Abstract: Prosthesis (1) for the knee joint comprising a tibial component (2), adapted to be fixed to one end of the tibial bone in proximity to the knee joint, and a femoral component (3), adapted to be fixed to one end of the femoral bone in proximity to the knee joint, wherein the tibial component (2) is adapted to come into contact and be articulated with the femoral component (3), wherein the tibial component (2) comprises a protrusion (25) adapted to be inserted in an opening present in the femoral component (3); method for the assembly of the prosthesis (1).
"CONSTRAINED PROSTHESIS FOR THE KNEE"

TECHNICAL FIELD OF THE INVENTION

The present invention refers to a constrained joint prosthesis adapted to be implanted at a knee joint. A joint prosthesis is intended to be implanted for a final use and hence its duration is permanent - except if particular drawbacks arise or if there is an onset of infection, i.e. except for very particular and specific cases.

STATE OF THE PRIOR ART

As is known, joint prostheses are implanted in the human body at a bone or at a bone articulation that is damaged or weakened. A joint prosthesis is intended to be implanted in a definitive manner and hence its duration is permanent, except for very particular and specific cases in which the prosthesis is removed. When the implant site is particularly weak or damaged, or when the implant of a prosthesis occurs for a second time, for example due to the substitution of a first prosthesis that is infected, it is necessary to use a constrained prosthesis, e.g. re-implant prosthesis, in which its femoral and tibial components are connected or constrained to each other.

It is therefore necessary to arrange a preformed constrained prosthesis, capable of providing the aforesaid constraint between the components thereof.

OBJECTS OF THE INVENTION

One object of the present invention is to improve the state of the prior art. A further object of the present invention is to provide a constrained prosthesis, also possibly secondary or re-implant prosthesis, which is preformed and simultaneously able to allow good mobility for the patient, notwithstanding the weakness of the tissues surrounding the implant.

A further object of the present invention is to provide a constrained prosthesis that ensures high stability for the knee joint.

In accordance with one aspect of the present invention, a constrained prosthesis for a knee is provided according to the enclosed claim 1.
The present invention further refers to a method for the assembly of a constrained prosthesis for a knee according to the enclosed claim 19.

The dependant claims refer to preferred and advantageous embodiments of the invention.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will be more evident from the detailed description of a preferred but not exclusive embodiment of a constrained prosthesis for a knee, illustrated as a non-limiting example in the enclosed drawing tables in which:

figure 1 and figure 2 are perspective views of the constrained prosthesis according to the present invention which illustrate two mutual positions of a femoral component with respect to a tibial component;

figures 3 to 5 are respectively a front view, a top view and a side view of the tibial component of the constrained prosthesis according to the present invention;

figures 6 to 9 are respectively a side perspective view, a top view, a bottom front view and a bottom rear view of the femoral component of the constrained prosthesis according to the present invention;

figures 10 and 11 are front views of the constrained prosthesis according to the present invention respectively provided or not provided with a further closure or locking element;

figures 12 and 13 are side schematic views of the constrained prosthesis according to the present invention which illustrate two mutual positions of the femoral component with respect to the tibial component;

figures 14 and 15 are side schematic views in section of the constrained prosthesis according to the present invention pursuant to figures 12 and 13, taken along the trace plane XIV-XIV of figure 10;

figure 16 is a side perspective view of the constrained prosthesis according to one version of the invention;

figure 17 is an exploded side perspective view of the constrained prosthesis according to one version of the invention.
EMBODIMENTS OF THE INVENTION

With reference to the enclosed figures, reference number 1 generically indicates a constrained prosthesis.

By constrained prosthesis, it is intended a prosthesis whose tibial and femoral components are joined together, i.e. they are hinged or it is not possible to modify the relative distance therebetween.

In substance, the femoral component is capable of rotating and translating with respect to the tibial component (and vice versa) but the two components cannot be separated from each other. This serves so that, once the two components are fixed to the bone of the patient during implant, the knee joint cannot undergo dislocations, or that tibia and femur do not have irregular relative rotation.

The femoral component and the tibial component of the prosthesis 1 according to the present invention, according to that defined now and as will be better understood in the course of the present description, are constrained to each other in an articulated manner, and they are both adapted to be stably and/or permanently fixed to the respective bone of the patient.

Such constrained prosthesis is preformed and adapted to be implanted at the knee joint.

The constrained prosthesis 1 according to the present invention comprises a tibial component 2 and a femoral component 3.

The tibial component 2 is adapted to be fixed to the end of the tibial bone at the knee joint while the femoral component 3 is adapted to be fixed to the end of the femoral bone in proximity to the knee joint.

In one version of the invention, only the femoral component 3 and the tibial component 2 are present, constrained to each other, while no patellar component is present.

The tibial component 2 comprises a tibial plate 20, on which the femoral component 3 is adapted to abut, roll and slide and with which it is articulated.

In one version of the invention, the tibial plate 20 abuts against and/or is fixed to a tibial base 20a which is adapted to come into contact during use with the tibial bone of the patient.

The tibial plate 20 and the tibial base 20a constitute, at least in one version of the
invention, the tibial component 2 of the prosthesis 1 according to the present invention. The tibial plate 20 comprises two condylar articular bases 21, 22. The condylar articular bases 21, 22 are substantially concave and have a curvature radius R2 (as is visible in figure 12).

The tibial component 2 further comprises, between the condylar articular bases 21, 22, a rib 23.

Such rib 23 is in relief with respect to the surface of the tibial plate 20 and/or of the condylar articular bases 21, 22.

At its front portion, the tibial component 2 and/or the rib 23 has a protrusion 25.

Such protrusion 25 has a substantially curved and/or C-shaped or swan-neck projection and during use is projected upward or towards the femoral component 3.

The protrusion 25 has a head or end 26 that is substantially T-shaped.

Specifically, the protrusion 25 comprises, as stated, a substantially curved shape and/or C shape comprising a first section that corresponds with at least part of the rib 23, a second section, with substantially vertical section, and a third section, raised with respect to the rib 23, but which is substantially parallel to the latter.

Such third section departs from the second section and terminates with the head or end 26, shaped as a T.

In one version of the invention, the rib 23 is not present and therefore the protrusion 25 only has a section with substantially vertical progression, from which a further section departs, substantially parallel to the tibial plate 20 and which terminates with the head or end 26.

The third section or the further section of the protrusion 25 is extended towards the rear part of the tibial component 2.

Therefore, the head or end 26 of the protrusion 25 comprises two sections 26', 26" that are extended on opposite sides with respect to the third section (and/or to the protrusion 25). In one version of the invention, the two sections 26', 26" are lateral bulges of the protrusion 25 or of its third section.

The sections 26', 26" have a progression that is lateromedial or parallel to the transverse axis of the human body.
The transverse axis of the human body is an axis of the human body that goes from right to left.

Due to the shape of the protrusion 25, the head or end 26 thereof comes to be situated in raised position substantially at the center of the tibial plate 20 and/or of the rib 23.

In particular, as visible in figure 15, the head or end 26 is situated at a distance D from the rib 23 or at a distance B from the most-front part of the tibial plate 20 and/or of the tibial component 2.

As visible in figure 4, the head or end 26, including the sections 26', 26", has a size or width, calculated according to the transverse axis of the human body, equal to F.

In particular, F is greater than the width F1 of the rib 23 (and/or of the protrusion 25).

The width of the first and/or second and/or third section or of the section with substantially vertical progression and/or of the further section of the protrusion 25 also have a width substantially corresponding to F1.

The tibial component 2 and/or the tibial base 20a, along a surface adapted to come into contact with the tibial bone of the patient or in any case opposite the condylar articular bases 21, 22, has a hole 24.

The hole 24 is adapted to house and fix, through for example a screw-nut screw coupling, at least one pin 28.

The at least one pin 28, possibly threaded, is a pin adapted for the connection, fixing and/or centering or orientation of the tibial component 2 with respect to the bone end of the tibial bone of the patient.

The at least one pin 28 is extended from the face of the tibial component 2 opposite that which has the two condylar articular bases 21, 22 or from the lower during use face of the tibial base 20a.

In one version of the invention, the at least one pin 28 is adapted to be screwed into a suitably threaded hole of a stem 28a (or to be connected to the same in a suitable manner), adapted for the connection, fixing and/or centering or orientation of the tibial component 2 with respect to the bone end of the tibial bone of the patient.

The protrusion 25, during use, is adapted to be inserted in the femoral component 3, in a
manner such to create a guided articulation or a constraint articulation between the femoral component 3 and the tibial component 2.

The femoral component 3 has a shape that generally reproduces the condylar articulation surfaces of the femur. In particular, the femoral component 3 has, as is visible for example in figures 12 and 13, a substantially U-shaped form - in cross section according to a plane parallel to the sagittal plane of the human body.

The femoral component 3 comprises an internal surface 31, substantially concave, adapted to be positioned in contact with the bone seat, and an external surface 32, substantially convex, adapted to come into contact and be articulated with the tibial component 2 and/or with the tibial plate 20.

The femoral component 3 is symmetric, with respect to a plane of symmetry parallel to the sagittal plane of the human body.

More in detail, the femoral component 3 comprises a first condylar portion 33 placed laterally and a second condylar portion 34 medially placed with respect to the sagittal plane of the human body, each having a shape similar to that of the condyles of the knee.

The condylar portions 33, 34 in turn have a substantially U-shaped form - in cross section according to a plane parallel to the sagittal plane of the human body.

The condylar portions 33, 34, in their front during use portion of the constrained prosthesis 1 according to one version of the present invention, converge towards each other and are joined together to form a joining portion or surface adapted to come into contact with the patella or to be arranged substantially in the zone where it is usually situated from the anatomical standpoint.

The condylar portions 33, 34 are during use adapted to come into contact with and be articulated on the condylar articular bases 21, 22 of the tibial component 2.

The condylar portions 33, 34 are separated from each other by an intercondylar space 50. The intercondylar space 50 is extended at least along the during use rear and central portion of the femoral component 3 and/or of the condylar portions 33, 34. In one version of the invention, the intercondylar space 50 is also extended for a portion of the
front part of the femoral component 3, e.g. the portion which, during use, is placed downward and towards the central portion thereof.
The femoral component 3 comprises a box element 35, placed on the internal surface 31.
The box element 35 is connected to the internal surface 31 and, in one version of the invention, is integrally made therewith and/or with the femoral component 3.
The box element 35 has two lateral walls and one connector wall, which connects and joins the lateral walls. The connector wall is placed above the lateral walls of the box element. The lateral walls have a progression parallel to the sagittal plane of the human body. During use, they are extended therefore from the front portion to the rear portion of the internal surface 31 of the tibial component 3.
The box element 35 has a substantially overturned U shape - in cross section according to a plane parallel to the front plane of the human body.
Between the lateral walls and the connector wall of the box element 35, a seat or cavity is comprised or enclosed, corresponding to the abovementioned intercondylar space 50.
At the connector wall of the box element 35, a hole 36 and/or a cylindrical protrusion or stem 38 (possibly threaded) can be present, for the connection, fixing and/or centering or orientation of the femoral component 3 with respect to the bone end of the femoral bone.
In one version of the invention, the at least one pin 38 is adapted to be screwed in a suitably threaded hole of a stem 38a (or to be connected to the same in a suitable manner), adapted for the connection, fixing and/or centering or orientation of the tibial component 2 with respect to the bone end of the tibial bone of the patient.
The condylar portions 33, 34 have, in at least one portion of their profile, a curvature radius R1, as is visible for example in figure 12.
The radius R1 is present at least in the rear portion of the condylar portions 33, 34.
In a further version of the invention, the condylar portions 33, 34 have, in at least one portion of their profile, a curvature radius R3, as is visible for example in figure 13.
The radius R3 is present at least in the central portion of the condylar portions 33, 34.
The curvature radius R1, in one version of the invention, is smaller than the curvature
radius R2.
In a further version, the curvature radius R3 is substantially equal to the curvature radius R2.

The box element 35 comprises an external surface 42 and an internal surface 43. The internal surface 43 faces towards the intercondylar space 50.
The internal surface 43 in turn comprises two internal lateral walls and one internal connector wall, which delimit the intercondylar space 50.

Each or at least one of the internal lateral walls of the internal surface 43 have a step 44. Such step 44 is projecting with respect to the internal lateral surface of the internal surface 43. Therefore, the step 44 is extended towards the intercondylar space 50.

Such step 44 constitutes a kind of guide for the head or end 26 of the tibial component 2. Indeed, such head or end 26, during the articulation of the femoral component 3 on the tibial component 2, slides and/or can rotate along such step 44, allowing the articulation of the knee of the patient in which the constrained prosthesis 1 has been implanted.

Simultaneously, the step 44 determines the constraint of the femoral component 3 with the tibial component 2, since the head or end 26 of the latter abuts against (particularly due to the sections 26', 26") and is substantially prevented - regarding its movements from right to left - from exiting from the seat determined by the box element 35 and/or, hence, from the intercondylar space 50.

In one version of the invention, such step 44 has a substantially overturned S shape.
Regarding such overturned S, during use: the upper horizontal section coincides with the internal connector wall, the concavity is placed at the rear part of the tibial component 3, the convexity is placed at the front part of the tibial component 3 and the lower horizontal second section coincides with the (central) external surface 42 of the femoral component 3.
The overturned S shape of the step 44 and/or the presence of the step 44 allows creating an opening, in the femoral component 3 and in particular between its two condylar portions 33, 34, comprising two portions and/or having two widths. By width, in this case, it is intended the size of the opening along a direction that goes from right to left,
hence considered along the front plane of the human body or parallel to the same. Such
direction is horizontal, i.e. also parallel to the abutment surface of the human body.
The opening determined by the box element 35 and by the step 44 coincides with the
intercondylar space 50.

5 In particular, as is visible for example in figure 8, for example in proximity to the front
zone of the femoral component 3, a first opening 48 is present having a width L.
In proximity instead to the central and lower zone of the femoral component 3, a second
opening 49 is present which has a width N, in which N is smaller than L.
In particular, as will be better described hereinbelow, the width L corresponds
substantially or is slightly greater than the width F of the head or end 26 of the femoral
component 2. In such a manner, it is possible to insert such head or end 26 inside the
intercondylar space 50, through such first opening 48.
Then, once the protrusion 25 is inserted in the femoral component 3 by means of its
head or end 26, the latter is engaged with, or at least abutted against, the step 44 and is
unable to exit from the second opening 49 having width N.
Indeed, the width N is smaller than the width F and substantially corresponds to the
width Fl, or is slightly greater than the latter.
According to a section taken along a plane parallel to the front plane of the human body,
therefore, the opening has a substantially T shape, substantially corresponding to the T
shape of the protrusion 25 and/or of the head or end 26 of the protrusion 25.
The constrained prosthesis 1, according to at least one version of the invention, then
comprises a closure or locking element 46.
The closure or locking element 46 has size substantially corresponding to that of the
first opening 48 or at least of its initial part. In particular, such closure or locking
element 46 is capable of closing the first opening 48 and preventing the exit of the head
or end 26 from the intercondylar space 50 delimited by the box component 35 of the
femoral component 3.
In one version of the invention, the closure or locking element 46 is provided with a pin
47, adapted to be inserted, e.g. snap-inserted, in at least one hole 36b suitably made in
the femoral component 3.
The hole 36b is placed at the front portion of the femoral component 3, in a manner so as to maintain the closure or locking element 46 in the front or frontal portion thereof.
In a further version of the invention, not illustrated in the figures, closure or locking element 46 comprises a through hole. The longitudinal progression of such through hole can correspond with the longitudinal progression of the hole 36b present in the femoral component 3.
For example, in one version of the invention, such holes can have a substantially vertical longitudinal progression, considering the prosthesis according to the present invention in its implant position or during use.
In this version, the pin 47 is not present and is substituted by a screw, for example a metallic screw. Such screw passes, possibly being screwed, through the longitudinal hole of the closure or locking element 46 and, possibly, also through the hole 36b.
In such a manner, the locking (from the outside, by means of the screw itself) of such element on the femoral component 3 occurs. Simultaneously, a kind of "stop" is created that prevents the protrusion 25 from exiting from the space or opening in which it is inserted.
The pin 47, when present, can be made integrally with the body of the closure or locking element 46 or it can be assembled or fixed to the same according to known modes.
The closure or locking element 46 and/or the pin 47 can be made of a metallic material or of a plastic material such as polyethylene or ultra-high molecular weight polyethylene (UHMWPE).
When both the pin 47 and the closure or locking element 46 are made of plastic material, they can be glued or locked or joined in a stable manner to the femoral component 3, for example by means of the bone cement.
When the closure or locking element 46 and/or the pin 47 are made of plastic material, they can be glued or locked or joined in a stable manner to the femoral component 3, for example by means of bone cement.
The closure or locking element 46 has an internal face 46d (during use directed towards the bottom wall 35d of the box element 35) that is substantially concave. In such a
manner, the sections 26', 26" can also rotate into such position of contact with the internal face 46d, and hence the femoral component 3 can also be articulated in this position with respect to the tibial component 2.

The closure or locking element 46 substantially has a prism shape, e.g. with triangular base, as visible in figure 22.

Seen in cross section, i.e. in a section parallel to the sagittal plane of the human body, as illustrated in the figures 14 and 15, the first opening 48 has a substantially wedge-like shape while the second opening 49 has a progression that is substantially wedge-shaped or L-shaped. In the latter version, for example, the sections of the L interest (the longer one) the central portion towards the bottom and (the shorter one) the rear portion of the femoral component 3, at its external surface 32.

In particular, the second opening 49 is a through opening, from front to rear of the femoral element 3.

The first opening 48, instead, is only open at its front part. In the rear part, however, it is closed by the bottom wall 35d of the box element 35.

The bottom wall 35d, therefore, acts as a block for the sliding of the head or end 26 on the steps 44 and hence as a block for the maximum articulation of the femoral component 3 with respect to the tibial component 2.

The bottom wall 35d has a curvature substantially corresponding to that of the sections 26', 26" of the protrusion 25, in a manner so as to allow the rotation thereof - and hence the rotation of the femoral component 3 on the tibial component 2 - also in such position.

The first and the second opening 48, 49 identify corresponding portions in the internal lateral walls of the box element 35.

Such portions are delimited, on each side, by the step 44.

In particular, the internal lateral walls have a first portion or surface 51 and a second portion or surface 52.

Both such portions have a progression substantially parallel to the sagittal plane of the human body. The first portion or surface 51, nevertheless, is placed more in proximity to the internal connector wall of the box element 35. In such a manner, it is situated
more internally with respect thereto.
Such first portion or surface 51 has a progression that is substantially rectangular with
smoothed edges. The height of such first portion or surface 51 is substantially equal to
the bulk of each of the sections 26', 26".

The sections 26' and 26", in one version of the invention, are small cylinders which
depart laterally from the protrusion 25. In a further version, the sections 26', 26" have a
shape adapted to allow the rotation of the femoral component 3 on the tibial component
2, e.g. small balls, etcetera.

The sections 26', 26", in fact, act as a rotation hinge or axis around which a relative
rotation occurs between the tibial component 2 and the femoral component 3.

The second portion or surface 52 is instead more external with respect to the internal
connector wall of the box element 35. In particular, such second portion or surface 52 is
closer to the tibial component 2, with respect to the first 51.

This second portion or surface 52 has a substantially L-shaped progression, in which its
larger section is substantially parallel to the progression of the first portion or surface
51, while its shorter section continues upward in a substantially perpendicular manner,
considering the constrained prosthesis 1 during use.

The distance between the first portions or surfaces 51 is equal to L while the distance
between the two second portions or surfaces 52 is equal to N.

The closure or locking element 46, at least in one version of the invention, determines
the front wall of the box element 35.

As is seen, the present invention allows attaining the pre-established objects, since it
allows a rotational-translational and stable movement of the femoral component on the
tibial component, even in the presence of damaged bone tissues or bone tissues that
have been weakened due to the size of the damage or repetition of the operations. Such
movement cannot translate laterally, but only in front-back direction, since the femoral
component is constrained in an articulated manner to the tibial component.

For such reason, therefore, the prosthesis 1 comprises means for the rotation-translation
or for the sliding and the rotation of the femoral component 3 on the tibial component 2
and vice versa. The rotation-translation or rotation and sliding or translation movement
is a relative movement of the femoral component 3 on the tibial component 2.
Such means, in at least one version of the invention, are constituted by the protrusion
25, with its head or end 26 and by the intercondylar opening or space 50 of the femoral
component 3, possibly defined by the presence of the step 44.

The prosthesis according to the present invention, therefore, follows the physiological
movement of the knee joint.
If necessary, the closure or locking element 46 could be removed from the prosthesis 1,
for example in the remote case in which the latter must be removed from the human
body, preserving the surrounding tissues as much as possible during the step of
extraction of the various components.

The constrained prosthesis 1, according to a non-limiting version of the invention, is
assembled according to the following method: arranging a tibial component 2 and a
femoral component 3 as described above and inserting or housing the protrusion 25 of
the tibial component inside an opening present in the femoral component 3.

In particular, the head or end 26 of the tibial component 2 is inserted in the first opening
48 of the femoral component 3. Then, the sections 26', 26" abut against a step 44
placed on both sides of the opening of the femoral component 3, and they can slide on
the step itself.

In this manner, the protrusion 25 can slide and traverse the second opening 49 of the
femoral component 3. Simultaneously, the latter is articulated with the tibial component
by rotating and/or translating thereon.

Finally, the closure or locking element 46 is inserted in the femoral component 3, for
example in a hole 36b thereof, in a manner so as to prevent the protrusion 25 from
exiting from the femoral component 3. In such a manner, the femoral component 3 and
the tibial component 2 are constrained to each other in an articulated manner.

The at least one pin 28, 28a and/or the cylindrical protrusion or stem 38, 38a can then be
inserted or screwed, in a manner so as to stabilize (during use) the application
respectively of the tibial component 2 on the tibial bone and/or of the femoral
component 3 on the femoral bone.

Finally, it is possible to lock the closure or locking element 46 by means of bone cement
or by means of a screw.
If it is necessary to once again extract the prosthesis 1, it would be sufficient to remove
the bone cement that blocks and fixes the closure or locking element 46 in position, e.g.
by means of a small scalpel, so to be able to remove and free the passage for the
protrusion 25.
Or, if there is the screw for locking the closure or locking element 46 to the femoral
component 3: if it is necessary to once again extract the prosthesis 1, it would be
sufficient to unscrew the screw that locks and fixes the closure or locking element 46 in
position, so to be able to remove and free the passage for the protrusion 25.
By making the latter exit from the first opening 48, it will be possible to release the
tibial and femoral components and then remove both components (or at least one) from
the implant site without having to overly compromise the residual tissues of the
articulation of the patient.
As seen above, the prosthesis 1 - even if implanted in situations of serious bone loss and
loosening of the ligaments as well as in less damaged situations - is constrained, thus
ensuring good stability for the knee joint.
In addition, the prosthesis according to the present invention can, during use, be
implanted in the two affected bone ends and be constrained after implant of the femoral
and tibial components. Indeed, once the femoral component and tibial component are
implanted, it is possible to insert the protrusion 25 in the suitable space or opening of
the femoral component. The access point of the protrusion in the femoral element is
then closed by the presence of the closure or locking element.
A facilitated method is thus obtained, with advantages in terms of reduction of time and
pain, both for the patient and for the doctor.
In addition, due to this the patient can lead a self-sufficient life for the entire period of
use of the constrained prosthesis according to the present invention.
The constrained prosthesis 1 according to the present invention is made of biologically
compatible manner.
Such biologically compatible manner can be selected from among metals, metal alloys
and organometallic compounds.
The constrained prosthesis according to the present invention, in fact, must be made of extremely durable materials, both since it is a permanent prosthesis, and since - being constrained - it must be able to resist stresses and forces of considerable intensity. Simultaneously, the material constituting the prosthesis according to the present invention must ensure a limited wear over time. This is facilitated by the fact that the tibial plate 20 is made of a plastic material with low friction coefficient, such as polyethylene or ultra-high molecular weight polyethylene (UHMWPE).

Therefore, while the femoral component 3 and/or the tibial base 20a can be made of a metallic material, among those listed above such as steel, chrome-cobalt steel, the tibial plate 20 can be made of a low friction plastic material, such as polyethylene material or UHMWPE.

The UHMWPE material is self-lubricating.

The thickness of the tibial plate 20, in one version of the invention, is comprised between 10 and 15 mm.

The thickness of the femoral component 3 or of the tibial base 20a, in one version of the invention, can be comprised between 1 and 5 mm, e.g. 2 mm.

If the tibial plate 20 is made of a plastic material, the protrusion 25 and/or the head 26 can be made of metal.

In one version of the invention, the protrusion 25 and/or the head 26 and/or the rib 23 are integrally made with the tibial base 20a, above which the tibial plate 20 made of plastic material is placed, as an insert. For example, the plastic material insert that constitutes the tibial plate 20 can only affect the zones relative to the two condylar articular bases 21, 22.

In such a manner, it is possible to confer a greater stability to the plant, a high load strength, etcetera.

The invention thus conceived is susceptible to numerous modifications and variations, all falling within the scope of the inventive concept.

In addition, all the details can be substituted by other technically equivalent elements. In practice, the materials used, as well as the contingent shapes and sizes, can be of any type in accordance with requirements, without departing from the protective scope of
the following claims.
CLAIMS

1. Prosthesis (1) for the articulation of the knee comprising a tibial component (2), adapted to be fixed to one end of the tibial bone in proximity to the knee joint, and a femoral component (3), adapted to be fixed to one end of the femoral bone in proximity to the knee joint, wherein said tibial component (2) is adapted to come into contact and be articulated with said femoral component (3), characterized in that said tibial component (2) comprises a protrusion (25) adapted to be inserted in an opening present in said femoral component (3), in order to allow the sliding and rotation of said femoral component (3) on said tibial component (2), wherein said protrusion (25) has a substantially C-shaped conformation.

2. Prosthesis (1) according to claim 1, comprising means for the relative roto-translation of said femoral component (3) on said tibial component (2), wherein said means for the roto-translation comprise at least said protrusion (25), and/or wherein said protrusion (25) has a head or end (26) provided with two sections (26', 26") which are extended on the side opposite said protrusion (25) and/or said head or end (26).

3. Prosthesis (1) according to claim 1 or 2, wherein said tibial component (2) comprises a tibial plate (20) provided with two condylar articular bases (21, 22) and a rib (23) placed between said condylar articular bases (21, 22), wherein said condylar articular bases (21, 22) are adapted to come into contact and be articulated with said femoral component (3).

4. Prosthesis (1) according to any one of the preceding claims, wherein said femoral component (3) has a substantially U-shaped form in cross section according to a plane parallel to the sagittal plane of the human body and comprises a substantially concave internal surface (31), in contact with the femoral bone seat, and a substantially convex external surface (32) adapted to come into contact with said tibial component (2).

5. Prosthesis (1) according to any one of the preceding claims, wherein said femoral component (3) comprises a first and a second condylar portion (33, 34), said first condylar portion (33) being laterally placed and said second condylar portion (34)
being medially placed with respect to the sagittal plane of the human body, said condylar portions (33, 34) having a substantially U-shaped conformation in cross section according to a plane parallel to the sagittal plane of the human body, wherein said first condylar portion (33) and said second condylar portion (34) are separated from each other by an intercondylar space (50).

6. Prosthesis (1) according to any one of the preceding claims, wherein said femoral component (2) comprises a box element (35), placed on the internal surface (31) of said femoral component (3), wherein said box element (35) comprises two lateral walls, a connector wall connected to said lateral walls, wherein said walls identify an internal connector wall and two internal lateral walls which delimit said opening or said intercondylar space (50).

7. Prosthesis (1) according to any one of the preceding claims, wherein said opening comprises a first opening (48) having width (L) and a second opening (49) having width (N), wherein (L) is greater than (N).

8. Prosthesis (1) according to any one of the preceding claims when dependent on claim 2, wherein said a head or end (26) provided with two sections (26', 26") has a width (F) and wherein said protrusion (25) has a width (Fl), wherein said width (F) substantially corresponds to or is slightly smaller than said width (L) and wherein said width (Fl) substantially corresponds to or is slightly smaller than said width (N).

9. Prosthesis (1) according to any one of the preceding claims when dependent on claim 6, wherein said means for the roto-translation comprise at least a step (44) placed on each internal lateral wall of said box element (35), and/or each internal lateral wall of said box element (35) comprises a step (44), wherein said step (44) delimits a first portion or surface (51) and a second portion or surface (52) of said internal lateral wall, wherein said first portion or surface (51) is placed in proximity to the internal connector wall of the box element while said second portion or surface (52) is placed in proximity to said tibial component (2).

10. Prosthesis (1) according to the preceding claim, wherein said first portions or surfaces (51) are separated by a distance (L) while the second portions or surfaces
(52) are separated by a distance (N) of said intercondylar space (50) or of said respective first opening (48) and said second opening (49).

11. Prosthesis (1) according to any one of the preceding claims, wherein said step (44) has an overturned S conformation and/or wherein said first opening (48) is delimited on the rear by a bottom wall (35d) of said box element (35).

12. Prosthesis (1) according to any one of the preceding claims, comprising a closure or locking element (46) adapted to close said first opening (48) and to prevent the exit of said protrusion (25) from said opening of said femoral component (3), wherein said closure or locking element (46) comprises a pin (47) or a through hole for example for a locking screw.

13. Prosthesis (1) according to any one of the preceding claims, wherein said first portion or surface (51) has a substantially rectangular progression with smoothed edges, and/or wherein said first portion or surface (51) has a height substantially equal to the bulk of said sections (26', 26")).

14. Prosthesis (1) according to any one of the preceding claims, wherein said second portion or surface (52) has a substantially L-shaped progression, wherein its greater segment is substantially parallel to the progression of said first portion or surface (51), while its shortest segment continues upward in a substantially perpendicular manner, considering the arrangement of said prosthesis (1) during use.

15. Prosthesis (1) according to any one of the preceding claims, wherein said sections (26', 26") have a conformation adapted to allow the rotation of said femoral component (3) on said tibial component (2) and/or have a cylinder, ball conformation, or the like.

16. Prosthesis (1) according to any one of the preceding claims, wherein said prosthesis (1) is made of biologically compatible material selected from among a metal, a metal alloy, an organometallic compound.

17. Prosthesis (1) according to any one of the preceding claims, wherein said tibial component (2) comprises a tibial base (20a) on which said tibial plate (20) is abutted or fixed.
18. Prosthesis (1) according to any one of the preceding claims, wherein said tibial base (20a) is made of biologically compatible material selected from among a metal, metal alloy, an organometallic compound and/or wherein said tibial plate (20) and/or said closure or locking element (46) and/or said pin (47) are made of a plastic material with low friction coefficient, such as polyethylene or ultra high molecular weight polyethylene or UHMWPE.

19. Method for the assembly of a prosthesis (1) for the articulation of the knee comprising a tibial component (2), adapted to be fixed to one end of the tibial bone in proximity to the knee joint, and a femoral component (3), adapted to be fixed to one end of the femoral bone in proximity to the knee joint, wherein said femoral component (3) is adapted to come into contact and be articulated with said tibial component (2), comprising the steps of:

- providing a tibial component (2), provided with a tibial plate (20) and with a protrusion (25), and a femoral component (3), provided with an opening, wherein said protrusion (25) has a substantially C-shaped conformation,
- inserting said protrusion (25) in said opening of said femoral component (3), in a manner such to constrain said femoral component (3) to said tibial component (2) in a rotary manner. And allow the sliding and rotation of said femoral component (3) on said tibial component (2).

20. Method according to the preceding claim, wherein said insertion step comprises inserting a head or end (26) provided with two sections (26', 26") of said protrusion (25) in a first opening (48) having width (L).

21. Method according to claim 19 or 20, wherein said femoral component (3) has a box element (35) having two internal lateral walls and an internal connector wall, wherein each internal lateral wall comprises a step (44), with substantially overturned S conformation, wherein said method comprises the steps of sliding and/or rolling said sections (26', 26") on said step (44) in a manner so as to allow the sliding and the rotation of said femoral component (3) on said tibial component (2).

22. Method according to any one of the claims 20 to 21, comprising a step of
providing a closure or locking element (46) and closing said first opening (48) by means of said closure or locking element (46), so as to prevent the exit of said protrusion (25) from said opening of said femoral component (3).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61F2/38

ADD.

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)

A61F

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search

24 August 2017

Date of mailing of the international search report

04/09/2017

Name and mailing address of the ISA

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Authorized officer

Storer, John

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