

## Effects of toothbrush with black silica filaments

### Report

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## Introduction

At division of environmental pathology department of oral science graduate school of dentistry Kanagawa Dental University, product evaluation of “Wakka” manufactured by SHINYEI KAISHA was performed. The main theme of this evaluation is for the verification in the effects of a toothbrush with black silica filaments.

## 1. Teeth cleaning effects by toothbrush with black silica filaments

### The purpose

Black silica is expected to have the surface unevenness and far-infrared effect. The purpose of this study is to verify whether toothbrush with filaments combined by black silica is useful on high cleaning effects or not.

### Experimental procedure

#### • Materials

Study item (toothbrush): The core contains PBT6.12 and the tip contains PBT6.12 containing black silica. The linearity is 0.15-0.30mm.

Control item (toothbrush): The study item (toothbrush) does not contain black silica.

#### • Method

The experiment is performed in accordance to a time schedule. Brushing is performed by dividing the upper and lower dentition into 12 blocks of anterior and posterior parts (left and right), cheek (lip) side and tongue (palate) side, each for 45 seconds, for a total of 9 minutes (scrubbing method). The brushing time of 9 minutes is based on the experimental report by Satoshi Tokura. The above experiment is taken as one procedure, and it is performed with the study toothbrush and a control toothbrush (the order of use is randomly assigned).

The presence or absence of plaque on each tooth is recorded on a full jaw chart in which one tooth is divided into four sides by using PCR of O'Leary. If plaque is observed on the cervical region of each surface, it is judged as (+). If no plaque is observed, it is judged as (-). The same examiner measures the PCR throughout the research duration (Yuko Yamamoto). According to this PCR chart, the number of plaque-attached surfaces of tooth is determined, and PCRI is the percentage by dividing to the number of tested surfaces of teeth. In addition, a percentage obtained by dividing PCRI changed by brushing to PCRI before brushing is defined as a cleaning efficiency, and it is compared

between experimental groups.

The subjects were 6 volunteer men. The volunteers were given informed consent and this experiment was performed after obtaining their consent. This experiment has been approved by the University Ethics Review Committee.

## Time schedule

### 1<sup>st</sup> day

The subjects have no meals without dinner and no snacks after lunch. They do not drink alcohol. They do not brush their teeth after lunch and dinner. There is no restriction on the use of toothpaste or mouthwash before lunch on the 1<sup>st</sup> day.

### 2<sup>nd</sup> day

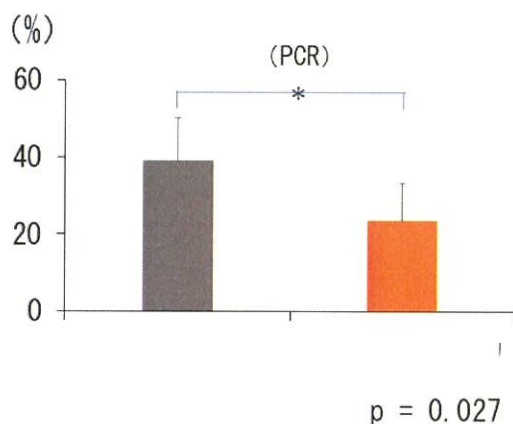
All subjects have the same breakfast and have no meals or snacks afterwards. They do not brush their teeth after breakfast.

Dyeing out plaque

PCR before brushing

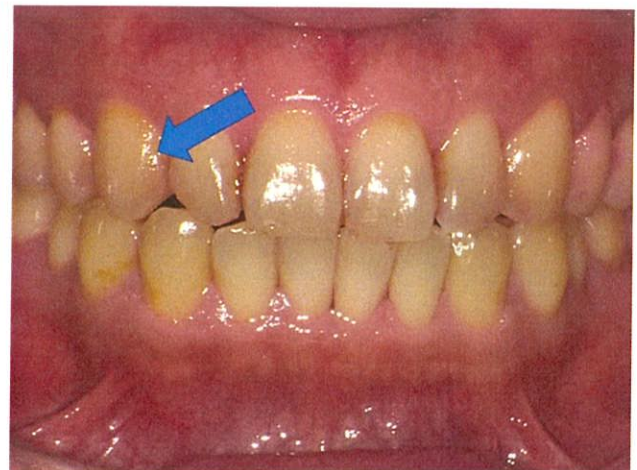
PCR after brushing

## The result



- Welch's *t* test
- n = 6

It was shown that the PCR of the black silica group was significantly lower than that of the control group.



The photo shows after cleaning with a control toothbrush and a black silica toothbrush. As shown by the arrow, the insufficient brushing on the adjacent surface is stood out with the control toothbrush.

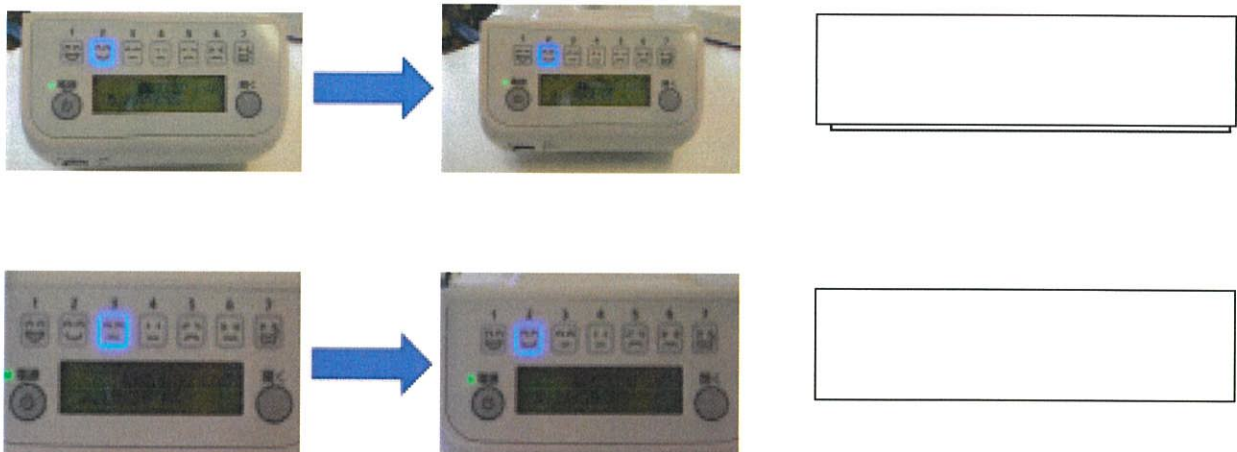


The photo shows before and after brushing with a black silica toothbrush. There is almost no red dyeing and the high cleaning effect with a black silica toothbrush

## The Conclusion

It was considered that toothbrush with black silica filaments had a lower PCR than the control toothbrush and a higher cleaning effect. It is reported that black silica has negative ions and far-infrared effects. No previous study regarding the relationship between the cleaning effect of a toothbrush and far-infrared effect was found, however there are reports that link the negative ion effect with the cleaning effect of toothbrush. This suggests that the negative ion effects by black silica may enhance the cleaning effect.

## 2. Study on bacterial count after brushing by toothbrush with black silica filaments



## The Conclusion

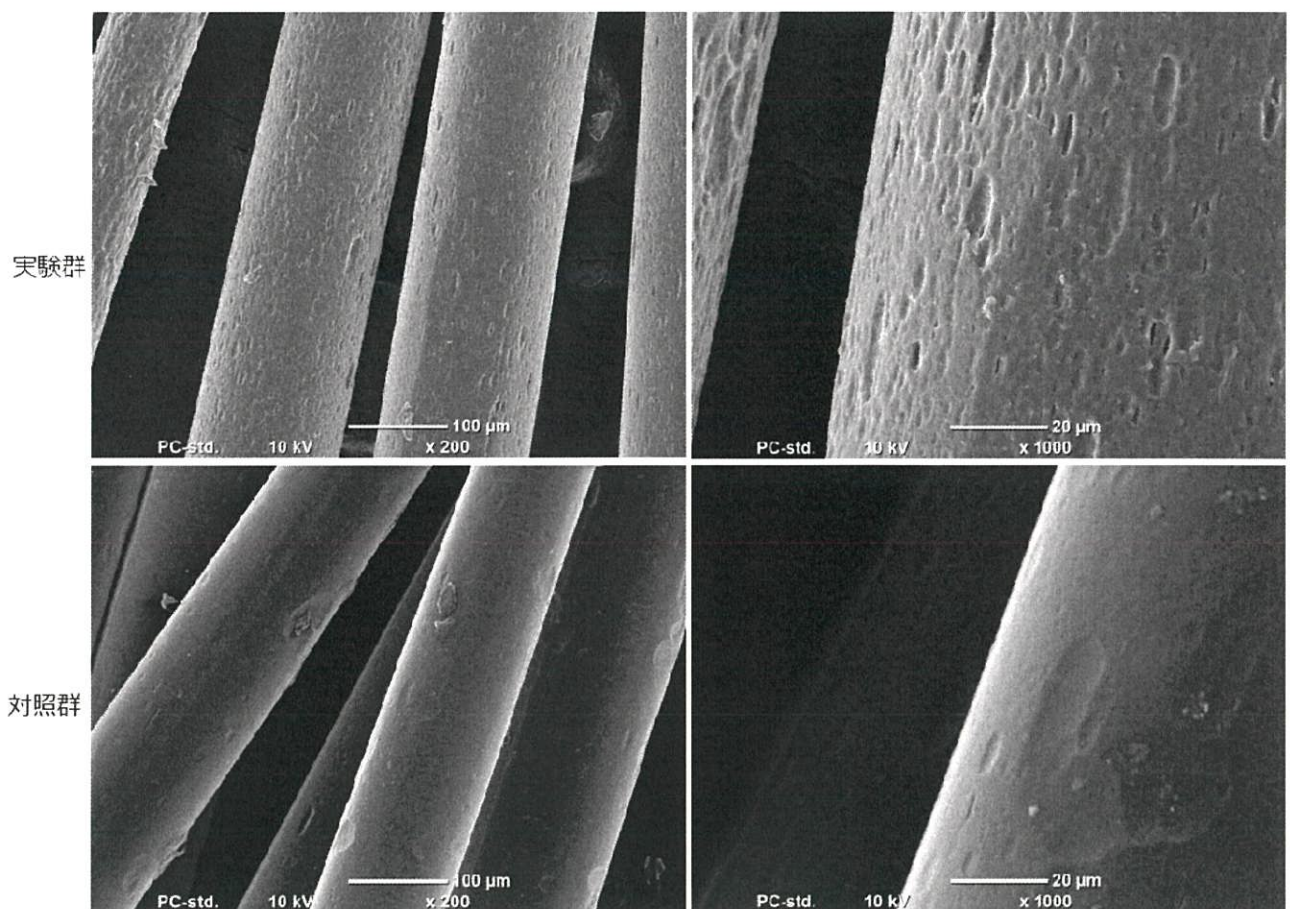
We have chosen one subject from the subjects of the experiment in 1 and have examined under substantially the same conditions as 1. On another day, the subject has cleaned the teeth with a black silica toothbrush and a control toothbrush, then the number of bacteria in saliva was measured. As a result, the number of bacteria was smaller when cleaning with a black silica toothbrush. This result supports the conclusion of 1 experiment.

### 3. Analysis of Surface Morphology by Scanning Electron Microscopy of Toothbrush Tip

#### Methods

We have observed the surface of toothbrushes including control and black silica toothbrush by JCM-6000Plus NeoScope™ Neoscope A tabletop scanning electron microscope.

#### The Result



The ultrastructure of the surface of the control group (control toothbrush/2<sup>nd</sup> pictures) and that of the study group (black silica/1<sup>st</sup> pictures) were clearly different. The control group was relatively smooth, but the experimental group showed a conspicuous concave surface structure. In addition, a micro convex structure is also observed.

## The Conclusion

It is unclear why the surface of the toothbrush containing black silica has a concave or micro convex structure. The effect of black silica particles is the most conceivable reason, however, the particles themselves are not found. It is also proposed that this roughness is involved in the improvement of the cleaning effects, and the verification by an engineering expert is required.

## Overall Summary

As a result of product evaluation of “Wakka” manufactured by SHINYEI KAISHA it became clear that toothbrush with black silica filaments has high cleaning effects in condition of not using toothpaste.