

[DESCRIPTION]

[TITLE OF INVENTION]

TOOTHBRUSH

[Technical Field]

5 [0001]

The present invention relates to a toothbrush.

Priority is claimed on Japanese Patent Application No. 2015-074553, filed on March 31, 2015, the contents of which are incorporated herein by reference.

[Background Art]

10 [0002]

In a toothbrush, a head portion may be thinned in some cases so that operability is enhanced and every side of the inside of the oral cavity can be brushed. Agendas accompanying with the thinning of the head portion include (1) securing rupture strength of the head portion, (2) securing strength of bristles, and (3) avoiding warping of the head.

15 Regarding the aforementioned agenda (1), for example, Patent Document 1 discloses a toothbrush in which resin characteristics, breaking resistance strength, the thickness range of a head portion, and the shortest distance between the outermost tuft holes and the end edge in the width direction of the head portion are specified. In addition, regarding the aforementioned agenda (2), for example, Patent Document 2 discloses a toothbrush in which the thickness range of a head portion, the thickness and the width of a bristle-anchor wire, and the relationship between the diameter and the depth of a tuft hole, in addition to resin materials, are defined.

[List of Prior Art Documents]

25 [Patent Documents]

[0003]

[Patent Document 1]

Japanese Patent No. 5530776

[Patent Document 2]

5 Japanese Patent No. 5427486

[Summary of Invention]

[Technical Problem]

[0004]

However, regarding the aforementioned agenda (3) of avoiding warping of the
10 head, sufficient technologies therefor could not be provided by Patent Document 1 and
Patent Document 2.

[0005]

The present invention was made under considering the aforementioned points of
view, and has an object of providing a toothbrush in which warping of a head portion can
15 be suppressed even if the head portion is thinned.

[Solution to Problem]

[0006]

According to a first embodiment of the present invention, a toothbrush is
provided with a head portion having a plurality of tuft holes, formed at a surface for
20 tufting bristles, and tufts of bristles inserted into the tuft holes, wherein the minimum
thickness of the head portion is 2.0 mm or more and 3.5 mm or less, and the value
obtained by the following expression:

$$(T - D) \times (1 - d) \times (W - n \times d) \times (T / L / W) \times 100$$

is 1.5 or more and 4.0 or less, wherein the minimum thickness of the head portion is T,
25 the maximum width of the head portion in a short direction is W, the diameter of the tuft

holes is d , the depth of the tuft holes is D , the length of a range in which the tuft holes are provided in the longitudinal direction of the head portion is L , the pitch at which the tuft holes are arranged in the longitudinal direction is l , and the number of the tuft holes in the short direction is n .

5 [0007]

In the toothbrush of the present invention, the value mentioned above is preferably 2.0 or more and 3.5 or less.

[0008]

In the toothbrush of the present invention, the minimum thickness of the head
10 portion is preferably 2.5 mm or more and 3.5 mm or less.

[0009]

In the toothbrush of the present invention, the bristles are preferably fixed to the head portion by means of metal pieces.

[Advantageous Effects of Invention]

15 [0010]

According to the present invention, even if a head portion is thinned, warping thereof can be suppressed.

[Brief Description of Drawings]

[0011]

20 Fig. 1 is a diagram showing an example of a container of the present invention, and is a front view of a toothbrush.

Fig. 2 is a plane view showing a surface for tufting bristles of a head portion which constitutes the toothbrush of Fig. 1.

Fig. 3 is a cross-sectional view taken along the line A - A in Fig. 2.

25 Fig. 4 is a table showing specifications and evaluations of Examples and

Comparative Examples.

[Description of Embodiments]

[0012]

Hereinafter, an embodiment of a toothbrush of the present invention is described
5 with reference to Fig. 1 to Fig. 4.

The toothbrush of the embodiment is shown in Fig. 1 to Fig. 3. Fig. 1 is a front
view of a toothbrush 1. Fig. 2 is a plane view showing a tufting surface 12 of a head
portion 10 which constitutes toothbrush 1. Fig. 3 is a cross-sectional view taken along
the line A - A in Fig. 2.

10 [0013]

Toothbrush 1 of the present embodiment is provided with head portion 10 in
which tufts 11 of bristles are tufted, a neck portion 20 extendedly provided from the base
end side of head portion 10, and a handle portion 30 extendedly provided from the base
end side of neck portion 20 (hereinafter, a combination of head portion 10, neck portion
15 20, and handle portion 30 is referred to as a handle body).

[0014]

The handle body is integrally molded as a whole in an elongated shape, and is
obtained by, for example, injection molding with a resin as a material.

Examples of the material of the handle body include a polypropylene resin (PP),
20 a polyacetal resin (POM), a polystyrene resin (PS), a polyethylene terephthalate resin
(PET), a polybutylene terephthalate resin (PBT), an acrylonitrile butadiene styrene resin
(ABS), a polyallylate resin, a polycarbonate resin, an acrylonitrile styrene resin (AS), and
the like. Among these materials, a polybutylene terephthalate resin and a polyacetal
resin are preferable from the viewpoint of increased strength and ease of thickness
25 reduction of the head portion.

One type of the aforementioned resins may be used alone, or two or more types thereof may be used in combination.

In addition, the handle body may be partially or entirely covered with a soft resin such as an elastomer in order to improve a gripping property.

5 [0015]

As shown in Fig. 2, a plurality of tuft holes 12a are formed at tufting surface 12 which is the surface of head portion 10. Bristle tufts 11 are tufted on tufting surface 12. The minimum thickness of head portion 10 is 2.0 mm or more and 3.5 mm or less. The minimum thickness of head portion 10 is more preferably 2.5 mm or more and 3.5 mm or
10 less. When the minimum thickness of head portion 10 is equal to or less than the upper limit value mentioned above, operability in the oral cavity of toothbrush 1 can be improved. When the minimum thickness is equal to or more than the lower limit value mentioned above, reduction in strength of head portion 10 can be prevented.

[0016]

15 As the bristles for constituting the bristle tufts 11, bristles (tapered bristles) in which a diameter thereof gradually decreases toward the tip of each bristle, bristles (straight bristles) having substantially the same outer diameter except the rounded portion at the tip of each bristle, or bristles in which the tip of each bristle is in a spatula shape, a spherical shape, a split shape, or the like can be used.

20 [0017]

Examples of the material of the bristles include synthetic resin materials such as a polyamide (for example, 6-12 nylon, or 6-10 nylon), a polyester (for example, polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate), a polyolefin (for example, polypropylene), an elastomer (for examples,
25 olefin-based, or styrene-based one) and the like. These resin materials may be used

alone or a combination of two or more may be used.

In addition, the bristles may have a multicore structure having a core portion and at least one sheath portion provided outside of the core portion.

[0018]

5 The shape of the transverse cross section of the bristles is preferably circular, but it is not necessarily limited thereto. The shape of the transverse cross section of the bristles can be arbitrarily determined according to the purpose of use of toothbrush 1. The transverse cross-sectional shape of the bristles can be, for example, elliptical, polygonal (for example, triangular, quadrangular, pentagonal, hexagonal, or the like),
10 irregular (for example, star shaped, three-leaf clover shaped, four-leaf clover shaped, or the like), or the like.

[0019]

The thickness of each bristle is not particularly limited, and is, for example, preferably 4 to 8 mil (1 mil = 1/1000 inch = 0.025 mm) when the transverse cross section
15 is circular. As long as the thickness is equal to or more than the lower limit value mentioned above, self-sustainability is improved and a cleaning property becomes increased. If the thickness is equal to or less than the upper limit value mentioned above, the bristle stiffness of the bristle tufts 11 becomes appropriate and improved comfortability can be provided.

20 All the bristles constituting the bristle tufts 11 may have the same thickness, or two or more types of bristles having different thickness may be combined.

[0020]

The length of the bristles preferably ranges from 8 mm to 13 mm for adults and preferably ranges from 6 mm to 9 mm for children, for example. In addition, from the
25 viewpoint of usability and sensation during use in the oral cavity, it is preferable to

shorten the length of the bristles as the diameter of the selected bristles is smaller.

Furthermore, a plurality of the bristles which are different in thickness may be used in combination according to the purpose such as sensation during use, brushing sensation, cleaning effects, durability and the like.

5 [0021]

A method for tufting bristle tuft 11 may be an anchor-holding bristle tufting method in which a bundle of bristles is folded in half, and an anchor wire sandwiched therebetween was tufted into each tuft hole 12a, or may be a thermal fusion bonding type bristle tufting method in which bristle tuft 11 is subjected to thermal fusion bonding to
10 head portion 10. As the method for tufting bristle tuft 11, the anchor-holding bristle tufting method is preferable from the viewpoint of low cost. The anchor wire is installed into each tuft hole 12a through the center portion of tuft hole 12a and so as to stride over tuft hole 12a. As a material of an anchor wire, for example, a metal piece such as brass or stainless steel piece may be mentioned, and in addition thereto, a hard
15 plastic, a biodegradable plastic or the like may be used.

[0022]

The length, width and thickness of the anchor wire may be arbitrarily adjusted according to bristle tufts 11 and tuft holes 12a. The length of the anchor wire is usually larger than the diameter of tuft hole 12a. The width of the anchor wire is set to be
20 smaller than the depth of tuft hole 12a. By adjusting the thickness of the anchor wire, it is possible to reliably fix bristle tuft 11 into tuft hole 12a and to reduce the air gap. In addition, in order to prevent removal thereof from tuft hole 12a, the total length of the portions protruding from both sides of hole 12a is preferably 0.3 to 0.6 mm.

More particularly, the width of the anchor wire ranges from 1.0 to 1.5 mm, and
25 is preferably 1.2 mm.

In addition, the thickness of the anchor wire ranges from 0.15 to 0.30 mm, and is preferably 0.20 mm.

[0023]

In head portion 10 in the present embodiment, the minimum thickness is in the range of 2.0 mm to 3.5 mm. Head portion 10 is thinner than the head portion of the conventional toothbrushes, and for this reason, operability in the oral cavity is improved.

Further, in head portion 10, tuft holes 12a are arranged in a lattice pattern. The value represented by expression (1) described below is set to be 1.5 or more and 4.0 or less, wherein the minimum thickness of head portion 10 is T (mm), the maximum width of head portion 10 in the short direction (vertical direction in Fig. 2) is W (mm), the diameter of tuft hole 12a is d (mm), the depth of tuft hole 12a is D (mm), the length of the range in which tuft holes 12a are provided in the longitudinal direction (the left-right direction (horizontal direction) in Fig. 2) of head portion 10 is L (mm), the arrangement pitch of tuft holes 12a in the longitudinal direction is l (mm), and the number of tuft holes 12a in the short direction is n .

The length, L (mm), of the range in which tuft holes 12a are provided in the longitudinal direction is the distance between the outer edges of tuft holes 12a arranged outermost in the longitudinal direction. In addition, the minimum thickness of head portion 10 is represented by the distance between tufting surface 12 and the rear surface of tufting surface 12. The depth of tuft hole 12a is represented by the distance between tufting surface 12 and the deepest portion at the bottom of tuft hole 12a. The arrangement pitch of tuft holes 12a is the distance in the longitudinal direction between the center positions of tuft holes 12a adjacent to each other in the longitudinal direction. Tuft holes 12a adjacent to each other in the longitudinal direction are not only the case where the central positions of tuft holes 12a are arranged on a straight line parallel to the

longitudinal direction, but also the case where the central positions of tuft holes 12a are not necessarily arranged on a straight line parallel to the longitudinal direction, as in the case of the distance between tuft hole 12a positioned at the most left row and tuft hole 12a positioned at the second row from the most left row. The number of tuft holes 12a in the short direction is the number of tuft holes 12a in which the center positions thereof are arranged on a straight line extending in the short direction, and in the case where the number of tuft holes 12a is plural (three types of 2 holes, 3 holes, and 4 holes in Fig. 2), the maximum number is available.

$$(T - D) \times (1 - d) \times (W - n \times d) \times (T / L / W) \times 100 \quad \dots \quad (1)$$

10 [0024]

In expression (1), in the case where the resin volume located at a position distant from tuft hole 12a among the resin volumes positioned between tuft hole 12a and a rear surface 13 of head portion 10 in the thickness direction is large, or in the case where the minimum thickness of head portion 10 is large, the value of equation (1) becomes large.

15 In expression (1), in the case where the maximum width W of head portion 10, or the length L of the range where tuft holes 12a are provided are increased, the value of expression (1) decreases.

[0025]

When the value of expression (1) is less than 1.5, warping is so large that problems in usability occur, and cracking and/or whitening of head portion 10 may occur. These are not preferable. It is believed that they occur for the following reasons. For example, when the resin volume at a position distant from tuft hole 12a is small, the non-uniform cooling via a pin portion partially arranged in order to form tuft hole 12a, as compared to the rear surface 13 side which is cooled uniformly over the entire surface at the time of resin molding, may occur, or the insufficient strength due to small thickness

20

25

in the thickness direction may be exhibited.

[0026]

On the other hand, when the value of expression (1) exceeds 4.0, problems arise such as a reduction in bristle strength or a reduction in brushing power due to an increase
5 in size of head portion 10.

In contrast, the value of the aforementioned expression (1) is 1.5 or more and 4.0 or less in head portion 10 of the present embodiment, and for this reason, while suppressing the occurrence of cracking and whitening in head portion 10, it is possible to obtain the effects of improving operability in the oral cavity and increased brushing
10 power due to thinning of head portion 10.

[Examples]

[0027]

Hereinafter, the present invention is described in detail with reference to Examples. It should be understood that the present invention is not limited to these
15 Examples, and can be carried out by appropriately modifying within a scope which does not depart from the gist of the invention.

[0028]

(Materials used)

Handle portion: Polybutylene terephthalate (PBT): flexural modulus 2300 MPa.

20 Bristles: Polybutylene terephthalate (PBT): ACRAS manufactured by Toray Monofilament Co., Ltd.

[0029]

(Examples 1 to 10 and Comparative Examples 1 to 4)

In accordance with the specifications shown in Fig. 4, a handle portion 30 made
25 of polybutylene terephthalate was produced by injection molding, a bundle of bristles

was folded in half, and an anchor wire sandwiched therebetween was tufted into each tuft hole 12a. Thereby, each bristle tuft 11 was tufted into each tuft hole 12a, and thereby, a toothbrush of each of the examples was obtained.

Evaluation of each example was carried out based on the level of strain. A case in which a deformation amount of the tip portion of head portion 10, as compared with that before tufting was less than 0.5 mm, evaluation was set to OO; a case in which the deformation amount was 0.5 mm or more and less than 1.0 mm, evaluation was set to O; and a case in which the deformation amount was 1.0 mm or more, evaluation was set to X.

10 [0033]

As shown in Fig. 4, it can be seen that in the case where the minimum thickness T of head portion 10 is 2.0 mm or more and 3.5 mm or less, and then when the value represented by the aforementioned expression (1) is 1.5 or more and 4.0 or less, a good toothbrush 1 with reduced strain (warping) is obtained. In addition, it can be seen that when the value represented by the aforementioned expression (1) is 2.0 or more and 3.5 or less, a toothbrush 1 with further reduced strain (warping) is obtained. In addition, it can be confirmed that in the case where the minimum thickness T of head portion 10 is 2.5 mm or more and 3.5 mm or less, a toothbrush 1 with reduced strain (warping) tends to be obtained.

20 [Industrial Applicability]

[0031]

The present invention can be applied to a toothbrush.

[Reference Signs List]

[0032]

25 1 ... Toothbrush,

10 ... Head portion

11 ... Bristle tuft

12 ... Tufting surface

20 ... Neck portion

5 30 ... Handle portion

[CLAIMS]

[Claim 1]

A toothbrush characterized by being provided with a head portion having a plurality of tuft holes formed at a surface for tufting bristles, and tufts of bristles inserted into said tuft holes,

wherein a minimum thickness of said head portion is 2.0 mm or more and 3.5 mm or less, and

holding the following relationship:

$$0.14 \leq (T-D) / T \leq 0.17, \text{ and}$$

a value obtained by the following expression:

$$(T - D) \times (1 - d) \times (W - n \times d) \times (T / L / W) \times 100$$

is 1.5 or more and 4.0 or less, wherein the minimum thickness of said head portion is T, a maximum width of said head portion in a short direction is W, a diameter of said tuft holes is d, a depth of said tuft holes is D, a length of a range in which said tuft holes are provided in a longitudinal direction of said head portion is L, a pitch at which said tuft holes are arranged in a longitudinal direction is l, and a number of said tuft holes in a short direction is n.

[Claim 2]

A toothbrush characterized by being provided with a head portion having a plurality of tuft holes formed at a surface for tufting bristles, and tufts of bristles inserted into said tuft holes,

wherein a minimum thickness of said head portion is 2.0 mm or more and 3.5 mm or less, and

holding the following relationship:

$$(T-D) / T \leq 0.2, \text{ and}$$

a value obtained by the following expression:

$$(T - D) \times (1 - d) \times (W - n \times d) \times (T / L / W) \times 100$$

is 1.5 or more and 4.0 or less, wherein the minimum thickness of said head portion is T, a maximum width of said head portion in a short direction is W, a diameter of said tuft holes is d, a depth of said tuft holes is D, a length of a

range in which said tuft holes are provided in a longitudinal direction of said head portion is L, a pitch at which said tuft holes are arranged in a longitudinal direction is l, and a number of said tuft holes in a short direction is n, and

wherein the number n of said tuft holes in a short direction is 4 or more.

[Claim 3]

The toothbrush according to Claim 1 or 2, wherein said value is 2.0 or more and 3.5 or less.

[Claim 4]

The toothbrush according to Claim 3, wherein said value is 2.4 or more and 3.5 or less.

[Claim 5]

The toothbrush according to Claim 1 to 4, wherein the minimum thickness of said head portion is 2.5 mm or more and 3.5 mm or less.

[Claim 6]

The toothbrush according to any one of Claims 1 to 5, wherein said bristles are fixed to said head portion by metal pieces.