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(54) **A TOOTHBRUSH**

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Description

Field of the Invention

[0001] The present invention is in the field of toothbrushes; and in particular relates to toothbrushes with improved teeth whitening efficacy.

Background of the Invention

[0002] In recent years, tooth-whitening has been one of the most rapidly growing oral care sectors fueled by the consumers' demand for both healthy and cosmetically attractive smiles. Indeed, for the majority of people, the appearance of teeth is very important, and any discolouration or stain that may form on them will affect their aesthetic qualities. The colour of the teeth is influenced by a combination of their intrinsic colour and the presence of discolouration or extrinsic stains which may form in the acquired enamel pellicle. The intrinsic colour of teeth is predominantly determined by the colour properties of the underlying dentine projected through relatively translucent outer enamel layer. Extrinsic stains particularly form on those areas of the teeth which are less accessible to toothbrushing and the abrasive action of toothpaste. In addition, extrinsic staining is often promoted by smoking, dietary intake of tanning-rich foods (e.g. red wine) and the use of certain cationic agents such as chlorhexidine, or polyvalent metal salts such as tin and iron.

[0003] Toothbrushes providing whitening benefit in addition to cleaning or polishing benefits are widely known in the art.

[0004] WO03/015575 (Unilever) discloses a tooth brush with a radially extending rubbery cleaning element. WO11093874(Colgate) discloses a toothbrush with polishing member dispersed within Y shaped Bristles WO 01/21036 (Unilever) discloses a toothbrush comprising a handle and a head, said head comprising upstanding bristles and at least one upstanding tooth polishing element, characterised in that the tooth polishing element is in the form of a resilient wall-like member and is flanked by bristles.

[0005] WO2008/103598 discloses an oral care implement or toothbrush including a head and a tooth cleaning element for enhanced cleaning and whitening of the teeth. The tooth cleaning element has a base connected to the head. The base has structure in the form of a concave surface facing a distal region of the head such that dentifrice applied to the head is adapted to be directed towards the distal region of the head. A protrusion extends from the concave surface towards the distal region of the head. The head may include a plurality of concave surfaces that are substantially aligned along a longitudinal axis of the head, and protrusion extends from the curved surface.

[0006] WO04/026075(Unilever) discloses a toothbrush comprising a longitudinal resilient member comprising perlite for whitening.

[0007] Although the toothbrushes in the prior art provides for whitening benefit, improved whitening of teeth still remains to be desired.

[0008] Accordingly, it is an object of the present invention to provide improved teeth whitening or stain removal efficacy.

[0009] It is a further object to provide a toothbrush with improved teeth whitening or stain removal efficacy and adequate polishing and plaque removal benefits.

[0010] Surprisingly, it has been found that when the tooth whitening element is in a specific arrangement on the head of the toothbrush, improved teeth whitening or stain removal can be obtained.

Summary of the Invention

[0011] Accordingly, the present invention provides a toothbrush comprising a handle (1) and a head (2), said head comprising bristles and a tooth whitening element (3) in the form of a resilient wall-like member wherein the tooth whitening element has a central portion (4) running along a longitudinal axis of the head and two lateral portions (5) cupping an end of the central portion wherein two lateral portions (5) are shaped with two spokes or star-shaped with at least 3 spokes (6) and the central portion (4) and the lateral portions (5) are detached from each other, characterised in that the central portion (4) has a straight-line length of 10 mm to 15 mm.

[0012] In another aspect the invention provides use of a toothbrush according to the invention for improved dental hygiene.

[0013] These and other aspects, features and advantages will become apparent to those of ordinary skill in the art from a reading of the following detailed description and the appended claims. For the avoidance of doubt, any feature of one aspect of the present invention may be utilised in any other aspect of the invention. The word "comprising" is intended to mean "including" but not necessarily "consisting of" or "composed of." In other words, the listed steps or options need not be exhaustive. It is noted that the examples given in the description below are intended to clarify the invention and are not intended to limit the invention to those examples per se. Similarly, all percentages are weight/weight percentages unless otherwise indicated. Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of

materials and/or use are to be understood as modified by the word "about". Numerical ranges expressed in the format "from x to y" are understood to include x and y. When for a specific feature multiple preferred ranges are described in the format "from x to y", it is understood that all ranges combining the different endpoints are also contemplated.

Detailed Description of the Invention

[0014] The invention relates to toothbrushes providing improved whitening or stain removal efficacy. The toothbrushes of the invention also provide adequate polishing and plaque removal benefits.

[0015] Preferably, the toothbrush is a manual toothbrush. Preferably the shape of the toothbrush head is substantially rectangular.

Tooth whitening element

[0016] The tooth whitening element is in the form of a resilient wall-like member. The wall-like member is preferably made from a material soft enough to provide a whitening benefit to the teeth and so it is preferred that it is made from a material with Shore A hardness of between 5 and 80, preferably from 15 to 50.

[0017] The tooth whitening element provides a whitening benefit as it is rubbed along the surface of the teeth during brushing. Due to its wall-like structure and its resilient composition it is capable of being elastically deformed.

[0018] The tooth whitening element represents a lamella which is inserted in between the bristles of the toothbrush. The tooth whitening element is preferably made of thermoplastic elastomers (TPE).

[0019] The thermoplastic elastomers are made of polymer materials, such as block copolymers. Preferred block copolymers include styrenes (for example styrene ethylene butadiene styrene, or styrene butadiene styrene), polyolefins (for example polypropylene/ethylene propylene diamine modified systems (i. e. synthetic rubber)), polyamides (for example polyamide (2 or polyamide 6), polyesters (for example polyester ester or polyether ester), polyurethanes (for example polyesterurethane, polyetherurethane or polyesteretherurethane).

[0020] It is further preferred that the whitening element comprises perlite particles.

[0021] It is envisaged that the whitening element can be made by any conventional method, i.e. die-cut or moulded. However, a preferred method of making such a structure would be by injection moulding. The material of the wall-like member may be linked to the head of the toothbrush in any way whether it be by chemical means, mechanical means or both.

[0022] Without wishing to be bound by theory, it is thought that the tooth whitening element has the advantage of trapping the toothpaste particles against the tooth. These particles will be retained within the contact as the brush is drawn against the flat surface of the tooth. Alongside this, the bristles in the toothbrush have the advantage of carrying the toothpaste particles into the crevices and narrow gaps between teeth, thereby providing a combination of whitening and cleaning benefits. The tooth whitening element of the present invention has a central portion and two lateral portions. The central portion (4) of the tooth whitening element (3) runs preferably continuously along the longitudinal axis of the head (2).

[0023] The central and the lateral portions are detached from each other and preferably at no points join to form a single unit.

[0024] The central portion of the tooth whitening element runs continuously along the longitudinal axis of the head. The central portion has a straight-line length of 10 mm to 15 mm, preferably 10mm to 13mm, still more preferably 10mm to 12mm.

[0025] Where the central portion runs for a distance greater than the length of the head, i.e. the running length is greater than the length of the head, it may be necessary for the central portion to be curved in some fashion. This may be a gentle curve but it may also be curved in a snake-like, sinusoidal or zig-zag fashion.

[0026] The running length should not be confused with the straight-line length which is the shortest distance between either ends of the central portion.

[0027] The central portion is in the form of a straight-line.

[0028] The tooth whitening element preferably has one central portion.

[0029] The tooth whitening element of the present invention has two lateral portions cupping an end of the central portion.

[0030] The lateral portion is shaped in order to cup the ends of the central portion. Preferably, the lateral portion has a V-shaped, a U-shaped or a U-V shaped region to cup the ends of the central portion.

[0031] Preferably, the lateral portion has a V-shaped region to cup the ends of the central portion. The lateral portion may be formed as a result of the lateral portion being V-shaped with two spokes or star-shaped with at least 3 spokes, preferably 3 spokes. The spokes may be of the same or different lengths. The length of the spokes may vary from 1mm to 7mm, preferably 2mm to 6mm, more preferably 3mm to 6mm. The spokes may further be straight or curved outwardly at the pointy end.

[0032] The toothbrush according to the invention may be made from any materials commonly used in the art.

[0033] Accordingly, the handle and head of the brush can be moulded from polyolefins such as polypropylenes and polyethylenes, polyamides such as nylons, and polyesters such as polyethylene terephthalate. Other suitable materials include polymethylmethacrylate, styrene acrylonitrate and cellulose esters, for example cellulose propionate.

[0034] The bristles of the brush may be made from a flexible material suitable for use in dental hygiene. Generally, materials suitable for the bristles are polyamides such as nylon or polyesters such as polybutylene terephthalate.

[0035] In a second aspect, the present invention provides for use of a toothbrush according to the invention for improved dental hygiene.

Drawings

[0036] An embodiment of the toothbrush according to the invention is described herein with reference to the following figure. Figure 1 shows a schematic drawing of the toothbrush according to the invention. In figure 1, the toothbrush comprises a head (2) and a handle (1). The head has a tooth whitening element (3) having two portions, a central portion (4) and lateral portions (5). The lateral portions have spokes (6). The head also shows bristle tufts (7).

[0037] Figure 2 shows the result of comparison of the 3 toothbrushes of Example 3. Colour blue (first bar) indicates the toothbrush according to the invention, colour green (third bar) indicates Oral B flat trim toothbrush and colour red (second bar) indicates Signal toothbrush.

[0038] The invention will now be illustrated by means of the following non-limiting examples.

Exam pies

Example 1: Effect of the toothbrush according to the invention on whitening

[0039] In this example, the toothbrush according to the invention was compared to an existing toothbrush in the market known for its whitening benefit and sold under the brand name Signal (White System Ex Italy 2016).

Apparatus:

[0040] The apparatus used in this example were the following:

Abrader, Grit paper;
WIRA brushing machine;
Chroma Meter Minolta CR321(Minolta Camera Co. Ltd, Japan) in CIE L*a* b* mode.

Staining procedure:

[0041] Cleaning was assessed as described in Stookey GA, Burkhard TA, Schemehorn B R. in vitro removal of stain with dentifrices J Dent Res 1982 61: 1236-1239. The percentage stain removed is given by the following equation:

$$\%Stain\,\mathrm{Re}\,moved = \frac{L*Brushed - L*Stained}{L*Pumiced - L*Stained} \times 100$$

L* Brushed : L* value after brushing time
L* Stained : L* value at baseline stain
L* Pumiced : L* value after final polishing with a prophylaxis

Test products:

[0042]

Code	Test Product
A	Unilever's Signal White System Toothbrush
B	Toothbrush according to the invention

[0043] The toothbrush according to the invention used in this example was of the following specifications:

Head

Design:

[0044] Bristle cut profile: multilevel (with power tip)

Material

Anchor Wire:

[0045]

Metal alloy (nickel/silver wire)
Supplier- Berkenhoff
Grade-Nickel Silver NS 12

Filaments:

[0046]

Nylon 6/12
Supplier: DuPont/STP
Grade: PA6.12 Filaments
+
Nylon 6/12
Supplier: BBC - tbc
Grade: Charcoal Filaments

Tuft Map:

[0047] As in Figure 1

Filament Caliper & Color of Filaments:

[0048]

		Diameter (mils)	
Tuft	**Bristles Type**	**SOFT**	**MEDIUM**
Toe Tuft	Standard	7	7
Rounded Tuft	Standard	7	8
Rectangular Tuft	Charcoal	7	7
Squared Tuft	Standard	7	8

Trim Dimension:

[0049]

Heights: Higher Tufts = 12.5 ±0,5mm
Lower Tufts = 10.5 ±0,5mm
Lamella = 10.5 ±0,2mm

Results:

[0050] In this study, toothbrushes A and B were tested using an experimental design matrix ensuring random allocation of bristles tested in the 4 troughs of the brushing machine. The results are summarized in Table 1. Statistical analysis of the data was performed via JMP 11 (statistical software from SAS). The comparison using Tukey-Kramer HSD test was carried out to assess if the differences, between products, were statistically significant.

[0051] Table 1 shows the mean of percentage of stain removal with the relative standard deviation value and the standard error value for each tested products.

Table 1

Test product	N°	% Stain Removal (mean)	SD	Std Error
Toothbrush according to the invention (B)	8	29,95	1,14	0,36
Unilever's White System Signal (A)	8	27,21	1,09	0,34
(*) Means with different letters differ significantly at 95% confidence ($p<0.05$).				

[0052] The above table shows that statistical differences were found in terms of stain removal efficacy or whitening. The toothbrush according to the present invention is seen to be performing better than Signal toothbrush.

Example 2: Effect of the toothbrush according to the invention on plaque removal

[0053] In this example, the toothbrush according to the invention was compared to an existing toothbrush in the market sold under the brand name Signal to evaluate the cleaning performance by measuring the amount of plaque which remains in the inter-dental spaces after a circular brushing movement.

Apparatus:

[0054] The apparatus used in this example were the following:
Brushing machine: having a combination of co-linear and cross-brushing modes, it and approximates to typical circular brushing motions observed in subjects.

Teeth Models:

[0055] Coloured plates of polyurethane and comprising four crevices running parallel was used to simulate inter-dental spaces between incisor and molar teeth as in a human mouth. The crevice full of paste appear as white band of 4mm in width; following brushing, the crevices partially cleaned shows white bands of decreasing width. The analysis considered only the two central crevices.

[0056] *Apparatus for measuring the plaque removal:* Whiteness was measured with a spectrophotometer where 'L' in the L* a* b* Colour System is recorded for crevice empty, crevice full and crevice following brushing.

Artificial Plaque:

[0057] The crevices on the teeth models were filled with a synthetic soft white paste which simulates human plaque in its physical properties.

[0058] A palette knife was used to spread the paste in the crevices on the plates and the excess was leveled off on the plate surface.

Test procedure:

[0059] The toothbrush was soaked in water for 5 minutes to soften the bristles. The head of the toothbrush was then placed perpendicularly in the gripping unit of the brushing machine in a manner that the tuft was not compressed during and after it was being placed. Using a chromameter, the values of the full and empty plates were measured. Six measurements in the two central crevices (three measurements for each of the crevices: one in the middle and one in each sides) were taken and the average was calculated. The teeth plate prepared with plaque filling was put in a specific container and saliva was added to cover the entire plate. The container was placed in the machine holder. By means of weights, 190 grams of load was applied on the brush head and the brushing machine was allowed to run for 30 total

strokes (frequency 150 double strokes/ min). The plate was then carefully washed with distilled water to remove the saliva residuals and was pulled out of the container. The plate removal was evaluated photometrically from crevices as done for full and empty values. The plate was washed and the analysis was repeated applying 275 grams of load for the same brush head.

[0060] The percentage of plaque removal was determined using the following equation:

$$\% \text{ Removal} = \frac{L \text{ (full)} - L \text{ (following brushing)}}{L \text{ (full)} - L \text{ (empty)}} \times 100$$

Test products:

[0061]

Code	Test Product
A	Unilever's Signal Toothbrush
B	Toothbrush according to the invention

[0062] The toothbrush according to the invention used in this example has the same specifications as in example 1.

Results:

[0063] In this study, toothbrushes A and B were tested for plaque removal.

[0064] Table 2 shows the mean of percentage of plaque removal with the relative standard deviation value for each tested products.

Table 2

	Unilever's Signal (A) (190 grams)				**Toothbrush according to the invention (B) (190 grams)**			
	L (empty)	L (full)	L (foll. brushing)	% of removal	L (empty)	L (full)	L (foll. brushing)	% of removal
1	70,48	91,84	79,04	59,93	72,97	92,67	80,38	62,39
2	70,20	92,04	78,86	60,35	72,51	92,96	80,45	61,17
3	70,35	91,88	79,02	59,73	72,77	92,60	80,26	62,23
4	70,13	91,95	79,10	58,89	72,84	92,56	80,33	62,02
Mean	70,29	91,93	79,01	59,72	72,77	92,70	80,36	61,95
SD	0,16	0,09	0,10	0,61	0,19	0,18	0,08	0,54
	Unilever's Signal (A) (275 grams)				**Toothbrush according to the invention (B) (275 grams)**			
1	70,25	92,41	72,44	90,12	67,99	90,48	70,18	90,26
2	70,30	92,83	72,54	90,06	68,36	90,12	70,33	90,95
3	70,70	93,39	72,77	90,88	68,22	89,96	70,48	89,60
4	70,13	92,83	72,36	90,18	68,55	89,98	70,66	90,15
Mean	70,35	92,87	72,53	90,31	68,28	90,14	70,41	90,24

(continued)

	Unilever's Signal (A) (275 grams)				Toothbrush according to the invention (B) (275 grams)			
SD	0,25	0,40	0,18	0,38	0,24	0,24	0,21	0,55

[0065] The above table shows that the test products were statistically equal. The toothbrush according to the present invention is seen to be performing similar to Signal toothbrush.

Example 3: Effect of the toothbrush according to the invention on polishing

[0066] In this example, the toothbrush according to the invention was compared to existing toothbrushes in the market sold under the brand name Signal and Oral B to evaluate its polishing ability.

Test products:

[0067]

	Test Product
A	Unilever's Signal Toothbrush
B	Toothbrush according to the invention
C	Oral B Flat trim

Materials used:

Brushing Machine

Black Perspex tiles

Sheen Microgloss 155/SO

Test procedure:

[0068] The gloss value of each tile was measured using a Sheen Micro-gloss Meter at 60o/60o (incident/measured) angle. For each tile, initial gloss measurements were taken, then the Perspex surface was dulled using abrasive paper, and the gloss value was measured again. This gave the maximum and minimum gloss values of the tile, from which the percent gloss was then calculated.

[0069] Slurry was prepared as follows:

1 part Toothpaste (Signal Sensitive toothpaste)
1 part Water
1 part SCMC diluent
10g of above slurry was applied on each sample and tiles were brushed. Gloss measurements were taken after 200, 1000, 3000 and 5000 brushing strokes.

Results:

[0070] In this study, toothbrushes A, B and C were tested for polishing ability.

[0071] Figure 2 shows the results at the different time points. Overall it can be concluded that toothbrush according to the invention (indicated by colour blue in figure 2) is superior in polishing action compared to Oral B flat trim toothbrush (indicated by colour green in figure 2) and statistically similar in performance to Signal toothbrush (indicated by colour red in figure 2).

Claims

1. A toothbrush comprising a handle (1) and a head (2), said head comprising bristles and a tooth whitening element (3) in the form of a resilient wall-like member wherein the tooth whitening element has a central portion (4) running along a longitudinal axis of the head and two lateral portions (5) cupping an end of the central portion wherein the two lateral portions (5) are shaped with two spokes or star-shaped with at least 3 spokes (6) and the central portion (4) and the lateral portions (5) are detached from each other, **characterised in that** the central portion (4) has a straight-line length of 10 mm to 15 mm.

2. A toothbrush according to claim 1 wherein the central portion (4) of the tooth whitening element (3) runs continuously along the longitudinal axis of the head (2).

3. A toothbrush according to any preceding claim, wherein the spokes (6) are of the same or different lengths.

4. A toothbrush according to any preceding claim, wherein the spokes (6) are 1 mm to 7 mm in length.

5. A toothbrush according to any preceding claim, wherein the spokes (6) are straight or curved.

6. A toothbrush according to any of the preceding claims, wherein the tooth whitening element (3) has one central portion (4).

7. A toothbrush according to any of the preceding claims, wherein the tooth whitening element (3) represents a lamella.

8. A toothbrush according to any of the preceding claims, wherein the tooth whitening element (3) comprises perlite.

Patentansprüche

1. Zahnbürste, die einen Griff (1) und einen Kopf (2) umfasst, wobei der Kopf Borsten und ein Element (3) zum Weißen der Zähne in der Form eines elastischen wandartigen Elements umfasst, wobei das Element zum Weißen der Zähne einen zentralen Abschnitt (4), der entlang einer Längsachse des Kopfs verläuft, und zwei quer verlaufende Abschnitte (5), die sich am Ende des zentralen Abschnitts erheben, umfasst, wobei die zwei quer verlaufenden Abschnitte (5) mit zwei Speichen oder sternförmig mit wenigstens drei Speichen (6) ausgebildet sind und der zentrale Abschnitt (4) und die quer verlaufenden Abschnitte (5) voneinander getrennt sind, **dadurch gekennzeichnet, dass** der zentrale Abschnitt (4) eine geradlinige Länge von 10 mm bis 15 mm aufweist.

2. Zahnbürste nach Anspruch 1, wobei der zentrale Abschnitt (4) des Elements (3) zum Weißen der Zähne durchgehend entlang der Längsachse des Kopfs (2) verläuft.

3. Zahnbürste nach einem der vorhergehenden Ansprüche, wobei die Speichen (6) gleiche oder unterschiedliche Längen haben.

4. Zahnbürste nach einem der vorhergehenden Ansprüche, wobei die Speichen (6) eine Länge von 1 mm bis 7 mm haben.

5. Zahnbürste nach einem der vorhergehenden Ansprüche, wobei die Speichen (6) gerade oder gebogen sind.

6. Zahnbürste nach einem der vorhergehenden Ansprüche, wobei das Element (3) zum Weißen der Zähne einen zentralen Abschnitt (4) aufweist.

7. Zahnbürste nach einem der vorhergehenden Ansprüche, wobei das Element (3) zum Weißen der Zähne eine Lamelle darstellt.

8. Zahnbürste nach einem der vorhergehenden Ansprüche, wobei das Element (3) zum Weißen der Zähne Perlit umfasst.

Revendications

1. Brosse à dents comprenant un manche (1) et une tête (2), ladite tête comprenant des poils et un élément pour le blanchiment des dents (3) sous la forme d'un élément analogue à une paroi élastique, dans laquelle l'élément pour le blanchiment des dents a une portion centrale (4) s'étendant le long d'un axe longitudinal de la tête et deux portions latérales (5) coiffant une extrémité de la portion centrale, dans laquelle deux portions latérales (5) ont la forme de deux rayons ou d'une étoile à au moins trois branches (6) et la portion centrale (4) et les portions latérales (5) sont détachées les uns des autres, **caractérisée en ce que** la portion centrale (4) a une longueur en ligne droite de 10 mm à 15 mm.

2. Brosse à dents selon la revendication 1, dans laquelle la portion centrale (4) de l'élément pour le blanchiment des dents (3) s'étend en continu le long de l'axe longitudinal de la tête (2).

3. Brosse à dents selon l'une quelconque des revendications précédentes, dans laquelle les rayons ou branches (6) ont des longueurs identiques ou différentes.

4. Brosse à dents selon l'une quelconque des revendications précédentes, dans laquelle les rayons ou branches (6) ont une longueur de 1 mm à 7 mm.

5. Brosse à dents selon l'une quelconque des revendications précédentes, dans laquelle les rayons ou branches (6) sont droits ou courbés.

6. Brosse à dents selon l'une quelconque des revendications précédentes, dans laquelle l'élément pour le blanchiment des dents (3) a une seule portion centrale (4).

7. Brosse à dents selon l'une quelconque des revendications précédentes, dans laquelle l'élément pour le blanchiment des dents (3) représente une lamelle.

8. Brosse à dents selon l'une quelconque des revendications précédentes, dans laquelle l'élément pour le blanchiment des dents (3) comprend de la perlite.

Fig. 1

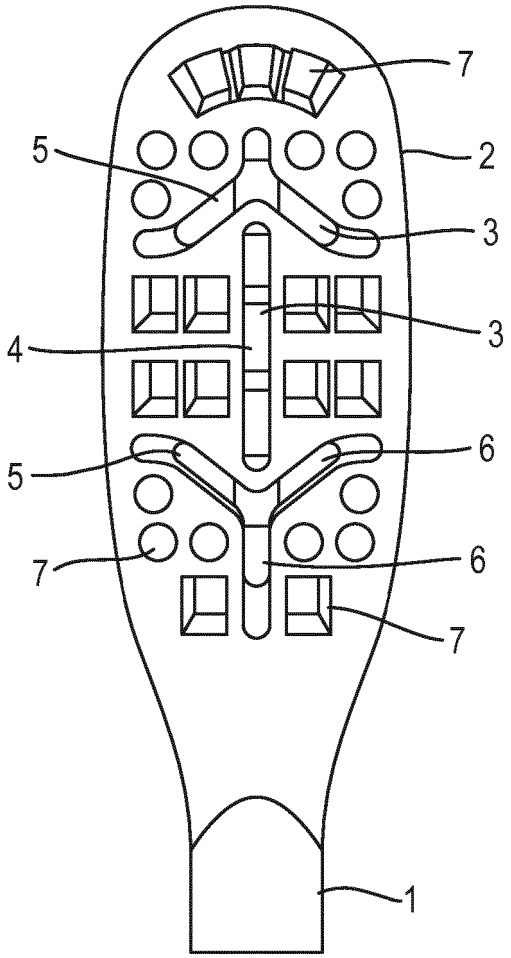
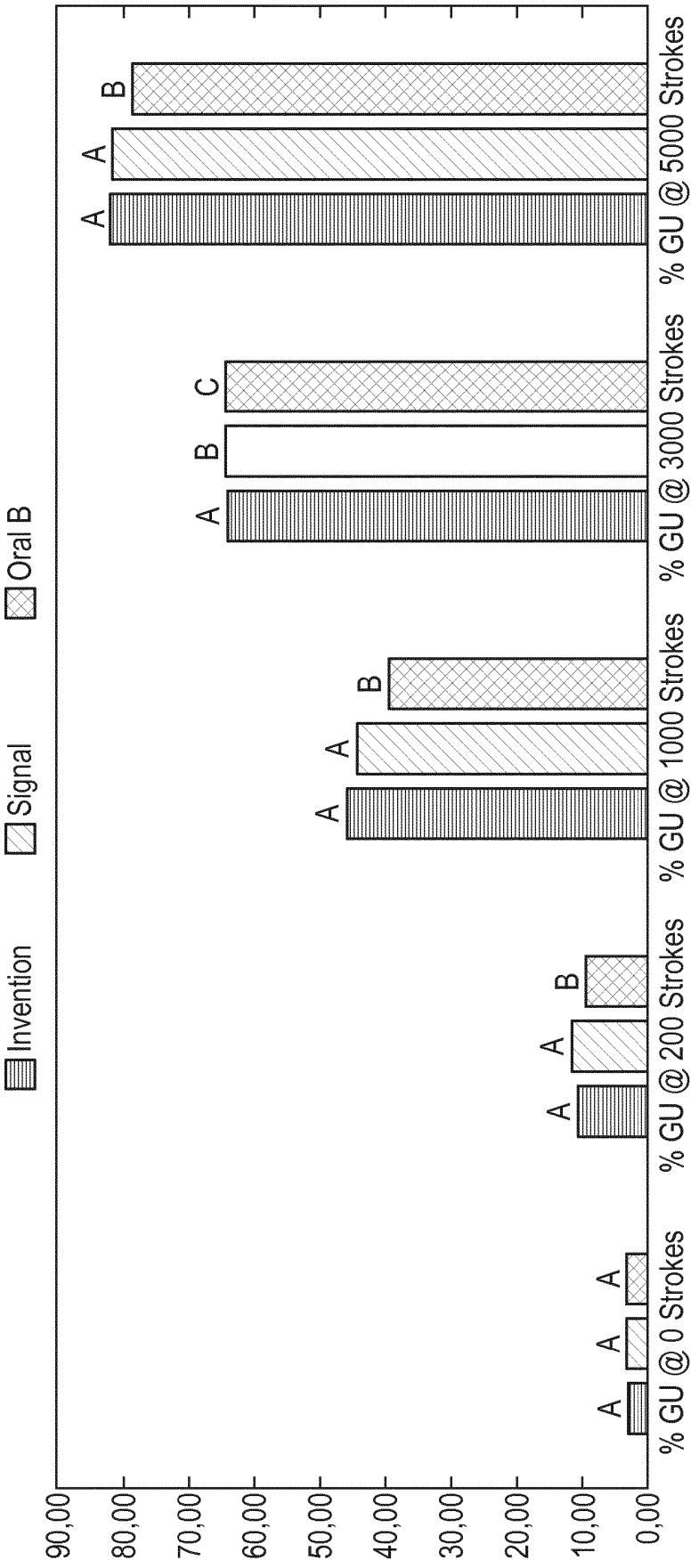


Fig. 2


Invention
Signal
Oral B
90,00
80,00
70,00
60,00
50,00
40,00
30,00
20,00
10,00
0,00
% GU @ 0 Strokes
% GU @ 200 Strokes
% GU @ 1000 Strokes
% GU @ 3000 Strokes
% GU @ 5000 Strokes
A
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C
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REFERENCES CITED IN THE DESCRIPTION

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