

[54] PROSTHETIC HIP JOINT DEVICES

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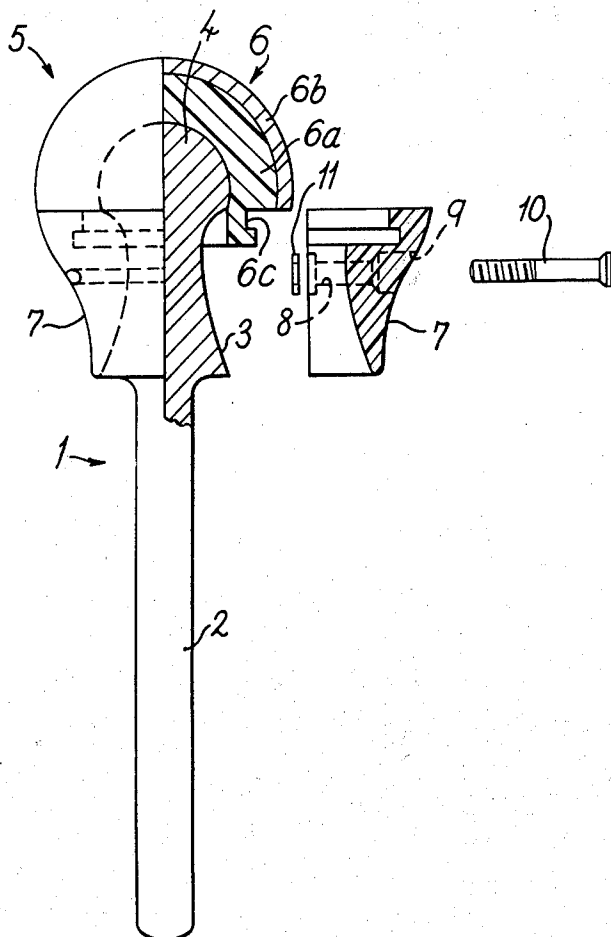
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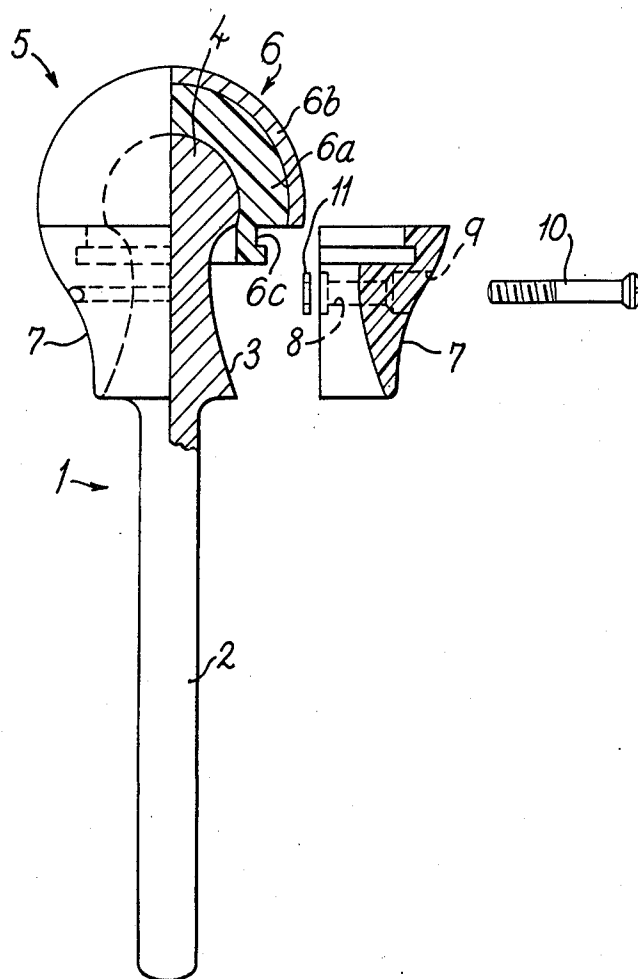
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ABSTRACT

The femoral component of a prosthetic total hip joint replacement device which normally also includes an acetabular socket component is modified for initial use as a partial hip joint replacement by the securement in demountable manner of a larger ball-shaped head around the ball-shaped head of the original femoral component. Thus, the modified component is used with the natural acetabular socket, and future provision of a total hip joint replacement in the same patient then only requires demounting of the larger head assembly and provision of a prosthetic acetabular socket.

10 Claims, 1 Drawing Figure





PROSTHETIC HIP JOINT DEVICES

This invention concerns prosthetic hip joint devices and more particularly such devices for femoral head replacement.

The latter devices are used basically in two situations which are commonly referred to as partial and total hip joint replacement, respectively. Partial replacement in this context involves replacement of the natural femoral head, normally by way of a prosthetic femoral device having a tapered intramedullary stem which terminates, by way of a necked portion, at its wider end with a ball-shaped head offset from the longitudinal axis of the stem. Total replacement in the same context normally involves use of a femoral component similar to that just described which co-operates with a prosthetic acetabular component in the form of a concave socket member to receive the ball-shaped head of the femoral component in mutual articulating bearing relationship. While the femoral components used in both the partial and total replacement situations are basically similar, it is relevant to note that the head is normally larger in the first situation compared to the second since the one head co-operates with the natural acetabulum, while the other head co-operates with a prosthetic socket which is normally of smaller dimensions than the natural acetabulum.

The invention is concerned with a difficulty which becomes more pronounced with increasing use of partial replacements. Thus, fractures of the femoral neck and other conditions in which the function of the femoral head, but not the acetabulum, is affected have been conventionally treated by the use of pins, plates and similar fixation devices, but are now often treated by use of partial replacement. This last use arises from the fact that advantage accrues in a quicker return to full mobility for the patient. Also, this treatment is preferable for patients, such as the aged, who are more liable than the average to suffer a recurrence of the original, or a similar, condition requiring treatment. However, by the same token, this increase in use is accompanied by an increase in situations where a partial replacement will be followed, in the course of time, by a requirement for a total replacement due to deterioration of the natural acetabulum. The more particular difficulty is that the transition from a partial to total replacement involves removal, from the femoral shaft, of the prosthesis for partial replacement and substitution, in such shaft, of a component of a new prosthesis for the total replacement.

An object of the present invention is to obviate this last difficulty and, to this end, provides a prosthetic hip joint device comprising a femoral component of a form such as described above having a smaller head, and a larger head assembly adapted for securement around said smaller head in demountable manner.

It will be appreciated that the device of the present invention is intended to be employed for partial hip joint replacement, when the larger head assembly of the device will be employed to co-operate with the natural acetabulum, while allowing subsequent demounting of the larger head assembly to expose the smaller head for co-operation with a prosthetic acetabular socket component in the event that a total hip joint replacement becomes appropriate. The self-evident advantage of this situation is that the later requirement for total hip joint replacement only involves exposure of the joint, removal of the larger head assembly, and

the implantation of the necessary prosthetic acetabular component.

The femoral component of the proposed device is preferably of integral metal construction, in which case the larger head assembly should seal the smaller head against intrusion of body fluid or other matter which may give rise to corrosion of the smaller head. This sealing conveniently involves use of a plastics material to define the inner surface of the larger head assembly, but such assembly also preferably has an outer surface, for articulation with the acetabulum, which is made of metal.

In any event, a clearer understanding of the invention can be gained by consideration of the single FIGURE of the accompanying drawing which is given by way of example and illustrates in a side elevation one form of a device according to the invention. For reasons of clarity, one longitudinal half of the drawing shows the relevant device in fully assembled form, while the other half shows the components of the device in partly-sectioned form and exploded manner.

The illustrated device comprises a femoral component denoted generally at 1 and comprising an intramedullary stem 2, a necked portion 3, and a ball-shaped head 4. When seen in an orthogonal side elevation to that of the drawing, the stem is tapered towards its free end, and cranked or curved part-way along its other end portion to offset the head 4 relative to the longitudinal axis of the major 'straight' length of the stem 2. The component 1 is in fact of 'Charnley' type, for example, as employed for total hip joint replacement, and is of integral metal construction.

The remaining parts of the illustrated device comprise a larger head assembly denoted generally at 5 and which comprises a cap part 6 and two similar neck parts 7. The cap part 6 is in the form of a hollow part-spherical member of which the inner surface is of complementary form to the outer surface of the head 4. Accordingly, the outer surface of the cap part 6 will be spherically concentric with the outer surface of the head 4.

The cap part 6 is of double-layer construction having a thicker inner layer 6a of plastics material and an outer layer 6b of metal. Also, the inner layer extends to a greater extent at its rim than does the outer layer, and this further extended part of the inner layer is formed with an annular groove 6c extending circumferentially around its outer surface adjacent its rim.

The neck parts 7 are formed as diametrically opposed halves of an annular continuation of the head part 6, which continuation has an inner surface complementary with the grooved portion of the cap part 6 and also the neck 3, and an outer surface which continues smoothly from that of the cap 6 in convergent manner towards the end of the neck 3 adjacent stem 2.

The remaining feature of the necked parts 7 is the provision of two bores 8 in each part, corresponding ones of these bores being aligned in orthogonal relation with the mutually engaged faces of the parts 7 on opposite sides of the neck 3 when the device is completely assembled. In one of the necked parts 7 the outer ends of these bores 8 are counterbored at 9. The bores 8 receive screws 10 to secure the device in its fully assembled form, the heads of the screws being disposed in the counter bores 9 so as not to protrude.

From this description and the drawing it will be appreciated that the cap part 6 can be engaged over the

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head 4, conveniently in a snap-fit manner, and held captive by screw connection of the neck parts 7, while the neck parts 7 serve to seal the head 4 within the cap part 6. In this assembled form, the device serves as a femoral head component for use in a partial hip joint replacement, while demounting of the larger head assembly 5 exposes the femoral head component 1 for use in a total hip joint replacement.

This demounting can be facilitated by further counter boring the inner ends of the bores 8 which receive the threaded ends of the screw 10, the further counter bores serving to receive washers 11 which cooperate with the screws 10 to withdraw the associated neck part 7 from the full assembly when the screws are themselves withdrawn.

While the invention has been more particularly described with reference to the illustrated embodiment, the scope of the invention is not intended to be limited thereby. Indeed, the illustrated embodiment is presently regarded as a development prototype which may be subject to modification during further development of the invention. For example, in the illustrated embodiment the rim of the outer layer 6b of the larger head assembly 5 is defined by a plane orthogonal to the longitudinal axis of the stem as viewed in the drawing, but in practice it may be preferred to incline this plane in a similar sense to that in which the stem/neck region of the component 1 is cranked or curved. This takes account of the fact that the normal position of maximum load on the head assembly does not lie on the axis of symmetry thereof, but is offset from this axis in the sense just indicated and it is desirable to provide a maximized circumferential extent for the articulating surface of layer 6b in any direction from this position of maximum load. Also it may be preferred to arrange for securement of the head assembly 5 around the head 4 in such a way as to inhibit mutual rotational movement therebetween. This can be effected by the provision of complementary flats in the groove 6c and the neck parts 7, for example. It may also be preferred to employ bore and screw arrangements or some other fixation device for the neck parts 7 whereby the outer surfaces of these parts are subject to a lesser interruption in smoothness and continuity.

We claim:

1. A prosthetic hip joint device comprising:
 - a femoral head replacement component of integral metal construction including a relatively small ball-shaped head for use in articulating engagement with a prosthetic acetabular socket component, and a larger ball-shaped head assembly secured around said smaller head to modify said femoral component for initial use in articulating engagement with the natural acetabular socket, said larger ball-shaped head assembly being adapted for release from said smaller head, and said larger ball-shaped head assembly being of multiple-layer construction including an inner layer of plastic material adjacent said smaller head and an outer layer of metal remote from said smaller head.
2. A device according to claim 1 wherein said femoral component and said assembly are sealably se-

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cured together against ingress of body fluid and like matter therebetween.

3. A device according to claim 1 wherein said larger ball-shaped head assembly is secured with said femoral head replacement component in mutually non-rotatable manner.

4. A device according to claim 1 wherein said femoral component comprises an elongated tapered intramedullary stem terminating, at its wider end, and by way of a necked portion, in said smaller head; said assembly inner layer extends over said smaller head and said necked portion; and said assembly outer layer extends over only said smaller head and is seated in said inner layer to provide a substantially continuous exterior surface for said assembly.

5. A device according to claim 1 wherein said assembly comprises:

- a cap formed by said inner and outer layers to engage over said smaller head, and
- a pair of similar semi-annular shells formed by further parts of said inner layer, which shells mutually connect around said necked portion and secure said cap.

6. A device according to claim 1 wherein said smaller and larger heads have mutually-concentric respective spherical exterior shapings.

7. A prosthetic hip joint device comprising:

- a femoral head replacement component having a relatively small spherically-shaped head for use in articulating engagement with a prosthetic acetabular socket component; and a larger spherically-shaped head assembly secured around said smaller head in mutually non-rotatable, liquid-tight, demountable manner to modify said femoral component for initial use in articulating engagement with the natural acetabular socket.

8. A device according to claim 7 wherein the spherical shapings of said smaller and larger heads are concentric.

9. A prosthetic hip joint device comprising:

- a femoral head replacement component having a relatively small spherically-shaped head for use in articulating engagement with a prosthetic acetabular socket component; and a larger spherically-shaped head assembly secured concentrically around said smaller head in demountable manner to modify said femoral component for initial use in articulating engagement with the natural acetabular socket.

10. The use of a prosthetic hip joint device comprising a femoral head replacement component having a relatively small ball-shaped head with a larger ball-shaped head demountably secured therearound, which use comprises:

- initially securing said femoral component in the femur to employ said larger head in articulating engagement with the natural acetabulum; and subsequently securing a prosthetic acetabular component in the acetabulum, and removing said larger head assembly to employ said smaller head in articulating engagement with said acetabular component.

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