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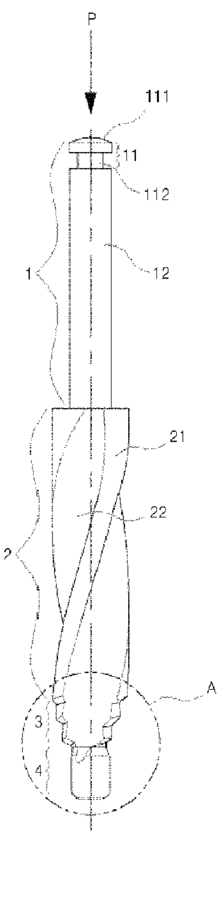
[Continued on next page]

(54) **Title:** A DENTAL IMPLANT DRILL HAVING A MULTI-STEP STRUCTURE

FIG. 2



(57) Abstract: Provided is a dental implant drill having a multi-step structure, in which a multi-step portion including a plurality of steps with blades formed thereon is provided so that thrust loads applied to the dental implant drill are constant by increasing a thrust load applied to an external circumference of the dental implant drill and reducing a thrust load applied to the center of the dental implant drill, in order to minimize a cutting temperature, so that chips are smoothly discharged by regularly distributing a cutting force to the blades, in order to minimize a cutting temperature. Also, a drilled hole in which a fixture can be implanted is formed by a single drilling operation and the time required for an implant operation is reduced. Further, the dental implant drill includes a guide portion so as to accurately drill an alveolar bone along a desired path.

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Description

A DENTAL IMPLANT DRILL HAVING A MULTI-STEP STRUCTURE

Technical Field

[1] The present invention relates to a dental implant drill having a multi-step structure, in which a multi-step portion including a plurality of steps with blades formed thereon is provided so that thrust loads applied to the dental implant drill are constant by increasing a thrust load applied to an external circumference of the dental implant drill and reducing a thrust load applied to the center of the dental implant drill, in order to minimize a cutting temperature, so that chips are smoothly discharged by regularly distributing a cutting force to the blades, in order to minimize a cutting temperature. Also, a drilled hole in which a fixture can be implanted is formed by a single drilling operation and the time required for an implant operation is reduced. Further, the dental implant drill includes a guide portion so as to accurately drill an alveolar bone along a desired path.

Background Art

[2] Implants generally refer to substitutes for lost body tissue, and in the field of dentistry, refer to artificial teeth. Implants are nowadays used widely for replacing damaged or lost teeth.

[3] An artificial tooth is implanted by drilling the alveolar bone with a drill so as to form a drilled hole, inserting a fixture by screwing a screw unit of a fixture into the drilled hole, coupling an abutment to an upper end of the fixture fixed to the alveolar bone and then covering the abutment with a prosthesis.

[4] An operation of implanting the artificial tooth includes a bone elimination operation. The bone elimination operation refers to an operation of forming the drilled hole in which the fixture is inserted and fixed in the alveolar bone, by using a drill. The drilled hole is formed by enlarging a groove formed by an initial drill so as to have a size almost equal to or larger than the drilled hole.

[5] FIG. 1 illustrates successive operations of enlarging a drilled hole by conventional implant drills having various diameters.

[6] Referring to FIG. 1, in a conventional bone elimination operation for forming the drilled hole, a multi-step drilling operation including forming an initial drilled hole having a small diameter and enlarging the initial drilled hole to a size suitable for accommodating a fixture is required in order to prevent bone tissue from necrotizing due

to an increased cutting temperature. In a first operation (step 1), an alveolar bone is perforated by an initial drill 101 having a small diameter, and the initial drilled hole is formed in the alveolar bone. In a second operation (step 2), an upper portion of the drilled hole formed in the first operation is enlarged by a pilot drill 103, a diameter of a lower portion of the pilot drill 103 is equal to that of a lower portion of the initial drill 101 so as to function as a guide, and a diameter of an intermediate portion of the pilot drill 103 is slightly greater than that of the lower portion of the pilot drill 103 so that the pilot drill 103 can enlarge an upper portion of the drilled hole formed in the first operation.

[7] In a third operation (step 3), a lower portion of the drilled hole formed in the second operation is enlarged by an intermediate drill 104, a diameter of a lower portion of the intermediate drill 104 is equal to that of the intermediate portion of the pilot drill 103 so that a lower portion of the drilled hole is formed to be relatively wide. Likewise, in a fourth operation (step 4), an upper portion of the drilled hole is enlarged by a pilot drill 103'. In a fifth operation (step 5), a lower portion of the drilled hole formed in the fourth operation is enlarged by a last drill 102.

[8] When the drilled hole is formed by a drill having a small diameter and then the drilled hole is enlarged by a drill having a large diameter by a multi-step operation in order to minimize heat applied to the alveolar bone, since thrust loads applied to the center and external circumference of the dental implant drill are not constant, a cutting temperature increases. Since a bone elimination operation is performed by a multi-step operation, for the time required to perform an implant operation increases and it is difficult for an operator to accurately drill the alveolar bone along a desired path. In addition, when a subsequent drill is used, since it is difficult to match the centers of the drill and groove formed by a drill used in a previous operation, the drilled hole might be formed in an undesired position.

[9] In particular, since a conventional implant drill has different cutting speeds at the center and external circumference of the implant drill during the rotation of the implant drill, thrust loads applied to the center and external circumference of the implant drill are different, and thus a cutting temperature increases. In addition, since heat applied to the alveolar bone increases, bone tissue may necrotize. A thrust load refers to a force applied to a drill in an opposite direction to an axial direction of drilling during the drilling operation. In addition, when the implant drill is used, chips having a size equal to the length of the cutting blade are formed and the chips cannot be smoothly discharged due to the sizes of the chips, and the cutting temperature further increases.

Thus, bone tissue may necrotize.

Disclosure of Invention

Technical Problem

[10] The present invention provides a dental implant drill having a multi-step structure in which a multi-step portion including a plurality of steps is provided so that small pieces of chips are formed so as to be smoothly discharged through a chip discharge groove in order to minimize heat applied to the alveolar bone.

[11] The present invention also provides a dental implant drill having a multi-step structure in which a multi-step portion tapering from an upper portion to a lower portion and blades of the steps are provided so that a drilled hole in which a fixture can be implanted can be formed by a single drilling operation, so that it is not necessary to match the centers of the dental implant drill and drilled hole, and so that the time required for an implant operation can be reduced.

[12] The present invention also provides a dental implant drill having a multi-step structure including a first step having a smaller diameter than a second step, wherein the point angle of the second step is greater than the point angle of the first step, and the clearance angle of the second step is equal to or less than the clearance angle of the first step, and thus thrust loads applied to the entire dental implant drill can be constant by increasing a thrust load applied to an external circumference of the dental implant drill, and thus heat applied to an alveolar bone can be minimized.

[13] The present invention also provides a dental implant drill having a multi-step structure in which small pieces of chips can be easily discharged through a groove depressed and extending towards an axis in an end of a first flank surface.

[14] The present invention also provides a dental implant drill having a multi-step structure in which a guide portion extending from an end of a multi-step portion is provided so that an operator can accurately drill the alveolar bone along a desired path when enlarging an initial drilled hole formed by an initial drill.

Technical Solution

[15] According to an aspect of the present invention, there is provided a dental implant drill having a multi-step structure, for enlarging a drilled hole formed in an alveolar bone, the dental implant drill including an extending portion extending from an end of a shaft in an axial direction; and a multi-step portion extending from a lower portion of the extending portion in the axial direction and including a chip discharge groove, wherein the multi-step portion may include a plurality of steps so that small pieces of chips are formed to be smoothly discharged through the chip discharge groove in order

to minimize heat applied to the alveolar bone, and wherein each of the plurality of steps may include a first flank surface inclined towards an axis of the dental implant drill and a lower portion thereof in the axial direction, and a cutting blade, for cutting the alveolar bone, formed on one side of the first flank surface.

[16] Diameters of the plurality of steps may decrease towards a lower portion of the multi-step portion so as to reduce the time required for an implant operation.

[17] The plurality of steps of the multi-step portions may be formed so that a point angle of a first of the steps is greater than a point angle of a second of the steps having a smaller diameter than the first step, and a clearance angle of the first step may be equal to or less than a clearance angle of the second step.

[18] The plurality of steps of the multi-step portions may be formed so that, when a first of the steps has a smaller diameter than that of an adjacent step constituting a second step, the clearance angle of the first step may be smaller than the clearance angle of the second step by about 1 to about 5°.

[19] Each of the plurality of steps of the multi-step portions may further include a groove extending from one side of the first flank surface to the chip discharge groove through which chips are easily discharged.

[20] The groove may be inclined towards an axis of the dental implant drill.

[21] The groove may be formed to have a depth from about 0.1 to about 0.25 mm.

[22] The chip discharge groove may extend along an axial direction of the dental implant drill in a spiral shape.

[23] At least two chip discharge grooves may be symmetrically disposed with respect to the axis of the dental implant drill.

[24] The dental implant drill may further include a guide portion extending from a lower portion of the multi-step portion in an axial direction.

[25] The guide portion may have a circular cross section having a size corresponding to a size of the drilled hole.

[26] The chip discharge groove may extend from the guide portion to an upper portion of the multi-step portion.

[27] A second flank surface may be inclined towards a lower portion thereof and away from the axis at a lower portion of the first flank surface.

[28] According to an aspect of the present invention, there is provided a dental implant drill having a multi-step structure, for enlarging a drilled hole formed in an alveolar bone by rotation in an axial direction, the dental implant drill including a multi-step portion inserted into the drilled hole, extending along the axial direction, and including

a chip discharge groove formed along the axial direction; and a guide portion extending from a lower portion of the multi-step portion and having a circular cross section having a size corresponding to a size of the implantation portion, wherein the multi-step portion may include a plurality of steps so that small pieces of chips are formed to be smoothly discharged through the chip discharge groove in order to minimize heat applied to the alveolar bone, and wherein diameters of the plurality of steps decrease towards an axis and a lower portion of the multi-step portion so as to reduce the time required for an implant operation.

[29] Each of the plurality of steps may include a first flank surface inclined towards an axis and a lower portion thereof in the axial direction, and a cutting blade, for cutting the alveolar bone, formed on one side of the first flank surface, which contacts the chip discharge groove.

[30] The plurality of steps of the multi-step portions may be formed so that a point angle of a first of the steps is greater than a point angle of a second of the steps having a smaller diameter than the first step, and a clearance angle of the first step may be equal to or less than a clearance angle of the second step.

Advantageous Effects

[31] The present invention can have the following advantageous effects according to the above construction and relationship between elements.

[32] The dental implant drill includes a multi-step portion including a plurality of steps, and thus small pieces of chips can be formed so as to be smoothly discharged through a chip discharge groove, and thus heat applied to the alveolar bone can be minimized.

[33] The dental implant drill includes a multi-step portion tapering from an upper portion to a lower portion and blades of the steps, and thus a drilled hole in which a fixture can be implanted can be formed by a single drilling operation, it is not necessary to match the centers of the dental implant drill and drilled hole, and the time required for an implant operation can be reduced by simply performing the implant operation.

[34] The dental implant drill may include a multi-step portion including a first step having a smaller diameter than a second step, and thus since the point angle of the second step is greater than the point angle of the first step, and the clearance angle of the second step is equal to or less than the clearance angle of the first step, thrust loads applied to the entire dental implant drill can be constant by increasing a thrust load applied to an external circumference of the dental implant drill, and thus heat applied to an alveolar bone can be minimized.

[35] Small pieces of chips can be easily discharged through a groove depressed and

extending towards an axis in an end of a first flank surface.

[36] The dental implant drill also includes a guide portion extending from an end of the multi-step portion, and thus an operator can accurately drill the alveolar bone along a desired path when enlarging an initial drilled hole formed by an initial drill.

Description of Drawings

[37] FIG. 1 illustrates successive operations of enlarging a drilled hole by using conventional implant drills having various diameters;

[38] FIG. 2 is a structural view of a dental implant drill having a multi-step structure, according to an embodiment of the present invention;

[39] FIG. 3 is an enlarged image of a portion of FIG. 2, according to an embodiment of the present invention;

[40] FIG. 4 is a diagram illustrating point angles, according to an embodiment of the present invention;

[41] FIG. 5 is a diagram illustrating clearance angles, according to an embodiment of the present invention;

[42] FIG. 6 is a structural view of a dental implant drill having a multi-step structure including a groove formed therein, according to another embodiment of the present invention;

[43] FIG. 7 is an enlarged image of a portion of FIG. 6, according to an embodiment of the present invention;

[44] FIG. 8 illustrates an operating state in which a drilled hole is formed by a conventional initial drill; and

[45] FIG. 9 illustrates an operating state in which the drilled hole of FIG. 8 is enlarged by a dental implant drill having a multi-step structure, according to an embodiment of the present invention.

Best Mode

[46] Hereinafter, a dental implant drill having a multi-step structure will be described in detail by explaining exemplary embodiments of the invention with reference to the attached drawings.

[47] FIG. 2 is a structural view of a dental implant drill having a multi-step structure, according to an embodiment of the present invention. FIG. 3 is an enlarged image of a portion A of FIG. 2, according to an embodiment of the present invention.

[48] Referring to FIGS. 2 and 3, the dental implant drill having the multi-step structure includes a shank portion 1, an extending portion 2, a multi-step portion 3 and a guide portion 4.

[49] The shank portion 1 includes a chuck coupling portion 11 and a shaft 12 which is coupled with a chuck (not shown). The chuck coupling portion 11 includes a chuck coupling surface 111 which is coupled with the chuck and a chuck groove 112 formed along a circumferential direction of the chuck coupling portion 11. The chuck coupling surface 111 and the chuck groove 112 are fixed in the chuck.

[50] The extending portion 2 extends from an end of the shaft 12 and includes a plurality of blades 21 and a chip discharge groove 22. Each of the blades 21 extends along a circumferential direction of the extending portion 2 in a spiral shape having a predetermined length. The chip discharge groove 22 extends between the blades 21 from a top portion of the extending portion 2 to a top portion of the guide portion 4, which will be described later, in a predetermined shape, preferably, a spiral shape so as to easily discharge a chip of the alveolar bone to the outside during a drilling operation.

[51] The multi-step portion 3 is formed at a lower portion of the extending portion 2. More particularly, the multi-step portion 3 extends in an axial direction P, and includes a chip discharge groove formed in the axial direction P. The multi-step portion 3 includes a plurality of steps so that chips of the alveolar bone are formed in small pieces so as to be smoothly discharged in order to minimize heat transmitted to the alveolar bone by the guide portion 4, which will be described later. In this case, the steps of the multi-step portion 3 have decreasingly smaller diameters towards the guide portion 4, and thus the time required for performing an implant operation can be reduced.

[52] In particular, the steps extend from the wing 21 and are similar to each other in terms of construction. Referring to FIG. 3, a step S is illustrated. The step S includes a first flank surface S1 and a second flank surface S2.

[53] The first flank surface S1 is inclined towards an axis and a lower portion of the step S in the axial direction P, and includes a cutting blade S1a, for cutting an alveolar bone, that is disposed on one side of the first flank surface S1. In addition, the second flank surface S2 is formed in the axial direction P from an end of the first flank surface S1, and the diameter of the step S is defined as a distance between the second flank surface S2 of the step S and another second flank surface S2. Thus, chips are formed in small pieces by the cutting blade S1a of the first flank surface S1 of the step S so as to be smoothly discharged to the outside of a drilled hole through the chip discharge groove 22, and thus a cutting temperature can be reduced.

[54] According to another embodiment of the present invention, since the multi-step portion 3 includes the steps inclined in the axial direction P and the chips are formed in

small pieces by the steps so as to minimize the cutting temperature, the drilled hole 8 in which a fixture can be implanted can be formed by enlarging an initial drilled hole formed by an initial drill similar to the initial drill 101 of FIG. 1 by a single drilling operation. Conventionally, when an implant operation is performed by a plurality of drilling operations, the center of a drill might not match the center of the drilled hole 8. However, by using the dental implant drill of FIG. 1, since the drilled hole 8 can be formed by a single drilling operation, this problem can be overcome.

[55] FIG. 4 is a diagram illustrating point angles of a multi-step portion according to an embodiment of the present invention. FIG. 5 is a diagram illustrating clearance angles of a multi-step portion according to an embodiment of the present invention. Referring to FIGS. 4 and 5, the multi-step portion includes three steps 31, 32 and 33, but the present invention is not limited thereto.

[56] According to another embodiment of the present invention, as illustrated in FIGS. 4 and 5, in the multi-step portion 3, a point angle α_1 of a first step 31 may be greater than a point angle α_2 of a second step 32, the point angle α_2 of the second step 32 may be greater than a point angle α_3 of a third step 33, a clearance angle $ß_1$ of the first step 31 is less than a clearance angle $ß_2$ of the second step 32, and the clearance angle $ß_2$ of the second step 32 may be less than a clearance angle $ß_3$ of the third step 33 so that thrust loads applied to the center and external circumference of the dental implant drill are constant in order to reduce the cutting temperature.

[57] A point angle of the step S refers to an angle between an axis 10 of the multi-step portion and an imaginary surface extending from any of the first flank surface S1 in a direction parallel thereto, and is proportional to thrust load.

[58] A clearance angle of the step S refers to an angle between a horizontal plane and an imaginary surface extending from the flank of any of the first through third steps 31 through 33. A clearance angle is a factor for determining friction between the alveolar bone and the cutting blade S1a. With a large clearance angle, chipping might easily occur due to lack of tensile strength, and a surface of the alveolar bone might be broken in triangular or pentagonal shapes due to vibration generated during an initial operation for forming the drilled hole 8, or vertical vibration might occur so that the step S cannot cut the alveolar bone. With a small clearance angle, the first and second flank surfaces S1 and S2 might contact the alveolar bone, and thus the cutting temperature increases.

[59] The point angle is proportion to the thrust load, and the clearance angle is inversely proportional to the thrust load. The diameter of a step is inversely proportional to the

thrust load. These may be represented by Equation (1).

[60] $$T=C_1*\alpha/(\beta*D)$$

....(1)

[61] where T is thrust load, C_1 is a proportional factor, α is a point angle of a step, β is a clearance angle of the step, and D is a diameter of the step.

[62] Referring to Equation (1), since each of the steps may have a cutting blade so that a diameter D1 of the first step 31 is greater than a diameter D2 of the second step 32, a point angle of the first step 31 is greater than that of the second step 32, the point angle of the second step 32 is greater than that of the third step 33, a clearance angle of the first step 31 is less than that of the second step 32, and the clearance angle of the second step 32 is less than that of the third step 33, entire thrust loads applied to the dental implant drill are constant by increasing a thrust load applied to an external circumference of the dental implant drill. Alternatively, in order to reduce variables for manufacturing the dental implant drill having the multi-step structure, clearance angles of steps may be constant and a thrust load applied to an external circumference of the dental implant drill may be increased by varying the point angles of the multi-step structure, or clearance angles of steps may be constant and a thrust load applied to an external diameter of the dental implant drill may be increased by varying the clearance angles of the multi-step structure.

[63] According to another embodiment of the present invention, in order to increase a thrust load applied to an external circumference of the dental implant drill, the multi-step portion 3 may be formed so that a clearance angle of the first step 31 may be less than that of the second step 32 by a predetermined angle, and the clearance angle of the second step 32 may be less than that of the third step 33 by a predetermined angle, preferably, an angle in the range of about 1 to about 5 °, which is determined by a cutting speed. The cutting speed is proportional to the thrust load, is proportional to a diameter of the step, and is proportional to the number of revolutions per minute (rpm). These may be represented by Equation (2)

[64] $$T=C_2/V$$

[65] $$V=\pi*D*N/1000$$

....(2)

[66] where T is thrust load, C_2 is a proportional factor, V is a cutting speed, D is a

diameter of a step, and N is rpm

[67] Referring to Equations 1 and 2, N is fixed to about 1000 to about 1500, and a diameter of the dental implant drill is less than 6 mm. In addition, the greater the diameter of the step, the greater the cutting speed so that a thrust load of the external circumference of the dental implant drill decreases. Thus, since the thrust loads applied to the center and external circumference of the dental implant drill may be constant by increasing a thrust load applied to a step having a relatively large diameter, the clearance angle β_1 of the first step 31 may be less than the clearance angle β_2 of the second step 32 by an angle in the range of about 1 to about 5°, and the clearance angle β_2 of the second step 32 may be less than the clearance angle β_3 of the third step 33 by an angle in the range of about 1 to about 5°.

[68] Equation 3 for regularly distributing thrust loads of the dental implant drill having the multi-step structure may be represented by Equations 1 and 2 as follows.

[69] $$T=C*\alpha/(\beta*D*V) \quad \text{.......}(3)$$

[70] where T is thrust load, C is a proportional factor with respect to a specific cutting resistance per unit area, α is a point angle of a step, β is a clearance angle of the step, D is a diameter of the step, and V is a cutting speed.

[71] FIG. 6 is a structural view of a dental implant drill having a multi-step portion 3 including a groove S3 formed therein, according to another embodiment of the present invention. FIG. 7 is an enlarged image of a portion B of FIG. 6, according to an embodiment of the present invention.

[72] Referring to FIGS. 6 and 7, a step S of the multi-step portion 3 may further include a groove S3. The groove S3 extends from one end of the first flank surface S1 to the chip discharge groove 22 in a direction towards the center of the step, i.e., towards the axis so as to have a predetermined depth, preferably, a depth in the range of about 0.1 to about 0.25 mm from an end of the first flank surface S1. The depth of the groove S is determined according to the durability and strength of the dental implant drill having the multi-step structure so as to discharge tiny chips. Conventionally, tiny chips formed by a conventional implant drill cannot be discharged to be condensed, and thus an operator may have difficulty operating the conventional implant drill. However, this problem can be prevented by the groove S3.

[73] The chip discharge groove 22 may extend along a circumferential direction of the dental implant drill in a spiral shape, but the present invention is not limited thereto.

For example, the chip discharge groove 22 may be formed in a linear shape or other various shapes. In the present embodiment, one chip discharge groove 22 is formed, but the present invention is not limited thereto, and three chip discharge grooves may be symmetrically provided about an axis of the dental implant drill. In this regard, two or more chip discharge grooves may be formed about an axis of the dental implant drill.

[74] The chip discharge groove 22 may be formed from the guide portion 4 to an upper end of the multi-step portion 3, but the present invention is not limited thereto. Thus, the longitudinal length of the chip discharge groove 22 may be variously changed according to an implantation condition.

[75] The guide portion 4 may extend from a lower portion of the multi-step portion 3 in an axial direction to have a predetermined length and a predetermined shape, and preferably, to have an appropriate length and a cylindrical shape so as to be easily inserted into an initial implantation grove formed by a conventional initial drill similar to the similar to the initial drill 101 of FIG. 1 so that an operator can accurately drill alveolar bone along a desired path. In particular, the guide portion 4 may be a pole extending in an axial direction while having a circular cross section, wherein the size of the circular cross section may correspond to a drilled hole to which the guide portion 4 is to be inserted. Of course, alternatively, the size of the circular cross section of the guide portion 4 may be smaller than the drilled hole. An end of the guide portion 4 may be rounded, but the present invention is not limited thereto.

[76] Hereinafter, an operating state of a dental implant drill having a multi-step structure will be described with reference to FIGS. 8 and 9.

[77] FIG. 8 illustrates an operating state in which a drilled hole is formed by a conventional initial drill. FIG. 9 illustrates an operating state in which the drilled hole of FIG. 8 is enlarged by a dental implant drill having a multi-step structure, according to an embodiment of the present invention.

[78] Referring to FIGS. 8 and 9, when an operator performs a bone elimination operation in order to implant a fixture, an initial drilled hole having a relatively small diameter is formed by a conventional initial drill, a guide portion formed at a lower portion of the dental implant drill having the multi-step structure is inserted into the initial drilled hole formed by the conventional initial drill, drilling is performed towards a lower portion of the initial drilled hole, and an upper portion of the initial drilled hole is enlarged by each step of a multi-step portion of the dental implant drill according to the present embodiment. Thus, after the initial drilled hole is enlarged, a lower portion

of the initial drilled hole formed by the conventional initial drill can be enlarged by the dental implant drill having the multi-step structure according to the present embodiment.

[79] That is, when an operator rotates the dental implant drill having the multi-step structure installed in a chuck in order to form the drilled hole in the patient's alveolar bone, the dental implant drill passes through the patient's teeth ridge, and contacts and presses the alveolar bone. Then, the guide portion of the dental implant drill is guided to the initial drilled hole formed by the initial drill, and the alveolar bone is intermittently cut by cutting blades of a plurality of steps of the multi-step structure. Therefore, since the cutting temperature can be minimized, and the thrust loads of the center and external circumference of the dental implant drill can be maintained constant, the cutting temperature can be further minimized, and small pieces of chips of the cut alveolar bone can be easily discharged through a chip discharge groove of the dental implant drill. Thus, the cutting temperature can be further minimized, thereby minimizing heat applied to the alveolar bone.

[80] While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by one of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

Claims

[1] A dental implant drill having a multi-step structure, for enlarging a drilled hole formed in an alveolar bone, the dental implant drill comprising:
an extending portion extending from an end of a shaft in an axial direction; and
a multi-step portion extending from a lower portion of the extending portion in the axial direction and comprising a chip discharge groove,
wherein the multi-step portion comprises a plurality of steps so that small pieces of chips are formed to be smoothly discharged through the chip discharge groove in order to minimize heat applied to the alveolar bone, and
wherein each of the plurality of steps comprises a first flank surface inclined towards an axis of the dental implant drill and a lower portion thereof in the axial direction, and a cutting blade, for cutting the alveolar bone, formed on one side of the first flank surface.

[2] The dental implant drill of claim 1, wherein diameters of the plurality of steps decrease towards a lower portion of the multi-step portion so as to reduce the time required for an implant operation.

[3] The dental implant drill of claim 2, wherein the plurality of steps of the multi-step portions are formed so that a point angle of a first of the steps is greater than a point angle of a second of the steps having a smaller diameter than the first step, and a clearance angle of the first step is equal to or less than a clearance angle of the second step.

[4] The dental implant drill of claim 3, wherein the plurality of steps of the multi-step portions are formed so that, when a first of the steps has a smaller diameter than that of an adjacent step constituting a second step, the clearance angle of the first step is smaller than the clearance angle of the second step by about 1 to about 5°.

[5] The dental implant drill of claim 1, wherein each of the plurality of steps of the multi-step portions further comprises a groove extending from one side of the first flank surface to the chip discharge groove through which chips are easily discharged.

[6] The dental implant drill of claim 5, wherein the groove is inclined towards an axis of the dental implant drill.

[7] The dental implant drill of claim 5, wherein the groove is formed to have a depth from about 0.1 to about 0.25 mm.

[8] The dental implant drill of claim 1, wherein the chip discharge groove extends along an axial direction of the dental implant drill in a spiral shape.

[9] The dental implant drill of claim 8, wherein at least two chip discharge grooves are symmetrically disposed with respect to the axis of the dental implant drill.

[10] The dental implant drill of claim 1, further comprising a guide portion extending from a lower portion of the multi-step portion in an axial direction.

[11] The dental implant drill of claim 10, wherein the guide portion has a circular cross section having a size corresponding to a size of the drilled hole.

[12] The dental implant drill of claim 10, wherein the chip discharge groove extends from the guide portion to an upper portion of the multi-step portion.

[13] The dental implant drill of claim 1, wherein a second flank surface is inclined towards a lower portion thereof and away from the axis at a lower portion of the first flank surface.

[14] A dental implant drill having a multi-step structure, for enlarging a drilled hole formed in an alveolar bone by rotation in an axial direction, the dental implant drill comprising:

a multi-step portion inserted into the drilled hole, extending along the axial direction, and comprising a chip discharge groove formed along the axial direction; and

a guide portion extending from a lower portion of the multi-step portion and having a circular cross section having a size corresponding to a size of the implantation portion,

wherein the multi-step portion comprises a plurality of steps so that small pieces of chips are formed to be smoothly discharged through the chip discharge groove in order to minimize heat applied to the alveolar bone, and

wherein diameters of the plurality of steps decrease towards an axis and a lower portion of the multi-step portion so as to reduce the time required for an implant operation.

[15] The dental implant drill of claim 14, wherein each of the plurality of steps comprises a first flank surface inclined towards an axis and a lower portion thereof in the axial direction, and a cutting blade, for cutting the alveolar bone, formed on one side of the first flank surface, which contacts the chip discharge groove.

[16] The dental implant drill of claim 14, wherein the plurality of steps of the multi-step portions are formed so that a point angle of a first of the steps is greater than

a point angle of a second of the steps having a smaller diameter than the first step, and a clearance angle of the first step is equal to or less than a clearance angle of the second step.

FIG. 1

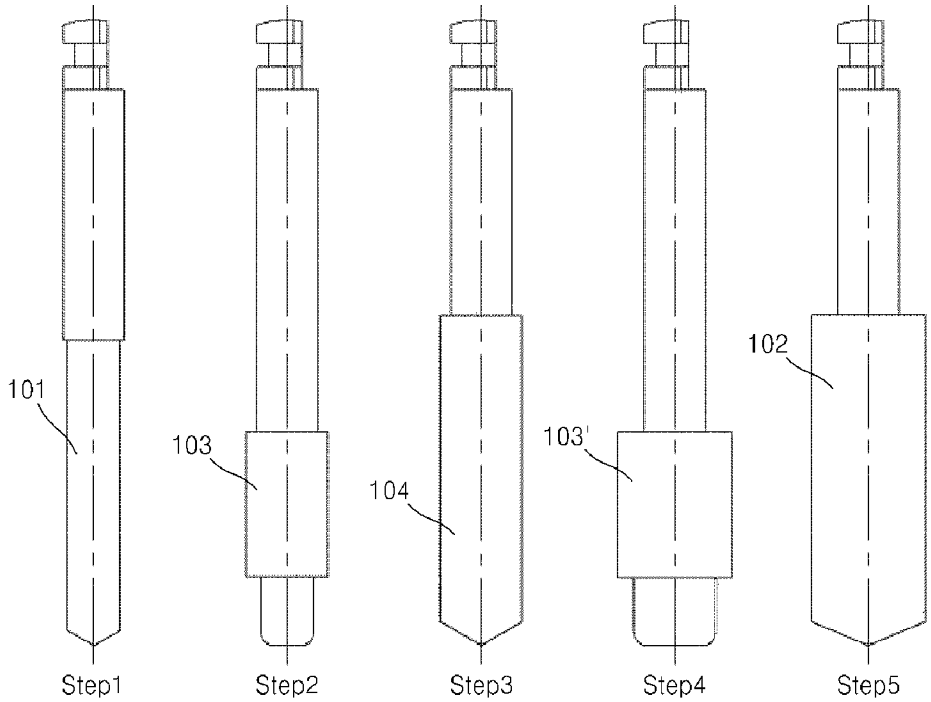


FIG. 2

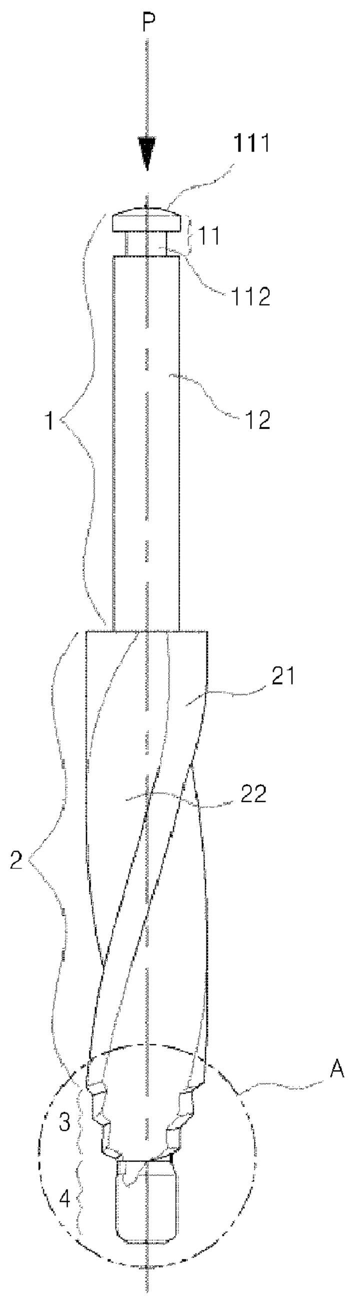


FIG. 3

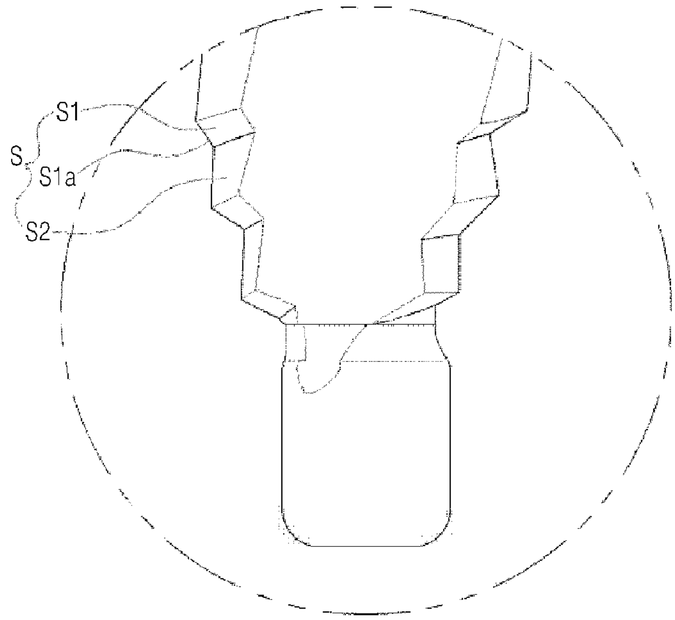


FIG. 4

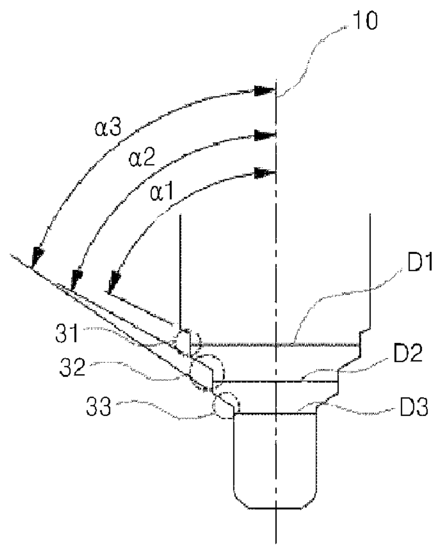


FIG. 5

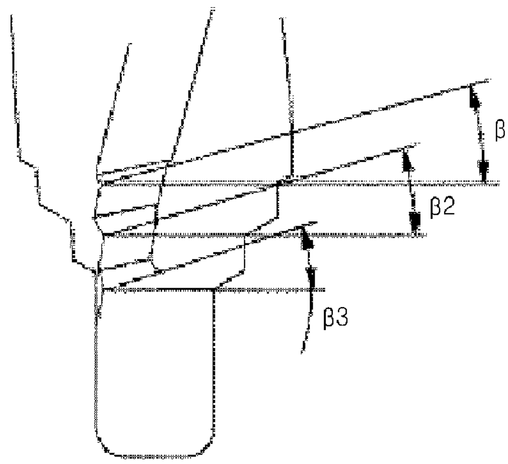


FIG. 6

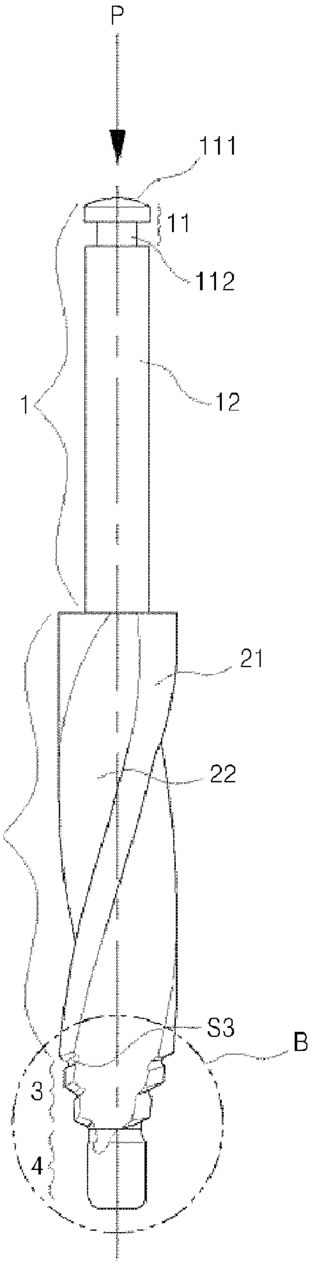


FIG. 7

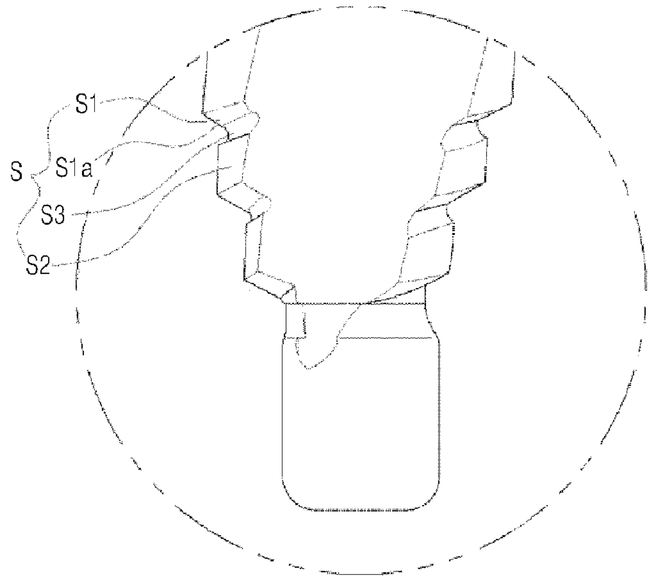


FIG. 8

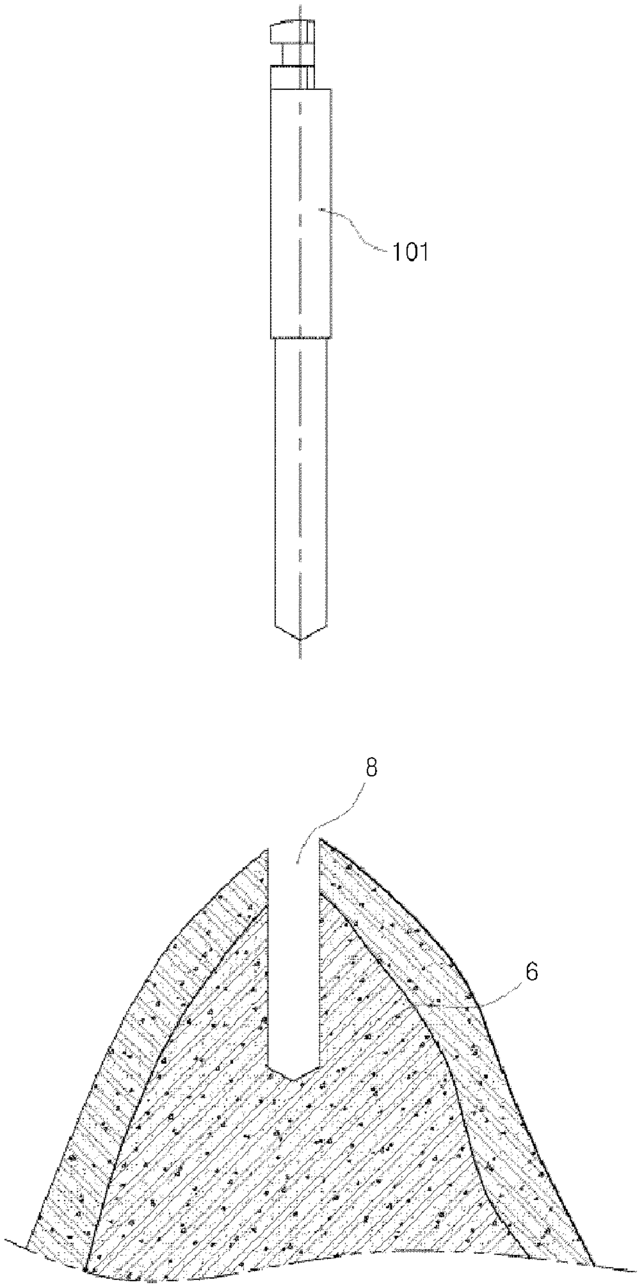
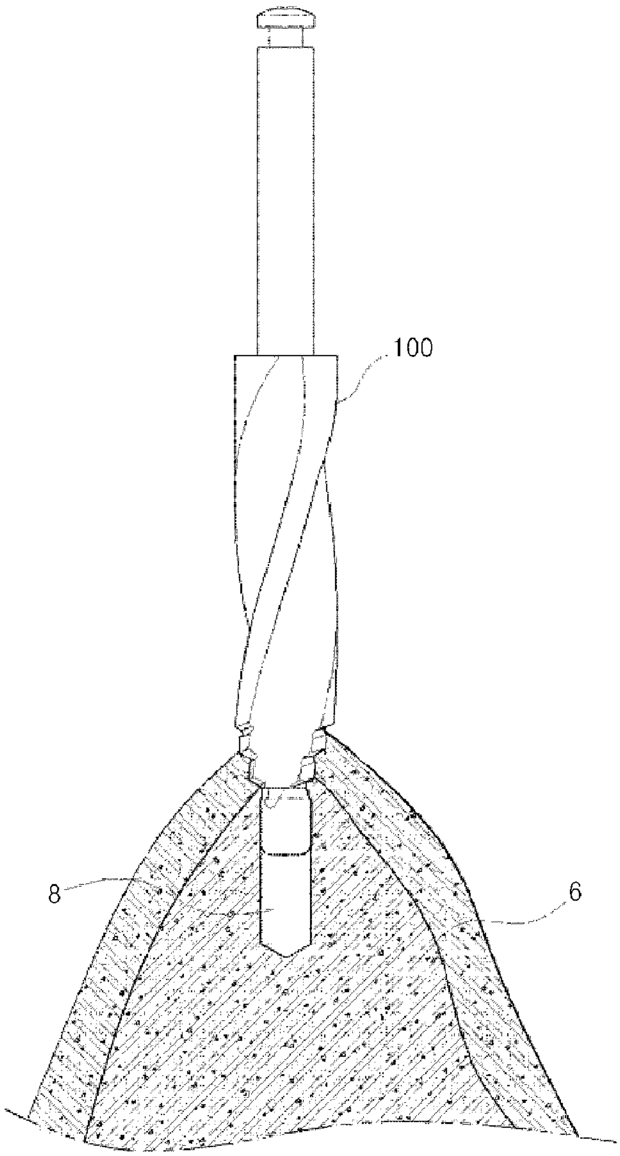


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/006825

A. CLASSIFICATION OF SUBJECT MATTER

A61C 3/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC A61C 3/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

KOREAN UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975
JAPANESE UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS, PAJ "Keyword: dental, implant, drill, multi-step, guide and similar terms"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 06641395 B2 (AJAY KUMAR and STEVEN M. HURSON) 04 November 2003 See abstract and claims	1 - 16
A	JP 06-304187 A (NIKON CORP.) 01 November 1994 See abstract , claims and figures	1 - 16
A	US 06036410 A (EVGENY V. SHUN`KO) 14 March 2000 See the whole document	1 - 16
A	US 05931615 A (JUERGEN WIKER) 03 August 1999 See the whole document	1 - 16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 MARCH 2009 (25.03.2009)	**26 MARCH 2009 (26.03.2009)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/006825

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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JP 06-304187 A	01.11.1994	None	
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US 5931615 A	03.08.1999	None	