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TOOTHBRUSH

The invention relates generally to the field of oral care, and in particular to toothbrushes. More particularly, the invention relates to a toothbrushes with a three-dimensional bristle profile to provide improved cleaning of interproximal and gingival marginal regions of teeth.

Toothbrushing and flossing are fundamental steps in achieving good oral hygiene. The practice of flossing, unfortunately, has not met with widespread acceptance among the general populace even though it is acknowledged by the general populace that flossing is something that should be completed as part of good oral hygiene. Furthermore, even people who floss oftentimes do not perform adequate flossing in hard to reach areas of the mouth. Unfortunately, while most commercially available toothbrushes clean the outer buccal face of teeth adequately, they fail to provide improved cleaning of plaque and debris from the gingival margin, interproximal areas, lingual surfaces and other hard to reach areas of the mouth.

One reason that such toothbrushes do not adequately clean the rear-most molars (e.g. wisdom teeth or second molars) is that the one or more tufts secured to the toothbrush head at a location most distal from the toothbrush handle are not angled towards a direction along which the head extends from the handle. As such, these tufts cannot extend far enough past the end of the head of the toothbrush to sufficiently clean the molar teeth in the back of the mouth.

Additionally, in those brushes having tufts of bristles which angle towards the handle and other tufts which angle away from the handle, all of such tufts are essentially the same length and have the same cross-section. Consequently, while these angled tufts may clean one part of the teeth in a satisfactory manner, other parts of the teeth will not be cleaned sufficiently due to the homogeneous length, spacing and cross-section of the tufts.

Further, prior art toothbrushes disclose tufts of bristles having at most three different types of cross-sections. However, there are more than three parts of the teeth which need to be cleaned by a brush (e.g. the outer buccal face, gingival margin, interproximal areas, lingual surfaces and rearward most molars). As such, prior art brushes do not provide tufts of sufficiently varied cross-section specifically designed to clean all areas of the teeth.

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The present invention is directed to overcoming one or more of the problems set forth above. Briefly summarized, according to one aspect of the present invention, a toothbrush includes a handle, a head extending from the handle, and a plurality of tufts of bristles secured to the head. One of the tufts is secured to the head at a location such that no other tuft is secured to the head at a location which is more distal from the handle than the location where the one tuft is secured to the head. The one tuft is angled by about 81 degrees or less relative to an imaginary line which is tangent to or co-planar with a surface of the head through which the one tuft is secured to the head. The one tuft is tilted away from the handle towards a direction along which the head extends from the handle.

By angling the one tuft as described in the previous paragraph, the tuft is able to extend past the end of the head of the toothbrush and thus clean molars in the back of the mouth in a more sufficient manner.

According to another aspect of the invention, a toothbrush includes a handle, a head extending from the handle, and a plurality of tufts of bristles secured to the head. Two of the tufts are each at an acute angle relative to an imaginary line which is tangent to or co-planar with a surface of the head through which the two tufts are secured to the head. The two tufts have a different characteristic from each other selected from the group of characteristics consisting of length, cross-section, color, material and combinations thereof.

Providing angled tufts which vary in their length, cross-section, color, materials or combinations thereof, allows such angled tufts to clean more than one part of the teeth. For example, one type of angled tuft will clean the buccal face of teeth while another type of angled tuft will clean the interproximal areas of the teeth.

According to a third aspect of the invention, a toothbrush includes a handle, a head extending from the handle, and, a multiplicity of tufts of bristles secured to the head. The multiplicity of tufts include tufts with at least five different types of cross-sections.

By providing tufts with at least five types of cross-sections, these tufts can clean all areas of the teeth (e.g. the outer buccal face, gingival margin, interproximal areas, lingual surfaces and rearward most molars) properly.

These and other aspects, objects, features and advantages of the present

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invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

FIG. 1 is a perspective view of a toothbrush according to the present invention;

FIG. 2 is a top view of the toothbrush of FIG. 1;

FIG. 3 is a side view of the toothbrush of FIG. 1;

FIGs. 4 and 5 are partial side views of the head and respective portions of the tufts of the toothbrush of FIG. 1;

FIG. 6 is a partial sectional view of the head of the toothbrush taken along the lines of 6-6 of FIG. 3; and

FIG. 7 perspective view of the head and a portion of the handle of the toothbrush of FIG. 1.

Beginning with FIGs. 1-3, a toothbrush 10 includes a handle portion 12 and a head portion 14 which extends from the handle in a direction D. The overall length of toothbrush 10 is preferably about 7.7 inches while the width of head 14 at its widest portion is preferably about 0.5 inches. A main portion 16 of handle 12, and head 14 are made of a unitary piece of polypropylene. Remaining portions of handle 12, including thumb gripping portion 18, optional Trademark 24 (preferably about .83 inches long) and finger gripping portion 20 are preferably made of a thermoplastic elastomer, preferably kraton rubber (a hydrogenated or unhydrogenated oil filled block co-polymer of styrene and butadiene or isoprene having a shore A hardness of between about 5 and about 70). Thumb gripping portion 18 and a portion of finger gripping portion 20 have a series of seventeen raised ribs 22 which aid in the gripability of the handle. Ribs 22 are preferably .05 inches in width.

With reference to FIGs. 3-7, a plurality of tufts 26 of bristles are secured to head 14 of the toothbrush. Each tuft is made up of a large number of bristles, and all of the bristles are preferably end-rounded. There are five different types of tufts secured to the head each tuft type having a cross-section which differs in both area and shape to the other tuft types.

A first type of tuft, type 28, is made up of bristles formed of polybutylene-terephthalate (PBT) with an abrasive such as kaolin clay particles mixed

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throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .440 inches. The cross-sectional tufted area for tuft 28 is about 0.0373 square inches, providing a tuft volume measured from the head surface of about
5 .0164 cubic inches (preferably this volume is between about .015 and .018 cubic inches). There is only one type 28 tuft secured to head 14 and it is located more distal from handle 14 than any other tuft.

A second type of tuft, type 32, is made up of nylon Indicators™ type bristles which are formed of 6.12 nylon and colored blue on their external surface. As
10 is well known in the art, the blue coloring on these bristles is slowly worn away as the brush is used over time to indicate the extent to which the toothbrush is worn. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .350 inches. The cross-sectional area of each tuft 32 is about 0.0045 square inches.
15 As shown in FIG. 6, type 32 tufts have a round cross-section. There are between 8 and 12 type 32 tufts secured to head 14.

A third type of tuft, type 34, is made up of bristles formed of PBT with an abrasive such as kaolin clay particles mixed throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter.
20 The length of these bristles, measured from surface 30 of head 14, is about .440 inches. The cross-sectional area of each tuft 34 is about 0.0027 square inches. There are between eight and twelve type 34 tufts secured to head 14. As shown in FIG. 6, type 34 tufts are rectangular in shape with rounded ends.

A fourth type of tuft, type 36, is made up of bristles formed of PBT
25 with an abrasive such as kaolin clay particles mixed throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .007 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .440 inches. The cross-sectional area of each tuft 36 is about 0.0040 square inches. There are between four and six type 36 tufts secured to head 14. As shown in FIG. 6,
30 type 36 tufts are rectangular in shape with rounded ends, and are wider across the head than type 34 tufts.

A fifth and final type of tuft, type 38, is made up of bristles formed of

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PBT with an abrasive such as kaolin clay particles mixed throughout the PBT. These bristles are between about .005 to .009 inches in diameter, preferably .006 inches in diameter. The length of these bristles, measured from surface 30 of head 14, is about .350 inches. The cross-sectional area of each tuft 38 is about 0.0084 square inches.

- 5 There are between four and six type 38 tufts secured to head 14. As shown in FIG. 6, type 36 tufts are rectangular in shape with rounded ends, and are wider than type 36 tufts.

Based on the cross-sectional areas of the various tufts described above, tuft type 28 has a cross-section which is more than four times as large as any other tuft secured to head 14. Although specific materials were described above from which the
10 bristles of each tuft are made, other materials can be used. As such, any of the bristles attached to head 14 could be made from, for example, PBT with or without an abrasive such as kaolin clay, 6.12 nylon with or without an abrasive, or nylon Indicator™ material with or without an abrasive.

- 15 Additionally, the bristles within a tuft and between tufts can have varying lengths, diameters, cross-sectional shapes, cross-sectional areas, colors and be made of differing materials.

As best seen in FIGs. 2, 4 and 5 and seven, all of the tufts on head 14 are angled either towards direction D or towards the direction opposite of direction D
20 by preferably less than about 81 degrees, more preferably between about 69 degrees to about 81 degrees, and most preferably by about 75 degrees, relative to an imaginary straight line 40 which is tangent to surface 30 of head 14. If surface 30 was flat, rather than curved, then line 40 would be co-planar with surface 30. Two outer rows of tufts 42 are angled towards direction D away from handle 12. An inner row of tufts
25 44 are angled opposite direction D towards handle 12 with the exception of large tuft 28 which is tilted towards direction D away from handle 12.

Toothbrush 10 can be made by the following process which is generally understood by those skilled in the art. Each of the tufts of bristles are formed by gathering together a desired amount of bristles of a selected material, length and
30 diameter. The tufts are then inserted into apertures in part of a mold of an injection molding machine. An end of the tuft which is or will project into the mold cavity is then melted to join the bristles together in a fused mass or ball at that end of the tuft.

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The mold part bearing the tufts is then joined with another portion of the mold which together define a cavity used to form main portion 16 of the toothbrush. The fused masses of the tufts are located just within the cavity.

5 Polypropylene is then injected into the cavity to form portion 16 of toothbrush 10. The polypropylene is then cooled at which point the partially finished toothbrush is moved to a second injection molding station. The cooled, hardened polypropylene secures the fused masses of the tufts to head 14 of the toothbrush. At the second molding station, the partially finished brush is put into a second mold having cavities to form the thumb gripping portion 18, trademark 24 and finger
10 gripping portion 20. A thermoplastic elastomer is then injected into the mold after which the elastomer is cooled and finished toothbrush 10 is removed from the mold. The toothbrush is then packaged.

CLAIMS

1. A toothbrush (10) having a head (14) with a frontal free end and a rearward section followed by a handle (12), comprising tufts of bristles (32, 34, 36, 38) arranged in longitudinal rows (42, 44) on the rearward section of the head (14) and having different lengths, with tufts of bristles having either a first greater length or a second smaller length, with tufts of bristles (32, 34, 36, 38) of the first and second length being provided in every longitudinal row (42, 44) and adjacent tufts of bristles (32, 34, 36, 38) of a longitudinal row (42, 44) alternately having the first and the second length, characterized in that tufts of bristles (32, 34) in a longitudinal row (42) are tilted in a first direction (D) towards the free end of the head (14) and tufts of bristles (36, 38) of another longitudinal row (44) are tilted towards a second direction opposite of the first direction (D) and forming an acute angle with the surface (30) of the head (14),

and by a further tuft of bristles (28) being secured to the frontal free end of the head (14) and being tilted substantially only towards the first direction (D) and having the first greater length.
2. The toothbrush of claim 1, characterized in that all tufts of bristles (32, 34, 36, 38) of a longitudinal row (42, 44) alternately have the first and the second length.
3. The toothbrush according to claim 1 or 2, characterized in that all tufts of bristles (32, 34, 36, 38) of every longitudinal row (42, 44) alternately have the first and the second length.
4. The toothbrush according to any of the preceding claims, characterized in that tufts of bristles (32, 34, 36, 38) arranged in the longitudinal rows (42, 44) form an angle of less than approximately 81 degrees with the surface (30) of the head (14).
5. The toothbrush according to any of the preceding claims, characterized in that the further tuft of bristles (28) secured to the frontal free end of the head (14) forms an angle of approximately 81 degrees with the surface (30) of the head (14).
6. The toothbrush according to any of the preceding claims, characterized

in that tufts of bristles (32, 34) of the outer longitudinal rows (42) are tilted towards the first direction (D) and tufts of bristles (36, 38) of an inner longitudinal row (44) are tilted towards the second direction.

7. The toothbrush according to any of the preceding claims, characterized in that at least some tufts of bristles (28, 32, 34, 36, 38) provide a different color.

8. The toothbrush according to any of the preceding claims, characterized in that at least some tufts of bristles (28, 32, 34, 36, 38) have different cross-sectional areas.

9. The toothbrush according to any of the preceding claims, characterized in that at least some tufts of bristles (28, 32, 34, 36, 38) have a different cross-sectional shape.

10. The toothbrush according to any of the preceding claims, characterized in that at least some tufts of bristles (28, 32, 34, 36, 38) consist of different material.

11. The toothbrush according to any of the preceding claims, characterized in that the cross-sectional area of the further tuft of bristles (28) is at least four times the size of the cross-sectional area of any other tuft of bristles (32, 34, 36, 38) secured to the head (14).

12. The toothbrush according to any of the preceding claims, characterized in that no other tuft of bristles (32, 34, 36, 38) is secured to the head (14) at a location that is farther away from the handle (12) than the location at which the further tuft of bristles (28) is secured to the head (14).

13. The toothbrush according to any of the preceding claims, characterized in that the first greater length and the second smaller length differ from each other by approximately 2.286 mm (0.090 inches).

14. The toothbrush according to any of the preceding claims, characterized in that the first greater length is approximately 11.18 mm (0.440 inches) or the second smaller length is 8.89 mm (0.350 inches).

15. The toothbrush according to any of the preceding claims, characterized in that the cross-section of the tufts of bristles (32, 34, 36, 28) arranged on the rearward section of the head (14) provides a cross-sectional area of 3.02 mm², (0.0045 square inches) or 1.74 mm² (0.0027 square inches) or 2.58 mm² (0.0040 square inches) or 5.42 mm² (0.084 square inches) and that the cross-section of the further tuft of

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bristles (28) is approximately 24.06mm² (0.0373 square inches).

16. The toothbrush according to any of the preceding claims, characterized in that each tuft of bristles (28, 32, 34, 36, 38) consists of a large number of bristles, with the bristles having rounded-off ends.

17. The toothbrush according to any of the preceding claims, characterized in that the bristles secured to the head (14) are made from PBT, from 6,12-nylon or from a nylon-Indicators (Trade Mark) material, each with or without abrasive, such as for instance kaolin clay.