	45	37.5
	▪ Slight noticeable odour	69	57.5
	▪ Moderate odour	5	4.2
	▪ Strong odour	1	0.8
	▪ Extremely foul odour	0	0
10	Organoleptic score (After treatment)	120	
	▪ No appreciable odour	67	55.8
	▪ Slight noticeable odour	53	44.2
	▪ Moderate odour	0	0
	▪ Strong odour	0	0
	▪ Extremely foul odour	0	0

organoleptic were done subjectively by two examiners. To examine the validity of tongue index and organoleptic score of this study, the coefficient agreement of Kappa was used to analyze the result. All the Kappa's coefficient shows that the examiners have a "very good

agreement" ($> 0,8$) except for organoleptic score before treatment which have a "good agreement" (0,767), it means that all data are valid for statistical analysis.

The intra oral status for tooth brushing groups was record before and after treatment.

Table 2

NO	Intra Oral Status & VSC levels	Mean with Antiplaque [®]		Mean with Placebo	
		Before Treatment	After Treatment	Before Treatment	After Treatment
1	OHI-S	0.88 ± 0.55	0.73 ± 0.39	0.95 ± 0.44	0.82 ± 0.44
2	Debris Index	0.22 ± 0.34	0.06 ± 0.09	0.22 ± 0.31	0.09 ± 0.14
3	Tongue Index	0.58 ± 0.55	0.37 ± 0.47	0.47 ± 0.52	0.35 ± 0.47
4	Plaque Score	7.10 ± 3.99	4.53 ± 2.56	9.67 ± 4.11	7.50 ± 3.23
5	Organoleptic	0.58 ± 0.60	0.40 ± 0.48	0.45 ± 0.49	0.47 ± 0.52
6	DMF-T	3.17 ± 2.80	-	3.27 ± 2.99	-
7	CPITN	0.73 ± 1.36	-	1.47 ± 1.50	-
8	Calculus Index	0.67 ± 0.38	-	0.73 ± 0.41	-
9	VSC levels using Halimeter	192.67 ± 66.56	145.87 ± 78.53	153.07 ± 47.14	151.07 ± 57.78

It has shown in table 2 that there are reductions in average score for OHI-S, Debris index, Tongue Index and Plaque score after treatment in both group, but there is some increase for organoleptic score after treatment on placebo group. For debris index, tongue index and plaque score, the reductions on Antiplaque® group are larger than placebo group, while for OHI-S, the reduction in placebo group are larger than Antiplaque® group. The DMF-T score, CPITN categories and Calculus index was also recorded prior to treatment. Most of the subject in both group have a very low DMF-T (33,3%). In CPITN categories, most of subjects in both group are also did not need any periodontal treatment (Antiplaque® = 63,3%, Placebo = 40,0%).

The Kolmogorov-Smirnoff test of normality was employed before counting the significance of the data. Since the distribution of the data is not normal, we use the non-parametric statistical analysis to analyze all variables in this experiment. Table 2 shows that there is a reduction of mean of VSC levels in both group but the reduction on group using Antiplaque® toothpaste are larger (-46,8) than the placebo group (-2). There also a mean reduction of organoleptic

score in both tooth brushing group using Antiplaque® or placebo toothpaste, but the reduction in group using placebo is larger (-0,28) than Antiplaque® group (-0,18). The Wilcoxon signed ranks test for two paired samples are performed to analysis the significance of reduction of VSC level before and after the tooth brushing treatment. There is a significance reduction ($P < 0.05$) of VSC levels in tooth brushing treatment using Antiplaque® toothpaste, but the reduction is statistically not significant in placebo group ($P > 0.05$). While the reduction of organoleptic score in both group, are statistically not significant. The Mann-Whitney U Test for two independent samples is performed to analyze the significance to reduced VSC levels between Antiplaque® toothpaste and placebo toothpaste. There is a significant difference between Antiplaque® toothpaste and placebo ($P < 0,05$) in tooth brushing treatment in order to reduce the VSC levels, means that the Antiplaque® toothpaste reduced VSC levels significantly lower than placebo toothpaste. While the value are statistically not significant for organoleptic score ($P > 0,05$), means that there is no significant difference between Antiplaque® and placebo

toothpaste in reducing the organoleptic score.

Tooth Brushing and Tongue Cleaning Group (TBTC)

To examine the validity of tongue index and organoleptic score of this study, the coefficient agreement of Kappa was used to analyze the result. All the Kappa's coefficient shows that the examiners have a "very good agreement" ($> 0,8$) except for organoleptic score before treatment in Antiplaque® group (0,789) and after treatment using placebo (0,634) which have a "good agreement", it means that all data are valid for statistical analysis.

Mean of all intra oral status in group of

combination tooth brushing and tongue cleaning (TBTC) using Antiplaque® and placebo toothpaste are show in table 3. There are reductions in means score for OHI-S, Debris index, Tongue index, Plaque score and organoleptic score after treatment. For debris index, tongue index and plaque score, the reduction on Antiplaque® group are larger than placebo group, while for OHI-S and organoleptic score, the reduction in placebo group are larger than Antiplaque® group.

The Wilcoxon signed ranks test for two paired samples are performed to analysis the significance of reduction of VSC level before

Table 3

NO	Intra Oral Status & VSC levels	Mean with Antiplaque®		Mean with Placebo	
		Before Treatment	After Treatment	Before Treatment	After Treatment
1	OHI-S	0.83 ± 0.45	0.77 ± 0.42	0.86 ± 0.47	0.79 ± 0.53
2	Debris Index	0.13 ± 0.17	0.06 ± 0.11	0.17 ± 0.19	0.11 ± 0.14
3	Tongue Index	0.57 ± 0.50	0.20 ± 0.38	0.48 ± 0.49	0.20 ± 0.41
4	Plaque Score	8.63 ± 4.67	4.10 ± 1.82	4.13 ± 4.42	1.03 ± 1.15
5	Organoleptic	0.63 ± 0.52	0.60 ± 0.49	0.43 ± 0.50	0.35 ± 0.43
6	DMF-T	3.80 ± 3.33	-	3.53 ± 3.55	-
7	CPITN	0.73 ± 1.11	-	0.43 ± 0.50	-
8	Calculus Index	0.70 ± 0.40	-	0.69 ± 0.44	-
9	VSC levels using Halimeter	177.00 ± 64.55	103.70 ± 45.29	165.73 ± 76.26	152.83 ± 27.23

and after the tooth brushing treatment. There is a significance reduction ($P < 0.05$) of VSC levels in TBTC group using Antiplaque® toothpaste, but the reduction is statistically not significant in placebo group ($P > 0.05$). The reduction of organoleptic score in both group, are statistically significant ($P < 0.05$). The Mann-Whitney U Test for two independent samples is performed to analyze the significance to reduced VSC levels between Antiplaque® toothpaste and placebo toothpaste. There is a significant difference between Antiplaque® toothpaste and placebo ($P < 0,05$) in TBTC group in order to reduce the VSC levels, means that the Antiplaque® toothpaste reduced VSC levels significantly lower than placebo toothpaste. While the value are statistically not significant for organoleptic score ($P > 0, 05$), means that there is no significant difference between Antiplaque® and placebo toothpaste in reducing the organoleptic score.

The Mann-Whitney U for two independent samples was performed to analyze the significance of VSC levels reduction between TB and TBTC group either using Antiplaque® or placebo toothpaste. Combination of tooth brushing and tongue cleaning treatment reduced VSC levels significantly lower ($P < 0, 05$) than

tooth brushing treatment, while the reduction of VSC levels were not statistically different ($P > 0,05$) in placebo group. Reduction of organoleptic score between TB and TBTC group were not significantly different ($P > 0, 05$) in either group using Antiplaque® or placebo toothpaste.

Discussion

Halitosis can be classified into categories of genuine halitosis, pseudohalitosus and halitophobia; genuine halitosis is subclassified into physiologic halitosis and pathologic halitosis. Pathologic halitosis itself is categorized into oral pathologic halitosis and extraoral pathologic halitosis. If halitosis does not exist but the patient believes that he or she has halitosis, the patient would be diagnosed as having pseudo-halitosis. After treating either genuine halitosis or pseudo-halitosis, if the patient still believe that he or she has halitosis, a rediagnosis of halitophobia is warranted. In this case, there is no physical or social evidence exist to suggest that halitosis is present.¹⁴

The subject is instructed to perform the treatment before bedtime and the following morning. Daylong measurement carried out some

8 to 10 hours later (in the late afternoon) were compared with baseline measurement carried out at about the same time on the previous day, considering that the amount of supragingival plaque estimated by the plaque index are generally required 8 to 24 hours of maturation before plaque deposits produce VSC.¹⁵ Also considering that triclosan, being non-ionic, is compatible with dentifrice formulation and has reasonable substantives detected on the oral mucosa and in dental plaque at least 3 and 8 hour respectively after dosage.¹⁵

On the tooth brushing group, the subject is instructed to do the tooth brushing using Bass method. It has been suggested that the best way in reducing halitosis is to motivate patient to perform a good oral hygiene,¹⁷ such as tooth brushing^{1,2,5,17} or flossing.¹⁷ Tooth brushing is the most common and easy oral hygiene procedure, which regularly perform by most of people. It has been suggested that Bass tooth brushing method have the best effect among other technique in cleaning gingival sulcus and removing plaque from cervical one-third of the tooth, where plaque very easily accumulated.¹⁸ In general, tooth brushing is commonly accompanied with paste or powder dentifrice.¹⁸

The main ingredient of most toothpaste is soap or synthetic detergent like sulfocolaurate or sodium alkyl sulfoacetate and flavorings agent. Other ingredient in tooth paste are abrasive substance such as calcium carbonate, calcium phosphate, calcium sulphate ; fluid such as glycerine, water or alcohol ; Binding agent such as tragacanth, alginate or cellulose derivate; fluoride in many form, such as stannous fluoride, sodium fluoride, amine fluoride or sodium mono fluoroacetate.¹⁸ Chemotherapeutic agents for topical application from dentifrice requires a number of basic properties, they need to have : an intrinsic antimicrobial or antiplaque activity, chemical stability during storage, along with compatibility with the toothpaste formulation, property of agent to be retain at the site of action for prolonged periods after application and have a toxicological safety.¹⁶ Tooth brushing activity in this experiment is accompanied by the 1 cm of Antiplaque[®] toothpaste, based on the instruction from the manufactured.

The subject on tooth brushing and tongue cleaning group, was instructed to perform tongue cleaning besides the Bass method of tooth brushing. Combining tooth and tongue brushing was stated to be the most effective technique

for reducing expired sulphur-containing volatile.² Tongue cleaning is the other way to reduced halitosis and consider as one of basic treatment for halitosis.¹⁹ Mechanical tongue cleaning can be done by several devices, such as tongue brush, tongue scrapers or regular toothbrush.⁴

In this experiment, the tongue cleaning was perform by brushing their tongue 10 stroke from the posterior aspect of the tongue the anterior aspect of the tongue using the regular toothbrush that they use for tooth brushing. Although it has been suggested that using a regular toothbrush for tongue cleaning is inferior for removing debris and organism from the tongue compared with using a scrapping debridement tool,⁴ using regular toothbrush is the most inexpensive and easy way for most of people. It was assumed that on average fewer than 30 strokes are needed to clean the tongue.²⁰

However, it is disable to use product that provides maximum effect with minimum number of movement on the tongue thus reducing the gagging effect.⁴ Considering the last fact, we choose a cleaning procedures that used 10 strokes on the tongue. It has been suggested that the tongue cleaning can be more effective if perform by wetting the brush with an effective

mouthwash.²¹ It is questionable if the single mechanical cleaning of the tongue can reduce odor related to VSC, but the result of combination tongue brushing with the use of a dentifrice has resulted in VSC reduction for at least one an one half hours.⁴ Based on the previous study, the subject in this experiment was instructed to wetting the brush use for tongue cleaning with Antiplaque® water diluted paste which prepared by dilute 1 cm of Antiplaque® toothpaste in 20 cc of water in order to modified the regular toothpaste.

The result shows that there is a significant reduction of VSC levels after both treatment in subject using Antiplaque® toothpaste, but the reduction is not significant when using placebo toothpaste. It has been suggested before, that tooth brushing can reduce the VSC level at least for 3 hours.⁵ However, the reduction on group which perform the combination of tooth brushing and tongue cleaning treatment is larger than the tooth brushing group, this might be because the reduced tongue coating on the dorsum of the tongue which comprised of desquamate epithelial cells, blod cells and bacteria can reduced the VSC levels even more than just tooth brushing.¹⁹ Besides, it also been

stated that brushing the tongue decrease VSC by approximately 75% and reduced oral malodor in an undetectable level in most cases. In contrast, tooth brushing resulted in less than 25% reduction of hydrogen sulphide and mercaptan.¹⁵ There also a significant reduction on comparison between those two toothpaste, in both treatment group, which means that the Antiplaque[®] toothpaste was reduced the VSC levels significantly lower than placebo toothpaste. When the comparison was done for the two treatments, there is a significant reduction on group using Antiplaque[®] toothpaste, means that the combination of tooth brushing and tongue cleaning treatment was reduced the VSC levels significantly lower than the tooth brushing treatment. Therefore, the active ingredient of Antiplaque[®] toothpaste seems to play an important role in reducing halitosis. That is Triclosan which have a broad-spectrum antimicrobial agent, having activity against all of the major bacterial generally found in dental plaque.¹⁶ Antiplaque[®] toothpaste have several active ingredients which are: Cloxifenol (5 Chloro-2-(2,4 dichloro phenocyclophenol) = $C_{12}H_7Cl_3O_2$) another denomination: Triclosan (3,4,4-trichloro-2-hydroxyphenyl ether)/Irgasan

TP 300; Sodium monofluorofosphate (Fluoride – Na_2PO_3F) ; Oleum caryophylli (Eugenol = $C_{10}H_{12}O_2$) ; and Arnica tincture. Cloxifenol is derivate phenol, which is known as an effective antiseptic or fungi and Gram-negative bacteria.²² Triclosan is currently the most widely used clinically active antiplaque agent in commercial dentifrice, it has excellent safety record.^{16,23} Fluoride will give protection to teeth from caries process by hardening the teeth enamel.²⁴ Oleum caryophylli is atsiri oil from Eugenia Sp flower. It has slightly antiseptic effect and can be use to protect sensitive teeth.²⁵ While arnica tincture is come from Arnica Sp flower and has astringent function.

For the organoleptic technique, the only significant reduction only happen in combination of tooth brushing and tongue cleaning treatment uses both toothpastes. The reason maybe because combining tooth and tongue brushing was the most effective technique for reducing expired sulphur containing volatile² which can be measured by halimeter or organoleptic technique. No other group or comparison shows a significant value of reduction. This might be because the objectivity of the technique even done by two judges. This technique was also

suppose to be done in separate special scent free room consist only the examiner and the subject, but in this study, because the lack of facilities, the organoleptic measurement was done in the same room as the halimeter measurement takes place. Therefore, it is possible that the organoleptic measurement was interfered by other scent in the room. This measurement suggested to be related to the measurement of VSC levels using halimeter, which is not showed in this experiment. That's probably because the halimeter only measured the VSC gasses which are H₂S and CH₃SH, while the organoleptic technique measured the full mouth odor.²⁶

Conclusion

It was concluded in this experiment that : the Antiplaque® toothpaste has significantly reduced the VSC levels compare to placebo toothpaste ; the combination of tooth brushing and tongue cleaning treatment has significantly reduced the VSC levels compare to tooth brushing group. As a suggestion, there are need to do further experiment about the effect of Antiplaque® toothpaste on VSC levels in group of subject with older age or subject with a complaint of

halitosis, the effect of Antiplaque® toothpaste on anaerobic bacteria, on other oral flora, on pH saliva, on buffer capacity of saliva and salivary flow rate.

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