



Plaque Removal Effect by Round-Shaped Toothbrush

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Abstract

Background and Objective: Plaque control is the most important factor in periodontal therapy. Especially patient with periodontitis needs good plaque control. We have developed round-shaped toothbrush and have tested its effectiveness of plaque removal.

Materials and Methods: We have selected ten volunteer students from Kyushu dental university dental hygienist course, and all volunteers were informed and consented. All members had healthy and periodontal tissue. Before examination, plaque index was calculated by O'Leary's Plaque Control Record (PCR). After 10 min brushing by bath method, plaque index were calculated again.

Results: Round-shaped toothbrush revealed significantly high plaque removal rate on lingual side of mandibular molars.

Conclusion: Round-shaped toothbrush might have possibility to lead to the perfect plaque control.

Keywords: Round-shaped toothbrush; Oral hygiene; Tooth brushing; Dental plaque

Introduction

It is widely accepted that most significant cause of periodontal disease is bacterial plaque [1,2]. The importance of plaque control in periodontal therapy had been recognized widely. Rosling et al. [3] were reported the importance of brushing method to cleanse supragingival plaque to in order to stabilize the periodontal tissue. In addition, Axelsson and Lindhe [4] were emphasized the important role of continuous plaque control even in the maintenance phase. To maintain good prognosis by periodontal therapy and long-term periodontal tissue health, daily plaque control by the patients themselves is essential. Morozumi et al. [5] were proposed to modify flat-type toothbrush head and handle, and developed new flat-type toothbrush that is easy to access to molars, lingual and interproximal surfaces. They were reported this modification improved handling so that it achieved higher plaque removal rate.

We have developed round-type toothbrush with dome-like shape bristle and reported the plaque removing ability on various tooth surfaces comparing with conventional flat-type toothbrush [6]. In this research, we examined the plaque removal effect on each tooth type comparing round-shaped and flat-shaped toothbrushes.

The Background Data discussing the present state of the field.

Materials and Methods

Subjects and exclusive conditions

This research was carried out with the approval by Kyushu Dental University Ethics Committee (No. 10-036). Subjects were fully informed of the purpose of this research and consented. Ten healthy volunteer students of Kyushu Dental University Dental Hygienist Course, average age of 20.8 ± 2.2 , with 28 teeth except third molar were selected (10 females). These volunteers were free from systemic disease, medication, restoration in the mouth, caries, gingival recession, orthodontic bracings and malalignment.

About the toothbrushes

Round-shaped toothbrush: The bristle of modified toothbrush is shown on Figure 1 and 2. Its bristles of heel and toe parts were cut shorter than original with three dome-shaped points and 2 edges with the straight handle. Toothbrush specification is as follows; the number of bristles is 34 which is consisted with 18 bristles in central part and 8 outer bristles on both sides. In the central part, there are 2 lines by 9 rows with 18 bristles. Those 9 rows are divided into 3 parts (toe, top and

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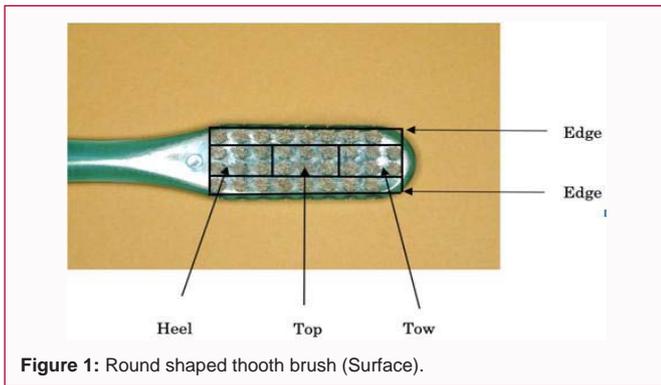


Figure 1: Round shaped toothbrush (Surface).

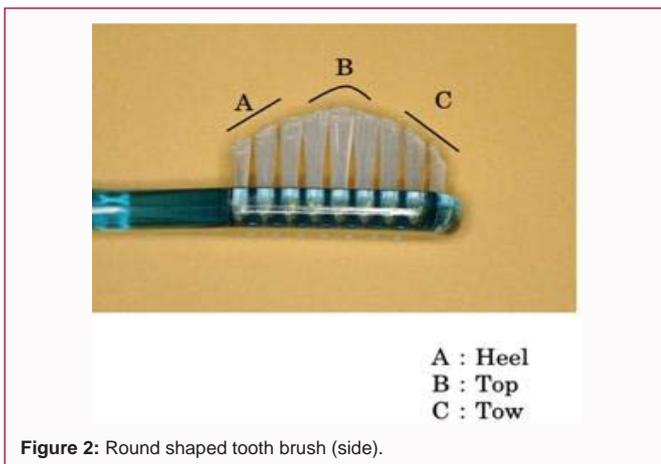


Figure 2: Round shaped toothbrush (side).

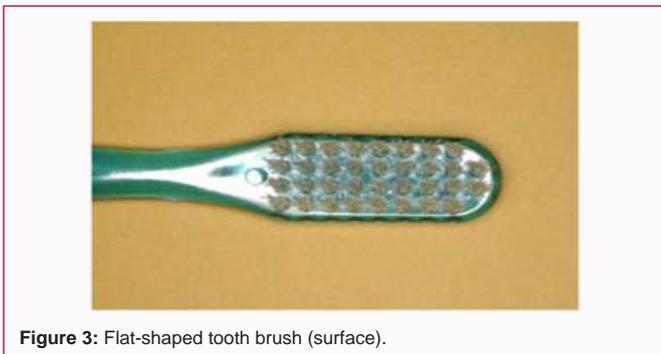


Figure 3: Flat-shaped toothbrush (surface).



Figure 4: Flat-shaped toothbrush (side).

heel) to be consisted with 2 lines and 3 rows for each part.

Bristles of both at heel and toe are continuously getting shorter than the top part to make a dome-like shape of the toothbrush head. The hair of the toothbrush is made with nylon by 0.4 mm diameter and 10 mm length.

Flat-type toothbrush: Specification of flat-type toothbrush: A straight handle with 0.4 mm diameter with 10 mm length nylon hair in 4 rows with 34 bristles (Figure 3 and 4).

Research methods

Before starting the examination, subjects did not brush their teeth for two days but not specific restriction on their diet. On each examination, PCR of individual examinee were evaluated first, and then each examinee brushed teeth for 5 min each for maxillary and mandibular teeth with round-shaped toothbrush. After 10 min of brushing, second PCR was evaluated.

One week later, another examination was performed with flat-shaped toothbrush with the same manner. PCR was evaluated by the same two experienced dentists, independently.

Measurement of plaque retention condition

Adhered plaque was evaluated based on O’Leary’s PCR method [7]. Before and after brushing, plaque was stained by plaque staining liquid (DENT, LION and Japan). Plaque retains on buccal, lingual and palatal surfaces of each tooth were calculated.

Data analysis

PCR score at buccal, lingual and palatal sides of each tooth after brushing by using round-shaped and flat-shaped toothbrush were analyzed by χ^2 test (JMP8.0.2 SAS Company, USA).

Results

There was no significant difference in PCR of each group before the experiment. The PCR of each group is shown as follows after the experiment.

PCR score of buccal side was evaluated and on the surface of 17, 24, 26, 37, 46, 47 tooth area, round-shaped toothbrush performed significant plaque removal compared to flat-shaped brush (Table 1). Scores of lingual and palatal surface, round-type toothbrush revealed significant plaque removal compared to flat-shaped toothbrush, especially on the surface of 14, 13, 12, 23, 25, 26, 27, 37, 36, 35, 34, 31, 41, 42, 46 and 47 tooth area (Table 2).

Oral photo of lingual side of the mandibular molars were showed round-shaped toothbrush performed plaque more removal compared to flat-shaped toothbrush (Figure 5).

Discussion

Plaque control is the most important in the treatment of periodontal disease; however it is still difficult to let patient perform

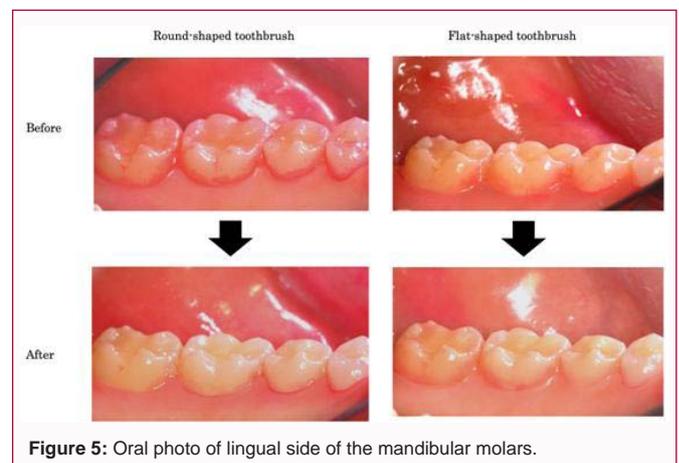


Figure 5: Oral photo of lingual side of the mandibular molars.

Table 1: PCR score at buccal of each tooth after brushing by using around-shaped or flat-shaped toothbrush (n=10).

Tooth area	Round-shaped tooth brush	Flat-shaped tooth brush	p
17	2	8	0.0055 [†]
16	1	3	0.2547
15	1	3	0.2547
14	0	1	0.2303
13	2	0	0.0835
12	1	1	1
11	0	0	1
21	1	1	1
22	1	1	1
23	1	0	0.2303
24	0	3	0.0303 [†]
25	1	2	0.5278
26	1	8	0.0009 [†]
27	4	8	0.0632
37	1	6	0.0148 [†]
36	0	4	0.0105 [†]
35	0	0	1
34	1	2	0.5278
33	2	2	1
32	1	1	1
31	1	2	1
41	1	1	1
42	1	2	0.5278
43	1	4	0.1116
44	1	4	0.1116
45	1	3	0.2547
46	0	4	0.0105 [†]
47	1	8	0.0009 [†]

n= Subject

perfect brushing [8]. For this research we needed to standardize the ability and knowledge for the dental brushing, we have chosen volunteer dental students of Kyushu Dental University Dental Hygiene Course, who have knowledge about meaning of brushing and its skill. We also have made the personal difference very small with age, teeth number, status of oral hygiene and health condition. We let the examinee to use unfamiliar round-shaped toothbrush first, because they are familiar to use of flat-type toothbrush in their daily life.

The specific feature of round-shaped toothbrush is the form that made to fit lingual side of the anterior teeth with the elastic bristles of the heel part. For premolars, three parts of toe, top, heel fit well and effectively work. The dome-like shape of the toothbrush head makes brushing that uses toothbrush tip will not load any lateral force on the lingual and palatal curvature of dentition.

Generally posterior area is difficult to toothbrush effectively especially on palatal and lingual side, this site-specific toothbrush design matches to the morphology and effectively removes plaque by using to part with short bristles. In addition, toe parties effective to go into narrow difficult places to brush such as buccal side of the molar

Table 2: PCR score at lingual and palatal of each tooth after brushing by using round shaped and flat-shaped tooth brush (n=10).

Tooth area	Round-type toothbrush	Flat-type toothbrush	p
17	3	5	0.3593
16	4	5	0.6528
15	3	4	0.6388
14	1	5	0.0437*
13	1	7	0.0042*
12	3	8	0.0213*
11	6	6	1
21	4	7	0.174
22	4	7	0.174
23	1	5	0.0437*
24	1	4	0.1116
25	1	6	0.0148*
26	0	7	0.0002*
27	0	6	0.0009*
37	1	7	0.0042*
36	1	7	0.0042
35	1	5	0.0437*
34	0	4	0.0105*
33	0	4	0.0105*
32	1	4	0.1116
31	0	5	0.0033*
41	0	3	0.0303*
42	0	3	0.0303*
43	1	2	0.5278
44	2	7	0.0213*
45	2	5	0.1545
46	1	9	0.0001*
47	0	6	0.0009*

n= Subject

with its half-length of bristles than top part with the relatively hard bristle.

Yokota et al. [9] were reported that even after tooth brushing, plaque tends to remain on distal surface of maxillary second molar, buccal and palatal sides of maxillary molars, and interproximal area of maxillary and mandibular dentition. For the conventional flat-type toothbrush, it is very difficult to brush buccal side of maxillary molars with the bristle tip, because that area is originally narrow and anatomical pressures such as coronoid process and muscles are existing.

In addition, on palatal surface, flat-type toothbrush cannot fit to the curvature of the maxillary dentition; toe and heel of the brush are bent so that it cannot utilize brush-tip brushing that makes plaque to remain. On the other hand, round-shaped toothbrush can perform brush-tip brushing with the short toe and heel that makes round shape. It has a favorable shape for brush-tip brushing to reach every part of the mouth. It enabled significant plaque removal even from the difficult area of maxillary and mandibular dentitions.

We considered round-shaped toothbrush can compensate the weak point of flat-type toothbrush and makes brush-tip brushing

possible for everyone. Because the periodontal disease is reported to be originated from bacterial plaque [1,2]. Thus, plaque control is the most important in periodontal disease therapy. We consider that round-shaped toothbrush can make periodontal disease therapy more effective and can contribute to save and retain natural teeth.

Conclusion

In this study, we have developed round-shaped toothbrush and have tested its effectiveness of plaque removal. As a result, round-shaped toothbrush revealed significantly high plaque removal rate on lingual side of mandibular molars. The use of round-shaped toothbrush can maintain good plaque control. We may be improved and prevented periodontal disease.

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