

Change of Oral Conditions after Combined Use of a Tongue Brush and Toothbrush: A Pilot Study

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Abstract

Introduction: This pilot study compared the effect of tongue cleaning by using a tongue brush alone and the one of combined using a tongue brush and toothbrush.

Materials and Methods: 20 healthy young men were studied. The effect of tongue cleaning was assessed according to the following three criteria, including a tongue coating index, H₂S concentration and oral bacterial count. These criteria were applied after tooth brushing combined with tongue brushing and then compared with the data by using a tongue brush alone. To evaluate the need for ongoing combined oral cleaning, its effect was evaluated on the day after a 7-day cleaning regimen's completion, and we compared it and the data obtained on the day before the study.

Results: After using a tongue brush alone, the tongue coating index improved and the oral bacterial count decreased ($p < 0.05$). After combined oral cleaning with both a tongue brush and toothbrush, significant improvements were revealed for the three criteria ($p < 0.01$). While, no significant difference was observed in the tongue coating index, H₂S concentration, and oral bacterial count between on the first day before cleaning and on the next day after the 7-day cleaning regimen completion.

Conclusion: This study indicated that oral cleaning by using a tongue brush alone resulted in a minimal decrease in the oral bacterial count, but significant improvement was achieved by combined use with a toothbrush. The results also suggested the necessity of daily combined use of a tongue brush and toothbrush for maintenance of a healthy oral cavity.

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Introduction

The association between oral bacteria and systemic disease has received considerable attention in recent years. A previous study reported that the risk of aspiration pneumonitis may possibly be reduced by decreasing the oral bacterial count through oral care in elderly people who require nursing care^[1]. The development of infectious endocarditis caused by bacteremia after bloody treatment in the oral cavity^[2,3] and worsening of diabetes by periodontal disease^[4] have also been studied. These reports suggested the importance of oral health to general health.

Most oral bacteria attach to dental plaque and the tongue coating to form biofilms. Granules are mainly composed of Streptococcus, Actinomyces, and Porphyromonas constitute

dental plaque^[5], while tongue coating is mainly comprised of Gram-positive cocci^[6]. Biofilm is a structure composed of micro-organisms^[7]. A variety of microorganisms are contained in the biofilm and create a community, while transferring information among themselves. Dental plaque and tongue coating can cause periodontitis and bad breath. Growth of dental plaque and tongue coating occurs under poor oral health conditions, and a decrease of dental plaque results in decreased tongue coating^[8,9]. Biofilm can only be removed by using mechanical methods. Tooth brushing removes dental plaque effectively, but it is not necessarily clear whether tongue brushing is effective for removal of tongue coating^[10].

Our pilot study reported the effect of oral cleaning by using a toothbrush and a tongue brush on the removal of dental



plaque and tongue coating which form oral biofilms, and on the amount of oral bacteria.

Materials and Methods

A total of 20 healthy young men from Hiroshima University School of Dentistry (age: 22 to 30) with normal occlusion and without subjective or objective chewing or swallowing difficulty were included in this pilot study.

This study was approved by the Ethics Committee for Epidemiological Research of Hiroshima University. The subjects received a full explanation about the study by the study dentist and voluntarily consented to participate.

A tongue brush (Shitatsutsumi®; Matsumoto-Die and Mold Co., Ltd, Hiroshima, Japan) (Figure 1), was used for cleaning of the tongue surface. The brush part of the apparatus is made with a synthetic resin elastomer. The brush part is flexible to conform to the entire surface of the tongue. A fine hook-shaped brush and a relatively flat spatula-shaped brush are located on the inside and outside of the apparatus to remove the thick and thin surface tongue coating respectively. The brush part is detachable to enable cleaning.

Sectional view of the tongue brush

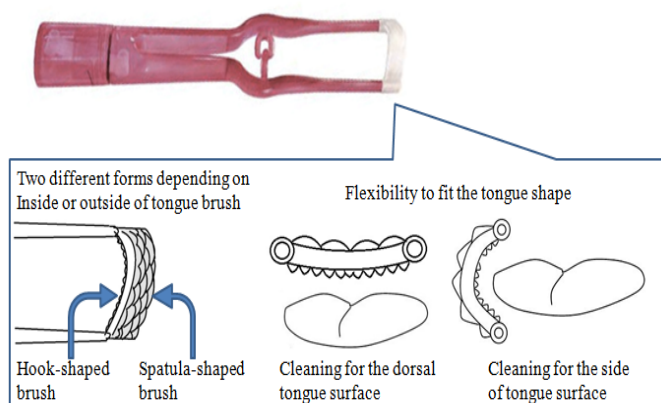


Figure 1: Structure of a tongue brush: Shitatsutsumi® (Matsumoto-Die and Mold Co., Ltd., Hiroshima, Japan).

The subjects were asked to discontinue tooth brushing for 1 day just before the first study (Study 1) started. They confirmed the presence or absence of their tongue coating with a mirror, and cleaned only their tongue surface by using only

tongue brush in the next morning before brunch. They were advised to brush their tongue surface from the terminal sulcus toward the tongue tip with appropriate pressure to avoid injury to the lingual tonsil, and to stop brushing when cleaning was visibly adequate in advance.

And then, another study (Study 2) was conducted. The subjects were asked to start combined oral cleaning with a tongue brush and toothbrush after an interval of more than 1 month. In this combined cleaning regimen, the subjects were asked to clean their tongue at first. The surfaces of the teeth were cleaned with a toothbrush after the tongue was visibly clean in the subject's judgment. This combined cleaning process was continued for 7 days.

The criteria included the amount of attached tongue coating, bad breath, and the oral bacterial count; these were evaluated and compared before and after the tongue cleaning procedures. The amount of attached tongue coating was evaluated according to the tongue coating index^[11]. To quantify the oral bacteria, a swab was scraped back and forth 3 times over a 1-cm width on the center of dorsal of the tongue, and the bacterial count was determined by using a Bacterial Counter® (Panasonic, Tokyo, Japan). Counting was repeated 3 times and the mean value was calculated. To assess bad breath, air from the oral cavity was collected with a syringe and H₂S concentration was determined using Oral Chroma CHM-2® (FIS, Osaka, Japan)^[12]. The data were compared between before and after cleaning in Study 1. As for Study 2, the data before cleaning with combined use of a tongue brush and toothbrush on Day 1 in 7-day regimen were compared with the one after cleaning on Day 7. In addition, the effect of ongoing combined oral cleaning was assessed between the data obtained on the next morning just after 7-day regimen's completion and the data on the Day 1 before cleaning. Statistical analysis was performed by the Wilcoxon signed rank sum test ($p < 0.01$) using SPSS Statistics 21.0 software (Japan IBM, Tokyo, Japan).

Results

After tongue cleaning by using a tongue brush alone, the tongue coating index and oral bacterial count decreased with a significance level at $p < 0.05$ but not at $p < 0.01$. H₂S concentration in the oral cavity decreased significantly ($p < 0.01$) after cleaning (2.8 ± 7.1 ng/10 ml), compared to before cleaning (4.9 ± 8.1 ng/10 ml) (Table 1).

Table 1: Comparison of oral cleanliness conditions in the subjects after the use of a tongue brush alone or the combined use of a tongue brush and toothbrush.

	Tongue brush alone		Combined tongue brush + toothbrush		
	Before	After	Before (Day 1)	After (Day 7)	The next day after a 7-day cleaning regimen
Tongue Coating Index (%)	5.6 ± 9.6	0.5 ± 1.5	10.2 ± 10.5	3.2 ± 6.3	9.0 ± 12.4
p-value	0.027		0.002		0.477
H₂S concentration (ng/10 ml)	4.9 ± 8.1	2.8 ± 7.1	2.1 ± 3.9	0.6 ± 1.2	1.4 ± 1.8
p-value	0.005		0.008		0.977
Oral bacterial count (× 10⁶ cfu/ml)	16.6 ± 12.6	8.2 ± 10.5	12.6 ± 10.0	4.4 ± 4.9	14.6 ± 11.8
p-value	0.030		0.002		0.156

When both a tongue brush and toothbrush were used for oral cleaning, a significant decrease ($p < 0.01$) was demonstrated in the tongue coating index, H₂S concentration and oral bacterial count (Table 1).

As for the comparison of the data between on the next day after 7-day regimen and on the Day 1 before cleaning, there was no significant difference (Table 1).

Discussion

This study demonstrated that the amount of tongue coating and oral bacterial count decreased more significantly after the oral cleaning with the combined use of a tongue brush and toothbrush than with the use of a tongue brush alone.

Only 20 male subjects were included in our pilot study. It would be difficult to ask women to stop tooth brushing for 1 day, because many women are more sensitive to bad breath than men and hesitate to leave their teeth unbrushed. Moreover, a close correlation was observed between the oral environment and hormonal balance related to the menstrual cycle^[13]. Furthermore, only young subjects were studied to exclude the effect of aging.

It was reported that bacterial count on the dorsal surface of the tongue decreased only slightly with mechanical removal of tongue coating^[14]. However, the bacterial count in the oral cavity clearly decreased with oral cleaning by using a tongue brush, dental floss, and gargling^[15]. In the present study, we also confirmed a significant decrease in the oral bacterial count after the combined use of a tongue brush and toothbrush. It was suggested that the amount of tongue coating also decreased with this combined application. Cleaning with a tongue brush was effective in preventing bad breath^[16]. In the present study, oral care with the use of a tongue brush alone and with the combined use of a tongue brush and toothbrush were effective in decreasing the bacterial count.

A scanning electron microscopic analysis of cross-sections of filiform papillae reported that most of the bacterial granules in the tongue coating were found among the epithelia of filiform papillae^[17]. Extended filiform papilla is a part of exfoliating keratosis and considered to have been removed by tongue cleaning. Although dental plaque or released epithelium could be removed from the teeth surface or mucous membranes, not all of the tongue coating was removed from the tongue^[5]. Keratosis of the mucosal epithelium on the tongue is considered as the defense mechanisms and plays a role in maintaining oral homeostasis^[18]. Therefore, this suggests that the amount of tongue coating can decrease by lowering the amount of oral bacteria on the tongue coating. In the present study, the amount of tongue coating decreased with the combined use of a tongue brush and toothbrush. Arora et al.^[6] indicated that active cleaning of the tongue was not needed in persons who can ingest orally because normal self-cleaning activity of the oral cavity would be expected. However, when the self-cleaning activity declined, tongue cleaning with weak pressure was recommended for removing contaminants that are present among the extended filiform papillae on the dorsal tongue. In the future, we will study the effect of this combined use of a tongue brush toothbrush in elderly persons based on the preliminary results of this paper.

No persistent effect of oral cleaning with combined use of a tongue brush and toothbrush was identified in this study. It was reported that the amount of tongue coating recovered to almost the baseline level in 2 days after removal by visual inspection^[19]. On the other hand, when the tongue was cleaned with topical antibiotics, the bacterial count on the dorsal of the tongue

significantly decreased even in 4 days after cleaning. However, the effect was transient, and regular cleaning was necessary for continual oral care^[20]. We surmised that daily oral cleaning by combined use of a tongue brush and toothbrush is important to decrease the oral bacterial count.

Conclusion

This study showed that combined use of a tongue brush and toothbrush increased the oral cleaning effect. However, this effect was transient. Daily oral cleaning with both a tongue brush and toothbrush is important to maintain a clean oral cavity.

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Conflict of Interest: Authors MM, MY, MY, TM, AH, CH and KT state that there are no conflict of interest.

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