(54) **Prosthesis for knee replacement**
    Kniegelenksprothese
    Prothèse d'articulation du genou

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Description

This invention relates to prostheses for knee replacement.

Background of the Invention

Most of the knee replacement designs in current use are of the Condylar Replacement type, where the arthritic joint surfaces are resected and are replaced with metal and plastic surfaces. There are two conflicting requirements in design; first, the desirability for freedom of motion requires relatively low conformity between the femoral and tibial surfaces while the desirability for low contact stresses on the plastic surface requires high conformity. This conflict similarly applies to the patello-femoral bearing joint.

US-A-4085466 discloses a knee prosthesis having two femoral bearing surfaces which are part spherically shaped and which bear on a pair of meniscal components supported on a tibial platform. The meniscal components are circular discs and each disc has one flat face for resting on the tibial platform and another face is shaped to the same radius as the femoral bearing surface. Each meniscal disc is held on the tibial platform by a mushroom shaped projection which allows independent sliding movement of the disc in all directions.

US-A-4586933 describes a knee prosthesis comprising a femoral component, a tibial base component and a pair of meniscal components. A separate meniscal component supports each femoral condylar surface. The tibial component and the meniscal component are shaped so as to be guided for sliding movement in an anterior-posterior direction. The femoral condyles have a curvature which does not correspond with that of the contacting surfaces of the meniscal components.

Summary of the Invention

The present invention provides a solution of this dilemma. It provides a femoral component wherein the usual sagittal shape is altered so that there is continuous contact with corresponding tibial surfaces and also, preferably, with the patella surface. In order to allow for full flexion, the femoral component bears on a one-piece meniscal component which is guided for sliding movement on a tibial base plate so that such movement is essentially constrained to an anterior-posterior direction.

The invention also includes variations of the above concept and various designs of tibial components which can be employed with the femoral component.

According to the invention there is provided knee prosthesis which comprises:

a femoral component having two condylar-bearing surfaces, each having an anterior portion, a posterior portion and a distalmost point therebetween, a tibial component and a one-piece meniscal-bearing component between the femoral and tibial components, said meniscal bearing component having concave depressions for receiving said condylar-bearing surfaces and guide means for guiding the meniscal bearing component on the tibial component for sliding movement in a path substantially constrained to an anterior-posterior axis, wherein the bearing surfaces of each femoral condyle and its corresponding concave depression in the meniscal component has a substantially common radius from posterior to a point more anterior than the distalmost point, when viewed in a plurality of sagittal sections, whereby contact between the femoral and meniscal component is maintained across a substantial width of the condylar-bearing surfaces throughout the range of flexion.

Preferably, the tibial bearing surface, when viewed in one or more sagittal sections, has a radius of curvature which substantially corresponds with the radius of the bearing surface of the femoral component. However, there may be differences in the profiles of the sagittal sections, provided that contact is substantially continuous from posterior to anterior. Indeed, this is desirable to provide for the required laxity in the joint. For example, the radii of the femoral sagittal sections may be slightly smaller than the radii of the corresponding sections of the tibial bearing surface, so as to allow sufficient clearance for taking up differences in surgical placement of the two components of the prosthesis, and allowing adequate laxity for normal functions.

Where the cruciate ligaments are retained in the fitting of the prosthesis, the femoral component portion which encases the resected condyles may be formed with a slot to permit passage of the ligaments. However, many surgeons prefer to resect the cruciate ligaments and in this case, the femoral component may be continued in the distal/posterior region across the full width, i.e. in the lateral-medial direction.

The extent to which the constant radius of the femoral component in sagittal planes extends around the distalmost point is the amount sufficient to give the desired degree of flexion of the joint.

Preferably, the anterior face of the femoral component is formed with a patella groove which is shaped so that there is contact between the patella and the groove through all degrees of flexion.

Conformity of the femoral and tibial bearing surfaces during all stages of flexion gives increased contact area between the metal and plastic bearing surfaces, leading to reduced wear and deformation. Also, as the sagittal curvature of the tibial component is upwardly concave, the up-sweep of the tibial bearing surface posteriorly and anteriorly gives increased stability in anterior-posterior, medial-lateral and internal-external rotations. Close contact between the patella (whether natural or artificial) with the patella groove during all stages of flexion also contributes to greater stability of the joint.
Preferably the tibial component of the knee prosthesis comprises a metal platform which is substantially cylindrical, with the axis of the cylinder extending in a lateral-medial line and the radius of the cylinder being larger than the maximum sagittal radius of the bearing surface between the femoral and tibial components. The curvature of the bearing surface between the femoral component and the tibial component in the sagittal plane is in the same sense as the curvature of the cylindrical mating surface, between the plastics component and the metal platform.

By providing for sliding movement in the anterior-posterior direction, the prosthesis has freedom of movement in the anterior-posterior direction, which allows a higher degree of flexion, while reducing shear stresses in the component-bone interfaces.

The cylindrical bearing surface between the plastics component and the metal platform viewed in a sagittal plane constrains the movement in the anterior-posterior direction. Also, the upwardly curved interface between the plastics component and the metal platform introduces increasing constraint due to gravity forces as the plastics bearing component displaces further away from its central position.

Various features and advantages of the present invention will become clear from the following description and accompanying drawings in which:

Figures 1(a), (b), (c), (d) and (e) are perspective views of the normal knee at various degrees of flexion from 0 to 120°.

Figure 2(a) is a perspective view of a knee fitted with a prosthesis in accordance with the invention at zero flexion.

Figure 2(b) is a perspective view of the knee (with the femur removed for clarity), fitted with same prosthesis at approximately 90° flexion.

Figure 3(a) is a perspective view of a femoral component in accordance with a first embodiment of the invention.

Figure 3(b) is a view similar to Figure 3(a) of a modified form of the femoral component.

Figure 3(c) is a perspective view of a tibial component intended for use with the femoral component of Figure 3(b).

Figure 4(a) is a perspective view similar to Figure 3(a) of a further embodiment in accordance with the invention and Figure 4(b) shows a perspective view of a corresponding tibial component.

Figure 5 is a sagittal view of the profile of a patella replacement (in broken lines) compared with a conventional replacement (full lines).

Figure 6 is an underside view of a femoral component showing the conformity of the patella with the patella groove.

Figure 7(a) is a plan view of a tibial component in accordance with the invention.

Figure 7(b) is a section taken on the line B-B in Figure 7(a),

Figure 7(c) is a section taken on the line A-A in Figure 7(a).

Figure 8(a) is a plan view of a modified tibial component.

Figure 8(b) is a section taken on the line A-A in Figure 8(a) but with the anchoring pegs omitted.

Figure 9 is a view similar to Figures 7(b) and 8(b) of a modified tibial component showing alternative ways of guiding the plastics component.

Figure 1 of the accompanying drawings shows a sagittal view of the natural knee at different flexion angles - 0 to 120° in thirty degree steps. The distal end of the femur 2 can be seen to have a larger radius than the posterior 3. At zero degrees flexion, the larger radius distal end 1 contacts the top of the tibia 4, resulting in greater conformity and a greater area of contact. Other structures increase the contact area, notably the menisci, which are deformable discs interposed between the femoral and tibial condyles. When the knee is flexed, the femoral-tibial conformity is reduced, which would reduce the contact area and result in higher contact stresses. However, the deformable menisci take up the shape between the femoral and tibial surfaces and once again spread the load. If the menisci are removed for injury, in later years, there is an increased chance of osteoarthritis.

The knee displays both laxity (which can be termed freedom of motion) and stability, which is the control of displacements and rotations to within acceptable limits. Laxity can include linear or rotational translation in any of the three mutually perpendicular coordinate axes. For purposes of the invention, laxity is only considered in anterior-posterior displacement, medial-lateral displacement and internal-external rotation, these being the most significant. The anterior-posterior stability is provided mainly by the cruciate ligaments. The anterior cruciate 5 can be seen in Figure 1, especially at the higher flexion angles. Rotational stability is provided by a combination of the cruciate and collateral ligaments. The muscles also play an important role in providing stability. The joint surfaces contribute to stability as force is applied across the joint, due to the slight dishing of the surfaces and the deformability of the articular cartilage. The laxity is due to the elastic extensibility of the ligaments, the joint surfaces, and other soft tissues surrounding the joint.

The patella is an important bone which transmits the force between the quadriceps and the upper tibia. In broad terms it can be regarded as a pulley, sliding up and down on the front of the femur. The patella fits closely into a groove on the front of the femur, such that the contact areas are broad bands across the width of the patella. Beyond about 90 degrees of flexion, the contact splits into two parts as the patella straddles the intercondylar groove.

When a condylar replacement is introduced (Figure 2), a femoral component 20 is attached to the end of the femur and a tibial component 21 to the upper part of the
tibia. Normally, the ends of the femoral condyles are resected and shaped to receive the femoral component and hold in place with bone cement and/or pegs extending into the condyles. The collateral and cruciate ligaments can be preserved by providing a slot 22 in the femoral component, although in most designs, either the anterior is resected, or both cruciate ligaments are resected. The patella 23, either the natural patella or a replacement, fits into the groove 24. When the knee is flexed with conventional prostheses, there is now a distinct lack of conformity between the femoral and tibial surfaces, with the result that the contact stresses on the plastic surface are high, leading to failure due to break-down of the plastic in many cases.

Prior designs suffer from a number of problems; for example there is no meniscus to spread the force as in the normal knee. If the anterior cruciate is resected, there should ideally be a posterior upsweep of the tibial plastic surface to compensate, and if the posterior cruciate is resected also, an anterior upsweep is needed. In angles of flexion beyond about 90 degrees, there are two separate contacts on the patella component, leading to high stresses and deformation, and also sometimes 'catching'.

A typical femoral component in accordance with the invention is shown in Figure 3(a). The condylar surfaces 31 resemble the anatomical, especially in the sagittal view, and there is a cut-out or slot 32 for one or both cruciate ligaments. A patella groove 33 is continuous down to the cut-out 32 after which it splits. The larger femoral component in Figure 3(b) now has continuous surfaces throughout, including the patella groove, but is otherwise the same. Such a configuration requires resection of both cruciate ligaments. The femoral shape is then used to computer-generate a tibial surface 35, based on input laxity requirements in anterior-posterior displacement and internal-external rotation. A computerised method of generating tibial surfaces is described in US Patent No. 4822365. The new femoral shape has two advantages. First, the contact on the tibial surface can now be spread over the entire width of the tibial surface, thus increasing the contact area. Second, the patella has a continuous track, and can maintain a broad contact area throughout motion, without a split of the contacts at higher flexion. However, there is still the disadvantage that the radius of curvature of the distal femur is greater than the posterior, such that once flexion is initiated, the smaller femoral radius contacts the tibia giving a reduction in contact area.

Figures 4(a) and 4(b) shows one solution to this problem. Here, the radius of the posterior portion 41 of the femoral component has been carried round to the distal femur 42. Now there is a constant radius R for contacting the tibial surface 43. A surface computer-generated with this component is clearly more dished than the previous component and provides an increase in the contact area throughout. The reduction in the contact stresses are calculated to be significant. Another benefit of the new surfaces is the enhanced stability. In the surfaces of Figure 3, it can be imagined that the flexed femur can slide forwards on the tibia with relatively little resistance. However, in Figure 4, the anterior sliding is much more restricted because of the steeper slope of the anterior tibial surface.

An improvement to the patello-femoral contact is apparent from Figure 6. The normal dome-shape has high conformity when seen in the overhead view (Figure 6), but low conformity in the sagittal view. Several experimental and theoretical studies have shown that the angle through which the patella rotates 23 relative to the femoral component in the sagittal plane is within 10 degrees. This means that a high degree of conformity can be designed into the patella with no loss in freedom of motion. The new sagittal profile of the patella is shown dotted in Figure 5. As can be seen, instead of having a continuous convex shape in sagittal view, it has a flattened inner face 51 and outwardly extending surfaces 52 (Figure 6), giving greater conformity with the sides of the patella groove 53. Such increase in conformity leads to greatly reduced contact stresses. A consequence of such a design is that if surgical placement is rotationally incorrect, there would be restriction of motion. However, the curvatures can be adjusted to allow for an appropriate margin of error.

The above design form in accordance with the invention is most suitable when the anterior and posterior cruciate ligaments are resected. In this case, there will still be sufficient anterior-posterior laxity (approximately 5 mm total) and rotational laxity (+ - 12 degrees), without restriction from taut ligaments. Such laxity will also be sufficient for activities of everyday living. The disadvantage is that the components are relied upon for
stability, and in the long run, this may lead to problems with the fixation of the components to the bone. In addition, resection of the cruciates is believed to reduce the proprioceptive response of the knee with consequent compensatory gait patterns. A further disadvantage is that extremes of motion which occur during more demanding activities may be restricted, a possible disadvantage to younger or active patients. One approach to this problem is to use a meniscal bearing type of arrangement, already embodied in several designs, notably the LCS New Jersey, the Oxford, the Minns, and the Polyzoides - see US Patents Nos. 4340978 and 4085466. In these designs, anterior-posterior translation and internal-external rotation is completely unrestricted, except by impingement of the plastic bearing pieces onto capsular soft tissue at the anterior and posterior of the tracks. An important restriction to the designs however is that both the anterior and posterior cruciate ligaments are required, otherwise the stability is insufficient and the plastic bearings can dislocate.

At least two of the designers of the above-named devices have considered the distal-posterior radius problem of the femoral component. If the radii were different, as in Figure 3, then the main advantage of the meniscal bearing concept, complete contact and low stresses, would be lost. US Patent No. 4,340,978 shows the meniscal bearing concept. In Figures 1 and 3 of this US Patent, the Oxford scheme is shown in US Patent No. 4,085,466. A uni-condylar femoral component has a spherical radius, but does not carry up into a patella flange. The New Jersey design opts for smaller radii posteriorly than distally (Figure 22), and illustrates the loss of full conformity in flexion in Figure 33.

One further improvement provided by the present invention is to provide for sufficient anterior-posterior and rotational stability so that the prosthesis can be used with or without the cruciate ligaments, and to provide complete femoral-tibial conformity throughout the entire range of flexion. In essence, it consists of making the polished metal platform for supporting the plastic bearing piece or pieces concave when seen in the sagittal view. The effect will be to offer steadily increasing resistance to displacement away from the neutral position. In this respect, the stability and laxity characteristics can be made similar to that of a normal knee, or to a usual type of condylar prostheses. The schematic views (Figure 7(a)) shows the overall arrangement seen in plan view, with a metal plate or platform 71, for attachment to the tibia, having a polished cylindrical surface on the top of the plate and a plastic bearing component 72 which slides on the polished surface. The femoral condylar surfaces are intended to have a constant sagittal radius in the region which articulates against the plastic surface, and conform closely with the tibial surface in both frontal and sagittal planes. An important feature is that the radius of the plastic surface is smaller than that of the cylindrical surface. The cylindrical shape of the bearing surfaces is shown in Figure 7(b) in which \( R^2 \) is greater than \( R^2 \). Figure 7(c) shows the medial-lat-

eral section and a central fixation peg 73 and anti-rotation pegs 74 to prevent the platform 71 rotating on the tibia.

For a one-piece plastic component of the kind shown in Figures 7(a) - 7(c), rotation is not possible without loss of complete contact on the cylindrical surfaces. However, anterior-posterior displacement is possible. The arrangement providing anterior-posterior motion from a one-piece plastics tibial bearing component is shown in Figures 8(a) and 8(b). The metal platform 81 supports a plastics bearing component 81 which is guided for anterior-posterior motion on a rail 83 fixed or integral with the platform 81. The platform may be curved in the sagittal plane as shown in Figure 7(b) or be planar. It may be convenient to constrain anterior-posterior motion within limits by providing suitable stops, e.g. by means of an upward post 84 secured to the platform and an elongated hole 85 in the bearing pad 82. Thus, the pad 82 may move freely in an anterior-posterior direction into the post 84 abutting one of the ends of the elongated hole. An alternative method of providing stops is indicated in dotted lines in Figure 8(a) in which the recess in the plastics meniscus component 82 has a wall 86 against which the end face of the rail 83 abuts to limit the anterior-posterior movement in one direction.

Different ways can be envisaged to engage the plastic components, such as by "T"-shaped metal rails, under which a plastic lip is captured. This is illustrated in Figure 9, which is a view similar to Figure 7(c). A tibial bearing pad 101 is supported for sliding anterior-posterior motion on platform 103. The pad 101 is trapped and guided by rail 102 having a "T"-shaped profile section. Figure 9 also shows an alternative trapping and guidance means by lateral guides 104 having inwardly turned projections 105 which engage in slots in the plastics pad. A central guide rail is preferred since this is less prone to jamming.

In the construction described above the femoral components and tibial metal platform are made from a metal acceptable for use for implantation in the human body. Examples are cobalt-chromium and titanium alloys and stainless steels. The artificial patella (where present) and/or the plastics bearing components may be made from any biocompatible material capable of withstanding the imposed loads and providing appropriate bearing properties when in contact with a polished metal surface. Preferably, the plastic material should exhibit low friction properties under these conditions. Examples of suitable materials are ultra-high molecular weight polyethylene or acetal copolymer.

Claims

1. A knee prosthesis which comprises:-

   a femoral component (20) having two condylar-bearing surfaces (31), each having an anterior portion (45), a posterior portion (41) and a dis-
talmost point (42) therebetween, a tibial component (71, 81, 103) and a one-piece meniscal-bearing component (72, 82, 101) between the femoral and tibial components, said meniscal bearing component having concave depressions for receiving said condylar-bearing surfaces and guide means (83, 84, 102) on said tibial component engaging the meniscal component for guiding the meniscal bearing component on the tibial component for sliding movement in a path substantially constrained to an anterior-posterior axis, wherein the bearing surfaces of each femoral condyle and its corresponding concave depression in the meniscal component has a substantially common radius from posterior to a point more anterior than the distalmost point, when viewed in a plurality of sagittal sections and the bearing surfaces in the respective sagittal sections of the femoral and meniscal bearing components being continuous from posterior to anterior, whereby contact between the femoral and meniscal component is maintained across a substantial width in the lateral-medial direction of the condylar-bearing surfaces throughout the range of flexion.

2. A prosthesis according to claim 1 wherein the femoral component is shaped in said anterior portion to provide a patella groove (53) for receiving an anatomical or artificial patella (23), said groove having a cross-sectional shape which corresponds to that of a patella, whereby a patella can slide in contact with the patella groove through flexion of said prosthesis between 0° and 90°.

3. A prosthesis according to claim 1 or 2 wherein the tibial component comprises a metal platform having a plastics meniscal bearing component supported thereon, said metal platform having an upwardly concave surface and said meniscal bearing component having a bearing surface whose curvature substantially corresponds with the upwardly concave surface of said metal platform and wherein the curvature of said upwardly concave surface and of said bearing surface lies on a cylinder whose axis extends in a generally lateral-medial line.

4. A prosthesis as claimed in claim 4 wherein said cylinder has a radius (R₂) which is at least as large as the sagittal radii of the condylar bearing surface.

5. A prosthesis according to claim 1 wherein the tibial component comprises a metal platform and wherein the sliding movement of the meniscal bearing component relative to the metal platform is constrained to an anterior-posterior direction by guide means on said metal platform.

6. A prosthesis according to claim 5 wherein the guide means comprises a ridge (83, 94, 102) formed on the metal platform extending in the anterior-posterior direction and co-operating with the meniscal component.

7. A prosthesis according to claim 1 wherein the tibial component comprises a metal platform and said guide means comprises a rail member (102) attached to the metal platform and extending in the anterior-posterior direction.

8. A prosthesis according to claim 7 wherein the rail member extends between lateral and medial condylar parts of the femoral component.

9. A prosthesis according to claim 7 or 8 wherein the rail member is substantially 'T'-shaped in cross-section and engages in slots provided in the meniscal bearing component whereby the rail member both guides and traps the meniscal member on the tibial component.

10. A prosthesis according to claim 5 wherein the guide means includes stops limiting the extent of sliding motion of said meniscal bearing component in an anterior or posterior direction.

11. A prosthesis according to claim 10 wherein the stops comprise a post standing from said rail and engaging in a slot in the meniscal bearing component.

**Patentansprüche**

1. Knierprothese, umfassend:

   eine femorale Komponente (20) mit zwei condylar-lagernden Flächen (31) deren jede einen vorderen Teil (45), einen hinteren Teil (41) und einen dazwischen befindlichen, am weitesten entfernten Punkt (42) aufweist;
   eine Tibiakomponente (71, 81, 103) und eine einteilige meniskal-lagernde Komponente (72, 82, 101) zwischen der femoralem und der tibialen Komponente, mit konkaven Dellen zum Aufnehmen der genannten condylar-lagernden Flächen und mit Führungsmitteln (83, 84, 102) auf der tibialen Komponente zum Erfassen der meniskalen Komponente zwecks Führens der meniskalen Lagerkomponente auf der tibialen Komponente zwecks gleitender Bewegung auf einem Weg, der in einer Vorwärts-Rückwärts-Achse im wesentlichen unbeschrankt ist, wobei die Lagerflächen einer jeden femoralen Condyle und deren entsprechende konkave Delle in der Meniskuskomponente im wesentlichen einen gemeinsamen Radius aufweisen von einem hinteren zu einem weiter vorn gelege-
nen Punkt gegenüber dem am weitesten entfernten Punkt, gesehen in einer Mehrzahl von Sagittalschnitten, wobei die Lagerflächen in entsprechenden Sagittalschnitten der femoralen und der meniskalen Lagerkomponenten von hinten nach vorne kontinuierlich verlaufen, wobei ein Kontakt zwischen der femoralen und der meniskalen Komponente über eine wesentliche Breite in der seitlich-medialen Richtung der kondylar-lagernden Flächen über den Beugungsbereich aufrechterhalten wird.

2. Prothese nach Anspruch 1, wobei die femorale Komponente im genannten vorderen Bereich derart gestaltet ist, daß eine Patellanut (53) geschaffen wird zur Aufnahme einer anatomischen oder künstlichen Patella (23), wobei die genannte Nut eine Querschnittsform aufweist, die jener einer Patella entspricht, so daß eine Patella in Kontakt mit der Patellanut durch Beugung der genannten Prothese zwischen 0 und 90 Grad gleiten kann.

3. Prothese nach Anspruch 1 oder 2, wobei die tibiale Komponente eine metallische Plattform umfaßt mit einer hiervon getragenen meniskalen, aus Kunststoff bestehenden Lagerkomponente, wobei die metallische Plattform eine nach oben konkave Fläche aufweist und die genannte meniskale Lagerkomponente eine Lagerfläche, deren Krümmung im wesentlichen der nach oben konkaven Fläche der metallischen Plattform entspricht, und wobei die Krümmung der nach oben konkaven Fläche und jene der Lagerfläche auf einem Zylinder liegen, deren Achse sich im wesentlichen in einer seitlich-medialen Linie erstreckt.

4. Prothese nach Anspruch 4, wobei der genannte Zylinder einen Radius \( R_2 \) aufweist, der wenigstens so groß ist, wie die sagittalen Radien der kondylaren Lagerfläche.

5. Prothese nach Anspruch 3, wobei die Tibialkomponente eine metallische Plattform umfaßt, und wobei die Gleitbewegung der meniskalen Lagerkomponente relativ zur metallischen Plattform durch Führungsmittel an der metallischen Plattform auf eine Vorwärts-Rückwärts-Bewegung beschränkt ist.

6. Prothese nach Anspruch 5, wobei die Führungsmittel eine Rippe (83, 94, 102) umfassen, die der metallischen Plattform angeformt ist, sich in Vorwärts-Rückwärts-Richtung erstreckt und mit der Meniskalkomponente zusammenarbeitet.

7. Prothese nach Anspruch 3, wobei die Tibialkomponente eine metallische Plattform umfaßt, und die Führungsmittel eine Schiene (102), die an der metallischen Plattform befestigt ist und sich in Vorwärts-Rückwärts-Richtung erstreckt.

8. Prothese nach Anspruch 7, wobei sich die Schiene zwischen seitlichen und medialen Condylarteilen der femoralen Komponente erstreckt.

9. Prothese nach Anspruch 7 oder 8, wobei die Schiene einen im wesentlichen T-förmigen Querschnitt aufweist und in Schlitzte eingreift, die in der meniskalen Lagerkomponente vorgesehen sind, so daß die Schiene das meniskale Lagerelement an der tibialen Komponente sowohl führt als auch festhält.


11. Prothese nach Anspruch 10, wobei die Anschläge einen Zapfen umfassen, der auf der Schiene steht und in einen Schlitz in der meniskalen Lagerkomponente eingreift.

Reivendications

1. Prothèse du genou qui comprend :

   un composant fé moral (20) comportant deux surfaces de support condylien (31) ayant chacune une portion antérieure (45), une portion postérieure (41) avec entre-elles, un point le plus distal (42),

   un composant tibial (71, 81, 103) et un composant support méniscal en une seule pièce (72,82,101) entre les composants fé moral et tibial, ledit composant support méniscal présentant des dépressions concaves afin de recevoir lesdites surfaces de support condylien et des moyens de guidage (83, 84,102), sur ledit composant tibial venant en prise avec le composant méniscal afin de guider le composant support méniscal sur le composant tibial pour un déplacement de glissement dans une trajectoire sensiblement limitée à un axe antérieur-postérieur, dans laquelle les surfaces de support de chaque condyle fé moral et leur dépression concave correspondante dans le composant méniscal présentent un rayon sensiblement commun depuis le postérieur jusqu'à un point plus antérieur que le point le plus distal, lorsque l'on observe dans une pluralité de directions sagittales et les surfaces de support dans les sections sagittales respectives des composants supports fé moral et méniscal étant continues du postérieur vers l'antérieur, selon que le contact entre les composants fé moral et méniscal soit maintenu sur une largeur substantielle dans la direction latérale-médiane des surfaces de support condylien sur tout le
domaine de flexion.

2. Prothèse selon la revendication 1 dans laquelle le composant fémoral est conforme dans ladite portion antérieure de façon à définir une rainure de rotule (53) destinée à recevoir une rotule anatomique ou artificielle (23), ladite rainure ayant une forme de section droite qui correspond à celle d’une rotule, afin qu’une rotule puisse glisser au contact de la rainure de rotule lors de la flexion de ladite prothèse entre 0 et 90°.

3. Prothèse selon la revendication 1 ou 2 dans laquelle le composant tibial comprend une plate-forme métallique comportant un composant support méniscal en matière plastique supporté par cette plate-forme, ladite plate-forme métallique présentant une surface concave dirigée vers le haut et ledit composant support méniscal ayant une surface de support dont la courbure correspond sensiblement à la surface concave dirigée vers le haut de ladite plate-forme métallique et dans laquelle la courbure de ladite surface concave dirigée vers le haut et de ladite surface support est située sur un cylindre dont l’axe s’étend selon une ligne latérale médiane.

4. Prothèse selon la revendication 3 dans laquelle ledit cylindre présente un rayon \( R_2 \) qui est au moins aussi important que les rayons sagittaux de la surface de support condylien.

5. Prothèse selon la revendication 1 dans laquelle le composant tibial comprend une plate-forme métallique et dans laquelle le mouvement de glissement du composant support méniscal par rapport à la plate-forme métallique est limité à une direction antérieure-postérieure par des moyens de guidage sur ladite plate-forme métallique.

6. Prothèse selon la revendication 5 dans laquelle les moyens de guidage comprennent un épaulement \( (83,94,102) \) formé sur la plate-forme métallique, qui s’étend dans la direction antérieure-postérieure et qui coopère avec le composant méniscal.

7. Prothèse selon la revendication 1 dans laquelle le composant tibial comprend une plate-forme métallique et lesdits moyens de guidage comprennent un élément en forme de rail \( (102) \) fixé à la plate-forme métallique et qui s’étend dans la direction antérieure-postérieure.

8. Prothèse selon la revendication 7 dans laquelle l’élément en forme de rail s’étend entre les parties condyliennes latérale et médiane du composant fémoral.

9. Prothèse selon la revendication 7 ou 8 dans laquelle l’élément en forme de rail présente en section droite sensiblement la forme d’un T et vient en prise dans des fentes qui sont prévues dans le composant support méniscal afin que l’élément en forme de rail guide et piège l’élément méniscal sur le composant tibial.

10. Prothèse selon la revendication 5 dans laquelle les moyens de guidage comprennent des butées qui imitent l’amplitude du mouvement de glissement dudit composant support méniscal dans une direction antérieure ou postérieure.

11. Prothèse selon la revendication 10 dans laquelle les butées comprennent une broche faisant saillie vers le haut dudit rail et venant en prise dans une fente du composant support méniscal.