A unicompartamental prosthetic knee joint device comprises a femoral component (21) for replacing the femur in the lateral region of the knee, a tibial component (1) for replacing the tibia in the lateral region of the knee, and a meniscal component (19) intermediate the femoral component and the tibial component. The meniscal component (19) has first and second surfaces (15, 13) so as to provide an articulated joint between the femoral and tibial components. The femoral component (21) has a convex bearing surface (23) slidably engaging the first surface (15) of the meniscal component (19). The tibial component (1) has an antero-posterior convex bearing surface (3) slidably engaging the second surface (13) of the meniscal component. The second surface (13) of the meniscal component has an antero-posterior concave configuration slidably engaging the bearing surface (3) of the tibial component (1).
This invention relates to a unicompartmental prosthetic knee joint device such as may be used for the replacement of a substantial part of the lateral condyle of a natural knee during the course of surgery.

It is known when undergoing surgery on a damaged knee to use a device known in clinical practice as a meniscal knee. A meniscal knee is an artificial knee joint which includes between the tibial and femoral components a meniscal component having first and second articulatory bearing surfaces.

Review of meniscal knee implants has shown that problems can occur with dislocation of the meniscal component especially where a lateral condyle of a natural knee has been replaced.

Patent specification GB-A-2 291 355 describes a device in which the tibial component has a medio-lateral convex cylindrical surface, that is with an axis about which the surface is curved extending in the antero-posterior direction, which corresponds to a concave articulatory surface on the meniscal component. Although this increases the retention of the meniscal component during medio-
lateral movement within the joint, at full flexion or extension the meniscal component could still undergo dislocation from the anterior or posterior regions, respectively, of the joint.

It is therefore an object of the present invention to provide a unicompartamental prosthetic knee joint device which overcomes or minimises these problems.

According to the present invention there is provided a unicompartamental prosthetic knee joint device comprising a femoral component for replacing the femur in the lateral region of the knee, a tibial component for replacing the tibia in the lateral region of the knee, and a meniscal component intermediate the femoral component and the tibial component and having first and second surfaces so as to provide an articulated joint between the femoral and tibial components, wherein the femoral component has a convex bearing surface slidably engaging the first surface of the meniscal component, the tibial component has an antero-posterior convex bearing surface slidably engaging the second surface of the meniscal component, and the second surface of the meniscal component has an antero-posterior concave configuration slidably engaging the bearing surface of the tibial component.
The tibial component may be adapted to be attached to a surgically prepared site on the tibia which is angled obliquely to the horizontal axis of the tibia.

The tibial component may be provided with means to prevent excessive medial movement of the meniscal component, for example in the form of a raised wall on the intercondylar, medial edge of the tibial component.

The upper surface of the raised wall may be provided with an antero-posterior convex surface and the curvature of the upper surface may be substantially the same as the curvature of the bearing surface of the tibial component.

The lateral surface of the raised wall may have an antero-posterior convex surface and the curvature of the convex lateral surface may conform substantially to an arc having a radius corresponding to the distance between the convex lateral surface and a central region of the meniscus on the medial side of the knee.

The lateral side of the tibial component may have an antero-posterior convex lateral surface.

The convex bearing surface of the femoral component may be part-spherical.
The convex bearing surface of the tibial component may be part-cylindrical. Alternatively, the convex bearing surface of the tibial component may be part-conical.

For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a plan view of the upper surface of a right tibia of a natural knee;

Figure 2 is a top plan view of a tibial component of an embodiment of a unicompartmental prosthetic knee joint device according to the present invention;

Figure 3 is a side view of the tibial component shown in Figure 2 showing a convex configuration of a medial surface of the tibial component;

Figure 4 is a perspective view of the tibial component shown in Figures 2 and 3 showing a convex configuration of a medial surface and of a bearing surface of the tibial component;
Figure 5 is a perspective view of a meniscal component of an embodiment of a unicompartmental prosthetic knee joint device according to the present invention;

Figure 6 is a perspective view of a femoral component of an embodiment of a unicompartmental prosthetic knee joint device according to the present invention;

Figure 7 is a plan view of a tibial component showing a raised side wall; and

Figure 8 is an elevational view of the tibial component shown in Figure 7.

Figure 1 shows the upper surface of a right tibia of a human being and illustrates the position of the medial condyle 10, the lateral condyle 8 and the intercondylar region 12 in relation to the anterior 4 and posterior 6 regions of the tibia.

The drawings in Figures 2 to 6 show a unicompartmental prosthetic knee joint device comprising a tibial component 1, a meniscal component 19, and a femoral component 21.

The tibial component 1 is shown in Figures 2 to 4 and is adapted to replace a substantial part of a lateral condyle
8 of a tibia in a knee region of a patient and comprises a plate-like structure of which one face 5 serves as a fixing surface for attachment, using techniques well known to the skilled person, to a surgically prepared part of the tibia, whilst the opposite face defines an antero-posterior generally cylindrical convex surface, that is with an axis about which the surface is curved extending in the medio-lateral direction, which acts as an articulatory bearing surface 3. Ideally the convex surface is substantially part conical with the apex of the cone ideally coinciding with a centre of rotation situated in a region of the meniscus on the medial side of the knee or at a point beyond the medial side of the knee. Further the diameter of the conical surface is chosen to correspond substantially to the curvature of the upper surface of the lateral condyle 8.

The lateral side of the tibial component 1 is curved in the antero-posterior direction with the central region of the curved part more distant from the medial region of the knee than end regions thereof to facilitate rotation of the meniscal component 19 about a centre of rotation situated in a region of the meniscus on the medial side of the knee.

The femoral component 21 is shown in Figure 6 is adapted to replace the lateral portion of the femur in the knee region
of the patient and comprises a concave internal fixing surface 25 for attachment, using techniques well known to the skilled person, to a surgically prepared portion of the femur, whilst the opposite external face 23 comprises a longitudinally curved bearing surface aligned in the antero-posterior direction of which the convex shape defines a part-spherical surface.

The meniscal component 19 is shown in Figure 5 comprises a rectangular body smaller than the dimensions of the bearing surface 3 of the tibial component 1.

The meniscal component 19 has an upper face 17 containing, or in the form of, a part spherical recess 15 which acts as an articulatory bearing surface and complements the curvature of the femoral bearing surface 23. When engaged, the surfaces 15 and 23 form a congruent sliding bearing.

The meniscal component 19 has a lower face 13 shaped with an antero-posterior concave cylindrical (conical) bearing surface, that is with an axis about which the surface is curved extending in the medio-lateral direction, which acts as an articulatory surface with, and complements the curvature of, the tibial bearing surface 3. When engaged, the surfaces 13 and 3 also form a congruent sliding bearing.
In use, the tibial and femoral components are secured to surgically prepared sites on the tibia and femur respectively.

The surgically prepared site on the tibia is such that the lateral condyle 8 of the tibia is cut away obliquely (i.e. at an acute angle) to the horizontal axis of the tibia (determined when the patient is erect) in order that more tibial material is removed from the anterior side of the lateral condyle 8 than from the posterior side of the lateral condyle 8.

Consequently, the subsequent attachment of the tibial component 1 of the prosthetic knee device to the surgically prepared site on the tibia substantially reproduces the configuration of the bearing surface of a lateral condyle 8 of a natural tibia.

The cylindrical axis of the convex surface 3 of the tibial component is orientated in the medio-lateral direction. The tibial component therefore is positioned such that the axes of movement of the tibia are substantially unchanged.

The meniscal component is positioned and engaged between the attached tibial and femoral components in the same way as with known methods of unicompartmental implantation.
The unicompartmental prosthetic knee joint device according to the present invention enables the movements of a natural knee to be simulated and maintains the required engagement between the various components over the natural range of movement of the knee.

The design of the present device, therefore, allows both medio-lateral and antero-posterior movement of the meniscal component between the femoral and tibial components but comprises means to prevent dislocation in both of these directions.

Dislocation in prosthetic knee joints occurs when the gap between the femoral and tibial components increases sufficiently for the meniscal component to pass through. The convex shaping of the upper surface of the tibial component and concave shaping of the bearing surfaces of the meniscal component results in the need for the femur and tibia to provide an even greater gap before the meniscal component can pass through.

The femoral and tibial components can be made of metal suitable for surgical applications and the meniscal component can be fabricated from known plastics material, such as ultra-high molecular weight polyethylene.
The tibial component 1 may be provided with a raised wall 7 (see Figures 7 and 8) on the medial, intercondylar side of the tibial component to prevent excessive medial movement of the meniscal component 19. Also, as shown in Figures 7 and 8 the face 5 may be planar.

The medial, intercondylar side of such a wall of the tibial component should ideally be substantially planar and positioned in a plane substantially at right angles to the axis of the bearing surface 3.

The lateral side of the wall 7 is ideally curved in the antero-posterior direction with the central region of the curved part more distant from the medial region of the knee than end regions thereof to facilitate rotation of the meniscal component 19 about a centre of rotation situated in a region of the meniscus on the medial side of the knee.

The convex configuration of the lateral side of the wall of the tibial component allows the meniscal component to be more naturally rotated around the centre of rotation present in the central region of the meniscus on the medial side of a natural knee.
CLAIMS

1. A unicompartmental prosthetic knee joint device comprising a femoral component (21) for replacing the femur in the lateral region of the knee, a tibial component (1) for replacing the tibia in the lateral region of the knee, and a meniscal component (19) intermediate the femoral component and the tibial component and having first and second surfaces (15, 13) so as to provide an articulated joint between the femoral and tibial components, characterised in that the femoral component (21) has a convex bearing surface (23) slidably engaging the first surface (15) of the meniscal component (19), the tibial component (1) has an antero-posterior convex bearing surface (3) slidably engaging the second surface (13) of the meniscal component, and the second surface (13) of the meniscal component has an antero-posterior concave configuration slidably engaging the bearing surface (3) of the tibial component (1).

2. A unicompartmental prosthetic knee joint device as claimed in claim 1, characterised in that the tibial component (1) is adapted to be attached to a surgically prepared site on the tibia which is angled obliquely to the horizontal axis of the tibia.
3. A unicompartmental prosthetic knee joint device as claimed in claim 1 or 2, characterised in that the tibial component (1) is provided with means to inhibit excessive medial movement of the meniscal component.

4. A unicompartmental prosthetic knee joint device as claimed in claim 3, characterised in that movement inhibiting means comprises a raised wall in the intercondylar, medial region of the tibial component (1).

5. A unicompartmental prosthetic knee joint device as claimed in claim 4, characterised in that the upper surface of the raised wall is provided with an antero-posterior convex surface.

6. A unicompartmental prosthetic knee joint device as claimed in claim 5, characterised in that the curvature of the upper surface of the raised wall is substantially the same as the curvature of the bearing surface of the tibial component.

7. A unicompartmental prosthetic knee joint device as claimed in claim 4, 5 or 6, characterised in that the lateral surface of the raised wall has an antero-posterior convex surface.
8. A unicompartmental prosthetic knee joint device as claimed in claim 7, characterised in that the curvature of the convex lateral surface conforms substantially to an arc having a radius corresponding to the distance between the convex lateral surface and a central region of the meniscus on the medial side of the knee.

9. A unicompartmental prosthetic knee joint device as claimed in any preceding claim, characterised in that the lateral side of the tibial component (1) has an antero-posterior convex lateral surface.

10. A unicompartmental prosthetic knee joint device as claimed in any preceding claim, characterised in that the convex bearing surface (23) of the femoral component (21) is part-spherical.

11. A unicompartmental prosthetic knee joint device as claimed in any preceding claim, characterised in that the convex bearing surface (3) of the tibial component (1) is part-cylindrical.
# INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**

**IPC 7** A61F2/38

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61F

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 practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Date of the actual completion of the International search: 10 October 2003

Date of mailing of the international search report: 20/10/2003

Name and mailing address of the ISA:

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HJ, The Hague
Tel: +31-70 940-2040, Fax: 31 651 epos n, Fax: +31-70 940-3016

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