

INTERLOCKING BONE FIXATION DEVICE

FIELD OF THE INVENTION

The present invention relates generally to a bone fixation device, and particularly to a highly safe and comfortable interlocking bone fixation device.

BACKGROUND OF THE INVENTION

The bones of a human body in various parts have different shape and complicated structures. Once fractures occur, proper therapy and rehabilitation should be provided according to the bone structures at the affected parts. In the cases when the plaster fixation or other treatments is not applicable, such as simple or comminuted fractures due to car accidents or falls, osteoporosis, or the fracture part is close to or extends to joints, bone plates and bone screws are the most adopted fixation devices for treating fractures.

Thanks to the advancement in technologies, the new-generation bone screws and bone plates are developed continually in recent years. Taking the interlocking bone plate and bone screw for example, there are threads on the screw head and in the fixation hole of the bone plate for locking the screw on the bone plate. Thereby, the fixation for fracture is more secure. On the contrary, in the traditional design, the screw may loose with ease. Accordingly, for comminuted fracture or osteoporosis patients, better fixation is guaranteed. When the fracture occurs in the contact region between articular facets and muscle tissues, because the bone plate will cover the top of the articular facets, the thickness of the bone plate will discomfort the patients if the bone plate is implanted in the patients' body with thinner muscle tissues, such as collarbones or radii. Even worse, the bone plate will affect the patients' activity at the fracture part and further limit the reachable range of the recovered joints. Thereby, how to reduce the thickness of bone plates while maintaining a certain degree of fixation has become the major challenge nowadays.

Please refer to Figure 1A and Figure 1B, in which a general interlocking bone plate is shown. When a screw 1' is locked into a bone plate 2' perpendicularly, the screw column 12' of the screw 1' is locked to the bone below (not shown in the

figures). Besides, an outer thread set 102' on the outer surface of a screw head 10' of the screw 1' interlocks with inner threads 202' of a fixing hole 20' of the bone plate 2'. Thereby, higher fixation is attained. Moreover, as shown in Figures 2A and 2B, in general, no matter simple or comminuted fracture, for increasing fixation or stretching the bones for recovery, the screw 1' should be sloped and fixed to the bones, particularly for the parts requiring thinner bone plates 2' such as collarbones or hands. As the bone plate is thinned for improving comfort, around a half of the outer thread set 102' on the outer surface of the screw head 10' is exposed and unable to interlock with the bone plate 2'. If external force is exerted on the affected part of the patient or the patient has greater movements, the screw 1' may come off the bone plate 2' and endangering the patient. In addition, as shown in Figure 3, compared to the thickness T1 of the bone plate 2' in Figure 2A, the thickness T2 of the bone plate 2' is increased for improving fixation. Nonetheless, the bone plate 2' will discomfort the patient or even affect the patient's activity over the fracture part.

The bone fixation devices according to the prior art has the drawbacks described above; it is necessary to develop a new-generation bone fixation device. Thereby, how to breakthrough and solve the shortcomings of the prior art and enhance the safety, comfort, and economic benefits of bone plates have become the major subject in the field.

Accordingly, the present invention provides an interlocking bone fixation device having more safety, comfort, and economic benefits for solving the problems described above.

SUMMARY

An objective of the present invention is to provide an interlocking bone fixation device, which can enhance the fixation and safety of the interlocking bone fixation device.

Another objective of the present invention is to provide an interlocking bone fixation device, which can enhance comfort.

For achieving the objectives described above, the interlocking bone fixation device according to the present invention comprises a bone plate body. The bone plate

body has at least a fixing hole. The fixing hole has a first inner sidewall and a second inner sidewall in its inner side. The first inner sidewall has first inner threads on its surface; the second inner sidewall has second inner threads on its surface. The number of threads of the first inner threads is fewer than that of the second inner threads. The first inner sidewall further extends upwards and forming a sidewall having third inner threads.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1A shows a cross-sectional view of disassembled bone plate and screw according to the prior art;

Figure 1B shows a cross-sectional view of assembled bone plate and screw according to the prior art;

Figure 2A shows a cross-sectional view of the disassembled bone plate and screw according to the prior art;

Figure 2B shows a cross-sectional view of the assembled bone plate and screw according to the prior art;

Figure 3 shows a cross-sectional view of the bone plate and screw according to the prior art;

Figure 4 shows a cross-sectional view of a portion of the bone plate according to a preferred embodiment of the present invention;

Figure 5 shows a cross-sectional view of a portion of the embodied bone plate according to a preferred embodiment of the present invention;

Figure 6 shows a cross-sectional view of a portion of the embodied bone plate according to another preferred embodiment of the present invention;

Figure 7 shows a three-dimensional view of the bone plate according to another preferred embodiment of the present invention; and

Figure 8 shows a three-dimensional view of the disassembled bone plate according to another preferred embodiment of the present invention.

DETAILED DESCRIPTION

In order to make the structure and characteristics as well as the effectiveness of

the present invention to be further understood and recognized, the detailed description of the present invention is provided as follows along with embodiments and accompanying figures.

Most of the thicker interlocking bone fixation devices according to the prior art have better fixation. Nonetheless, thick bone plates cause patients' discomfort and thereby cannot be applied to the affected parts requiring thinner bone plates, such as collarbones or hands. When thinner bone plates are used and the screws are required to be fixed to the bone plates obliquely, the threads of the screws will be exposed and the fixation will be inferior. Besides, the pointed screws will make the skin of the affected part projected and discomfort the patient; it also affects the appearance of the skin (at the part with thinner muscles). Thereby, the interlocking bone fixation device according to the present invention is aimed at achieving great safety and comfort.

Figure 4 shows a cross-sectional view of a portion of the bone plate according to a preferred embodiment of the present invention. As shown in the figure, the interlocking bone fixation device 1 according to the present invention comprises a bone plate body 10. The bone plate body 10 has at least a fixing hole 102. According to the present embodiment, continuous inner threads are named by first inner threads 1042, second inner threads 1062, and third inner threads 1082, respectively, in the figure. The inner side of the fixing hole 102 has a first inner sidewall 104 and a second inner sidewall 106. The first inner sidewall 104 has the first inner threads 1042 on its surface; the second inner sidewall 106 has the second inner threads 1062 on its surface. The number of the first inner threads 1042 is fewer than that of the second inner threads 1062. The first inner sidewall 104 further extends upwards and forms a sidewall 108 having the third inner threads 1082.

The fixing hole 102 described above can be disposed perpendicularly to the bone plate body 10. Alternatively, the fixing hole 102 can be disposed in the bone plate body 10 obliquely. According to the present embodiment, an oblique fixing hole 102 is used for description. Moreover, the inner sides of the first inner sidewall 104, the second inner sidewall 106, and the sidewall 108 can be inverted cones, cylinders, or other shapes. According to the present embodiment, the fixing hole 102 is an inverted cone for description. Hence, the inner sides of the first inner sidewall 104, the second

inner sidewall 106, and the sidewall 108 contract gradually from the top to the bottom. The diameter D1 of the opening formed by the tops of the second inner sidewall 106 and the sidewall 108 is greater than the diameter D2 of the opening formed by the bottoms of the first and the second inner sidewalls 104, 106. The first and the second inner threads 1042, 1062 can interlock with the screw head of a screw (not shown in the figure). In addition, the fixing hole 102 further comprises the third inner threads 1082 for interlocking with the exposed screw head (comparing to Figure 2B). Thereby, the fixation of the interlocking bone fixation device 1 can be improved; the screw will not come off the bone plate body 10 easily and thus ensuring great safety. Besides, because the structure of the third inner threads 1082 enhances fixation, the structure of the fixing hole 102 can be applied to thinner bone plates, such as the ones for collarbones or hands; the patients will be free from discomfort on their muscles and skins. Moreover, thanks to the sidewall 108, the oblique and pointed screw becomes smoother and thus reducing discomfort on the skin of the affected part. Because of the smoother profile, the influence on the appearance of the skin is also lowered.

The bone fixation device according to the prior art does not include the sidewall 108. Thereby, its fixation is inferior. If external force is exerted or the patient has greater movements, the screw may come off the bone plate body 10 with ease and endangering the patient. The present invention solves the problems described above. The third inner threads 1082 are used for reinforcing the fixation of the bone plate body 10. In particular, thinner bone plates will have better fixation. Furthermore, the sidewall 108 improves the smoothness of the bone plate body 10 and the screws for reducing discomfort due to the protrusion on the skins of the affected parts. Thereby, the present invention provides great safety and comfort.

Please refer to Figure 5, which shows a cross-sectional view of a portion of the embodied bone plate according to a preferred embodiment of the present invention. As shown in the figure, by using the previous embodiment as the basis, the usage of the interlocking bone fixation device 1 is further described. The distances between adjacent threads, the travel distances, the outer diameters, the inner diameters, and the angles of threads for the first, the second, and the third inner threads 1042, 1062, 1082 can be identical, respectively. Besides, a fourth inner sidewall 109 is disposed

annularly and extending from the bottom of the first and second inner sidewalls 104, 106. In addition, the interlocking bone fixation device 1 further comprises at least a screw 12 having a screw head 122 and a screw column 124. The screw head is connected to the screw column 124. The diameter of the screw head 122 corresponds to the diameters of the openings of the first inner sidewall 104, the second inner sidewall 106, and the sidewall 108. In other words, the screw head 122 contracts gradually from the top to the bottom (inverted cone). The screw head 122 has a first thread part 1222 disposed on its outer periphery; the screw column 124 has a second thread part 1242 disposed on its outer periphery.

While using the interlocking bone fixation device 1, because the distances between adjacent threads, the travel distances, the outer diameters, the inner diameters, and the angles of threads for the first, the second, and the third inner threads 1042, 1062, 1082 are identical, respectively; the first thread part 122 can be screwed to the first, the second, and the third inner threads 1042, 1062, 1082. The screw column 124 passes and disposed on the inner side of the fourth inner sidewall 109. By screwing and fixing the portions described above, the screw 12 can interlock with the bone plate body 10. Furthermore, a portion of the screw column 124 can be screwed and fixed to a bone (not shown in the figure). The third inner threads 1082 increase the number of threads for fixing the screw head 122 close to the first inner threads 1042 and hence enhancing fixation. Please further refer to Figure 6. In addition to the situation described above, if the fixing hole 102 is disposed on a thinner edge 100 of the bone plate body 10, in order not to reduce the fixation, most of the first thread part 122 should not be exposed. Thereby, by using the third inner threads 1082 on the inner side of the sidewall 108, the fixation between the first thread part 1222 and the fixing hole 102 is increased.

Figure 7 and Figure 8 show three-dimensional views of the bone plate and of the disassembled bone plate according to another preferred embodiment of the present invention. According to the figures, the overall three-dimensional structure of the fixing hole 102 of the bone plate body 10 is clearly shown. As shown in the figures, the bone plate body 10 has a plurality of fixing holes 102 and a plurality of screws 12. When the number of the first inner threads 1042 of the plurality of fixing holes 102 is

smaller than that of the second inner threads 1062 (referring to Figure 4), by adding the inner side of the sidewall 108, the fixation between the first thread part 1222 and the fixing hole 102 is increased. Preferably, the sidewall 108 and the bone plate body 10 are formed integrally. Alternatively, the sidewall 108 can be disposed additionally to the extension of the first inner sidewall 104 (referring to Figure 4). Both methods can achieve the objective of great safety by improving fixation. Besides, the sidewall 108 can be crescent-moon shaped for covering the screw 12. Thereby, the oblique screw points become smoother because of the sidewall 108. Hence, the patient will feel comfortable on his skin of the affected portion due to the smoother bone plate body 10.

While using the thinner bone plate body 10, the interlocking bone fixation device 1 according to the present invention reinforces the fixation via the sidewall 108 for preventing the screw 12 from coming off the bone plate body 10 and thus having greater safety. In addition, thinner and smoother bone plate body 10 avoids discomfort of patients on their muscles and skins. Hence, more activity and comfort are achieved.

Accordingly, the present invention conforms to the legal requirements owing to its novelty, nonobviousness, and utility. However, the foregoing description is only embodiments of the present invention, not used to limit the scope and range of the present invention. Those equivalent changes or modifications made according to the shape, structure, feature, or spirit described in the claims of the present invention are included in the appended claims of the present invention.

CLAIMS

1. An interlocking bone fixation device, comprising:
a bone plate body, having at least a fixing hole, said fixing hole having a first inner sidewall and a second inner sidewall on its inner side, said first inner sidewall having first inner threads on its surface, said second inner sidewall having second inner threads on its surface, the number of said first inner threads smaller than the number of said second inner threads, said first inner sidewall further extending upwards and having a sidewall, and said sidewall having third inner thread on its inner side.
2. The interlocking bone fixation device of claim 1, wherein the diameter of the opening formed by the tops of said first inner sidewall, said second inner sidewall, and said sidewall are greater than the diameter of the opening formed by the bottoms of said first inner sidewall and said second inner sidewall.
3. The interlocking bone fixation device of claim 1, and further comprising at least a screw, having a screw head and a screw column, said screw head connected to said screw column, said screw head having a first thread part on its outer periphery, said first thread part screwed to said first inner threads, said second inner threads, and said third inner threads.
4. The interlocking bone fixation device of claim 3, wherein said screw column has a second thread part on its outer periphery.
5. The interlocking bone fixation device of claim 3, wherein said screw head is inverted-cone shaped.
6. The interlocking bone fixation device of claim 1, wherein the distances between adjacent threads, the travel distances, the outer diameters, the inner diameters, and the angles of threads for said first inner threads, said second inner threads, and said third inner threads are identical, respectively.

7. The interlocking bone fixation device of claim 1, wherein said sidewall is crescent-moon shaped.