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An agency of Industry Canada

CA 2439850 A1 2005/03/04

(21) 2 439 850

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2003/09/04

(41) Mise à la disp. pub./Open to Public Insp.: 2005/03/04

(51) Cl.Int.^{7}/Int.Cl.^{7} A61B 5/103, A61F 2/30

(71) Demandeur/Applicant:
ORTHOSOFT INC., CA

(72) Inventeurs/Inventors:
AMIOT, LOUIS-PHILIPPE, CA;
FONTAINE, ISABELLE, CA;
JANSEN, HERBERT ANDRE, CA;
ODERMATT, DANIEL, CA

(74) Agent: OGILVY RENAULT

(54) Titre : METHODE UNIVERSELLE DE DETERMINATION DE LA POSITION DE PROTHESES ACETABULAIRES ET FEMORALES LORS DE LA NAVIGATION CHIRURGICALE

(54) Title: UNIVERSAL METHOD FOR DETERMINING ACETABULAR AND FEMORAL IMPLANT POSITIONS DURING NAVIGATION

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UNIVERSAL METHOD FOR DETERMINING ACETABULAR AND FEMORAL IMPLANT POSITIONS DURING NAVIGATION

DESCRIPTION OF PROBLEM

- Acetabular and femoral prosthesis come in various shapes.

- There is a need to precisely digitize the center of rotation of the acetabular implant after its final positioning.

- There is a need to precisely digitize the center of rotation of the femoral implant while it is being positioned in order to optimize final leg length.

- As a "nice-to-have" it would be useful to also obtain alignment information of the femoral implant in the femur while it is being installed.

- Acetabular implants:

  - Have been standardized to accept a liner, installed in the titanium shell of the prosthesis.

  - The liner can be made out of polyethylene, metal or ceramic.

  - All liners have a hemi-sphere in their center.

  - The hemi-spheres have been standardized at diameters of 28 mm (most frequent); 28 mm, 32 mm, 38 mm, and 44 mm exist, but are far less frequent.

  - Once the liner is installed, a simple spherical digitizer of the appropriate diameter can be

used as means to locate precisely the center of rotation of the acetabular implant.

- o This would complete the navigation process: after navigated impaction of the acetabular shell, the final center of rotation of the combined prosthesis is digitized by the system.

- o This spherical digitizer provides means to digitize all acetabular components in the context of a universal application, or our current specific applications.

- Femoral implants

  - o Femoral spherical heads are attached to the femoral implants when the femoral implant is positioned appropriately in the femur. This provides a ball and socket articulation between the acetabular and femoral implants.

  - o As mentioned previously, femoral heads have been standardized in diameters.

  - o Knowing the difference between the center of rotation of the femoral head and the center of rotation of the acetabular liner allows the navigation system to compute leg length difference.

  - o When the femoral implant is being installed, the femoral head is not yet installed. The femoral implant is lowered in the femur until the proper height is reached. In conventional surgery, this is an empirical step.

  - o There is a standardized coupling between all femoral heads and the femoral implants: the Morse cone taper.

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- Using a digitizer that fits the Morse cone taper, we could track all femoral implants, in the context of a universal application or our current specific applications.

- This digitizer would therefore provide the position of the center of rotation of the femoral head that will be installed on the femoral implant.

- This would provide means to track the height of all types of femoral components, press-fit cement-less as well as cemented components.

- With proper means of orientation, the tracker could be aligned with the long axis of the femoral component, therefore providing axial alignment as well as height position.

- With axial & height measurements, the installation of the femoral component could be tracked and provide not only leg-length but also alignment information of the component in the femur.

- This tracking mechanism (height & alignment) would be available for all types of femoral implants, press-fit cement-less as well as cemented components.