Claims

1. A device for preparing a knee joint for a prosthesis in a patient undergoing total knee arthroplasty (TKA) surgery for any knee implant (prosthesis) in a universal and open platform fashion, this device consists of two parts: a femoral part and a tibial both are designed in the form of cutting blocks that have locating probes, slits and a surface for bone cutting, guide for adjusting rotation and holes for pin fixation. The tibial part has a hole for the creation of the stem and a slit for the creation of the keel.

2. A method of planning and complete virtual surgery of TKR in a universal and an open platform technique leading to the production of the device mentioned in claim 1, this method comprises of several steps including: sizing of implants, alignment, bone cutting and positioning of implants (prosthetic components) as well as virtual surgery.

3. The universal and an open platform device in claim 1 that is suitable to be used for any currently available knee implants (all on-shelf implants) regardless of different shapes and configurations of these implants

4. The device in claim 1 used for all patient specific implants.

5. The device in claim 1 consists of two parts: a femoral part and a tibial part. Both of these parts are independent of the design of knee implants and can work universally with all different designs of implants.

6. The device in claim 1 contains locating probes that are cannulated and have optional metallic sleeves to allow fixation pins to pass through and securely fix the instrument to the bone.

7. The device in claim 1 is designed in the form of a cutting block, through which most of the bone machining steps are carried out.

8. The trajectories for the bone machining steps mentioned in claim 1 such as saw and drills in addition to the path for fixation pins are multidirectional but they are mathematically positioned to prevent any intersection

9. Surface matching of the device in claim 1 relies on protruding locating probes that match bony surfaces away from the cartilage i.e. positioned on a "cartilage free area"

10. The device in claim 1 has one protruding removable probe for the femur that is positioned on a cartilage free area

11. The device in claim 1 is positioned directly to the bone with no other interfaces (guides, sleeves or cutting blocks)

12. The universal and open platform device is suitable for any knee implants that could be produced in the future regardless of the design or the shape of knee implants.

13. The universal and open platform method in claim 2 is suitable to be used for any commercially and currently available knee implant (on-shelf implants).

14. The universal and open platform method in claim 2 is suitable to be used for any patient specific knee implants.

15. The universal and open platform method is suitable to be used for any knee implants that could be produced in future regardless of the design or shape of knee implants

16. The method in claim 2 includes 3-D evaluation of the anatomy and pathology of the knee joint and identification of landmarks and axis followed by complete planning, including sizing of implants, alignment, bone cutting and positioning of the implants (prosthetic components)in a universal and an open platform technique.

17. The method in claim 2 includes simulation of surgery and template designing in a universal and an open platform technique.

18. The method in claim 2 leads to the production of the device in claim 1 (instruments) that guide the bone cuts or guide the accurate positioning of the conventional cutting jigs to be used for all implants in an open platform technique (universal)

19. The method of claim 2, comprising image-based 3-D preoperative planning to design the virtual templates which are then converted to physical templates using additive manufacturing such as rapid prototyping techniques

20. The method in claim 2 involves planning for the whole TKA surgery including sizing, alignment and rotation with simulation of the virtual surgical result

21. The method in claim 2 does not need for preoperative coupling with other surgical instruments such as drills or sleeves that are related to a particular company

22. The preoperative plan used in claim 19 is transferred to a two piece instrument that can replace the conventional instrumentation for TKA such as intramedullary, extra-medullary guides, sizing, rotation guides

23. The method in claim 2 is independent of the design of knee implants and can work universally with all different designs of implants

Claims

1. A device for preparing a knee joint for a prosthesis in a patient undergoing total knee arthroplasty (TKA) surgery for any knee implant (prosthesis) in a universal and open platform fashion, this device consists of two parts: a femoral part and a tibial part are designed in the form of cutting blocks that have locating probes, slits and a surface for bone cutting, guide for adjusting rotation and holes for pin fixation. The tibial part has a hole for the creation of the stem and a slit for the creation of the keel.

2. A method of planning and complete virtual surgery of TKR in a universal and an open platform technique leading to the production of the device mentioned in claim 1, this method comprises of several steps including: sizing of implants, alignment, bone cutting and positioning of implants (prosthetic components) as well as virtual surgery.

3. The device in claim 1 that is suitable to be used for any currently available knee implants (all on-shelf implants) regardless of different shapes and configurations of these implants.

4. The device in claim 1 used for all patient specific implants.

5. The device in claim 1 consists of two parts: a femoral part and a tibial part. Both of these parts are independent of the design of knee implants and can work universally with all different designs of implants.

6. The device in claim 1 contains locating probes that are cannulated and has metallic sleeves to allow fixation pins to pass through and securely fix the instrument to the bone.

7. The device in claim 1 is designed in the form of a cutting block, through which most of the bone machining steps are carried out.

8. According to claim 1, the trajectories for the bone machining steps such as saw and drills in addition to the path for fixation pins are multidirectional but they are mathematically positioned to prevent any intersection.

9. Surface matching of the device in claim 1 relies on protruding locating probes that match bony surfaces away from the cartilage i.e. positioned on a "cartilage free area".

10. The device in claim 1 has one protruding removable probe for the femur that is positioned on a cartilage free area.

11. The device in claim 1 is positioned directly to the bone with no other interfaces (guides, sleeves or cutting blocks).

12. According to claim 1 the universal and open platform device is suitable for any knee implants that could be produced in the future regardless of the design or the shape of knee implants.

13. The universal and open platform method in claim 2 is suitable to be used for any commercially and currently available knee implant (on-shelf implants).

14. The universal and open platform method in claim 2 is suitable to be used for any patient specific knee implants.

15. According to claim 2, the universal and open platform method is suitable to be used for any knee implants that could be produced in future regardless of the design or shape of knee implants.

16. The method in claim 2 includes 3-D evaluation of the anatomy and pathology of the knee joint and identification of landmarks and axis followed by complete planning, including sizing of implants, alignment, bone cutting and positioning of the implants (prosthetic components)in a universal and an open platform technique.

17. The method in claim 2 includes simulation of surgery and template designing in a universal and an open platform technique.

18. The method in claim 2 leads to the production of the device in claim 1 (instruments) that guide the bone cuts or guide the accurate positioning of the conventional cutting jigs to be used for all implants in an open platform technique (universal).

19. The method of claim 2 comprising image-based 3-D preoperative planning to design the virtual templates which are then converted to physical templates using additive manufacturing such as rapid prototyping techniques.

20. The method in claim 2 involves planning for the whole TKA surgery including sizing, alignment and rotation with simulation of the virtual surgical result.

21. The method in claim 2 does not need for preoperative coupling with other surgical instruments such as drills or sleeves that are related to a particular company.

22. The preoperative plan used in claim 19 is transferred to a two piece instrument that can replace the conventional instrumentation for TKA such as intramedullary, extra-medullary guides, sizing, rotation guides.

23. The method in claim 2 is independent of the design of knee implants and can work universally with all different designs of implants.