

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro



(43) Internationales Veröffentlichungsdatum
20. Januar 2005 (20.01.2005)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2005/004728 A1

(51) Internationale Patentklassifikation: A61B 17/17

(72) Erfinder; und

(21) Internationales Aktenzeichen: PCT/CH2003/000467

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(22) Internationales Anmeldedatum:
14. Juli 2003 (14.07.2003)

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(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

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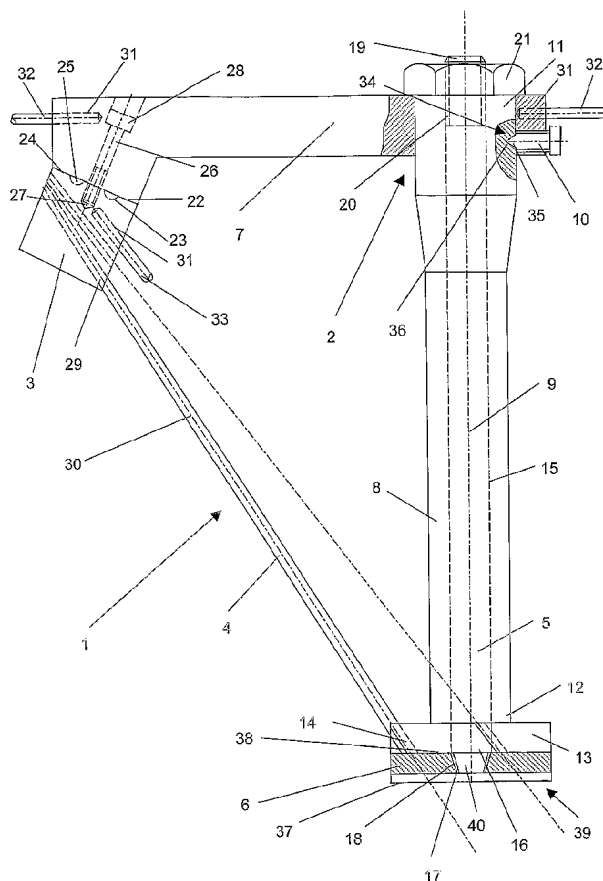
(81) Bestimmungsstaaten (national): AE, AG, AL, AM, AI, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PI, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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[Fortsetzung auf der nächsten Seite]

(54) Title: AIMING DEVICE

(54) Bezeichnung: ZIELVORRICHTUNG



(57) Abstract: The invention relates to an aiming device (1) which is used to guide and place longitudinal bone fixing means (4) in a predetermined direction with respect to a bone fixing device (6). The aiming device (1) comprises securing means (5) which can be detachably secured to a bone fixing device (39). The aiming device comprises A) a first centering part (13) which can be placed on the bone fixing device (39), and a second centering part (3) which is arranged at a distance from the first centering part; B) both of the centering parts (13;3) comprise at least one pair of guiding elements (14, 29) which are arranged in a coaxial manner in relation to each other.

(57) Zusammenfassung: Zielvorrichtung (1) zum Führen und Setzen von longitudinalen Knochenfixationsmitteln (4) in einer vorbestimmten Richtung relativ zu einer Knochenfixationsvorrichtung (6), wobei die Zielvorrichtung (1) mit Befestigungsmitteln (5) zur lösbaren Befestigung an einer Knochenfixationsvorrichtung (39) versehen ist, wobei die Zielvorrichtung A) ein erstes, zur Anlage an einer Knochenfixationsvorrichtung (39) geeignetes Zentrierteil (13), und ein davon abstandenes zweites Zentrierteil (3) umfasst, wobei B) die beiden Zentrierteile (13;3) mindestens ein Paar zueinander koaxiale Führungen (14;29) aufweisen.

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(84) **Bestimmungsstaaten** (*regional*): ARIPO Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— mit internationalem Recherchenbericht

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

1963/AU

Re: International Patent Application No. PCT/CH03/000467
“Aiming device”
in the name of Synthes AG Chur
(English translation of PCT Application)

I Dr. KAISER Peter
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do hereby certify that I am conversant with the English and German languages, and am a competent translator thereof, and I further certify that to the best of my knowledge and belief the attached document is a true and correct translation made by me of the documents in the German language attached hereto.

Signature of translator: *P. Kaiser*

Dated *9. 1. 2006*

English translation of the International Patent Application No. PCT/CH2003/000467 "Aiming device" in the name of Synthes AG Chur

TARGETING DEVICE

The invention relates to a targeting device of the introductory portion of claim 1.

In the case of bone fixation devices, particularly bone plates, the problem arises of fastening these devices by means of suitable, longitudinal bone fixation means, such as bone screws, bone wires, bone pins or Kirschner wires, to the bone fragments, so that the longitudinal bone fixation means have a particular direction with respect to the bone fixation device, especially, a specific angle to the bone plate. This problem arises principally in the case of bone plates, which consist of a plastic and do not yet have any plate boreholes, for example, the bone plate of WO 01/12081.

A device with a centering sleeve for setting the bone fixation means at a plastic plate is known from the DE-U 200 19 026. This known device comprises a targeting bracket, at which a bone plate can be attached by fastening means, and a guiding part, which can be shifted at the targeting bracket and shifted and rotated relative to the bone plate. The single guiding part is tubular in construction and serves to center and guide surgical instruments and/or implants. The tubular configuration of the guiding part permits only one bone fixation means to be accommodated. In the event that, for example, several Kirschner wires are to be set at one bone plate, the guiding part must be shifted and aligned once again with respect to the targeting bracket for each Kirschner wire, which is to be set. This results in the expenditure of much time for setting, for example, four Kirschner wires.

The invention is to provide a remedy here. It is an object of the invention to create a targeting device, which, on the one hand, permits drilling instruments or drill guide sleeves to be positioned in a previously determined direction with respect to the bone and/or, on the other, permits the surgeon to bring longitudinal bone-fixation means (Kirschner wires) into the bone in a previously determined direction, preferably in a direction, in which they diverge from one another.

Pursuant to the invention, this objective is accomplished by a targeting device, which has the distinguishing features of claim 1.

The advantages, achieved by the invention, are to be seen essentially therein that, due to the inventive targeting device:

- the longitudinal bone fixation means can be positioned precisely by the surgeon without previously having to implant a Kirschner wire in the bone;
- the position of the Kirschner wires is predetermined clearly by the surgeon without previously having to implant a Kirschner wire in the bone;
- the position of the Kirschner wires is predetermined clearly by the anatomy of the humerus and the position selected underneath the axillary nerve and becomes reproducible due to the targeting device (this is not the case with a targeting device, which permits the user to select the positioning freely);
- the bone fixation element can be implanted as well as explanted.

In a preferred embodiment, the two centering parts have at least two pairs of mutually coaxial guides. Each pair of guides comprises a guide in the first centering part, which is disposed at the front end of the targeting bracket and can be connected with the bone fixation device, and

a guide in the second centering part, which is disposed at the handle of the targeting bracket. Preferably, the pairs of guides are constructed so that the axes of the different pairs of guides diverge. By these means, the advantage can be achieved that several bone fixation means (Kirschner wires) can be implanted without having to adapt and adjust the targeting device once again to the directions of the individual Kirschner wires. Preferably, the bone fixation device is constructed as a bone plate.

In a different embodiment, the two centering parts and the targeting bracket are constructed so that the two centering parts at the targeting device are exchangeable. By these means, the further advantage can be obtained that the guiding pairs or longitudinal bone fixation agents can be set at angles determined in advance, for example, with respect to a bone plate, by one set of centering pairs with different orientations.

In yet another embodiment, the guides are fixed with respect to the centering parts, so that undesirable shifting of the guides relative to the centering parts is not possible.

In a further embodiment, the centering parts can be connected with the targeting device only in a position defined with respect to the targeting device. On the one hand, errors in the installation of the targeting device can be excluded by this configuration and, on the other, the positions of the two centering parts can be found easily, as a result of which the installation of the targeting device is simplified appreciably.

In yet another embodiment, the targeting device comprises a two-part targeting bracket with a sleeve, suitable for accommodating the fastening means between the targeting bracket and the bone fixation means and a handle part disposed transversely to the central axis. Preferably, the first centering part is connected firmly with this sleeve, the

sleeve being secured relative to the handle part against twisting about the central axis of the sleeve.

In a different embodiment, the guides in the second centering part, disposed at the handle part of the targeting bracket, are constructed as boreholes, so that the drill guide sleeves or bone fixation means, which can be introduced into the boreholes, are enclosed on the whole of the periphery and cannot be shifted laterally. The guides in the first centering part, which can be fastening, for example, to a bone plate, preferably are constructed as centering grooves, which are coaxial with the axes of the boreholes.

In yet another embodiment, the targeting device comprises one or more boreholes for accommodating longitudinal targeting aids, which preferably are constructed in the form of aiming stakes and make it easier for the surgeon to align the targeting device at the body of the patient.

The bone plates used preferably are made from PEEK, an implantable plastic with very good mechanical properties. The plate is provided with a central borehole, which is used for temporarily fixing the targeting instrument at the plate. However, due to the conical internal thread (which fits the head locking screws) in the borehole, a corresponding bone screw can also be fixed therein after the Kirschner wires have been positively located and the targeting instrument removed, in order to anchor the bone plate additionally with the bones.

Further advantageous developments of the invention are characterized in the dependent claims.

The invention is explained in even greater detail in the following by means of the partly diagrammatic representation of an example. In the drawing

Fig. 1 shows longitudinal sections through an embodiment of the inventive targeting device.

An example of the inventive targeting device 1 is shown in Fig. 1. It comprises a two-part targeting bracket 2, a first and a second centering part 13; 3 for accommodating and guiding bone fixation agents 4, such as Kirschner wires and a fastening means 5, which can be fastened at a bone plate 6.

The two-part targeting bracket 2 consists of a longitudinal, hollow cylindrical sleeve 8 with a central axis 9 and a handle part 7, which can be fastened at the rear end 11 of the sleeve 8 by means of a screw 10 and is disposed transversely to the central axis 9. The first centering part 13 is mounted at the front end 12 of the sleeve 8 and comprises guides 14, which are disposed skew with respect to the central axis 9 and are in the form of centering grooves for the bone fixation means 4, so that the bone fixation means 4, before they penetrate into the bone plate 6, are passed through the guides 14 of the first centering part 13. The central borehole 15 of the sleeve 8 also passes through the first centering part 13, so that the fastening agent 5, which is also cylindrical, can be passed through the central borehole 15 coaxially with the central axis 9. The sleeve 8 is locked in place at the handle part 7 so that it cannot rotate about the central axis 9. Security against rotation 34 is realized by the screw, which can be screwed into the handle part 7 and the tip 35 of which can be taken up in a depression 36 at the sleeve 8, so that, after the screw 10 is locked in place, the sleeve 8, together with the centering part 13, is immobilized in the handle part 7.

The tip 16 of the fastening means 5 is provided with an external conical thread 17, which can be screwed into a complementary internal thread 18 in the borehole 40 provided in the bone plate 6. By means of a nut 21, which can be screwed over an external thread 20 provided at the rear end 19 of the fastening means 5 and rests on the handle part 7, the fastening means 5, together with the bone plate 6, is fastened to the targeting bracket 2.

The second centering part 3 is constructed as a rectangular block and provided at its side surfaces 22, which are directed toward the targeting bracket 2, with three spherical depressions 21, whereas the targeting bracket 2, at its side surface 24 directed against the second centering part 3, has three spherical elevations 25, which are complementary to the depressions 23. The second centering part 3 is secured against twisting relative to the targeting bracket 2 by the elevations 25, which engaged the depressions 23. The second centering part 3 is fastened by means of a screw 26, which can be screwed into a corresponding borehole 27 in the second centering part 3 having an internal thread and the screw head 28 of which lies in contact with the handle part 7. Furthermore, the second centering part 3 comprises four guides 29 in the form of boreholes, which pass through the second centering part 3 transversely to the central axis 9 and the axes 30 of which extend transversely to the central axis 9 and are skew relative to one another. The guides 29 are disposed so that their axes 30 are aligned with the guides 14 in the first centering part 13, which are constructed as centering grooves, so that the bone fixation agents 4, when pushed through the guides 29, are guided in the guides 29, which are disposed remote from the bone plate 6, as well as in the guides 14, which are located close to the bone plate 6.

Furthermore, boreholes 31 for accommodating targeting aids 32; 33 in the form of aiming stakes are mounted at the centering part 3 as

well as at the handle part 7. The boreholes 31 are aligned so that the first targeting aid 32, which can be mounted at the handle part 7, is perpendicular to the central axis 9, while the second targeting aid 33, which can be mounted at the centering part 3, is aligned in the direction of the line connecting the centering part 3 and the centering part 13. The targeting aids 32, 33 enable the surgeon to align the targeting device 1 with respect to the bone that is to be treated.

The use and function of the inventive targeting device is described in greater detail below by means of the surgical method for the proximal humerus:

A) Implantation:

1. To begin with, the fractured, proximal humerus is repositioned roughly over the soft parts.
2. 2-3 cm skin incision underneath the axillary nerve at the proximal humerus;
3. Prepare the way bluntly with the index finger up to the shaft.
4. Guide the targeting device with the mounted plate up to the shaft and position it appropriately with the help of the external targeting wires.
5. Anchor the targeting device in the specified position at the shaft of the humerus with a 2.5 mm K wire.
6. Introduce the drill guide bushing into the marked borehole in the targeting instrument and advance up to the plate with a movement, oscillating circularly about the longitudinal axis.
7. Introduce 2.0 mm spiral drill. Before the drilling process, check once more the alignment of the targeting instrument along the longitudinal axis and, if necessary, correct. If the position along the longitudinal axis and the height are correct, the cortex in the shaft region is bored.

8. Remove 2.0 mm drill and introduce first 2.5 mm K wire up to the fracture line. Leave drill guide sleeve in the targeting instrument and use the second drill guide sleeve for the next Kirschner wire.
9. Use same procedure (pre-bore and introduce the K wire up to the fracture line) for the remaining three K wires.
10. Definitive reposition of the fracture and subsequent threading of Kirschner wires into the end position selected by the surgeon.
11. Remove targeting device from the plate.
12. Sever the protruding ends of the Kirschner wires with the trimming device as close as possible to the plate surface.
13. The ends of the Kirschner wires now protrude approximately 8-10 mm from the plate surface.
14. End of osteosynthesis.

B) Explantation

1. 2-3 cm skin incision below the axillary nerve at the proximal humerus.
2. Prepare the way bluntly with the index finger up to the shaft.
3. Guide the targeting device up to the plate and fix once more to the plate with the fastening screw.
4. Introduce the extraction bolt into the targeting device up to the end of the Kirschner wire.
5. Rotate extraction bolt counterclockwise and remove the Kirschner wire manually. Follow same procedure for the remaining Kirschner wires.
6. Remove the targeting device.
7. End of the explantation.

Claims

1. Targeting device (1) for guiding drilling instruments, drill guide sleeves and/or for guiding and setting longitudinal bone fixation means (4) in a predetermined direction relative to a bone fixation device (39), the targeting device (1) being provided with fastening means (5) for detachably fastening to a bone fixation device (39),

characterized in that

the targeting device (1) comprises

A) a first centering part (13), suitable for lying in contact with a bone fixation device (39) and, at a distance therefrom, a second centering part (3),

B) the two centering parts (13; 3) having at least one pair of guides (14; 29), which are coaxial with one another.

2. The targeting device (1) of claim 1, characterized in that the bone fixation device (39) is a bone plate (6).

3. The targeting device (1) of claims 1 or 2, characterized in that the two centering parts (13; 3) have at least two pairs of mutually coaxial guides (14; 29), the axes (30) of the guide pairs diverging.

4. The targeting device of one of the claims 1 to 3, characterized in that the two centering parts (13; 3) at the targeting device (1) are exchangeable.

5. The targeting device (1) of one of the claims 1 to 4, characterized in that the guides (14; 29) are fixed with respect to the centering parts (13; 3).

6. The targeting device (1) of one of the claims 1 to 5, characterized in that the centering parts (13; 3) can be connected with the

targeting device (1) only in one position defined with respect to the targeting device (1).

7. The targeting device (1) of one of the claims 1 to 6, characterized in that it comprises a two-part targeting bracket (2) with a sleeve (8), suitable for accommodating the fastening means (5) and having a central axis (9), and a handle part (7), disposed transversely to the central axis (9).

8. The targeting device (1) of claim 7, characterized and that the first centering part (13) is connected firmly with the sleeve (8) and that the sleeve (8) is secured against twisting about the central axis (9) relative to the handle part (7).

9. The targeting device (1) of one of the claims 1 to 6, characterized in that the guides (29) in the second centering part (3) are boreholes with axes (30).

10. The targeting device (1) of claim 9, characterized in that the guides (14) in the first centering part (13) are centering grooves coaxial with the axes (30).

11. The targeting device (1) of one of the claims 1 to 11, characterized in that it has one or more boreholes (31) for accommodating longitudinal targeting aids (32; 33), preferably in the form of aiming stakes.

