CLAIMS

1. A method of manufacturing a bone cutting assist device (1) used for cutting a bone (B) deformed into an abnormal condition, the method comprising:

acquiring three-dimensional data of a bone (B) to be treated and generating a three-dimensional bone model (BM) representing the bone (B) to be treated, on a basis of the acquired three-dimensional data:

generating bone piece models (BPM1, BPM2) divided by cutting the bone model (BM) along a cutting cross-section for correction defined with respect to the bone model (BM), the bone piece models (BPM1, BPM2) being movable or rotatable to a target correction position approximate to a target bone model (BM) representing a correction goal of the bone (B) to be treated;

calculating a position of a first rod model (LM1) representing a shape of a first rod (31) to be used for securing that the bone cutting assist device (1) is located at a planned position on the bone (B) to be treated, the first rod model (LM1) being attached to a feature point (V) of the bone model (BM) determined as a position where the first rod model (LM1) is to be thrust;

calculating, on a basis of a position of a second rod model (LM2) attached to each of the bone piece models (BPM1, BPM2) assumed to be located at the target correction position, a position of the second rod model (LM2) on an assumption that the bone piece models (BPM1, BPM2) are located at a position corresponding to the bone model (BM);

generating a bone cutting assist device model (M) representing a bone cutting assist device (1) including a fitting surface (12) to be fitted to a surface of the bone model (BM), a cutting slit (13) formed at a position corresponding to the cutting cross-section, to guide a cutting jig toward the cutting cross-section, a first guide hole (14) formed at the calculated position of the first rod model (LM1), so as to allow the first rod model (LM1) to be inserted, and a second guide hole (15) formed at the calculated position of the second rod model (LM2), so as to allow the second rod model (LM2) to be inserted;

outputting three-dimensional manufacturing data representing the generated bone cutting assist device model (M); and

manufacturing the bone cutting assist device (1) according to the outputted three-dimensional manufacturing data.

2. The method of manufacturing a bone cutting assist device (1) according to claim 1,

wherein the calculating of the position of the second rod model (LM2) includes calculating, as the position of the second rod model (LM2), the same position as the position to attach the first rod model (LM1), and

the generating of the bone cutting assist device model (M) includes generating a bone cutting assist device model (M) representing a bone cutting assist device (1) in which one of the second guide holes (15) is also utilized as the first guide hole (14), according to the calculated position to attach the second rod model (LM2).

3. The method of manufacturing a bone cutting assist device (1) according to claim 1 or 2, further comprising:

generating a block model representing a block (2) including insertion holes for inserting the second rod models (LM2), the insertion holes each being formed at a position corresponding to the second rod model (LM2) attached to one of the bone piece models (BPM1, BPM2) located at the target correction position;

outputting three-dimensional data for manufacturing the block (2), the data representing the block model generated in the generating of the block model; and

manufacturing the block (2) according to the outputted three-dimensional data for manufacturing the block (2).

4. The method of manufacturing a bone cutting assist device (1) according to claim 3,

wherein the generating of the block model includes generating a block model representing a block (2) including insertion holes for respectively inserting the first and second rod models (LM1, LM2), the insertion holes being located at positions corresponding to the first rod model (LM1) and the second rod models (LM2) attached to the bone piece models (BPM1, BPM2) located at the target correction position,

the outputting of the block manufacturing data includes outputting three-dimensional data for manufacturing the block (2) representing the block model generated in the generating of the block model, and

the manufacturing of the block (2) includes manufacturing the block (2) according to the three-dimensional data for manufacturing the block (2) outputted in the outputting of the block manufacturing data.

5. A program for manufacturing a bone cutting assist device (1), the program comprising causing a computer to act as:

a bone model generation unit (102) that acquires three-dimensional data of a bone (B) to be treated and generates a three-dimensional bone model (BM) representing the bone (B) to be treated, on a basis of the acquired three-dimensional data;

a bone piece model generation unit (104) that generates bone piece models (BPM1, BPM2) divided by cutting the bone model (BM) along a cutting cross-section for correction defined with respect to the bone model (BM), the bone piece models (BPM1, BPM2) being movable or rotatable to a target correction position approximate to a target bone model (BM) representing a correction goal of the bone (B) to be treated;

a first rod model position calculation unit (103) that calculates a position of a first rod model (LM1) representing a shape of a first rod (31) to be used for securing that the bone cutting assist device (1) is located at a planned position on the bone (B) to be treated, the first rod model (LM1) being attached to a feature point (V) of the bone model (BM) determined as a position where the first rod model (LM1) is to be thrust;

a second rod model position calculation unit (106) that calculates, on a basis of a position of a second rod model (LM2) attached to each of the bone piece models (BPM1, BPM2) assumed to be located at the target correction position, a position of the second rod model (LM2) on an assumption that the bone piece models (BPM1, BPM2) are located at a position corresponding to the bone model (BM);

a bone cutting assist device model generation unit (107) that generates a bone cutting assist device model (M) representing a bone cutting assist device (1) including a fitting surface (12) to be fitted to a surface of the bone model (BM), a cutting slit (13) formed at a position corresponding to the cutting cross-section, to guide a cutting jig toward the cutting cross-section, a first guide hole (14) formed at the calculated position of the first rod model (LM1), so as to allow the first rod model (LM1) to be inserted, and a second guide hole (15) formed at the calculated position of the second rod model (LM2), so as to allow the second rod model (LM2) to be inserted; and

a manufacturing data output unit (108) that outputs three-dimensional manufacturing data representing the generated bone cutting assist device model (M).

6. The program for manufacturing a bone cutting assist device (1) according to claim 5, comprising causing the computer to further act such that:

the second rod model position calculation unit (106) calculates, as the position of the second rod model (LM2), the same position as the position to attach the first rod model (LM1), and

the bone cutting assist device model generation unit (107) generates a bone cutting assist device model (M) representing a bone cutting assist device (1) in which one of the second guide holes (15) is also utilized as the first guide hole (14), according to the calculated position to attach the second rod model (LM2).

7. The program for manufacturing a bone cutting assist device (1) according to claim 5 or 6, comprising causing the computer to further act as:

a block model generation unit (109) that generates a block model representing a block (2) including insertion holes for inserting the second rod models (LM2), the insertion holes each being formed at a position corresponding to the second rod model (LM2) attached to one of the bone piece models (BPM1, BPM2) located at the target correction position; and

a block manufacturing data output unit (120) that outputs three-dimensional data for manufacturing the block (2), the data representing the block model generated by the block model generation unit (109).

8. The program for manufacturing a bone cutting assist device (1) according to claim 7, comprising causing the computer to further act such that:

the block model generation unit (109) generates a block model representing a block (2) including insertion holes for respectively inserting the first and second rod models (LM1, LM2), the insertion holes being located at positions corresponding to the first rod model (LM1) and the second rod model (LM2) attached to the bone piece models (BPM1, BPM2) located at the target correction position, and

the block manufacturing data output unit (120) outputs three-dimensional data for manufacturing the block (2) representing the block model generated by the block model generation unit (109).

9. A bone cutting assist device (1) used for cutting and dividing a bone (B) deformed into an abnormal condition, the bone cutting assist device (1) comprising:

a cutting slit (13) formed at a position corresponding to a cutting cross-section along which the bone (B) is to be cut, and configured to guide a

cutting jig toward the cutting cross-section when the bone cutting assist device (1) is in contact with a surface of the bone (B);

a first guide hole (14) that guides a first rod (31) to be inserted into the bone (B) to secure that the bone cutting assist device (1) is located at a planned position on the bone (B) to be treated, to a feature point (V) of the bone (B) determined as a position where the first rod model (LM1) is to be thrust, when the bone cutting assist device (1) is in contact with the surface of the bone (B); and

a second guide hole (15) that guides a second rod (32) to be inserted into the bone (B) to the bone (B), when the bone cutting assist device (1) is in contact with the surface of the bone (B).

10. The bone cutting assist device (1) according to claim 9, further comprising:

a fitting surface (12) formed at a position to oppose the bone (B) to be corrected, so as to fit to a surface of the bone (B);

wherein the ~~a~~ cutting slit (13) is formed at a position corresponding to the cutting cross-section, when the fitting surface (12) is fitted to the surface of the bone (B),

the first guide hole (14) guides the first rod (31) to the feature point (V) when the fitting surface (12) is fitted to the surface of the bone (B); and

the second guide hole (15) guides, when the fitting surface (12) is fitted to the surface of the bone (B), the second rod (32) to be inserted into the bone (B), such that the second rods (32) thrust into the bone pieces (BP1, BP2) assume a predetermined positional relationship therebetween, after the bone pieces (BP1, BP2) divided along the cutting cross-section are corrected to a positional relationship in a normal condition.

CLAIMS

1. A method of manufacturing a bone cutting assist device (1) used for cutting a bone (B) deformed into an abnormal condition, the method comprising:

acquiring three-dimensional data of a bone (B) to be treated and generating a three-dimensional bone model (BM) representing the bone (B) to be treated, on a basis of the acquired three-dimensional data:

generating bone piece models (BPM1, BPM2) divided by cutting the bone model (BM) along a cutting cross-section for correction defined with respect to the bone model (BM), the bone piece models (BPM1, BPM2) being movable or rotatable to a target correction position approximate to a target bone model (BM) representing a correction goal of the bone (B) to be treated;

calculating a position of a first rod model (LM1) representing a shape of a first rod (31) to be used for securing that the bone cutting assist device (1) is located at a planned position on the bone (B) to be treated, the first rod model (LM1) being attached to a feature point (V) of the bone model (BM) determined as a position where the first rod model (LM1) is to be thrust;

calculating, on a basis of a position of a second rod model (LM2) attached to each of the bone piece models (BPM1, BPM2) assumed to be located at the target correction position, a position of the second rod model (LM2) on an assumption that the bone piece models (BPM1, BPM2) are located at a position corresponding to the bone model (BM);

generating a bone cutting assist device model (M) representing a bone cutting assist device (1) including a fitting surface (12) to be fitted to a surface of the bone model (BM), a cutting slit (13) formed at a position corresponding to the cutting cross-section, to guide a cutting jig toward the cutting cross-section, a first guide hole (14) formed at the calculated position of the first rod model (LM1), so as to allow the first rod model (LM1) to be inserted, and a second guide hole (15) formed at the calculated position of the second rod model (LM2), so as to allow the second rod model (LM2) to be inserted;

outputting three-dimensional manufacturing data representing the generated bone cutting assist device model (M); and

manufacturing the bone cutting assist device (1) according to the outputted three-dimensional manufacturing data.

2. The method of manufacturing a bone cutting assist device (1) according to claim 1,

wherein the second guide hole comprises a plurality of second guide holes,

the calculating of the position of the second rod model (LM2) includes calculating, as the position of the second rod model (LM2), the same position as the position to attach the first rod model (LM1), and

the generating of the bone cutting assist device model (M) includes generating a bone cutting assist device model (M) representing a bone cutting assist device (1) in which one of the second guide hole (15) is also utilized as the first guide hole (14), according to the calculated position to attach the second rod model (LM2).

3. The method of manufacturing a bone cutting assist device (1) according to claim 1 or 2, further comprising:

generating a block model representing a block (2) including insertion holes for inserting the second rod models (LM2), the insertion holes each being formed at a position corresponding to the second rod model (LM2) attached to one of the bone piece models (BPM1, BPM2) located at the target correction position;

outputting three-dimensional data for manufacturing the block (2), the data representing the block model generated in the generating of the block model; and

manufacturing the block (2) according to the outputted three-dimensional data for manufacturing the block (2).

4. The method of manufacturing a bone cutting assist device (1) according to claim 3,

wherein the generating of the block model includes generating a block model representing a block (2) including insertion holes for respectively inserting the first and second rod models (LM1, LM2), the insertion holes being located at positions corresponding to the first rod model (LM1) and the second rod models (LM2) attached to the bone piece models (BPM1, BPM2) located at the target correction position,

the outputting of the block manufacturing data includes outputting three-dimensional data for manufacturing the block (2) representing the block model generated in the generating of the block model, and

the manufacturing of the block (2) includes manufacturing the block (2) according to the three-dimensional data for manufacturing the block (2) outputted in the outputting of the block manufacturing data.

5. A program for manufacturing a bone cutting assist device (1), the program comprising causing a computer to act as:

a bone model generation unit (102) that acquires three-dimensional data of a bone (B) to be treated and generates a three-dimensional bone model (BM) representing the bone (B) to be treated, on a basis of the acquired three-dimensional data;

a bone piece model generation unit (104) that generates bone piece models (BPM1, BPM2) divided by cutting the bone model (BM) along a cutting cross-section for correction defined with respect to the bone model (BM), the bone piece models (BPM1, BPM2) being movable or rotatable to a target correction position approximate to a target bone model (BM) representing a correction goal of the bone (B) to be treated;

a first rod model position calculation unit (103) that calculates a position of a first rod model (LM1) representing a shape of a first rod (31) to be used for securing that the bone cutting assist device (1) is located at a planned position on the bone (B) to be treated, the first rod model (LM1) being attached to a feature point (V) of the bone model (BM) determined as a position where the first rod model (LM1) is to be thrust;

a second rod model position calculation unit (106) that calculates, on a basis of a position of a second rod model (LM2) attached to each of the bone piece models (BPM1, BPM2) assumed to be located at the target correction position, a position of the second rod model (LM2) on an assumption that the bone piece models (BPM1, BPM2) are located at a position corresponding to the bone model (BM);

a bone cutting assist device model generation unit (107) that generates a bone cutting assist device model (M) representing a bone cutting assist device (1) including a fitting surface (12) to be fitted to a surface of the bone model (BM), a cutting slit (13) formed at a position corresponding to the cutting cross-section, to guide a cutting jig toward the cutting cross-section, a first guide hole (14) formed at the calculated position of the first rod model (LM1), so as to allow the first rod model (LM1) to be inserted, and a second guide hole (15) formed at the calculated position of the second rod model (LM2), so as to allow the second rod model (LM2) to be inserted; and

a manufacturing data output unit (108) that outputs three-dimensional manufacturing data representing the generated bone cutting assist device model (M).

6. The program for manufacturing a bone cutting assist device (1) according to claim 5,

wherein the second guide hole comprises a plurality of second guide holes, and

the program comprises causing the computer to further act such that:

the second rod model position calculation unit (106) calculates, as the position of the second rod model (LM2), the same position as the position to attach the first rod model (LM1), and

the bone cutting assist device model generation unit (107) generates a bone cutting assist device model (M) representing a bone cutting assist device (1) in which one of the second guide hole (15) is also utilized as the first guide hole (14), according to the calculated position to attach the second rod model (LM2).

7. The program for manufacturing a bone cutting assist device (1) according to claim 5 or 6, comprising causing the computer to further act as:

a block model generation unit (109) that generates a block model representing a block (2) including insertion holes for inserting the second rod models (LM2), the insertion holes each being formed at a position corresponding to the second rod model (LM2) attached to one of the bone piece models (BPM1, BPM2) located at the target correction position; and

a block manufacturing data output unit (120) that outputs three-dimensional data for manufacturing the block (2), the data representing the block model generated by the block model generation unit (109).

8. The program for manufacturing a bone cutting assist device (1) according to claim 7, comprising causing the computer to further act such that:

the block model generation unit (109) generates a block model representing a block (2) including insertion holes for respectively inserting the first and second rod models (LM1, LM2), the insertion holes being located at positions corresponding to the first rod model (LM1) and the second rod model (LM2) attached to the bone piece models (BPM1, BPM2) located at the target correction position, and

the block manufacturing data output unit (120) outputs three-dimensional data for manufacturing the block (2) representing the block model generated by the block model generation unit (109).

9. A bone cutting assist device (1) used for cutting and dividing a bone (B) deformed into an abnormal condition, the bone cutting assist device (1) comprising:

a cutting slit (13) formed at a position corresponding to a cutting cross-section along which the bone (B) is to be cut, and configured to guide a cutting jig toward the cutting cross-section when the bone cutting assist device (1) is in contact with a surface of the bone (B);

a first guide hole (14) that guides a first rod (31) to be inserted into the bone (B) to secure that the bone cutting assist device (1) is located at a planned position on the bone (B) to be treated, to a feature point (V) of the bone (B) determined as a position where the first rod model (LM1) is to be thrust, when the bone cutting assist device (1) is in contact with the surface of the bone (B); and

a second guide hole (15) that guides a second rod (32) to be inserted into the bone (B) to the bone (B), when the bone cutting assist device (1) is in contact with the surface of the bone (B).

10. The bone cutting assist device (1) according to claim 9, further comprising:

a fitting surface (12) formed at a position to oppose the bone (B) to be corrected, so as to fit to a surface of the bone (B);

wherein the ~~a~~ cutting slit (13) is formed at a position corresponding to the cutting cross-section, when the fitting surface (12) is fitted to the surface of the bone (B),

the first guide hole (14) guides the first rod (31) to the feature point (V) when the fitting surface (12) is fitted to the surface of the bone (B); and

the second guide hole (15) guides, when the fitting surface (12) is fitted to the surface of the bone (B), the second rod (32) to be inserted into the bone (B), such that the second rods (32) thrust into the bone pieces (BP1, BP2) assume a predetermined positional relationship therebetween, after the bone pieces (BP1, BP2) divided along the cutting cross-section are corrected to a positional relationship in a normal condition.