

[DESCRIPTION]

[TITLE OF INVENTION]

TOOTHBRUSH

[Technical Field]

5 [0001]

The present invention relates to a toothbrush.

Priority is claimed on Japanese Patent Application No. 2015-015466, filed January 29, 2015, the content of which is incorporated herein by reference.

[Background Art]

10 [0002]

Generally, a toothbrush is formed by implanting bristle bundles formed by bundling a plurality of bristles into a plurality of bristle-implanting holes provided on a bristle-implanting surface of a head portion through a method in which flat wires are driven or fused by heat.

15 It is desired for a single toothbrush to firmly clean each part of interdentium, collum dentis (a boundary between teeth and gums), tooth surfaces and molars.

To this end, various studies have been conducted on arrangements of bristle bundles and shapes of bristle tips of bristles in order to realize effective cleaning and a good feeling during a brushing operation.

20 [0003]

Patent Literature 1 discloses a toothbrush in which a first bristle bundle group is arranged at the front end of a bristle-implanting surface of a bristle implanting base (a head portion), and a second bristle bundle group arranged at a center portion of the bristle-implanting surface rather than the front end thereof and a third bristle bundle
25 group arranged outside the second bristle bundle group to surround the second bristle

bundle group in a width direction of the bristle implanting base are provided, and on the bristle-implanting surface, the plurality of bristles forming the second bristle bundle group have the highest height and the plurality of bristles forming the third bristle bundle group have the lowest height.

5 [0004]

Patent Literature 2 discloses a toothbrush in which a bristle-implanting surface having a front end region, a central belt-shaped region formed at the rear thereof and one pair of outer belt-shape regions is provided, the front end bristle bundle group is implanted in the front end region, a central bristle bundle group is implanted in the
 10 central belt-shaped region, an outer bristle bundle group is implanted in each of the outer belt-shape regions, the front end bristle bundle group, the central bristle bundle group and each of the outer bristle bundle group each share different characteristics, a longest bristle length of each of the front end bristles (bristles for the front end region) is longer than that of each of the central bristles (bristles for the central region), and an average
 15 bristle length of the outer bristles (bristles for the outer region) is shorter than that of the central bristles.

Patent Literature 2 discloses that a chevron-shaped profile is formed on a surface of a brush part.

[Citation List]

20 [Patent Literature]

[0005]

[Patent Literature 1]

Japanese Unexamined Patent Application, First Publication No. 2012-192175

[Patent Literature 2]

25 Japanese Unexamined Patent Application, First Publication No. 2004-105377

[Summary of Invention]

[Technical Problem]

[0006]

However, in the toothbrush disclosed in Patent Literature 1, since the height of
5 each of the plurality of bristle bundles forming the second bristle bundle group is formed
to be higher than that of each of the plurality of bristle bundles forming the third bristle
bundle group, it is difficult to bring the bristle bundles into contact with the collum dentis,
and thus it is difficult to sufficiently ensure cleaning power for the collum dentis.

Also, in the toothbrush disclosed in Patent Literature 1, the height of each of the
10 plurality of bristle bundles forming the second bristle bundle group is formed higher than
that of each of the plurality of bristle bundles forming the first bristle bundle group
arranged at the front end of the bristle-implanting surface. Therefore, when the molars
are brushed, the second bristle bundle group becomes an obstacle, and it is difficult to
sufficiently ensure cleaning power for the molars.

15 [0007]

In the toothbrush disclosed in Patent Literature 2, when round bristles are used
as the bristles (the used bristles) forming the brush part, it is difficult for the bristles to
enter the collum dentis and the interdentium with only the chevron-shaped profile formed
on the surface of the brush part, and thus it is difficult to sufficiently ensure cleaning
20 power for the collum dentis and the interdentium.

In the toothbrush disclosed in Patent Literature 2, since the bristle length of each
of the front end bristles is the longest, the front end bristle group becomes an obstacle
when parts other than the molars are brushed, and thus it is difficult to sufficiently ensure
the cleaning power for other parts (the interdentium, the collum dentis, the tooth surfaces
25 and the molars).

[0008]

However, in the toothbrushes disclosed in Patent Literatures 1 and 2, it is difficult to sufficiently ensure cleaning power for the interdentium, the collum dentis, the tooth surfaces and the molars with a single toothbrush.

5 [0009]

The present invention is made in view of such problems and an object of the present invention is to provide a single toothbrush capable of sufficiently ensuring cleaning power for the interdentium, collum dentis, tooth surfaces and molars.

[Solution to Problem]

10 [0010]

In order to achieve the aforementioned objects, according to one embodiment of the present invention, a toothbrush is provided in which a plurality of bristle bundles are implanted on a bristle-implanting surface of a head part, and the bristle-implanting surface comprises a first region disposed at the front end of the head part, a second region disposed between the first region and the rear end of the head part and also at a center portion thereof in a width direction of the head part, a pair of third regions disposed outside the second region and surround the second region in the width direction of the head part, and a fourth region disposed to divide at least the second region in a lengthwise direction of the head part, including first bristle bundles implanted into a plurality of first bristle-implanting holes provided in the first region, second bristle bundles implanted into a plurality of second bristle-implanting holes provided in the second region and have the lowest height from the bristle-implanting surface, third bristle bundles implanted into a plurality of third bristle-implanting holes provided in the third regions and have a height from the bristle-implanting surface that is lower than that of each of the first bristle bundles and also higher than that of the second bristle bundles,

and fourth bristle bundles implanted into a plurality of fourth bristle-implanting holes provided in the fourth region and have a height from the bristle-implanting surface that is the same as or higher than the height of each of the first bristle bundles, wherein inner diameters of the first and second bristle-implanting holes are larger than those of the third and fourth bristle-implanting holes.

[0011]

In the toothbrush according to one embodiment of the present invention, bristles forming the first to fourth bristle bundles may be tapered bristles.

[0012]

10 In the toothbrush according to one embodiment of the present invention, the diameter of the front end of each of bristles forming the second bristle bundles may be larger than that of the front end of each of bristles forming the first bristle bundles, the third bristle bundles and the fourth bristle bundles.

[0013]

15 In the toothbrush according to one embodiment of the present invention, the shape of each of the bristles forming the first and fourth bristle bundles may be a spiral shape.

[0014]

20 In the toothbrush according to one embodiment of the present invention, the fourth region is disposed to divide the pair of third regions, and the fourth bristle-implanting holes may be arranged between the third implanting holes in a lengthwise direction of the head part.

[0015]

25 In the toothbrush according to one embodiment of the present invention, assuming that an entire area of the first region is A1, an entire area of the second region is

A2, an entire area of the third region is A3 and an entire area of the fourth region is A4, a relationship of $A4 < A3 < A1 < A2$ may be satisfied.

[Advantageous Effects of Invention]

[0016]

5 According to the toothbrush of the present invention, it is possible to sufficiently ensure cleaning power for each of interdentium, collum dentis, tooth surfaces and molars with a single toothbrush.

[Brief Description of Drawings]

[0017]

10 FIG. 1 is a front view of a toothbrush according to a first embodiment of the present invention.

FIG. 2 is a side view of the toothbrush of FIG. 1.

FIG. 3 is a rear view of the toothbrush of FIG. 1.

FIG. 4 is an enlarged view of a portion surrounded by a region A of FIG. 1.

15 FIG. 5 is an enlarged view of a portion surrounded by a region B of FIG. 2.

FIG. 6 is an enlarged front view of a main part (a head part and a brush part) of a toothbrush according to a second embodiment of the present invention.

[Description of Embodiments]

[0018]

20 Hereinafter, embodiments of the present invention will be described in detail with reference to the drawings. In addition, the drawings below are used to explain constitutions of the present invention. Therefore, sizes, thicknesses, dimensions, etc. of respective parts shown in the drawings may be different from actual values.

25 [0019]

(First embodiment)

FIG. 1 is a front view of a toothbrush according to a first embodiment of the present invention. FIG. 2 is a side view of the toothbrush of FIG. 1. FIG. 3 is a rear view of the toothbrush of FIG. 1. In FIGS. 1 to 3, the same parts are designated by the same reference numerals.

In the present invention, a plan view of a toothbrush 10 seen from the side at which a brush part 16 is formed is referred to as a front view, and a plan view of the toothbrush 10 seen from the side opposite to that at which the brush part 16 is formed is referred to as a rear view.

X1 and X2 directions in FIGS. 1 and 3 are width directions of a head part 11. Y1 and Y2 directions in FIGS. 1 to 3 are lengthwise directions of a head part 11. Z1 and Z2 directions in FIG. 2 are height directions of first to fourth bristle bundles 31 to 34 forming the brush part 16.

[0020]

Referring to FIGS. 1 to 3, a toothbrush 10 of a first embodiment includes a head part 11, a neck part 13, a handle part 14 and a brush part 16.

[0021]

FIG. 4 is an enlarged view of a portion surrounded by a region A of FIG. 1. In FIG. 4, the same parts as those in FIGS. 1 to 3 are designated by the same reference numerals.

[0022]

Referring to FIG. 4, the head part 11 includes a head part body 18 and a plurality of first to fourth bristle-implanting holes 21 to 24.

The rear end of the head part body 18 is integrally formed with one end of the neck part 13. The head part body 18 has a bristle-implanting surface 26 formed at the

front surface side thereof.

The bristle-implanting surface 26 includes one first region 26-1, two second regions 26-2, pairs of third regions 26-3A and 26-3B (two pairs of third regions) and one fourth region 26-4.

5 [0023]

The first region 26-1 is disposed at the front end of the head part 11. The first region 26-1 is a region demarcated around a plurality of first bristle-implanting holes 21. For example, the first region 26-1 may have a C-shape in plan view.

In FIG. 4, the first region 26-1 having the C-shape in plan view is shown as an
10 example. However, the first region 26-1 is not limited to the shape shown in FIG. 4 as long as it is disposed at the front end of the head part 11.

[0024]

The two second regions 26-2 are provided at a center portion between the first region 26-1 and a rear end of the head part 11. The two second regions 26-2 are
15 disposed to face each other in the Y1 and Y2 directions with the fourth region 26-4 extending in the X1 and X2 direction therebetween. Each of the second regions 26-2 is a region demarcated around a plurality of second bristle-implanting holes 22.

In addition, the shapes of the second regions 26-2 illustrated in FIG. 4 are examples and are not limited to those shown in FIG. 4.

20 [0025]

The pair of third regions 26-3A include two third regions 28 and 29. The third regions 28 and 29 are provided outside the second region 26-2 disposed at the side of the first region 26-1. The third regions 28 and 29 are disposed to surround the corresponding second region 26-2 in the X1 and X2 directions. Each of the third
25 regions 28 and 29 is a region demarcated around a plurality of third bristle-implanting

holes 23.

The third regions 28 and 29 forming the pair of third regions 26-3A are disposed to face each other in the X1 and X2 directions with the second region 26-2 therebetween.

[0026]

5 The pair of third regions 26-3B have the same configuration as the pair of third regions 26-3A except for the arrangement positions thereof and include two third regions 28 and 29.

 The third regions 28 and 29 forming the pair of third regions 26-3B are provided outside the second region 26-2 disposed at the rear end side of the head part 11. The
10 third regions 28 and 29 forming the pair of third regions 26-3B are disposed to surround the corresponding second region 26-2 in the X1 and X2 directions.

 The shapes of the third regions 28 and 29 illustrated in FIG. 4 are examples and the shapes are not limited to those shown in FIG. 4.

[0027]

15 The fourth region 26-4 is a region demarcated around a plurality of fourth bristle-implanting holes 24.

 The fourth region 26-4 is disposed among the two third regions 28 disposed in the Y1 and Y2 directions, the two second regions 26-2 disposed in the Y1 and Y2 directions and the two third regions 29 disposed in the Y1 and Y2 directions and extends
20 in the X1 and X2 directions.

 Thus, the fourth region 26-4 divides the two third regions 28 disposed in the Y1 and Y2 directions, the two second regions 26-2 disposed in the Y1 and Y2 directions and the two third regions 29 disposed in the Y1 and Y2 directions.

[0028]

25 The length (length in the Y1 and Y2 directions) of the head part body 18 having

the above-described configuration is not particularly limited, but may be preferably within a range of, for example, 10 mm or more and 30 mm or less, and more preferably 12 mm or more and 28 mm or less.

When the length of the head part body 18 is shorter than 10 mm, it may be
5 difficult for an area of the bristle-implanting surface 26 on which a plurality of first to fourth bristle bundles 31 to 34 to be described below are implanted to be sufficiently ensured.

Meanwhile, when the length of the head part body 18 is longer than 30 mm, it is difficult to enhance operability of the toothbrush 10 in an oral cavity.

10 Therefore, by setting the length of the head part body 18 to 10 mm or more and 30 mm or less, the area of the bristle-implanting surface 26 can be sufficiently ensured, and the operability of the toothbrush 10 in the oral cavity can also be enhanced.

[0029]

A width (a width in the X1 and X2 directions) of the head part body 18 having
15 the above-described configuration is not particularly limited, but may be preferably within a range of, for example, 7 mm or more and 13 mm or less, and more preferably 8 mm or more and 12 mm or less.

When the width of the head part body 18 is narrower than 7 mm, it may be difficult for the area of the bristle-implanting surface 26 on which the plurality of first to
20 fourth bristle bundles 31 to 34 to be described below are implanted to be sufficiently ensured.

Meanwhile, when the width of the head part body 18 is wider than 13 mm, it is difficult to enhance operability of the toothbrush 10 in the oral cavity.

Therefore, by setting the width (the width in the X1 and X2 directions) of the
25 head part body 18 to 7 mm or more and 13 mm or less, the area of the bristle-implanting

surface 26 can be sufficiently ensured, and the operability of the toothbrush 10 in the oral cavity can also be enhanced.

[0030]

For example, a rigid resin may be used as a material of the head part body 18
5 having the above-described configuration.

For example, a resin having a bending elastic modulus (JIS K7203) of 500 to 3000 MPa may be used as the rigid resin.

For example, polypropylene (PP), polyethylene terephthalate (PET),
polybutylene terephthalate (PBT), polycyclohexylenedimethylene terephthalate (PCT),
10 polyacetal (POM), polystyrene (PS), an acrylonitrile-butadiene-styrene resin (ABS),
cellulose propionate (CP), a polyarylate, a polycarbonate, an acrylonitrile-styrene
copolymer resin (AS) or the like can be used as the rigid resin.

These rigid resins may be used independently or in a combination of two or more.

15 [0031]

If necessary, at least a part of the side surface and a rear surface of the head part body 18 may be coated with a soft resin. In this case, for example, a resin of which a shore A hardness of JIS K7215 is 90 or less may be used as the soft resin.

For example, an elastomer resin such as a polyolefin-based elastomer, a
20 styrene-based elastomer and a polyester-based elastomer may be used as such a soft resin.

In addition, when polypropylene (PP) is used as the rigid resin, the styrene-based elastomer resin may be used in view of weldability.

[0032]

25 The plurality of first bristle-implanting holes 21 are provided in the head part

body 18 corresponding to the first region 26-1 at predetermined intervals in the X1 and X2 directions and the Y1 and Y2 directions. Upper ends of the plurality of first bristle-implanting holes 21 are exposed from the bristle-implanting surface 26. The plurality of first bristle-implanting holes 21 are holes for implanting the first bristle bundles 31, which will be described later, used when molars are brushed.

Also, in FIG. 4, a case in which seven first bristle-implanting holes 21 are provided is illustrated as an example, but the number of the plurality of first bristle-implanting holes 21 is not limited to that illustrated in FIG. 4 as long as it is two or more.

10 [0033]

The plurality of second bristle-implanting holes 22 are provided in the head part body 18 corresponding to the second regions 26-2 at predetermined intervals in the X1 and X2 directions and the Y1 and Y2 directions. Upper ends of the plurality of second bristle-implanting holes 22 are exposed from the bristle-implanting surface 26. The plurality of second bristle-implanting holes 21 are holes for implanting the second bristle bundles 32, which will be described later, used when tooth surfaces are brushed.

Also, in FIG. 4, a case in which six second bristle-implanting holes 22 are provided in each of the second regions 26-2 is illustrated as an example, but the number of the second bristle-implanting holes 22 disposed in each of the second regions 26-2 is not limited to that illustrated in FIG. 4 as long as it is two or more.

[0034]

The plurality of third bristle-implanting holes 23 are provided in the head part body 18 corresponding to the third regions 28 and 29 at predetermined intervals. The plurality of third bristle-implanting holes 23 are generally disposed in the Y1 and Y2 directions.

Upper ends of the plurality of third bristle-implanting holes 23 are exposed from the bristle-implanting surface 26. The plurality of third bristle-implanting holes 23 are holes for implanting the third bristle bundles 33, which will be described later, used when the collum dentis is brushed.

5 Also, in FIG. 4, a case in which three third bristle-implanting holes 23 are provided in each of the third regions 28 and 29 is illustrated as an example, but the number of the third bristle-implanting holes 23 disposed in each of the third regions 28 and 29 is not limited to that illustrated in FIG. 4 as long as it is two or more.

[0035]

10 The plurality of fourth bristle-implanting holes 24 are provided in the head part body 18 corresponding to the fourth regions 26-4 at predetermined intervals in the X1 and X2 directions. Upper ends of the plurality of fourth bristle-implanting holes 24 are exposed from the bristle-implanting surface 26. The plurality of fourth bristle-implanting holes 24 are holes for implanting the fourth bristle bundles 34, which
15 will be described later, used when the interdentium is brushed.

Also, in FIG. 4, a case in which five fourth bristle-implanting holes 24 are provided in the fourth regions 26-4 is illustrated as an example, but the number of the fourth bristle-implanting holes 24 disposed in the fourth regions 26-4 is not limited to that illustrated in FIG. 4.

20 [0036]

Inner diameters of the first and second bristle-implanting holes 21 and 22 are preferably larger than those of the third and fourth bristle-implanting holes 23 and 24.

Therefore, it is possible to increase outer diameters of the first bristle bundles 31 used in brushing the molars and outer diameters of the second bristle bundles 32 used in
25 brushing the tooth surfaces, and thus it is possible to enhance cleaning power for the

molars and the tooth surfaces.

The inner diameters of the first and second bristle-implanting holes 21 and 22 may be appropriately set within a range of, for example, 1.8 to 3.0 mm. In this case, the inner diameters of the third and fourth bristle-implanting holes 23 and 24 may be

5 appropriately set within a range of, for example, 1.0 to 1.6 mm.

[0037]

An area of the first region 26-1 in which the plurality of first bristle-implanting holes 21 are disposed is preferably smaller than a total area of the two second regions 26-2 in which the plurality of second bristle-implanting holes 22 are disposed and also

10 larger than a total area of the third regions 28 and 29 in which the plurality of third bristle-implanting holes 23 are disposed, and an area of the fourth region 26-4 in which the plurality of fourth bristle-implanting holes 24 are disposed is preferably smaller than the total area of the third regions 28 and 29.

The first to fourth bristle bundles 31 to 34 implanted in the first to fourth regions

15 26-1 to 26-4 to satisfy the above-described conditions can exercise maximal cleaning power.

[0038]

One end of the neck part 31 is integrally formed with the head part 11, and the other end thereof is integrally formed with the front end of the handle part 14. The neck

20 part 13 is a member which extends in the Y1 and Y2 directions while being curved toward the brush part 16. In the X1 and X2 directions, a width of the neck part 13 is formed narrower than that of each of the head part 11 and the handle part 14. The neck part 13 is a part for enhancing the operability of the toothbrush 10 in the oral cavity.

[0039]

25 The neck part 13 may be formed of, for example, the above-described rigid resin

applicable to the material of the head part body 18. Furthermore, for example, the neck part 13 is preferably formed so that a base portion thereof is formed of the above-described rigid resin and at least a part of an outer surface of the base portion is coated with the above-described soft resin.

5 The length (length in the Y1 and Y2 directions) of the neck part 13 may be appropriately selected and may be appropriately selected within a range of, for example, 20 mm or more and 60 mm or less.

In addition, the neck part 13 may have any shape and size applicable to the toothbrush 10, and is not particularly limited.

10 [0040]

The handle part 14 is a part gripped by a user's hand when a tooth cleaning operation is performed. The handle part 14 extends in the Y1 and Y2 directions. The handle part 14 has a partially depressed shape to be easily gripped by the user's hand.

15 The handle part 14 may be formed of, for example, the above-described rigid resin applicable to the material of the head part body 18. Furthermore, for example, the handle part 14 is preferably formed so that a base portion thereof is formed of the above-described rigid resin and at least a part of an outer surface of the base portion is coated with the above-described soft resin.

[0041]

20 The length (length in Y1 and Y2 directions) of the handle part 14 may be appropriately selected, but, for example, when the length of the neck part 13 is within a range of 20 mm or more and 60 mm or less, it is possible to set a sum of the length of the neck part 13 and the length of the handle part 14 to be 40 mm or more and 80 mm or less.

25 In addition, the handle part 14 may have any shape and size applicable to the toothbrush 10, and is not particularly limited.

[0042]

FIG. 5 is an enlarged view of a portion surrounded by a region B of FIG. 2. In FIG. 5, the same parts as those in FIGS. 1 to 4 are designated by the same reference numerals.

5 [0043]

Referring to FIGS. 4 and 5, the brush part 16 is configured of the plurality of first to fourth bristle bundles 31 to 34. The first bristle bundles 31 are configured of a plurality of bristles and are bundles aligned at the same bristle length.

[0044]

10 In the present invention, “aligning the bundles at the same bristle length” means that the bristle length of each of the plurality of bristles forming the bristle bundles is visually aligned. That is, “aligning the bundles at the same bristle length” includes not only the case in which the bristle lengths of the bristles forming the bristle bundles are exactly the same but also cases in which the bristle lengths within the bristle bundles are
15 slightly different. For example, the difference in the bristle length among the plurality of bristles forming the bristle bundles having the aligned bristle lengths is preferably within $\pm 10\%$, and more preferably within $\pm 5\%$.

[0045]

The first bristle bundles 31 are implanted into the first bristle-implanting holes
20 21. Each of the first bristle bundles 31 has a larger outer diameter than each of the third and fourth bristle bundles 33 and 34.

For example, tapered bristles each having a diameter that is gradually reduced toward a bristle tip and a distal end formed to be sharpened, semi-tapered bristles each having a diameter that is gradually reduced toward a bristle tip and a diameter of a distal
25 end that is greater than those of the tapered bristles, and round bristles which have

substantially the same outer diameter except for rounded portions of bristle tips thereof may be used as the bristles forming the first bristle bundles 31.

[0046]

For example, the first bristle bundles 31 may be configured of only the tapered
5 bristles, may be configured of only the semi-tapered bristles, may be configured of only straight bristles or may be configured of a combination of two or more of the tapered bristles, the straight bristles and the semi-tapered bristles. However, it is preferable that they be configured of only the tapered bristles.

In this case, for example, the tapered bristles having an outer diameter of 10 μm
10 or more and 30 μm or less at a position moved by 0.1 mm from a distal end toward a proximal end may be used.

The height of each of the first bristle bundles 31 from the bristle-implanting surface 26 may be appropriately set according to a purpose thereof, but is preferably within a range of, for example, 10 mm or more and 13 mm or less. Also, a thickness of
15 each of base portions of the bristles forming the first bristle bundles 31 is preferably within a range of, for example, 0.15 mm or more and 0.25 mm or less.

[0047]

For example, a resin material including a polyamide such as 6-12 nylon or 6-10 nylon, a polyester such as PET, polybutylene terephthalate (PBT), polytrimethylene
20 terephthalate (PTT), polyethylene naphthalate (PEN) or polybutylene naphthalate (PBN), a polyolefin such as PP, an olefin-based elastomer, a styrene-based elastomer and the like may be used as a material of the bristles forming the first bristle bundles 31.

[0048]

In addition, a cross-sectional shape (specifically, the shape obtained by cutting
25 the bristles with a virtual plane including the X1 and X2 directions and the Y1 and Y2

directions) of each of the bristles forming the first bristle bundles 31 is preferably, for example, a circular shape. However, the cross-sectional shape is not limited to the circular shape.

The cross-sectional shape of each of the bristles forming the first bristle bundles 31 may be, for example, an oval shape, a polygonal shape (e.g., a triangular shape, a quadrangular shape, a pentagonal shape, a hexagonal shape, etc.), an irregular shape (e.g., a star shape, a three-leaf clover shape, a four-leaf clover shape, etc.) or the like.

[0049]

The second bristle bundles 32 are implanted into the second bristle-implanting holes 22. The second bristle bundles 32 are configured of the plurality of bristles and are bundles aligned at the same bristle length. The height of each of the second bristle bundles 32 from the bristle-implanting surface 26 is formed lower than that of each of the first bristle bundles 31, the third bristle bundles 33 and the fourth bristle bundles 34. That is, the second bristle bundles 32 are bundles which have the lowest height.

The outer diameter of each of the second bristle bundles 32 is formed larger than that of each of the third and fourth bristle bundles 33 and 34.

[0050]

For example, the second bristle bundles 32 may be configured of only the tapered bristles, may be configured of only the semi-tapered bristles, may be configured of only the straight bristles or may be configured of a combination of two or more of the tapered bristles, the straight bristles and the semi-tapered bristles. However, it is preferable that they be configured of only the semi-tapered bristles.

In this way, the cleaning power for the tooth surfaces can be enhanced by configuring the second bristle bundles 32 with only the semi-tapered bristles having larger outer diameters than the tapered bristles.

[0051]

For example, the semi-tapered bristles forming the second bristle bundles 32 having a diameter of 30 μm or more and 90 μm or less at a position moved by 0.1 mm from a distal end toward a proximal end may be used.

5 The height of each of the second bristle bundles 32 from the bristle-implanting surface 26 may be appropriately set according to a purpose thereof, but is preferably within a range of, for example, 8 mm or more and 11 mm or less. Also, a thickness of each of base portions of the bristles forming the second bristle bundles 32 is preferably within a range of, for example, 0.12 mm or more and 0.20 mm or less.

10 A material and a cross-sectional shape of the bristles forming the second bristle bundles 32 may be appropriately set according to a purpose thereof, for example, may be the same as those of the bristles forming the first bristle bundles 31.

[0052]

 The third bristle bundles 33 are implanted into the third bristle-implanting holes
15 23. The third bristle bundles 33 are configured of the plurality of bristles and are bundles aligned at the same bristle length. The height of each of the third bristle bundles 33 from the bristle-implanting surface 26 is formed lower than that of each of the first bristle bundles 31 but higher than that of each of the second bristle bundles 32.

 The outer diameter of each of the third bristle bundles 33 is formed smaller than
20 that of each of the first and second bristle bundles 31 and 32.

 In this way, since the outer diameter of each of the third bristle bundles 33 is formed smaller than that of each of the first and second bristle bundles 31 and 32 and thus the third bristle bundles 33 are easily inserted between teeth and gums (into the collum dentis), the cleaning power for the collum dentis can be enhanced.

25 [0053]

For example, the third bristle bundles 33 may be configured of only the tapered bristles, may be configured of only the semi-tapered bristles, may be configured of only the straight bristles or may be configured of a combination of two or more of the tapered bristles, the straight bristles and the semi-tapered bristles. However, it is preferable that
5 they be configured of only the tapered bristles.

In this way, since the third bristle bundles 33 are configured of only the tapered bristles and thus an insertion property of the third bristle bundles 33 between teeth and gums (into the collum dentis) is further enhanced, the cleaning power for the collum dentis can be enhanced.

10 In this case, for example, the tapered bristles having an outer diameter of 10 μm or more and 30 μm or less at a position moved by 0.1 mm from a distal end toward a proximal end may be used.

[0054]

The height of each of the third bristle bundles 33 from the bristle-implanting
15 surface 26 may be appropriately set according to a purpose thereof, but is preferably within a range of, for example, 9 mm or more and 12 mm or less. Also, a thickness of each of base portions of the bristles forming the third bristle bundles 33 is preferably within a range of, for example, 0.10 mm or more and 0.19 mm or less.

Furthermore, the difference between the height of each of the second bristle
20 bundles 32 and the height of each of the third bristle bundles 33 may be, for example, 0.5 mm or more and 2.0 mm or less.

[0055]

The fourth bristle bundles 34 are implanted into the fourth bristle-implanting
holes 24. The fourth bristle bundles 34 are configured of the plurality of bristles and are
25 bundles having the same bristle length. The height of each of the fourth bristle bundles

34 from the bristle-implanting surface 26 is formed to be the same as or higher than that of each of the first bristle bundles 31.

The outer diameter of each of the fourth bristle bundles 34 is formed smaller than that of each of the first and second bristle bundles 31 and 32.

5 In this way, since the outer diameter of each of the fourth bristle bundles 34 is formed smaller than that of each of the first and second bristle bundles 31 and 32 and thus the fourth bristle bundles 34 are easily inserted into the interdentium (a gap between teeth), the cleaning power for the interdentium can be enhanced.

[0056]

10 For example, the fourth bristle bundles 34 may be configured of only the tapered bristles, may be configured of only the semi-tapered bristles, may be configured of only straight bristles or may be configured of a combination of two or more of the tapered bristles, the straight bristles and the semi-tapered bristles. However, it is preferable that they be configured of only the tapered bristles.

15 In this way, since the fourth bristle bundles 34 are configured of only the tapered bristles and thus an insertion property thereof into the interdentium is enhanced, the cleaning power for the interdentium can be enhanced.

 In this case, for example, the tapered bristles having an outer diameter of 10 μm or more and 30 μm or less at a position moved by 0.1 mm from a distal end toward a
20 proximal end may be used.

[0057]

 The height of each of the fourth bristle bundles 34 from the bristle-implanting surface 26 may be appropriately set according to a purpose thereof, but is preferably within a range of, for example, 10 mm or more and 13 mm or less. Also, a thickness of
25 each of base portions of the bristles forming the fourth bristle bundles 34 is preferably

within a range of, for example, 0.15 mm or more and 0.20 mm or less.

Furthermore, the difference between the height of each of the first bristle bundles 31 and the height of each of the fourth bristle bundles 34 may be, for example, 0 mm or more and 1 mm or less.

5 [0058]

The toothbrush 10 of the first embodiment of the present invention is characterized by including the first bristle bundles 31 implanted into the plurality of first bristle-implanting holes 21 provided in the first region 26-1, the second bristle bundles 32 implanted into the plurality of second bristle-implanting holes 22 provided in the
10 second regions 26-2 and have the lowest height from the bristle-implanting surface 26, the third bristle bundles 33 implanted into the plurality of third bristle-implanting holes 23 provided in the third regions 28 and 29 and have a height from the bristle-implanting surface 26 that is lower than that of the first bristle bundles 31 and higher than that of the second bristle bundles 32, and the fourth bristle bundles 34
15 implanted into the plurality of fourth bristle-implanting holes 24 provided in the fourth region 26-4 and have a height from the bristle-implanting surface 26 that is the same as or higher than that of the first bristle bundles 31, wherein the inner diameters of the first and second bristle-implanting holes 21 and 22 are larger than those of the third and fourth bristle-implanting holes 23 and 24.

20 [0059]

With the above configuration it is possible to sufficiently ensure the cleaning power for the molars using the first bristle bundles 31, it is possible to sufficiently ensure the cleaning power for the tooth surfaces using the second bristle bundles 32, it is possible to sufficiently ensure the cleaning power for the collum dentis using the third
25 bristle bundles 33, and it is possible to sufficiently ensure the cleaning power for the

interdentium using the fourth bristle bundles 34.

Therefore, it is possible to sufficiently ensure the cleaning power for each of the interdentium, the collum dentis, the tooth surfaces and the molars.

[0060]

5 (Second embodiment)

FIG. 6 is an enlarged front view of a main part (a head part and a brush part) of a toothbrush according to a second embodiment of the present invention. In FIG. 6, the same parts as those in FIGS. 1 to 5 are designated by the same reference numerals.

[0061]

10 Referring to FIG. 6, a toothbrush 40 of a second embodiment has the same configuration as the toothbrush 10 of the first embodiment except that the head part 11 and the brush part 16 forming the toothbrush 10 are replaced with a head part 41 and a brush part 42.

[0062]

15 The head part 41 includes a head part body 45 and a plurality of first to fourth bristle-implanting holes 21 to 24.

A rear end of the head part body 45 is integrally formed with one end of a neck part 13. The head part body 45 has a bristle-implanting surface 47 formed at the front surface side thereof.

20 The bristle-implanting surface 47 has the same configuration as the bristle-implanting surface 26 of the first embodiment except that the pairs of third regions 26-3A and 26-3B (two pairs of third regions) and the fourth region 26-4 forming the bristle-implanting surface 26 described in the first embodiment are replaced with one pair of third regions 51 and a fourth region 52.

25 [0063]

The pair of third regions 51 include two third regions 55 and 56. The third regions 55 and 56 are provided outside parts of the two second regions 26-2 and outside a fourth region 52.

The third regions 55 and 56 are disposed to surround parts of the two second regions 26-2 and the fourth region 52 in the X1 and X2 directions. The third regions 55 and 56 are regions demarcated around a plurality of third bristle-implanting holes 23.

The third bristle-implanting holes 23, which number more than those in the third regions 28 and 29 described in the first embodiment, are provided in the third regions 55 and 56.

The third regions 55 and 56 are disposed to extend and face each other in Y1 and Y2 directions while being curved. The third regions 55 and 56 are disposed to face each other in the Y1 and Y2 directions with parts of the two second regions 26-2 and the fourth region 52 therebetween.

[0064]

The fourth region 52 is a region demarcated by the third regions 55 and 56 and the two second regions 26-2. The fourth region 52 is formed so that the length thereof in X1 and X2 directions is shorter than that in the fourth regions 26-4 described in the first embodiment and also a width thereof in the Y1 and Y2 directions is wider than that in the fourth regions 26-4.

In the fourth region 52, a plurality of (e.g., two in FIG. 6) bristle hole groups formed by fourth bristle-implanting holes 24 arranged in a row in X1 and X2 directions are arranged in the Y1 and Y2 directions.

[0065]

The brush part 42 is configured of a plurality of first to fourth bristle bundles 31 to 34 and has the same configuration as the brush part 16 described in the first

embodiment except that the number and the arrangement of the third and fourth bristle bundles 33 and 34 are different.

[0066]

The toothbrush of the second embodiment having the above-described
5 configuration can have the same effects as the toothbrush 10 of the first embodiment.

[0067]

Preferred embodiments of the present invention have been described above in detail. However, the present invention is not limited to these specific embodiments but can be modified and changed variously within the scope of the present invention
10 described in the claims.

[0068]

Examples will be described below, but the present invention is not limited to the examples described below.

[0069]

15 (Manufacturing of toothbrush of examples 1 to 6 and comparative examples 1 to 3)

As the toothbrush shown in FIGS. 1 to 5, toothbrushes C1 to C6 according to examples 1 to 6 and toothbrushes D1 to D3 according to comparative examples 1 to 3 were manufactured under conditions shown in Table 1.

20 At this point, tapered bristles formed of a polybutylene terephthalate (PBT) resin were used as the tapered bristles. Spiral tapered bristles formed of a PBT resin were used as spiral tapered bristles. Semi-tapered bristles formed of a PBT resin were used as the semi-tapered bristles. Round bristles formed of nylon were used as the round bristles.

25 [0070]

In examples 1 to 5 and comparative example 3, the height of each of the fourth bristle bundles was the same as that of each of the first bristle bundles.

In example 6, the height of each of the fourth bristle bundles was formed higher than that of each of the first bristle bundles by 1 mm. In comparative examples 1 and 2,
5 the height of each of the fourth bristle bundles was formed lower than that of each of the first bristle bundles by 1 mm.

In examples 1 to 6, comparative example 1 and comparative example 2, the inner diameter of each of the third and fourth bristle implant holes was formed smaller than that of each of the first and second bristle implant holes. In comparative example 3,
10 the inner diameter of each of the third and fourth bristle implant holes was formed to be the same as that of each of the first and second bristle implant holes.

[0071]

[Table 1]

	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3	EXAMPLE 4	EXAMPLE 5	EXAMPLE 6	COMPARATIVE EXAMPLE 1	COMPARATIVE EXAMPLE 2	COMPARATIVE EXAMPLE 3
INNER DIAMETER (mm) OF FIRST AND SECOND BRISTLE-IMPLANTING HOLES	2	3	1.8	2	2	2	2	2	3
INNER DIAMETER (mm) OF THIRD AND FOURTH BRISTLE-IMPLANTING HOLES	1.5	1.6	1	1.5	1.5	1.5	1.5	1.5	3
KIND OF BRISTLES	FIRST BRISTLE BUNDLES	TAPERED	TAPERED	TAPERED	SPIRAL TAPERED	TAPERED	TAPERED	TAPERED	TAPERED
	SECOND BRISTLE BUNDLES	TAPERED	TAPERED	TAPERED	SEMI- TAPERED	TAPERED	TAPERED	SEMI- TAPERED	SEMI- TAPERED
	THIRD BRISTLE BUNDLES	TAPERED	TAPERED	TAPERED	TAPERED	TAPERED	TAPERED	TAPERED	TAPERED
	FOURTH BRISTLE BUNDLES	TAPERED	TAPERED	TAPERED	SPIRAL TAPERED	TAPERED	TAPERED	TAPERED	TAPERED
LENGTH (mm) OF BRISTLES	FIRST BRISTLE BUNDLES	12	12	12	12	12	12	12	12
	SECOND BRISTLE BUNDLES	10	10	10	10	10	10	10	10
	THIRD BRISTLE BUNDLES	11	11	11	11	11	11	11	11
	FOURTH BRISTLE BUNDLES	12	12	12	12	13	11	11	12
OUTER DIAMETER (mm) OF BRISTLES	FIRST BRISTLE BUNDLES	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203
	SECOND BRISTLE BUNDLES	0.178	0.178	0.178	0.178	0.178	0.178	0.178	0.178
	THIRD BRISTLE BUNDLES	0.152	0.152	0.152	0.152	0.152	0.152	0.152	0.152
	FOURTH BRISTLE BUNDLES	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190
EVALUATION RESULTS	CLEANING POWER FOR MOLARS	A	A	B	A	A	A	A	A
	CLEANING POWER FOR INTERDENTIUM	A	B	A	A	A	D	D	D
	CLEANING POWER FOR COLLUM DENTIS	A	B	A	A	A	A	A	B
	CLEANING POWER FOR TOOTH SURFACES	B	A	B	A	A	B	A	C
	CONTACT FEELING	A	A	A	B	C	A	B	B

[0072]

(Evaluation of cleaning power for molars)

An evaluation test was performed on a cleaning power model for molars of the toothbrushes C1 to C6 of examples 1 to 6 and the toothbrushes D1 to D3 of comparative examples 1 to 3. In the evaluation test on the cleaning power model for molars, model plaque was attached to a seventh occlusal surface of a jaw mock-up, a cleaning operation was performed for 3 minutes with each of the toothbrushes C1 to C6 and D1 to D3, and an area from which the plaque of an entire tooth was removed was measured.

Additionally, a removal area with respect to an initial area was taken as a plaque removal rate, and the plaque removal rate was obtained by the following (1).

[0073]

Plaque removal rate (%) = ((plaque occupying area before test on cleaning power model for molars—plaque area after test on cleaning power model for molars)/(plaque area before test on cleaning power model for molars))×100 …(1)

[0074]

In the evaluation, a case in which the plaque removal rate was 70% or more was indicated by A, a case in which the plaque removal rate was 50% or more and less than 70% was indicated by B, a case in which the plaque removal rate was 30% or more and less than 50% was indicated by C, and a case in which the plaque removal rate was less than 30% was indicated by D. The results are shown in Table 1.

[0075]

(Evaluation of cleaning power for interdentium)

An evaluation test was performed on a cleaning power model for the interdentium of the toothbrushes C1 to C6 of examples 1 to 6 and the toothbrushes D1 to D3 of comparative examples 1 to 3. In the evaluation test on the cleaning power model

for the interdentium, model plaque was attached to sixth and seventh occlusal surfaces of a jaw mock-up, a cleaning operation was performed for 3 minutes with each of the toothbrushes C1 to C6 and D1 to D3, and an area from which the plaque of the interdentium was removed was measured. Additionally, a removal area with respect to an initial area was taken as a removal rate.

In the evaluation, a case in which the plaque removal rate was 70% or more was indicated by A, a case in which the plaque removal rate was 50% or more and less than 70% was indicated by B, a case in which the plaque removal rate was 30% or more and less than 50% was indicated by C, and a case in which the plaque removal rate was less than 30% was indicated by D. The results are shown in Table 1.

[0076]

(Evaluation of cleaning power for collum dentis)

An evaluation test was performed on a cleaning power model for the collum dentis of the toothbrushes C1 to C6 of examples 1 to 6 and the toothbrushes D1 to D3 of comparative examples 1 to 3. In the evaluation test on the cleaning power model for the collum dentis, model plaque was attached to sixth and seventh occlusal surfaces of a jaw mock-up, a cleaning operation was performed for 3 minutes with each of the toothbrushes C1 to C6 and D1 to D3, and an area from which the plaque of the collum dentis was removed was measured. Additionally, a removal area with respect to an initial area was taken as a removal rate.

In the evaluation, a case in which the plaque removal rate was 70% or more was indicated by A, a case in which the plaque removal rate was 50% or more and less than 70% was indicated by B, a case in which the plaque removal rate was 30% or more and less than 50% was indicated by C, and a case in which the plaque removal rate was less than 30% was indicated by D. The results are shown in Table 1.

[0077]

(Evaluation of cleaning power for tooth surfaces)

An evaluation test was performed on a cleaning power model for the tooth surfaces of the toothbrushes C1 to C6 of examples 1 to 6 and the toothbrushes D1 to D3 of comparative examples 1 to 3. In the evaluation test on the cleaning power model for the tooth surfaces, model plaque was attached to sixth and seventh occlusal surfaces of a jaw mock-up, a cleaning operation was performed for 3 minutes with each of the toothbrushes C1 to C6 and D1 to D3, and an area from which the plaque of the entire tooth was removed was measured. Additionally, a removal area with respect to an initial area was taken as a removal rate.

[0078]

(Evaluation of contact feeling (feeling of use))

Next, a test evaluating a contact feeling (a feeling of use) of the toothbrushes C1 to C6 of examples 1 to 6 and the toothbrushes D1 to D3 of comparative examples 1 to 3 was performed.

The toothbrushes C1 to C6 and D1 to D3 were used for one week by five expert panelists, who evaluated the contact feeling with respect to the gums as one of four ratings using the following evaluation criteria.

A indicates an evaluation of “very good,” B indicates an evaluation of “good,” C indicates an evaluation of “neither good nor bad,” and D indicates an evaluation of “not good.” The results are shown in Table 1.

[0079]

(Summary of evaluation results for toothbrushes of examples 1 to 6 and comparative examples 1 to 3)

Referring to Table 1, it can be seen understood that very good results were

obtained with respect to the contact feeling (the feeling of use) and the cleaning power for the molars, the interdentium, the collum dentis and the tooth surfaces under the conditions described in example 1 when the tapered bristles were used as the first to fourth bristles 31 to 34.

5 It can be seen from the result of example 4 that very good results were obtained with respect to the contact feeling (the feeling of use) and the cleaning power for the molars, the interdentium, the collum dentis and the tooth surfaces when the first and fourth bristle bundles 31 and 34 were configured of the spiral tapered bristles, the second bristle bundles 32 were configured of the semi-tapered bristles, and the third bristle
10 bundles 33 were configured of the tapered bristles.

[0080]

It can be seen from the result of example 5 that the contact feeling was slightly impaired when the round bristles were used as the bristles of the second bristle bundles 32.

15 It was confirmed from the results of example 1 and comparative examples 1 and 2 that the cleaning power for the interdentium deteriorates when the height (the height of the fourth bristle bundles) of the bristles forming the fourth bristle bundles is lower than that (the height of the first bristle bundles) of the bristles forming the first bristle bundles.

Furthermore, it was confirmed from the results of example 1, example 6 and
20 comparative examples 1 and 2 that the height of each of the bristles forming the fourth bristle bundles should be the same as or higher than that of each of the bristles forming the first bristle bundles to sufficiently ensure the cleaning power for the interdentium.

[0081]

It was confirmed from the results of comparative example 3 that the cleaning
25 power for the collum dentis and the tooth surfaces deteriorated when the inner diameters

of the first and second bristle-implanting holes had the same sizes as those of the third and fourth bristle-implanting holes although the height of each of the bristles forming the fourth bristle bundles was set to be the same as or higher than that of each of the bristles forming the first bristle bundles.

5 It was confirmed from the results of examples 1 and 2 and comparative examples 2 and 3 that the inner diameters of the third and fourth bristle-implanting holes should be smaller than those of the first and second bristle-implanting holes to sufficiently ensure the cleaning power for the collum dentis and the tooth surfaces.

[0082]

10 It was confirmed from the above-described results that the height of each of the bristles forming the fourth bristle bundles should be the same as or higher than that of each of the bristles forming the first bristle bundles and the inner diameters of the third and fourth bristle-implanting holes should also be smaller than those of the first and second bristle-implanting holes to sufficiently ensure the cleaning power for each of the
15 interdentium, the collum dentis, the tooth surfaces and the molars with a single toothbrush.

[Industrial Applicability]

[0083]

The present invention can be applied to a toothbrush.

20 [Reference Signs List]

[0084]

10, 40 Toothbrush

11, 41 Head part

13 Neck part

25 14, 42 Handle part

	16 Brush part
	18, 45 Head part body
	21 First bristle-implanting hole
	22 Second bristle-implanting hole
5	23 Third bristle-implanting hole
	24 Fourth bristle-implanting hole
	26, 47 Bristle-implanting surface
	26-1 First region
	26-2 Second region
10	26-3A, 26-3B, 51 Pairs of third regions,
	26-4, 52 Fourth region
	28, 29, 55, 56 Third region
	31 First bristle bundles
	32 Second bristle bundles
15	33 Third bristle bundles
	34 Fourth bristle bundles

[CLAIMS]

[Claim 1]

A toothbrush in which a plurality of bristle bundles are implanted on a bristle-implanting surface of a head part, and the bristle-implanting surface comprises a
5 first region disposed at the front end of the head part, a second region disposed between the first region and the rear end of the head part and also at a center portion thereof in a width direction of the head part, a pair of third regions disposed outside the second region and surround the second region in the width direction of the head part, and a
10 fourth region disposed to divide at least the second region in a lengthwise direction of the head part, comprising:

first bristle bundles implanted into a plurality of first bristle-implanting holes provided in the first region;

second bristle bundles implanted into a plurality of second bristle-implanting holes provided in the second region and have the lowest height from the
15 bristle-implanting surface;

third bristle bundles implanted into a plurality of third bristle-implanting holes provided in the third regions and have a height from the bristle-implanting surface that is lower than that of the first bristle bundles and higher than that of the second bristle bundles; and

20 fourth bristle bundles implanted into a plurality of fourth bristle-implanting holes provided in the fourth region and have a height from the bristle-implanting surface that is the same as or higher than the height of the first bristle bundles,

wherein inner diameters of the first and second bristle-implanting holes are larger than those of the third and fourth bristle-implanting holes.

25 [Claim 2]

The toothbrush according to Claim 1, wherein bristles forming the first to fourth bristle bundles are tapered bristles.

[Claim 3]

5 The toothbrush according to Claim 1 or 2, wherein the diameter of the front end of each of bristles forming the second bristle bundles is larger than that of the front end of each of bristles forming the first bristle bundles, the third bristle bundles and the fourth bristle bundles.

[Claim 4]

10 The toothbrush according to any one of Claims 1 to 3, wherein the shape of each of the bristles forming the first and fourth bristle bundles is a spiral shape.

[Claim 5]

The toothbrush according to any one of Claims 1 to 4, wherein the fourth region is disposed to divide the pair of third regions, and the fourth bristle-implanting holes are arranged between the third implanting holes in a lengthwise direction of the head part.

15 [Claim 6]

The toothbrush according to any one of Claims 1 to 5, wherein, assuming that an entire area of the first region is A1, an entire area of the second region is A2, an entire area of the third region is A3 and an entire area of the fourth region is A4,

a relationship of $A4 < A3 < A1 < A2$ is satisfied.