PATIENT-SPECIFIC ACETABULAR GUIDE FOR ANTERIOR APPROACH

Abstract: An orthopedic device includes a patient-specific acetabular guide that can be used for preparing an acetabulum of a patient to receive an acetabular implant. The acetabular guide has a body with an outer three-dimensional surface configured to match an acetabulum of a specific patient's hip joint designed from data of the patient's hip joint. The acetabular guide can further include a peripheral annular rim.
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FIELD

[0001] The present teachings relate to an acetabular guide and particularly to a patient-specific guide and various associated instruments.

INTRODUCTION

[0002] The present teachings provide a patient-specific acetabular guide and associated instruments for implanting an acetabular implant into an acetabulum of a patient for hip joint arthroplasty.

SUMMARY

[0003] The present teachings provide various instruments and methods for generally preparing the acetabulum of a patient to receive an acetabular implant, such as, for example, an acetabular cup along an alignment axis. The alignment axis and various patient-specific guides and other associated instruments can be designed during a pre-operative plan using a three-dimensional reconstruction of the patient's relevant anatomy, such as the pelvis or portions thereof, including the acetabular and periacetabular areas of the pelvis. The three-dimensional reconstruction can be based on medical images, including MRI, CT, ultrasound, or X-ray scans and prepared using commercially available imaging software.

[0004] The present teachings provide, for example, a patient-specific acetabular guide that can be used for preparing an acetabulum of a patient to receive an acetabular implant, such as an acetabular cup. The acetabular guide has a dome-shaped body with a peripheral annular rim and an outer three-dimensional surface configured to match an acetabulum of a specific patient's hip joint from three-dimensional medical images of the patient's hip joint during a preoperative plan for the patient. A patient-specific registration guide can be permanently or removably attached to the peripheral rim. The patient-specific registration guide has a longitudinal bore defining a patient-specific alignment axis with an alignment orientation configured for guiding an acetabular implant.
for the patient during the preoperative plan of the patient. The registration guide has a patient-specific undersurface configured to mate with a corresponding portion of a periacetabular surface and/or acetabular rim surface of the acetabulum of the patient.

[0005] In some embodiments, the acetabular guide can include a plurality of spaced-apart registration hooks. Each registration hook can extend from and be attached to the peripheral rim of the acetabular guide. Each registration hook has a patient-specific undersurface configured to mate with a corresponding surface of the acetabular rim of the patient's acetabulum.

[0006] The present teachings also provide a method for hip joint arthroplasty. The method includes inserting a patient-specific acetabular guide into an acetabulum of a patient. A patient specific undersurface of a dome-shaped body of the acetabular guide mates substantially as negative of a corresponding surface of the acetabulum. At least one patient-specific registration hook extends from a peripheral rim of the acetabular guide over a portion of an acetabular rim of the acetabulum. The method includes inserting an alignment pin into the patient's bone through a bore of a patient-specific registration guide. The patient-specific registration guide is removably attached to the peripheral rim of the acetabular guide. The patient-specific registration guide is preoperatively configured to define a patient-specific alignment orientation for inserting an acetabular implant. The method includes removing the acetabular guide without removing the alignment pin and inserting an acetabular implant along an orientation parallel to the alignment pin.

[0007] In some embodiments, the acetabular guide can be inserted into the acetabulum using an inserter with a removable adapter element. A distal bore of the adapter element can be coupled to a first post of the acetabular guide. A second post of the acetabular guide can held between first and second flanges extending from the adapter element.

[0008] Further areas of applicability of the present teachings will become apparent from the description provided hereinafter. It should be understood that the description and specific examples are intended for purposes
of illustration only and are not intended to limit the scope of the present teachings.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0009] The present teachings will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] FIG. 1A is a front isometric view of a patient-specific acetabular guide according to the present teachings;

[0011] FIG. 1B is a back isometric view of a patient-specific acetabular guide of FIG. 1A

[0012] FIG. 2A is an isometric environmental view of the patient-specific acetabular guide of FIG. 1;

[0013] FIG. 2B is another isometric environmental view of the patient-specific acetabular guide of FIG. 1 shown the axial plane, the sagittal and anterior pelvic plane;

[0014] FIG. 3 is an isometric environmental view of the patient-specific acetabular guide of FIG. 1 shown with a tip element of an acetabular guide inserter according to the present teachings;

[0015] FIG. 4 is an isometric view of the patient-specific acetabular guide of FIG. 1 shown with the tip element of FIG. 3;

[0016] FIG. 5 is an isometric environmental view of an acetabular implant;

[0017] FIG. 6 is a bottom view of the instrument handle tip element shown in FIG. 4;

[0018] FIG. 7 is a top view of the instrument handle tip element shown in FIG. 4;

[0019] FIG. 8 is an isometric view of an acetabular guide inserter shown with the tip element of FIG. 6;

[0020] FIG. 9 is an isometric view of the acetabular guide inserter of FIG. 7 shown without the tip element;
[0021] FIG. 10 is an isometric view of the inserter of FIG. 7 coupled to the patient-specific acetabular guide of FIG. 1 according to the present teachings;

[0022] FIG. 11 is an environment isometric view of the inserter of FIG. 7 coupled to the patient-specific acetabular guide of FIG. 1 according to the present teachings;

[0023] Figs. 12A and 12B illustrate top isometric views of a patient-specific acetabular guide according to the present teachings;

[0024] Fig. 13 illustrates a detail isometric environmental view of the patient-specific acetabular guide of FIG. 12A; and

[0025] Fig. 14 illustrates a lesser detail isometric environmental view of the patient-specific acetabular guide of FIG. 12A.

[0026] Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0027] The following description is merely exemplary in nature and is in no way intended to limit the present teachings, applications, or uses.

[0028] The present teachings generally provide patient-specific acetabular alignment guides, inserters and/or other associated instruments for use in orthopedic surgery, such as, for example, in joint replacement or revision surgery for the hip. The patient-specific alignment guides and associated instruments can be used either with conventional or with patient-specific implant components prepared with computer-assisted imaging methods based on medical scan of the specific patient.

[0029] As described in commonly assigned U.S. Patent No. 8,092,465, issued January 1, 2012, and co-pending U.S. Patent Application No. 13/400,652, filed February 21, 2012, both of which are incorporated by reference herein, during a preoperative planning stage, imaging data of the relevant anatomy of a patient can be obtained at a medical facility or doctor's office. The imaging data can include, for example, a detailed scan of a pelvis, hip, knee, ankle or other joint or relevant portion of the patient's anatomy. The imaging data can be
obtained using an MRI, CT, and X-Ray, ultrasound or any other imaging systems. The imaging data obtained can be used to construct a three-dimensional computer image of the joint or other portion of the anatomy of the patient and prepare an initial preoperative plan that can include bone or joint preparation, such as planning for resections, milling, reaming, broaching, as well as implant selection and fitting, design of patient-specific guides, templates, tools and alignment protocols for the surgical procedure. Additionally, physical modes of the patient's joint and associated bones can be prepared for visualization and trialing of the guides and implants prior to the surgical procedure.

[0030] Computer modeling for obtaining three-dimensional computer images of the relevant patient's anatomy can be provided by various CAD programs, applications and/or software commercially available from various vendors or developers, such as, for example, from by Object Research Systems or ORS, Montreal, Canada. The computer modeling program or other application can be configured and used to plan a preoperative surgical plan, including planning various bone preparation procedures, to select or design/modify implants and design patient-specific guides and tools including patient-specific prosthesis components, and patient-specific tools, including reaming, broaching, milling, drilling or cutting tools, alignment guides, templates and other patient-specific instruments.

[0031] The preoperative plan can be stored in any computer storage medium, in a computer file form or any other computer or digital representation, including three-dimensional graphical files or digital data sets. The preoperative plan, in a digital form associated with interactive software or other application, can be made available via a hard medium, a web-based or mobile or cloud service, or a cellular portable device to the surgeon or other medical practitioner, for review. Using the interactive software or application, the surgeon can review the plan, and manipulate the position of images of various implant components relative to an image of the anatomy. The surgeon can modify the plan and send it to the manufacturer with recommendations or changes. The interactive review process can be repeated until a final, approved plan, is sent to a manufacturing facility for preparing the actual physical components. In other embodiments,
physical and digital patient-specific bone models guides and instruments and can be provided preoperatively to the surgeon for trialing and marking.

[0032] After the surgical plan is approved by the surgeon, patient-specific implants and associated tools, including, for example, alignment guides, cutting/milling/reaming/broaching or other tools for the surgical preparation of the joint or other anatomy portion of the specific patient can be designed using a CAD program or other three-dimensional modeling software, such as the software provided by Object Research Systems or ORS, Montreal, Canada, for example, according to the preoperative surgical plan. Patient-specific guides and other instruments can be manufactured by various stereolithography methods, selective laser sintering, fused deposition modeling or other rapid prototyping methods. In some embodiments, computer instructions of tool paths for machining the patient-specific guides and/or implants can be generated and stored in a tool path data file. The tool path data can be provided as input to a CNC mill or other automated machining system, and the tools and implants can be machined from polymer, ceramic, metal or other suitable material depending on the use, and sterilized. The sterilized tools and implants can be shipped to the surgeon or medical facility for use during the surgical procedure.

[0033] Patient-specific implants, guides, templates, tools or portions thereof are defined herein as those constructed by a preoperative plan for a specific patient from three-dimensional images of the specific patient's anatomy reconstructed from preoperative medical scans of the patient. The patient-specific components are constructed to closely conform and mate or match substantially as a negative mold or negative surface or inverse or mirror surface of corresponding surface portions of the patient's anatomy, including bone surfaces with or without associated soft tissue, such as articular cartilage, for example, depending on the particular procedure, implant and tool use. Minute irregularities of the patient's joint surfaces need not be mirrored.

[0034] As discussed above, patient-specific alignment guides and implants are generally configured to match the anatomy of a specific patient and can fit in only one position on a corresponding surface of the specific patient because anatomic features that are unique to each patient can function as
landmarks and can guide placement of the alignment guide or implant in only one position without the need of intraoperative navigation, patient marking or other intraoperative guidance. The patient-specific alignment guides are generally configured and manufactured using computer modeling based on the patient's 3-D anatomic image and have an engagement surface that is made to conformingly contact and match as a mirror or negative or inverse surface to a corresponding surface of a three-dimensional image/model of the patient's bone surface (with or without cartilage or other soft tissue), by the computer methods discussed above. Generally, the patient specific guide has an exterior surface that contacts about 80% of the patient's anatomy when properly positioned, including about 90%, and about 98%. The exterior surface of the patient matched guide can, therefore, substantially mate with the selected portion of the anatomy. It is understood, however, that certain exterior portions of a patient specific guide may not have substantial contact with the patient, while other portions are designed to ensure contact even when other portions are not contacting the patient. Thus, a patient matched guide can have portions that are substantially patient matched and have or can achieve the selected amount of contact with the patient.

[0035] The patient-specific alignment guides can include one or more custom-made guiding formations, such as, for example, guiding bores or cannulated guiding posts or cannulated guiding extensions or receptacles that can be used for supporting or guiding other instruments, such as drill guides, reamers, cutters, cutting guides and cutting blocks or for inserting pins or other fasteners according to a surgeon-approved pre-operative plan. The patient-specific alignment guides can be used in minimally invasive surgery, and also in surgery with multiple minimally-invasive incisions. Various alignment guides and pre-operative planning procedures are disclosed in commonly assigned U.S. Patent No. 8092465, issued January 10, 2012; U.S. Patent No. 8070752, issued December 6, 2011; U.S. Patent No. 8133234, issued March 13, 2012; co-pending U.S. Patent Application No. 12/211407, filed September 16, 2008; co-pending U.S. Patent Application No. 12/025414, filed February 4, 2008; co-pending 13/111007, filed May 19, 2011; co-pending U.S. Patent Application No.
Referring to FIGS. 1A-9, the present teachings provide a patient-specific acetabular guide 100 and an acetabular guide inserter 300 an adapter element 350. As discussed herein, the adapter element may or may not be removable from a handle portion during operation. The acetabular guide 100 can be used in connection with various other instruments to generally provide a patient-specific alignment axis A. The patient-specific alignment axis A is used to insert an alignment pin 230 and generally to orient, insert, and implant an acetabular implant or acetabular cup 250 in an acetabulum (or acetabulum cavity) 82 of the patient, to facilitate guided reaming of the acetabulum 82, and generally guide any instruments and procedures relative to the alignment axis A or the alignment pin 230. The alignment axis A is determined during the preoperative plan from the three-dimensional image of the hip joint of the patient as the axis along which the acetabular implant 250 is to be centered and inserted. The alignment axis A is generally perpendicular the acetabulum 82 and corresponding acetabular engagement surface 252 of the acetabular implant 250. More specifically, with reference to FIG. 2B, the orientation (i.e., angles) of the alignment axis A can be selected and specified relative the axial plane (AP), sagittal plane (SP) and anterior pelvic plane (APP). The coronal plane is a vertical plane that is orthogonal to the axial and sagittal planes (not shown). The anterior pelvic plane (APP) is defined as a plane passing through the two anterior iliac spines and the pubic symphysis of the pelvis 80 of the patient. The APP may deviate from being parallel to the coronal plane when viewed in the weight-bearing profile of the patient (standing). Additionally, the APP plane may have a different orientation in the supine position. The deviation varies from patient to patient, such that the anterior pelvic plane cannot be relied on by the surgeon without additional information to guide the acetabular implant and avoid impingement during motion. The angle between the anterior pelvic plane and the coronal plane can be referenced as a pelvic tilt and is zero when the anterior pelvic plane is parallel to the coronal plane. The present teachings determine a
patient-specific axis for inserting an acetabular implant. The patient-specific alignment axis is physically and uniquely identified by the orientation of an alignment pin inserted into the bone using the patient-specific acetabular guide and landmark registration incorporated into the acetabular guide during the preoperative plan. Specifically, the preoperative plan that is based on images of the hip joint of the patient can accurately determine the orientation of the alignment axis A and fix it intraoperatively via the patient-specific acetabular guide 100 on the pelvis 80 of the patient to guide the surgeon during the surgical procedure.

[0037] The patient-specific acetabular guide 100 can engage the acetabulum 82 of the specific patient in a unique (only one) position and can provide an accurate alignment axis A relative to the planned orientation of the acetabular implant 250. The patient-specific acetabular guide 100 can also provide secure fitting and rotational stability in a design that is lightweight and has compact size and small bulk.

[0038] FIGS. 1A-3 illustrate a patient-specific acetabular guide 100 that has a dome-shaped body 102 with a three-dimensional patient-specific undersurface or outer surface 104 configured to contact and engage the acetabulum 82. The outer surface 104 is designed and/or formed to match as a negative of a corresponding surface of the acetabulum 82 from the three-dimensional image of the patient's hip joint. Thus, the outer surface 104 is formed to mate closely, such as to contact about 85% to about 100% of the acetabulum 82 when positioned in the acetabulum 82.

[0039] The dome-shaped body 102 of the patient-specific acetabular guide 100 can have one or more openings in the form of windows 106 that reduce the weight of the patient-specific acetabular guide 100 and provide improved visualization of the underlying anatomy. The dome-shaped body 102 can also include additional holes or other apertures 109 for drilling holes in the acetabulum 82 and corresponding to holes 254 for fixation screws of the acetabular implant 250. The dome-shaped body 102 of the patient-specific acetabular guide 100 is bounded by a guide rim 108 in the form of a closed-contour peripheral annular surface that has an uneven, irregular, jagged or wavy
shape that follows the corresponding irregular shape of an acetabular rim 84 (and periacetabular surface) around the acetabulum 82 of the patient. Additionally, the patient-specific acetabular guide 100 can include one or more registration hooks or extensions 110 that extend from the guide rim 108 along a three-dimensional curved surface around the acetabular rim 84 at different and spaced-apart positions. The registration hooks 110 are configured to provide additional registration locations for the patient-specific acetabular guide 100 by replicating corresponding underlying surface portions or landmarks of the acetabular rim 84 in a patient-specific manner. Specifically, each registration hook 110 can have a curved (three-dimensional) undersurface 112 that is patient-specific and negative of the surface of the acetabular rim 84 at specific locations selected as landmark locations during the preoperative plan for the patient. Each registration hook 110 can include a hole 114 for receiving a fixation pin or other fixation element 116 (shown in FIG. 4) for attaching the patient-specific acetabular guide 100 to the pelvis of the patient.

[0040] The patient-specific acetabular guide 100 can include a removable or non-removable registration and alignment guide 120 (referenced as registration guide 120, for short) that has a longitudinal bore 124 along the patient-specific alignment orientation A. A removable drill insert 122 with a longitudinal bore 126 can be received concentrically in the bore 124 of the registration guide 120. The wall of the bore 124 of the registration guide 120 can define a taper that engages a complementary taper 127 of an end of the removable drill insert 122. The complementary tapers can ensure appropriate and selected alignment of the bore 124 and the insert bore 126. Thus, the bore 124 and the insert bore 126 can be concentric and coextensive.

[0041] The drill insert 122 can provide stability during the insertion of an alignment pin 230 that can define the alignment axis A. The alignment pin 230 can include a drill tip 231 that can drill into the bone of or near the acetabulum. The alignment pin 230 is received into the concentric and coextensive bores 124, 126 of the registration guide 120 and of the drill insert 122. Accordingly, the alignment pin 230 is oriented along the alignment axis A. The drill insert 122 can be formed of a tough and/or strong material. For
example, the drill insert 122 can be metallic and reusable, while the registration
guide 120 and the acetabular guide 100 are patient-specific and can be made of
a softer material, such as a polymer material, and can be disposable. The tough
material of the drill insert 122 can engage the alignment pin 230 without
deforestation and protect the registration guide 120 from damage due to engaging
the alignment pin 230.

[0042] The registration guide 120 has an undersurface portion that is a
patient-specific undersurface 128 that can hook around or snap-on or otherwise
engage and contact the guide rim 108 at a pre-defined marked location
determined during the preoperative plan of the patient. The registration guide
120 that includes the patient-specific undersurface 128 matches the surface of
the acetabular rim 84 and/or periacetabular area of the pelvis 80 of the patient at
a corresponding location. The bore 124 of the registration guide 120 and the
bore 126 of the drill insert 122 can have an open (i.e., non-continuous) periphery
defining a longitudinal slit 133 that is configured to allow the patient-specific
acetabular guide 100 to be removed from the pelvis of the patient without
removing the alignment pin 230 that is inserted into the pelvis 80 and defines the
alignment axis A. In other words, the patient-specific acetabular guide 100 can
be also removed by side or lateral motion relative to the slit 133 and the
longitudinal axis A and not necessarily by only motion along the alignment axis A
or along the alignment pin 230.

[0043] The patient-specific acetabular guide 100 can include first and
second posts 130, 132 extending from an interior surface 105 (opposite to outer
surface 104) of the dome-shaped body 102 of the patient-specific acetabular
guide 100. The first post 130 can be tubular and can define a bore 134 that
passes through the dome-shaped body 102 of the acetabular guide for optional
fixation to the acetabulum 82 using a pin or other fastener. The bore 134 is not
necessary, however, and the post 130 can be a closed hollow post or a solid
post. The first post 130 can be centrally located and perpendicular relative to the
dome-shaped body 102 of the patient-specific acetabular guide 100 and the
underlying surface of the acetabulum 82. The second post 132 can be offset
relative to the first post 130 along a radial direction relative to the periphery of
the guide rim 108. The second post 132 can be shorter in height relative to the first post 130. The posts 130, 132 can be used to insert the patient-specific acetabular guide 100 using an acetabular guide inserter, such as the acetabular guide inserter 300 shown in FIG. 8.

[0044] It should be noted that other inserters can also be used to connect to one or both posts 130, 132 and be coupled to the patient-specific acetabular guide 100. According to various embodiments, the acetabular guide inserter 300 can be modular and include an elongated portion 302 and the adapter element (or inserter tip) 350 can be removable from the elongated portion 302. The elongated portion 302 can include a handle portion 308 and a shaft 304 having a distal post or boss 306. The adapter element 350 includes a tubular post 352 with a first bore 354 configured to connect and receive the boss 306 of the elongated portion 302 of the acetabular guide inserter 300. The elongated portion 302 can be interconnected to the adapter 350 at an appropriate time to insert the guide 100 (e.g. after the adapter 350 has engaged the post 130). It is understood, however, that the adapter can be manufactured to be fixed to the elongated portion 302 for use. For example, the elongated portion 302 and the adapter 350 can be formed as one piece or fixed together, such as with welding or an adhesive. Accordingly, it is understood that the inserter 300 need not be separable for use by a user.

[0045] The adapter element 350 includes a second bore 355 opposite to the first bore 354 and configured to receive the first tubular post 130 of the acetabular guide 100. The adapter element 350 includes first and second arms or flanges 356, 358 extending from a distal end of the adapter element 350 opposite to the post 352 and around the second bore 355. The first and second flanges 356, 358 define an open channel or a U-shaped inner surface 360 that can receive and hold the second post 132. The first and second flanges 356, 358 can be resiliently coupled to adapter element 350 and can be configured to snap-on to the second post 132 of the patient-specific acetabular guide 100 while the first post 130 of the acetabular guide 100 is received in the second bore 355 of the adapter element 350, as shown in FIGS. 3, 4 and 10.
The patient-specific acetabular guide 100 can be inserted in the acetabulum 82 using the inserter 300, as shown in FIG. 9. The inserter 300 can be removed, and the patient-specific acetabular guide 100 can be stabilized to the bone with fixation pins 232. A hole can be drilled through the drill insert 122 into the bone and the alignment pin 230 can be inserted along the alignment axis A defined by the registration guide 120. It is understood, that inserting the alignment pin 230 need not be a two-step process. For example, the alignment pin 230 can include a drill tip or portion 231 such that the alignment pin 230 is directly drilled into the bone.

Other holes can also be drilled into the bone through the holes 109 of the patient-specific acetabular guide 100 for attaching the acetabular implant 250. The fixation pins 232 can be removed and then the patient-specific acetabular guide 100 can be removed sideways without removing the alignment pin 230 and without disturbing its orientation along the alignment axis A. The acetabular implant 250 can be inserted in the acetabulum along an axis A’ parallel to the alignment axis A defined by the alignment pin 230 that is still attached to the bone. Additionally, reaming or other acetabular bone preparations can be performed using the orientation defined by the alignment pin 230 prior to the insertion of the acetabular implant 250.

The patient-specific acetabular guide 100 does not require the use of additional secondary guides to provide an alignment orientation for inserting an acetabular implant 250 or guiding other instruments. As such, the patient-specific acetabular guide 100 can be conveniently used in hip arthroplasty with an anterior supine incision along a patient-specific alignment axis A. The alignment axis A is preoperatively determined and transferred to the pelvis 80 using an alignment pin 230 guided by the registration guide 120 of the patient-specific acetabular guide 100, as discussed above.

According to various embodiments, an acetabular guide 500 is illustrated in Figs. 12A-14. The acetabular guide 500 can be similar to the acetabular guide 100, discussed above, including variations discussed further herein. Nevertheless, the acetabular guide 500 can be inserted or positioned in
the acetabulum 82 of the pelvis 80, in a manner similar to that of the acetabular guide 100.

[0050] The acetabular guide 500 can be positioned to allow for guiding placement of the alignment pin 230 at a selected location in the pelvis 80, as discussed further herein. The alignment pin 230 can be positioned to illustrate or identify a predetermined alignment axis A, as discussed above. The alignment pin 230 can be positioned through the removable drill insert 122 that is positioned in a removable or non-removable registration or alignment guide 520. The acetabular guide 500 can include portions that are substantially similar to portions of the alignment guide 100, and will not be described in detail here. The acetabular guide 500 can include an outer dome surface 504 that can be positioned to engage the acetabulum 82 in a manner similar to the outer dome surface 104 of the acetabular guide 100, as discussed above. Accordingly, the outer dome surface 504 and/or an upper rim 508 can include a geometrical configuration that are substantially similar or mirror the acetabulum or the rim of the acetabulum 82. For example, the mirror surface or patient matched surface can contact any selected amount of the acetabulum, such as greater than about 80%, including about 80%-90%, including further at least about 98%. Accordingly, the acetabular guide 520 can be substantially patient matched. The determination or geometry of the acetabular guide 500 can be based on various techniques, including image data obtained of the patient in a process as discussed above. The dome surface 504 and other portions of the guide 500 can be designed to be patient matched for engaging the patient in substantially only one orientation and location.

[0051] The acetabular guide 500 can further include various portions that engage an upper rim or edge or a portion external to the acetabulum 82. For example, the acetabular guide 500 can include one or more registration hooks 510. The registration hooks 510 can include a geometry or structure that extends from the upper rim 508, in one or more dimensions, to have an external engaging or contacting finger portion 511. The geometry of the registration hook 510 can further include a reinforcing rib portion 512 that extends at least a
portion of a length of the registration hook 510 to assist in providing rigidity and/or geometrical stability to the registration hooks 510.

[0052] The registration hooks 510 can be positioned at various positions around the rim 508 of the registration guide 500. However, it is understood, that various registration hooks are not required and may be selected to be removed or not provided with the acetabular guide 500. For example, a registration hook that is positioned or would be positioned near an ischium of the pelvis 80, such as an ischial registration hook 510c, need not be required. According to various embodiments, therefore, for example, for efficiency of manufacturing, the ischial registration hook 510c may not be provided. Nevertheless, the registration hooks 510a and 510b can be provided to assist in providing additional registration locations relative to the acetabular guide 500. Generally, the dome 504 of the acetabular guide 500 can provide appropriate registration of the acetabular guide 500 relative to the acetabulum 82 of the patient. As discussed herein, the registration of the hooks 510 and/or the dome 504 can ensure that the guide 500 is located and oriented at a pre-selected location and orientation relative to the pelvis 80 of the specific patient.

[0053] The acetabular guide 500 can also be positioned and held in place relative to the patient and the acetabulum 82 based upon the geometry of the dome 504 and/or the registration hooks 510a and/or 510b. Accordingly, additional fixation mechanisms, such as pins positioned through holes in the registration hooks 510 need not be provided. It is understood, however, that additional fixation mechanisms, such as pins positioned through the registration hooks 510, can be provided. Also, additional fixation holes 509 can be formed through the dome 504 to receive fixation pins or screws into the acetabulum 82.

[0054] Additionally, the alignment or registration guide 520 can be formed and positioned to be integral or connected to at least one of the registration hooks 510b. The positioning of the alignment guide 520 relative to the registration hook 510b is not required, but the combination can assist in providing rigidity and strength to each of the alignment guide 520 and the registration hook 510b. Additionally, the position of the registration hook 510b can be aligned with or positioned relative to the alignment guide 520 due to a
positioning or selected positioning of the alignment pin 230 relative to the acetabulum 82. As discussed herein, the pin 230 is positioned through an alignment bore 524 formed through the alignment guide 520.

[0055] The acetabular guide 500 can be positioned within the acetabulum 82 in a manner substantially similar to the acetabular guide 100, discussed above, as exemplarily illustrated in Figs. 13 and 14. The acetabular guide 500 can be positioned with the inserter 300, as discussed above. The inserter can engage a first post 530, such as with a central bore or blind bore formed in the inserter 300. The inserter 300 can further include one or more fingers or flanges 356 and 358, as discussed above, to engage a second or additional post 532. The acetabular guide 500, therefore, can be positioned within the acetabulum 82 of the patient substantially as discussed above, and as illustrated in Figs. 3 and 4. The posts 530 and 532, however, can be closed and need not include any passages or fixation portions to assist in holding the acetabular guide 500 relative to the acetabulum 82. It is understood that other passages, such as the passage 509, can be formed through the guide 500 to allow for positioning of various fixation portions through the acetabular guide 500.

[0056] Additionally, viewing passages 506 can be formed through the guide 500 to assist in viewing the acetabulum 82 of the patient. The viewing passages 506 can allow a user to view the acetabulum 82 during and after placement of the guide 500. This can assist in ensuring that the acetabular guide 500 is positioned within the patient in the acetabulum 82 in a selected manner.

[0057] The acetabular guide 500 is positioned within the acetabulum 82 such that the alignment guide 520 is selectively positioned relative to the inferior ischial spine. In particular, when the drill guide 122 is positioned within the alignment bore 524, then the alignment pin 230 that is passed through the drill guide 122 is on a line 580 that extends through the central post 530 and the interior spine of the ischium 570, as illustrated in Fig. 14. The guide pin 230 is also placed exterior to the acetabulum 83.
[0058] With continued reference to Figs. 13 and 14, the line 580 is defined through the interior spine 570, the guide bore 524, and the central post 530 of the acetabular guide 500. According to various embodiments, the guide 520 and/or the guide bore 524 define a guide long axis 524a. The central post 530 defines a post long axis 530a. The drill guide 122 also defines the insert bore 126, and the drill guide 122 and/or the insert bore 126 defines an insert long axis 126a. The respective long axes are of the various portions. The guide line 580 can be at least partially defined as a line through at least the post long axis 530a and one of the guide long axis 524a or the insert long axis 126a. The guide line 580 then extends to intersect the inferior ischial spine 570.

[0059] As discussed above, the shape and geometry of the acetabular guide 500 can be formed such that the acetabular guide 500 engages the acetabulum 82 in a manner such that the seating or engaging of the acetabular guide 500 is achieved when the alignment bore 524 is aligned along the line 580. Thus, the guide 500 is designed and manufactured to register with the acetabulum 82 of the specific patient in a single location and orientation. The design of the guide 500 can be based on images of the patient, as discussed above.

[0060] The single orientation and location of the guide 500 is generally relative to the inferior ischial spine 570. The guide line 580 is designed and selected to pass through the inferior ischial spine 570, as illustrated in Fig. 14. The one or more images acquired of the patient allows for determining of a geometry for designing and manufacturing the guide 500, such as the dome 504 and/or registration hooks 510, to properly engage the acetabulum 82 of the patient such that the alignment bore 524 is positioned on the line 580.

[0061] As discussed above, the insertion device 300 can be used to position the acetabular guide 500 within the acetabulum 82 to achieve the alignment of the alignment bore 524 with the spine 570 along the line 580. The drill guide insert 122 can be positioned within the guide bore 524 in a selected manner, such as that discussed above. For example, the drill guide 122 can include an external taper then engages an internal taper of the alignment bore 524 to ensure a substantially aligned fit of the drill guide 122. The alignment pin
230 can then be drilled into the pelvis of the patient to position the alignment pin 230 on the line 580.

 Accordingly, the acetabular guide 500 can be used to align and guide the alignment pin 230 into the pelvis of the patient to allow for guiding or alignment of various instruments following positioning of the alignment pin 230. For example, a reamer instrument, an insertion instrument for an acetabular shell, and/or other instrument can be provided to align with the alignment pin 230 once it is positioned within the pelvis. As discussed above, the drill guide member 122 can be removed from the alignment bore 524 and moved along the length of the alignment pin 230 to remove it from the patient. The acetabular guide 500 can then be removed from the alignment pin 230, such as through a side opening 533 formed through the alignment guide 520. Therefore, the acetabular guide 500 need not be removed along the length of the alignment pin 230, but can be removed with a sideways or lateral motion.

 Generally, the region superior to the acetabulum can provide substantially dense and strong bone of the pelvis for engaging the alignment pin 230. Accordingly, the alignment pin 230 can be firmly held in the pelvis relative to the acetabulum 82 during a procedure. The alignment pin 230 can be positioned within the pelvis of a patient for performing a procedure on the acetabulum and is generally selected to be maintained in a single orientation and location once placed. Accordingly, positioning the alignment pin 230 in substantially dense bone can assist in maintaining the alignment pin 230 in the selected location after the alignment pin 230 is positioned within the pelvis of the patient. Accordingly, the positioning the alignment bore 524 on the line 580 can assist in assuring that the alignment pin 230 will engage a selectively strong and dense bone portion to assure maintaining the selected position and orientation of the alignment pin 230 during the rest of the procedure.
The procedure can then proceed, as discussed above, including reaming the acetabulum 82 by aligning a reamer shaft with the alignment pin 230, placing an acetabular shell within the acetabulum 82 by aligning the inserter shaft with the alignment pin 230, and other procedure portions where the alignment pin 230 provides a reference for a user relative to the pelvis for performing a procedure in the acetabulum. Again, the acetabular guide 500 can be initially positioned within the acetabulum 82 in a substantially precise location and orientation based upon the geometry of the acetabular guide 500, including the external dome 504. The geometry of the acetabular guide 500 can ensure that the acetabular guide 500 engages the patient in substantially single and pre-selected orientation and location to ensure that the alignment bore 524 is positioned relative to the patient in the pre-selected location and orientation. Therefore, the alignment pin 230 that is passed through the alignment bore 524 is at the selected location and orientation generally on the line 580 and external to the acetabulum 82.

Various patient-specific guides, secondary guides, reamers, guide handles, inserters, impactors, support devices, electronic positioners and other instruments can be used in various combinations and based on surgeon preferences or patient and preoperative or intraoperative circumstances for preparing an acetabulum and guiding and implanting an acetabular implant along a preoperatively determined alignment orientation. In this respect, tools and instrumentation providing redundant functionality and of different embodiments may provide to the surgeon in a kit or per surgeon's request.

For example, adaptors and other instruments described above can be provided and used in various combinations within the scope of the methods described herein.

An orthopedic device includes a patient-specific acetabular guide that can be used for preparing an acetabulum of a patient to receive an acetabular implant. The acetabular guide has a dome-shaped body with a peripheral annular rim and an outer three-dimensional surface configured to match an acetabulum of a specific patient's hip joint from three-dimensional medical images of the patient's hip joint. A patient-specific registration guide is
removably attached to the peripheral rim and has a longitudinal bore defining a patient-specific alignment axis with an alignment orientation configured for guiding an acetabular implant for the patient. The registration guide has a patient-specific undersurface configured to mate with a corresponding surface of periacetabular surface of the acetabulum of the patient.

[0068] The foregoing discussion discloses and describes merely exemplary arrangements of the present teachings. Furthermore, the mixing and matching of features, elements and/or functions between various embodiments is expressly contemplated herein, so that one of ordinary skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as appropriate, unless described otherwise above. Moreover, many modifications may be made to adapt a particular situation or material to the present teachings without departing from the essential scope thereof. One skilled in the art will readily recognize from such discussion, and from the accompanying drawings and claims, that various changes, modifications and variations can be made therein without departing from the spirit and scope of the present teachings as defined in the following claims.
CLAIMS

What is claimed is:

1. An acetabular guide system for placing a guide pin near an acetabulum, comprising:
   an exterior surface of an acetabular guide configured to have a geometry to substantially engage the acetabulum of a specific patient;
   a central post extending from an interior surface of the acetabular guide; and
   a pin guide defining a guide bore extending exterior to the interior surface;
   wherein the central post and the guide bore are on a guide line; and
   wherein the guide line is configured to be aligned with an inferior ischial spine of the specific patient due to the geometry of the exterior surface.

2. The acetabular guide system of Claim 1, wherein the exterior surface is curved to contact the acetabulum of a specific patient.

3. The acetabular guide system of Claim 1, wherein the exterior surface is dome shaped.

4. The acetabular guide system of Claim 1, wherein the central post extends away from the interior surface of the acetabular guide and is closed to an environment outside of the central post.

5. The acetabular guide system of Claim 4, further comprising:
   a guide inserter having an elongated shaft defining an internal bore;
   wherein the internal bore of the elongated shaft engages an exterior surface of the central post to move the acetabular guide into the acetabulum.
6. The acetabular guide system of Claim 5, further comprising:
a second post that extends from the interior surface of the
acetabular guide substantially parallel to the central post.

7. The acetabular guide system of Claim 6, wherein the guide inserter
includes at least a first finger to engage the second post when the central post is
engaged within the internal bore of the guide inserter;
wherein the guide inserter has rotational and axial control of the
acetabular guide.

8. The acetabular guide system of Claim 1, further comprising:
a pin guide insert defining an insert bore, wherein pin guide insert
is placed in the guide bore such that the insert bore is placed on the guide line.

9. The acetabular guide system of Claim 8, further comprising:
the guide pin configured to be passed through the insert bore to
engage a region of a pelvis superior to the acetabulum on the guide line.

10. An acetabular guide system for placing a guide pin near an
acetabulum, comprising:
an exterior curved surface of an acetabular guide configured with a
geometry to substantially match the acetabulum of a specific patient based on a
geometry of the acetabulum of the specific patient;
a central post extending from an interior surface of the acetabular
guide;
a pin guide defining a tapered guide bore having an internal
tapered surface extending from the exterior curved surface; and
a pin guide insert having an external tapered surface and defining
an insert bore;
wherein the pin guide insert is configured to be placed in the
tapered guide bore in a pre-selected location relative to the pin guide;
wherein the central post and the insert bore are on a guide line when the exterior curved surface is engaged in the acetabulum and the pin guide insert is placed in the tapered guide bore; and

wherein the guide line is configured to be aligned with an inferior ischial spine of the specific patient due to the geometry of the exterior curved surface.

11. The acetabular guide system of Claim 10, wherein the guide line is defined by a first point on a first longitudinal axis through the central post and a second point on a second longitudinal axis through the pin guide.

12. The acetabular guide system of Claim 11, further comprising:
the guide pin configured to pass through the insert bore and engage a region of a pelvis superior to the acetabulum on the guide line.

13. The acetabular guide system of Claim 12, further comprising:
at least one registration hook extending from an acetabulum guide rim;
wherein the registration hook is configured to contact near an acetabular rim when the exterior curved surface is engaged in the acetabulum.

14. The acetabular guide system of Claim 13, wherein the at least one registration hook is formed to connect with the pin guide.

15. The acetabular guide system of Claim 12, further comprising:
a viewing passage formed through the exterior curved surface.

16. The acetabular guide system of Claim 12, further comprising:
a guide inserter having an elongated shaft defining an internal bore;
wherein the internal bore of the elongated shaft engages an exterior surface of the central post to move the acetabular guide into the acetabulum.

17. The acetabular guide system of Claim 12, further comprising:
a second post extending from the internal surface substantially parallel to the central post;
wherein the guide inserter includes at least one finger extending out from the elongated shaft to engage the second post.

18. A method of placing a guide pin with an acetabular guide system, comprising:
providing an exterior curved surface of an acetabular guide to have a geometry to substantially match the acetabulum of a specific patient based on a geometry of the acetabulum of the specific patient;
providing a central post extending from an interior surface of the acetabular guide along a post long axis;
providing a pin guide defining a tapered guide bore exterior to the interior surface and a pin guide long axis; and
providing a pin guide insert having an external tapered surface and defining an insert bore around an insert bore long axis, wherein the pin guide insert is configured to be placed in the tapered guide bore in a pre-selected location relative to the pin guide; and
providing the central post and the insert bore to be on a guide line when placed in the pin guide and when the exterior curved surface is engaged in the acetabulum;
wherein the guide line is configured to be aligned with an inferior ischial spine of the specific patient due at least to the geometry of the exterior curved surface.
19. The method of Claim 18, further comprising:
designing the exterior curved surface and a placement of the pin
guide to ensure a pre-selected location and a pre-selected orientation of the
insert bore long axis on the guide line when the exterior curved surface of the
acetabular guide is engaged in the acetabulum.

20. The method of Claim 19, wherein designing the exterior curved
surface includes acquiring images of the acetabulum of the specific patient.

21. The method of Claim 20, further comprising:
forming the exterior curved surface based on the design of the
exterior curved surface based on the acquired images of the acetabulum of the
specific patient; and
forming the pin guide on the exterior curved surface such that the
insert bore long axis is on the guide line when the pin guide insert is placed in
the pin guide and the exterior curved surface is engaged in the acetabulum.

22. An orthopedic device for hip joint arthroplasty comprising:
a patient-specific acetabular guide having a dome-shaped body
with a peripheral annular rim and an outer three-dimensional surface configured
to match an acetabulum of a specific patient's hip joint reconstructed from three-
dimensional medical images of the patient's hip joint according to a preoperative
plan for the patient; and
a patient-specific registration guide removably attached to the
peripheral rim and having a longitudinal bore defining a patient-specific
alignment axis with an alignment orientation configured for guiding an acetabular
implant for the patient, the registration guide having a patient-specific
undersurface configured to mate with a corresponding surface of periacetabular
surface of the acetabulum of the patient according to the preoperative plan for
the patient.
23. The orthopedic device of claim 22, further comprising a removable drill insert received in the longitudinal bore of the registration guide for guiding drilling along the alignment axis.

24. The orthopedic device of claim 22, further comprising a registration hook extending from and attached to the peripheral rim of the acetabular guide, the registration hook having a patient-specific undersurface configured to mate with a corresponding surface of acetabular rim of the patient according to the preoperative plan for the patient.

25. The orthopedic device of claim 22, further comprising a plurality of spaced-apart registration hooks or flanges, each registration hook extending from and attached to the peripheral rim of the acetabular guide, each registration hook having a patient-specific undersurface configured to mate with a corresponding surface of acetabular rim of the patient's acetabulum according to the preoperative plan for the patient.

26. The orthopedic device of claim 22, wherein the acetabular guide further comprises one or more openings configured as viewing windows.

27. The orthopedic device of claim 22, wherein the acetabular guide further comprises one or more fixation holes for interacting with the acetabular guide to attach the acetabular guide to the patient.

28. The orthopedic device of claim 22, wherein the longitudinal bore of the registration guide has an elongated slit configured to allow removal of the acetabular guide without removing a guiding pin passing through the longitudinal bore and affixed to the acetabulum of the patient.

29. The orthopedic device of claim 22, wherein the registration guide and the drill insert form an elongated slit configured to allow removal of the
acetabular guide without removing a guiding pin passing through the registration guide and affixed to the acetabulum.

30. The orthopedic device of claim 22, wherein the patient-specific acetabular guide includes a first post extending centrally from an inner surface of the dome-shaped body.

31. The orthopedic device of claim 30, wherein the patient-specific acetabular guide includes a second post extending from the inner surface of the dome-shaped body and offset relative to the first post.

32. The orthopedic device of claim 31, further comprising an inserter having a removable adapter element configured to engage the first post and the second post of the patient-specific acetabular guide.

33. The orthopedic device of claim 32, wherein the adapter element includes a bore removably coupleable to the first post of the acetabular guide.

34. The orthopedic device of claim 33, wherein the adapter element includes first and second flanges removably holding the second post of the acetabular guide therebetween.

35. The orthopedic device of claim 32, wherein the peripheral annular rim of the dome-shaped body has a wavy surface configured to follow a corresponding adjacent surface of the acetabular rim of the patient according to the preoperative plan for the patient.

36. An orthopedic device for hip joint arthroplasty comprising: a patient-specific acetabular guide having a dome-shaped body with a peripheral annular rim and an outer three-dimensional surface configured to match an acetabulum of a specific patient's hip joint reconstructed from three-
dimensional medical images of the patient's hip joint according to a preoperative plan for the patient;
   a patient-specific registration guide removably attached to the peripheral rim and having a longitudinal bore defining a patient-specific alignment axis with an alignment orientation configured for guiding an acetabular implant for the patient, the registration guide having a patient-specific undersurface configured to mate with a corresponding surface of periacetabular surface of the acetabulum of the patient according to the preoperative plan for the patient; and
   a plurality of spaced-apart registration hooks, each registration hook extending from and attached to the peripheral rim of the acetabular guide, each registration hook having a patient-specific undersurface configured to mate with a corresponding surface of acetabular rim of the patient's acetabulum according to the preoperative plan for the patient.

37. The orthopedic device of claim 36, further comprising a removable drill insert received in the longitudinal bore of the registration guide for guiding drilling along the alignment axis.

38. The orthopedic device of claim 36, wherein the patient-specific acetabular guide includes a first post extending centrally from an inner surface of the dome-shaped body and a second post extending from the inner surface of the dome-shaped body and offset relative to the first post.

39. The orthopedic device of claim 38, further comprising an adapter element having a distal portion configured to removably engage the first and second posts and a proximal portion configured to be removably coupled to an inserter shaft.
40. A method for providing a guide, comprising:
   forming a patient-specific acetabular guide such that a patient
   specific undersurface of a dome-shaped body of the acetabular guide is
   configured to mate as negative of a corresponding surface of the acetabulum
   and at least one patient-specific registration hook extends from a peripheral rim
   of the acetabular guide over a portion of an acetabular rim of the acetabulum;
   inserting an alignment pin through a bore of a patient-specific
   registration guide removably attached to the peripheral rim of the acetabular
   guide, the registration guide preoperatively configured to define a patient-specific
   alignment orientation for inserting an acetabular implant;
   forming the acetabular guide to be removed without removing the
   alignment pin

41. The method of claim 40,
   coupling the acetabular guide to a removable adapter element of
   an inserter by connecting a distal bore of the adapter element to a first post of
   the acetabular guide.

42. The method of claim 41, further comprising holding a second post
   of the acetabular guide between first and second flanges extending from the
   adapter element.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. A61B17/17

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A61B

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

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

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>Page 28, line 17 - page 29, line 14; figures 30-39</td>
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[X] Further documents are listed in the continuation of Box C.  
[X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reasons (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"X" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle, or theory underlying the invention

"D" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"A" document member of the same patent family

Date of the actual completion of the international search: 9 May 2014

Date of mailing of the international search report: 23/05/2014

Name and mailing address of the ISA:

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, 340-3016

Authorized officer:

Fourcade, Olivier
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<td>EP 2 491 873 A2 (BIOMET MFG CORP [US]) 29 August 2012 (2012-08-29) paragraphs [0059] – [0061], [0073]; figures 4-6,15</td>
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INTERNATIONAL SEARCH REPORT

Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.: 18-21, 40-42 because they relate to subject matter not required to be searched by this Authority, namely:
   see FURTHER INFORMATION sheet PCT/ISA/210

2. □ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

   see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

□ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

□ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.
Continuation of Box I.1
Claims Nos.: 18-21, 40-42

Claims 18-21 relate to subject-matter covered by the provisions of Rule 39.1(iv) PCT since the guide pin placed with an acetabular guide system is obviously placed in or next to the acetabulum of a human body (Method for treatment of the human or animal body by surgery). Claims 40-42 relate to subject-matter covered by the provisions of Rule 39.1(iv) PCT (Method for treatment of the human or animal body by surgery), see in particular the steps "inserting an alignment pin through a bore of a patient-specific registration guide" and "forming the acetabular guide to be removed without removing the alignment pin": the fact that the alignment pin is not removed clearly implies that the alignment pin has been inserted and remains inserted into the bone. Consequently, no opinion will be formulated with respect to the industrial applicability of the subject-matter of these claims which are also not searched.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-17

   Acetabular guide system having a central post and a pin guide which are aligned with an inferior ischial spine.

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2. Claims: 22-42

   Orthopaedic device comprising a patient-specific acetabular guide and a patient-specific registration guide.

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