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Blum

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(54) **TOTAL KNEE PROSTHESIS AND METHOD FOR TOTAL KNEE ARTHROPLASTY**

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This patent is subject to a terminal disclaimer.

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A61F 2/08 (2006.01)

(52) **U.S. Cl.** **623/13.12**

(58) **Field of Classification Search** 623/13.11–13.2, 623/20.24, 20.25, 20.28, 20.3, 20.31
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,597,766	A		7/1986	Hilal et al.
4,770,663	A	*	9/1988	Hanslik et al. 623/13.12
4,773,910	A		9/1988	Chen et al.
5,067,962	A		11/1991	Campbell et al.
5,133,758	A		7/1992	Hollister
5,282,867	A		2/1994	Mikhail
5,326,361	A		7/1994	Hollister
5,358,527	A		10/1994	Forte
5,413,604	A		5/1995	Hodge
5,967,790	A		10/1999	Strover
6,004,351	A		12/1999	Tomita
6,267,767	B1		7/2001	Strobel et al.
6,406,497	B2		6/2002	Takel
6,482,210	B1	*	11/2002	Skiba et al. ..... 606/86 R
6,582,469	B1		6/2003	Tornier
6,592,622	B1		7/2003	Ferguson
6,905,513	B1		6/2005	Metzger
7,014,660	B2		3/2006	Fenning
7,153,327	B1		12/2006	Metzger
7,255,715	B2		8/2007	Metzger
7,445,639	B2		11/2008	Metzger
2002/0010512	A1		1/2002	Takei
2002/0156535	A1		10/2002	Pappas
2004/0193279	A1		9/2004	Roger
2005/0187635	A1		8/2005	Metzger
2008/0188943	A1		8/2008	Gundlapalli
2008/0243258	A1		10/2008	Sancheti

* cited by examiner

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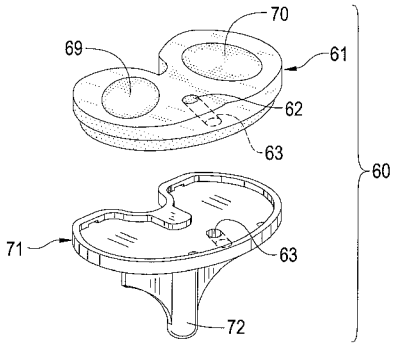
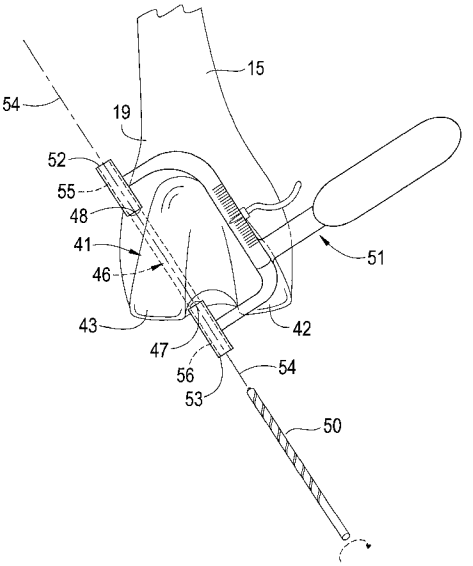
(57) **ABSTRACT**

A prosthetic knee implant for implantation into a mammal, which accommodates an anterior cruciate ligament substitute to provide stability to the knee implant. The prosthetic knee implant includes a femoral component having a pair of condylar surfaces and a tibial component having a surface portion adapted to slidably engage the femoral component upon rotation of the same. The femoral component further includes a recess between the condyles defining an aperture through the femoral component. The tibial component further includes a center portion defining an aperture through the tibial component substantially at its center. The femoral aperture and the tibial aperture are adapted to receive an anterior cruciate ligament substitute for biasing the mammalian femur and tibia together. Also disclosed is a method used to replace the total knee joint in a mammal with the improved prosthetic knee implant of the present invention.

5 Claims, 7 Drawing Sheets





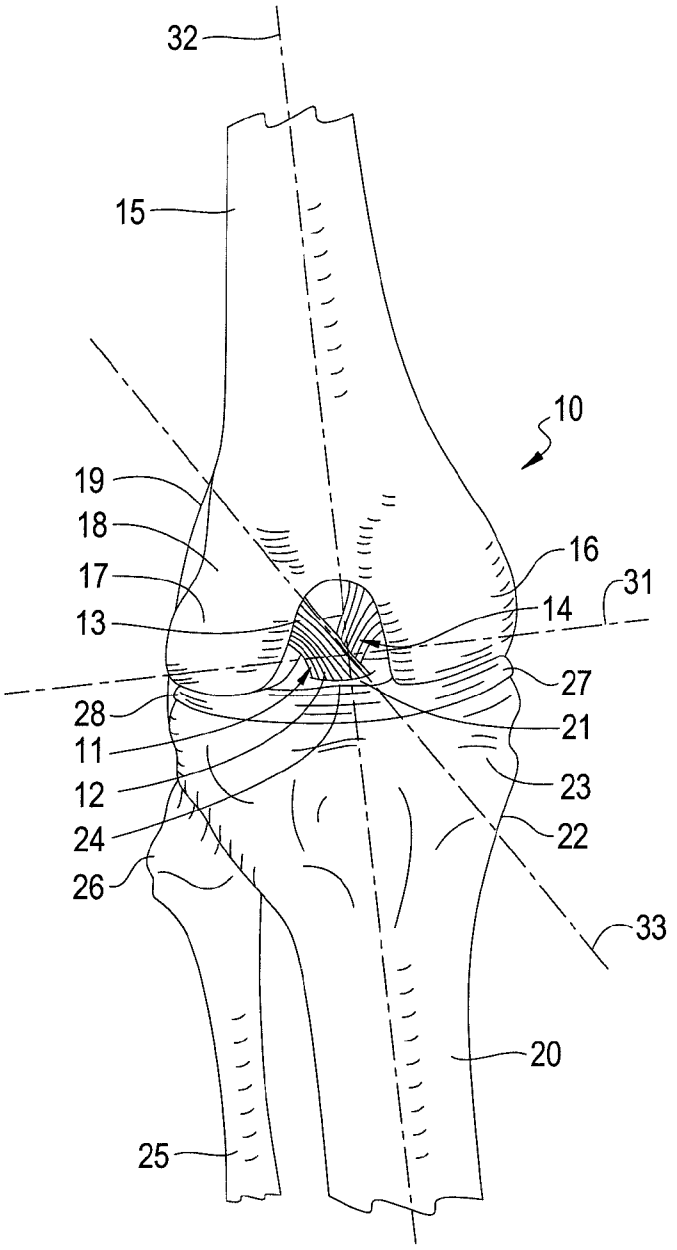

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FIG. 1

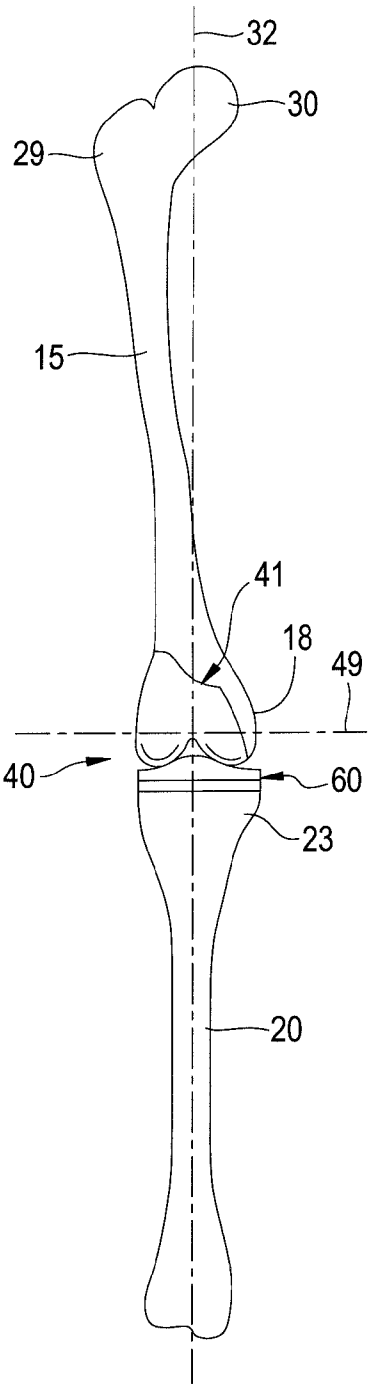
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FIG. 2

FIG. 3

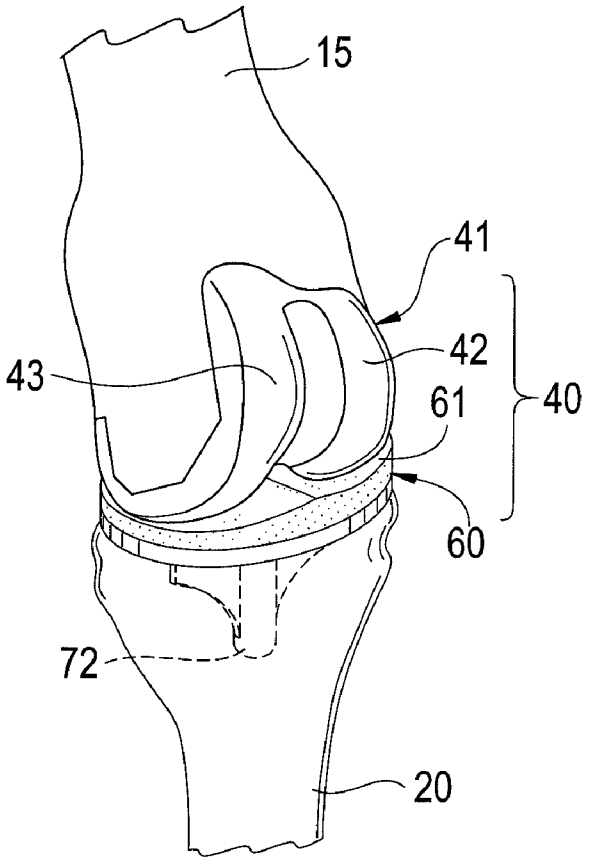
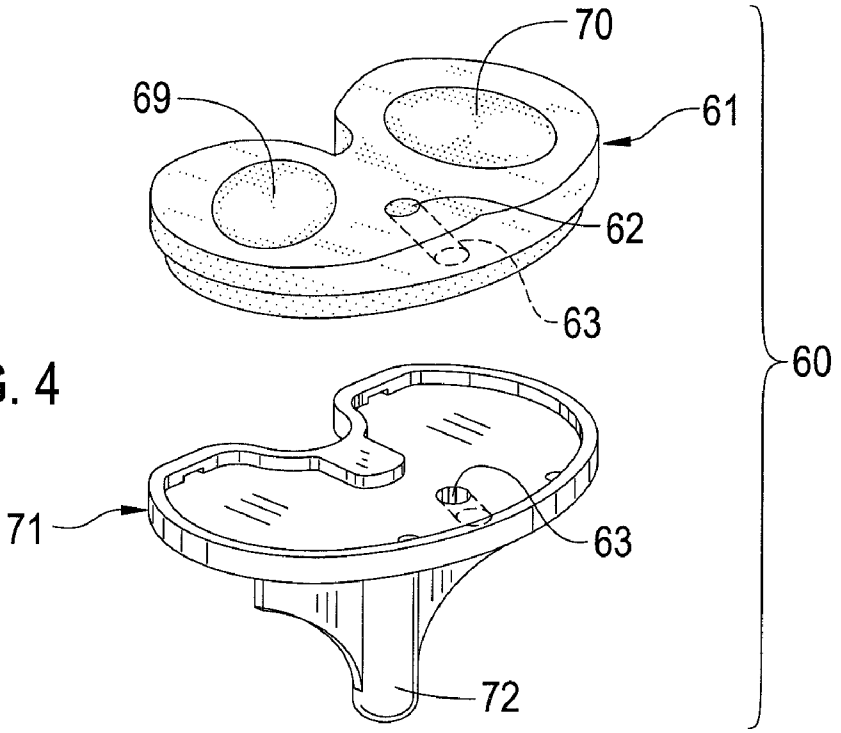


FIG. 4



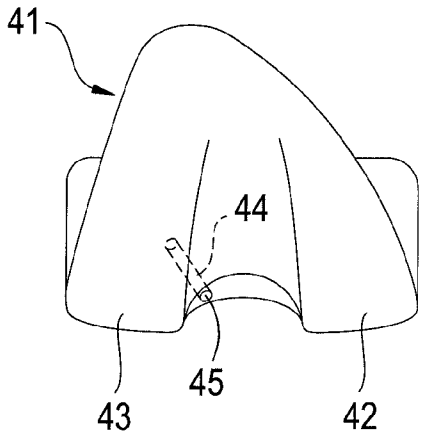


FIG. 5

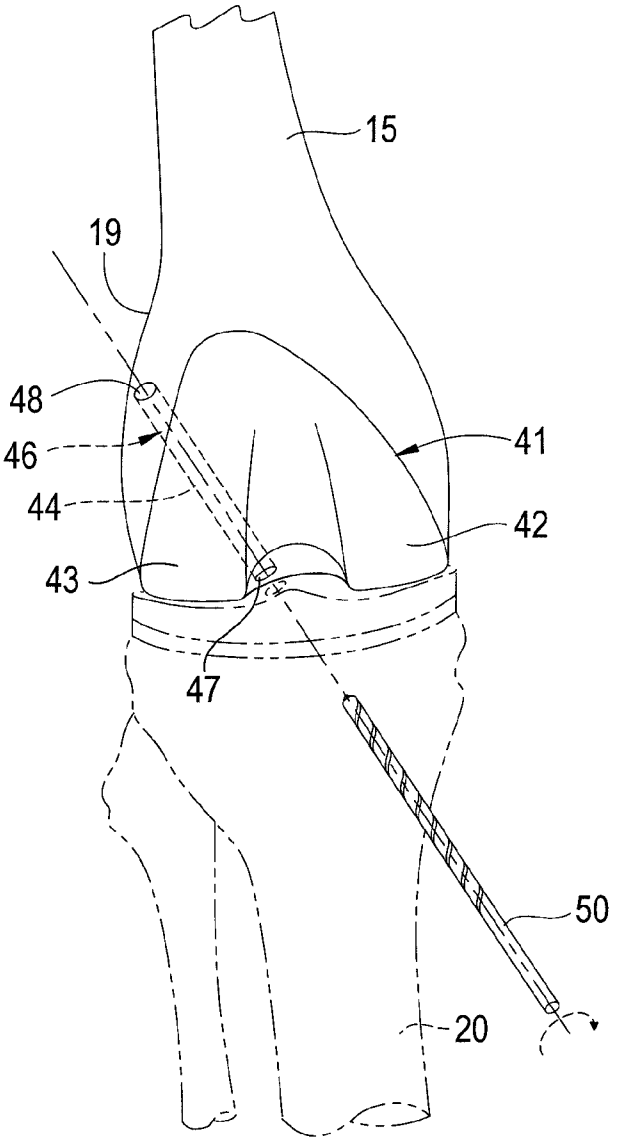


FIG. 6A

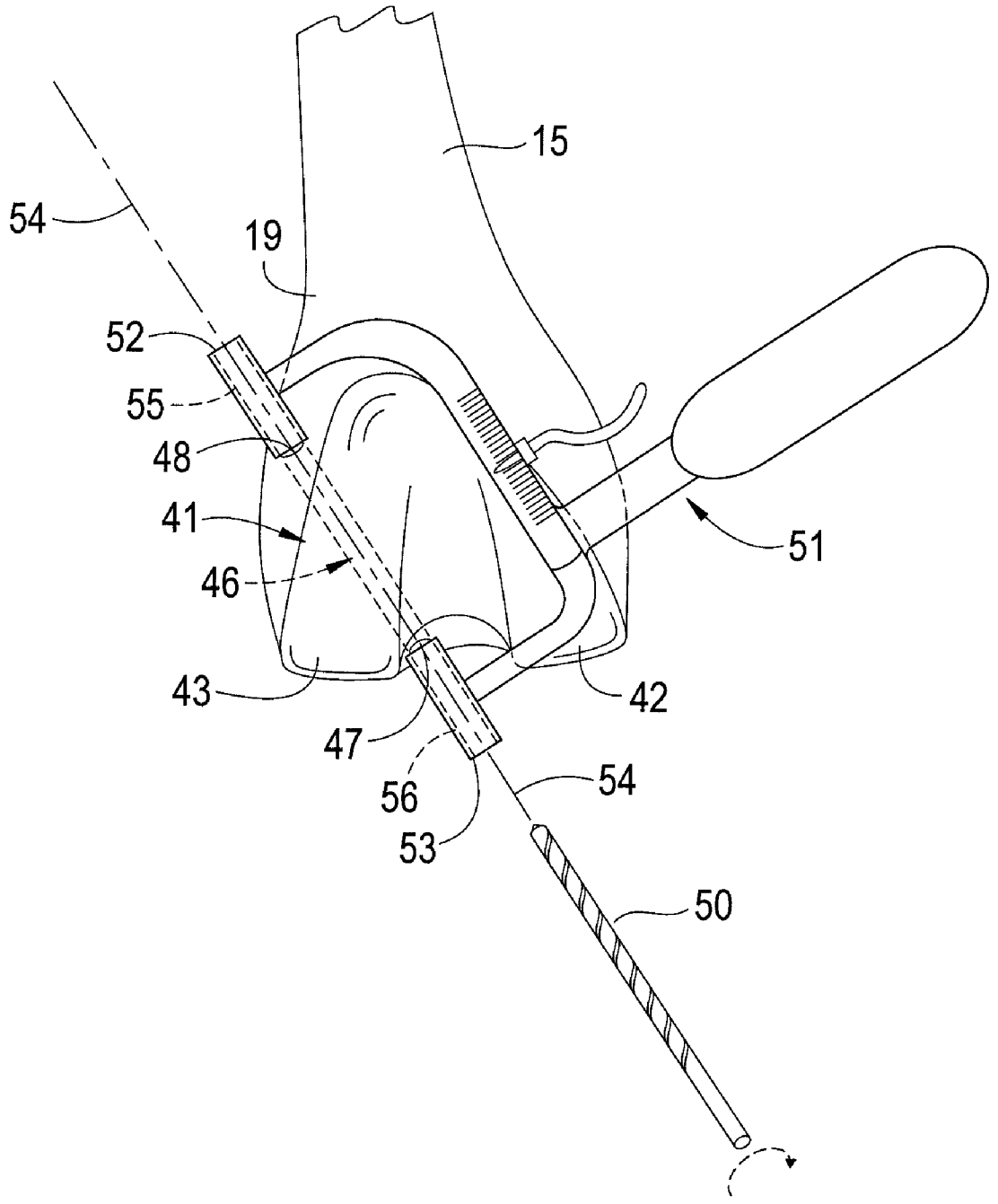


FIG. 6B

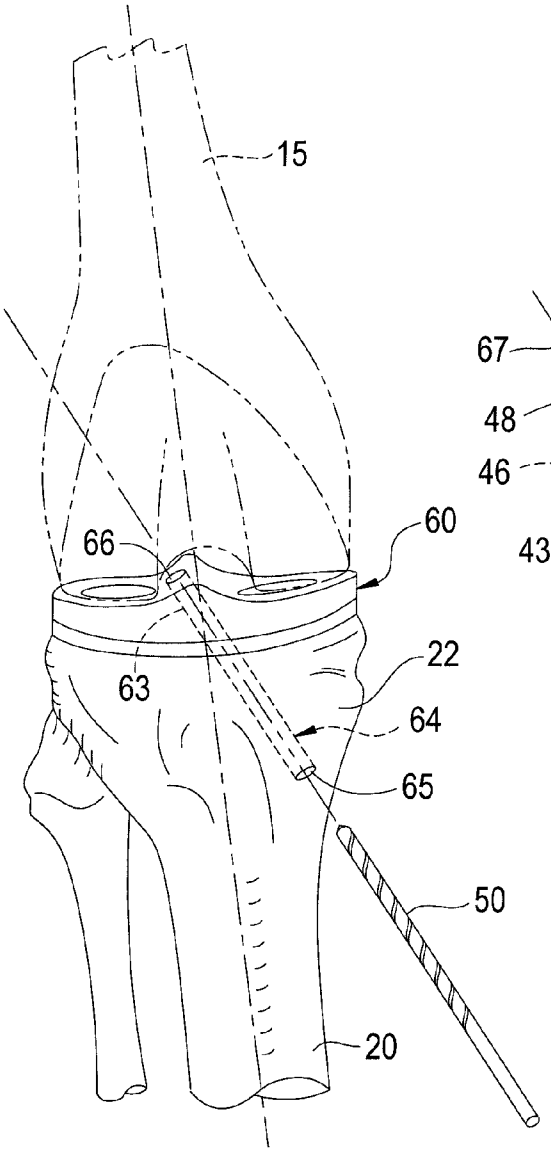


FIG. 7

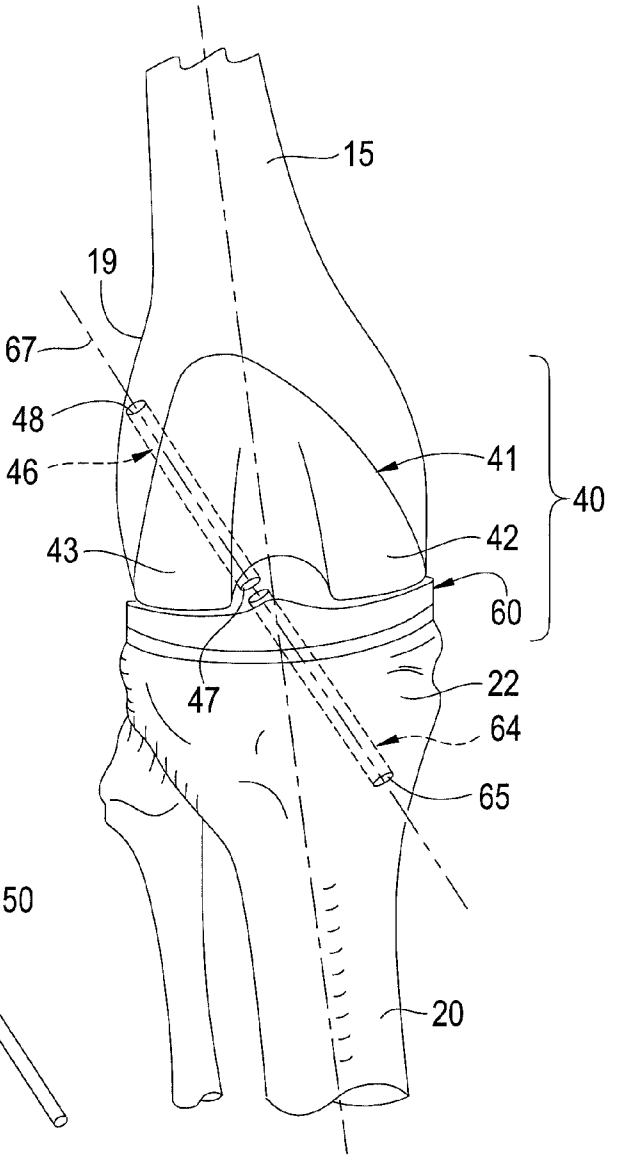


FIG. 8

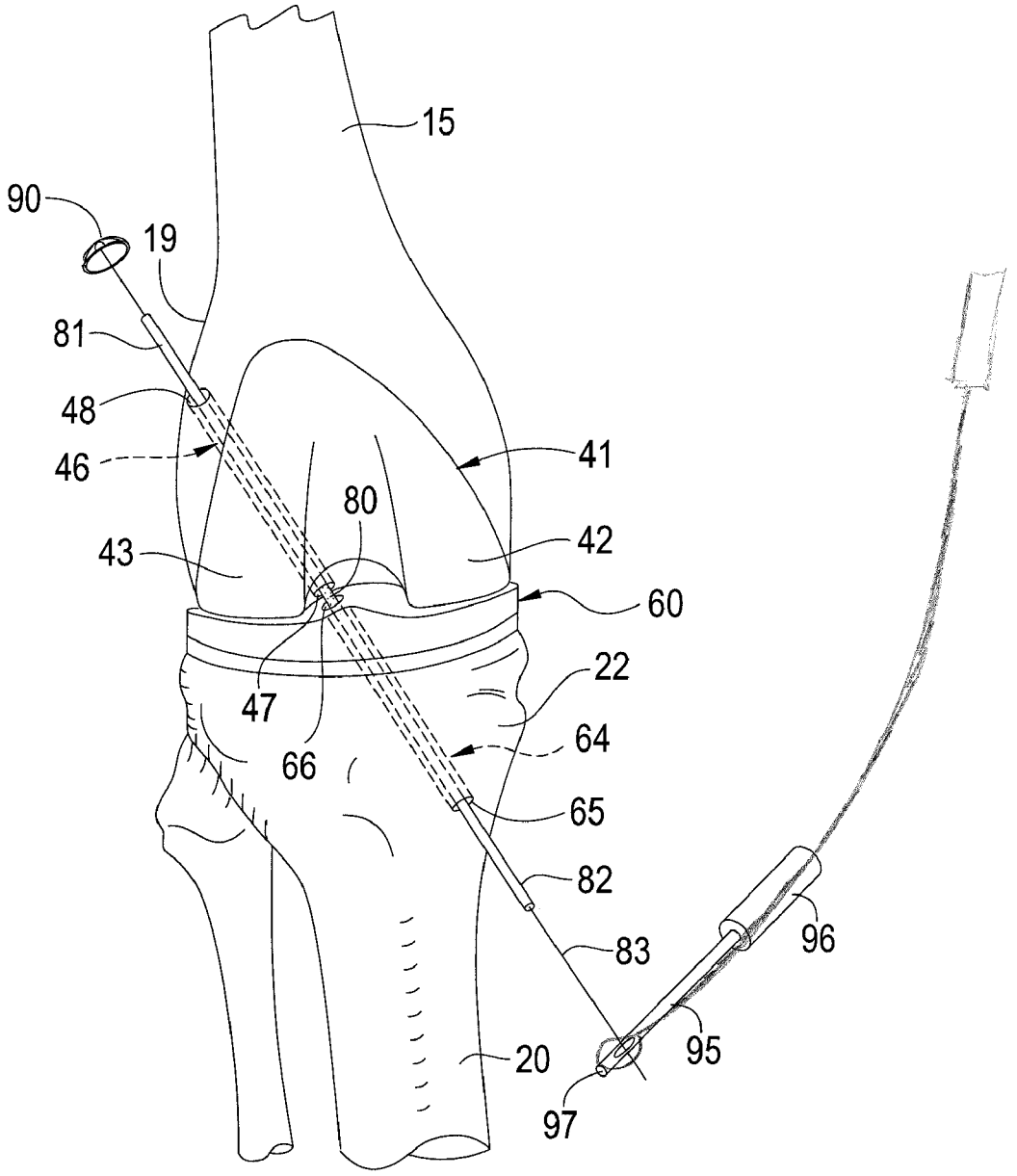


FIG. 9

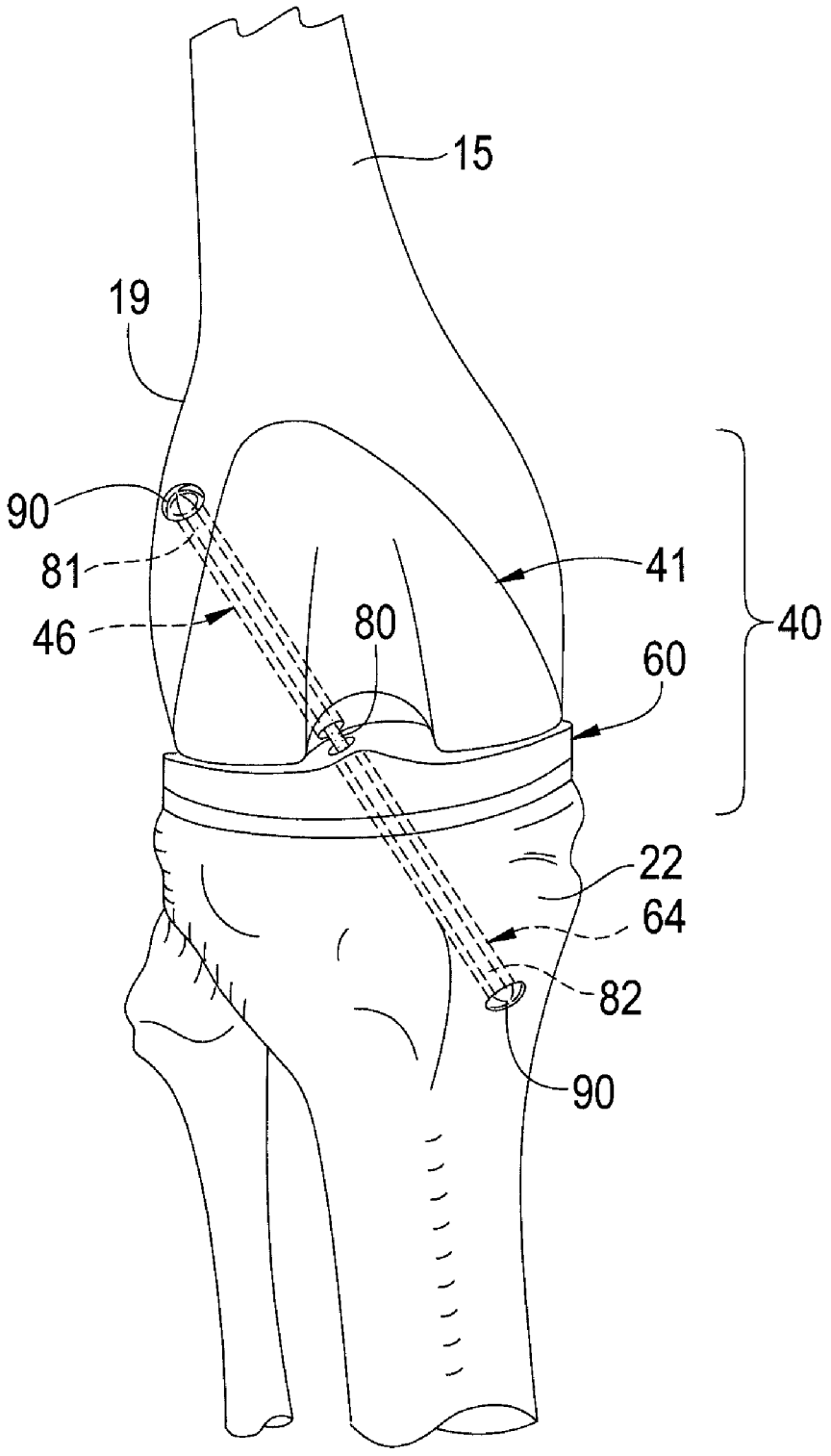


FIG. 10

TOTAL KNEE PROSTHESIS AND METHOD FOR TOTAL KNEE ARTHROPLASTY

FIELD OF THE INVENTION

The present invention relates generally to prosthetic knee implants and corresponding surgical methods used to replace the total knee joint in a mammal. More particularly, the invention relates to a prosthetic knee implant having a femoral component and a tibial component, which are adapted to receive an anterior cruciate ligament substitute for biasing the femur and tibia together.

BACKGROUND OF THE INVENTION

Mammalian knees wear out for a variety of reasons, including inflammation from arthritis, injury, or simple wear and tear. Over the past 40 years, total knee arthroplasties (commonly referred to as total knee replacements or "TKR") have become the standard of care for end-stage arthritis. In most TKR procedures, the natural bearing surfaces of the upper portion of the tibia (tibial plateau) and the lower portion of the femur (femoral condyles) are resected and replaced with artificial material. Specifically, approximately between 0.5 to 1.5 centimeters of the upper portion of the tibia, including both the intercondylar eminence and the medial and lateral tibial plateaus, are resected, leaving a relatively flat surface onto which a rigid support member is affixed. Then, a synthetic surface portion is affixed to the support member, with the surface portion simulating the intercondylar eminence and the tibial plateaus. A lower end portion of the femur is then resected, and a member having bearing surfaces replicating the femoral condyles is then affixed to the remaining end of the femur.

The majority of currently available prosthetic knee implants employed for TKR do not retain the natural anterior cruciate ligament. Rather, during the implant procedure, the anterior cruciate ligament is either removed or, if preservation is attempted, has been found to rupture shortly after implant of the prosthesis. This is particularly true for TSR candidates, who often have a sacrificed anterior cruciate ligament going into the surgery. As a result, the mechanical interaction between the femoral and tibial components in a TKR is the primary means to stabilize the anterior-posterior motion of the knee.

Although the existing TKR prostheses succeed in increasing patient mobility, and provide the patient with the desired therapeutic result, at least one significant disadvantage remains. Namely, in a TKR wherein the anterior cruciate ligament is lacking, the femoral condyles translate in a posterior direction in full extension and translate in an anterior direction in flexion, which is reverse of the motions in a natural knee joint. Such abnormal translation and pivot shift often results in the patient's compromised functional abilities, such as quadriceps avoidance, and changed upper body mechanics during activities such as stair climbing and rising from a chair. Even asymptomatic patients show gait abnormalities that could lead to reduced functional ability to perform activities of daily living over time.

Further, abnormal anterior translation of the TKR can lead to accelerated wear of the prosthesis. Indeed, current TKR prostheses have a functional lifespan of approximately 15 years, such that younger patients (who are increasingly receiving TKRs) are more likely to require revision surgery as they age. The amount of bone loss that is inherent in a TKR makes a revision procedure much more difficult in the future as even more bone must be removed.

Existing TKR prostheses attempt to compensate for the loss of the anterior cruciate ligament by containing or limiting the amount of abnormal translation in the nonstabilized knee. For example, U.S. Pat. No. 5,413,604 discloses a TKR prosthesis wherein the anterior cruciate ligament must be sacrificed, thereby resulting in a nonstabilized TKR with abnormal anterior translation. Without an anterior cruciate ligament, the prosthesis relies primarily on the mechanical interaction between the femoral and tibial components as a means to accommodate the abnormal anterior translation and stabilize the knee. Similarly, U.S. Pat. No. 7,014,660 discloses a TKR prosthesis that incorporates a control arm and stop pin assembly to limit the amount of anterior sliding movement caused by the lack of the anterior cruciate ligament. Unfortunately, neither prosthesis disclosed in the '604 and '660 patents actually prevents the abnormal anterior translation of the nonstabilized TKR; rather, they only attempt to accommodate or limit it. As a result, the patient's functional abilities remain limited, and the prosthesis is subject to premature wear and tear. The U.S. Pat. Nos. 5,413,604 and 7,014,660 are hereby incorporated by reference in their entireties.

Therefore, there exists a constant need in this art for an improved TKR prosthesis that allows for the replacement of an anterior cruciate ligament, and approaches the mobility, stability and longevity of a natural, healthy knee joint.

SUMMARY OF THE INVENTION

The present invention is directed to a prosthetic knee implant, and more particularly, to a prosthetic knee implant having a femoral component including a medial and lateral condyle, and a tibial component including a surface portion adapted to slidably engage the femoral component upon rotation of the same. The femoral component includes a recess between the medial and lateral condyles defining an aperture through the femoral component. The tibial component includes a center portion defining an aperture through the tibial component substantially at its center. The femoral aperture and the tibial aperture are adapted to receive an anterior cruciate ligament substitute for biasing the femur and the tibia together.

In addition, a method of total knee joint replacement in a mammal is presented consisting of replacing at least a portion of the lower femur with the improved prosthetic femoral component; replacing at least a portion of the upper tibia with the improved prosthetic tibial component; engaging a drill alignment guide to the femoral component between the femoral condyles and drilling a longitudinal channel through the femoral aperture and into the femur; engaging a drill alignment guide to the tibial component and extending the tibial aperture by drilling a longitudinal channel through the tibia aperture and into the tibia. The method further includes threading an anterior cruciate ligament substitute into the femoral channel and into the tibial channel and anchoring a first end of the ligament substitute to bone leaving a free end; applying tension to the free end; and, anchoring the free end to bone under tension such that said femur and the tibia are biased together.

BRIEF DESCRIPTION OF THE DRAWINGS

A total knee prosthesis apparatus and a method for total knee replacement incorporating the features of the invention are depicted in the attached drawings which form a portion of the disclosure and wherein:

FIG. **1** is an anatomical view of a human knee joint having an anterior cruciate ligament and posterior cruciate ligament;

FIG. **2** is a diagram of a prosthetic knee implant in accordance with a preferred embodiment of the present invention, and implanted at the joint between a human femur and tibia to provide a total knee replacement;

FIG. **3** is a perspective view of the prosthetic knee implant of FIG. **2**;

FIG. **4** is an exploded perspective view of the tibial component;

FIG. **5** is a partial exploded view of the femoral component;

FIG. **6**A is an illustration of the femur of FIG. **2** having the femoral channel drilled longitudinally through the femoral aperture and into the femur;

FIG. **6**B is an illustration of the femur of FIG. **2** with an aligned drill guide for drilling longitudinally through the femoral aperture and into the femur.

FIG. **7** is an illustration of the tibia of FIG. **2** having the tibial channel drilled longitudinally through the tibial aperture and into the tibia;

FIG. **8** is a combined illustration of FIG. **6**A and FIG. **7**, further depicting the femoral channel and tibial channel in substantial alignment in accordance with a preferred embodiment of the present invention;

FIG. **9** illustrates the anterior cruciate ligament substitute with a self-anchoring umbrella-type anchor being threaded downward through the femoral channel and tibial channel; and

FIG. **10** illustrates the anterior cruciate ligament substitute threaded through the femoral and tibial channels, under tension, and anchored to the exterior surfaces of the femur and tibia with umbrella-type anchors.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings for a better understanding of the function and structure of the invention, FIG. **1** shows a typical patient's natural knee joint **10** prior to the surgical procedure. Illustrated is upper portion **23** of the tibia **20** the upper portion **26** of the fibula **25**, the lower portion **18** of the femur **15**, the exterior surface **19** of the femur **15**, as well as the medial condyle **16** and lateral condyle **17**. The anterior cruciate ligament I1 and the posterior cruciate ligament **14** are seen to be present in the knee joint **10**. One end **12** of the anterior cruciate ligament **11** is attached to the anterior portion of the intercondylar eminence **21** of the tibia **20**, and the second end **13** of the anterior cruciate ligament **11** is attached to the posterior portion of the medial aspect of the lateral femoral condyle **17**, thereby defining an axis **33** of the anterior cruciate ligament **11**. The posterior cruciate ligament **14** passes upward and forward on the medial side of the anterior cruciate ligament **11**, extending from behind the intercondylar eminence **21** to the lateral side of the medial condyle **16** of the femur **15**. Also seen is the exterior surface **22** of the tibia **20**, the tibial plateau **24**, the medial meniscal cartilage **27** and lateral meniscal cartilage **28**.

The femur **15** and tibia **20** extend along a mechanical axis **32** which is generally parallel to the tibia **20** and passes through the head **30** of the natural hip joint (not shown). The tibia **20** rotates about an axis **31** relative to the lower portion **18** of the femur **15** that bisects the condyles **16** and **17** and is generally perpendicular to the mechanical axis **32**. Axis **31** corresponds with what is referred to in the medical industry as the "knee joint line," this joint line being separated into a medial joint line portion which is the portion of the joint line starting at the intersection of the axis **32** and axis **31** and extending to the right (i.e. in the medial direction) of the knee joint, and a lateral joint line which is the portion of the line starting at the intersection of the axis **32** and axis **31** and extending to the left (i.e. in the lateral direction) of the knee joint. During articulation of the knee joint **10** between flexion and extension, the medial condyle **16** engages the tibia **20** along a medial bearing surface bordered by the medial meniscal cartilage **27**, while the lateral condyle **17** engages the tibia **20** along a lateral bearing surface bordered by the lateral meniscal cartilage **28**. The anterior crucial ligament **11** limits forward movement of the tibia **20** under the femoral condyles **16** and **17**, while the posterior cruciate ligament **14** limits backward movement of the tibia **20** under the femoral condyles **16** and **17**.

Referring now to FIG. **2**, the natural knee joint **10** has been replaced by a prosthetic knee implant **40** constructed in accordance with a preferred embodiment of the present invention. The prosthetic knee implant **40** includes a femoral component **41** affixed to the lower portion **18** of the femur **15** and a tibial component **60** affixed to the upper portion **23** of the tibia **20**. The femoral component **41** includes a tibial axis of rotation **49** relative to the lower portion **18** of the femur **15** that is generally perpendicular to the mechanical axis **32** and is also oriented in substantial similarity to axis **31** of FIG. **1**.

Referring to FIGS. **3** and **4**, the femoral component **41** includes a replacement medial condyle **42** and a replacement lateral condyle **43** of the femur **15**. Normally, the ends of the femoral condyles **16** and **17** are resected and shaped to receive the femoral component **41** and affixed to the femur **15** as is known in the art, such as adhesion using bone cement and/or pegs extending into the condyles **16** and **17**.

The tibial component **60** includes a surface portion **61** adapted to slidably engage the femoral component **41** upon rotation of the tibia **20** about tibial axis **49**, in such a manner as to enable the prosthetic knee implant **40** to serve as a substitute for the natural knee joint **10** for relative motion of the femur **15** and tibia **20** between flexion and extension. In a preferred embodiment, the tibial component **60** provides replacement bearing surfaces in the form of lateral bearing surface **69** for engagement by the lateral condyle **43** and medial bearing surface **70** for engagement by the medial condyle **42** of the prosthetic knee implant **40**. The tibial component **60** further includes a center portion **62** that defines an aperture **63** through the tibial component **60** substantially at its center. Preferably, the tibial aperture **63** is of sufficient size to accommodate a replacement anterior cruciate ligament.

Typically, the natural anterior cruciate ligament **11** is removed, along with approximately between 0.5 to 1.5 centimeters of the upper portion **23** of the tibia **20**, including the tibial plateau **24**, the intercondylar eminence **21**, the medial meniscal cartilage **27**, and the lateral meniscal cartilage **28**, thereby leaving a relatively flat surface onto which the tibial component **60** is affixed. In a preferred embodiment, the tibial component **60** includes a support member in the form of a platform **71** having a unitary depending stem **72** inserted into the tibia **20** to assist in the accurate location and affixation of the platform **71** on the tibia **20**. In a preferred embodiment, a surface portion **61** is secured in place on platform **71** to be interposed between the femoral component **41** and platform **71** for providing medial and lateral bearing surfaces **70** and **69** and for engagement by the medial condyle **42** and the lateral condyle **43**, respectively, to enable articulation of the prosthetic knee implant **40**. The condyles **42** and **43** preferably are constructed of a biocompatible high-strength alloy, while the preferred material for the surface portion **61** is a synthetic polymeric material, such as high-density polyethylene. Surface portion **61** may be secured in place on platform **71** by means of any of several securing arrangements as described in greater detail in U.S. Pat. No. 5,413,604.

In effecting implant of the prosthetic implant **40**, the anterior cruciate ligament **11** of the natural knee has been sacrificed. Thus, during articulation of the prosthetic implant **40** between flexion and extension the condyles **42** and **43** translate in a posterior direction in full extension and translate in an anterior direction in flexion, as described in greater detail in U.S. Pat. No. 5,413,604, col. 4, lines 41-67.

Referring to FIG. **5**, the femoral component **41** includes a recess **45** between the medial and lateral condyles **42** and **43**, which defines an aperture **44** through the femoral component **41**. Preferably, the femoral aperture **44** is of sufficient size to accommodate an anterior cruciate ligament substitute.

Referring to FIG. **6**A, a longitudinal channel **46** is drilled in a conventional manner through the femoral aperture **44** and into the femur **15**. In a preferred embodiment, the femoral channel **46** has lower opening **47** and upper opening **48**. Alternatively, femoral channel **46** does not extend through the exterior surface **19** of the femur **15** but terminates within the femur **15** bone. The femoral channel **46** is drilled using a conventional two-step process with the engagement of a drill guide (depicted in FIG. **6**B) to the femoral component **41** between the femoral condyles **42** and **43**, followed by a drill **50** to create the femoral channel **46** of sufficient size to accommodate an anterior cruciate replacement. In a preferred embodiment, the drill guide (depicted in FIG. **6**B) is configured to align the femoral channel **46** with the femoral aperture **44**. The femoral channel **46** is typically debrided of all surrounding debris at upper opening **48**, and any sharp edges are chamfered using a conventional bone rasp.

Referring to FIG. **6**B, there is shown a drill guide **51** engaged with the femoral component **41** to provide a temporary guide for the drill **50** while drilling the femoral channel **46**. In a preferred embodiment, the guide **51** includes a first sleeve **52** and a second sleeve **53** aligned longitudinally along a drilling axis **54**. The first sleeve **52** and second sleeve **53** each include an aperture **55** and **56** disposed longitudinally along the drilling axis **54** suitable for allowing the passage of a drill bit **50**. The second sleeve **53** is adapted to nest in and mate with the femoral component aperture **44** along the drilling axis **54**.

Referring to FIG. **7**, a longitudinal channel **64** is drilled in a conventional manner into the tibia **20** and through the tibial aperture **63**. In a preferred embodiment, the tibial channel **64** has lower opening **65** and upper opening **66**. Alternatively, tibial channel **64** does not extend through the exterior surface **22** of the tibia **20** but terminates within the tibia **20** bone. The tibial channel **64** is drilled using a conventional two-step process with the engagement of a drill guide **51** (FIG. **6**B) to the tibial component **60**, followed by a subsequent drill **50** to create the tibial channel **64** of sufficient size to accommodate an anterior cruciate ligament substitute. The tibial channel **64** is typically debrided of all surrounding debris at lower opening **65**, and any sharp edges are chamfered using a conventional bone rasp. In a preferred embodiment, the surface portion **61** is affixed to platform **71** after the drilling of the tibial channel **64** to prevent damage to the surface portion **61** during drilling. Preferably, the tibial channel **64** and the femoral channel **46** are in alignment and are oriented along an axis generally parallel to the axis **33** of an anatomic anterior cruciate ligament **11**.

As mentioned above, the drill guide **51** (FIG. **6**B) may also be engaged with the tibial component **60** to facilitate drilling of the tibial channel **64**. Specifically, the second sleeve **53** may be adapted to nest in and mate with the tibial aperture **63** to define a drilling axis for the drill **50** while drilling the tibial channel **64**. The tibial channel **64** may be drilled from the lower opening **65** to the upper opening **66**, or vice versa.

Referring to FIG. **8**, there is shown a prosthetic knee implant **40** constructed in accordance with a preferred embodiment. The femoral channel **46** extends through the exterior surface **19** of the femur **15** having lower opening **47** and upper opening **48**. The tibial channel **64** extends through the exterior surface **22** of the tibia **20** having lower opening **65** and upper opening **66**. Femoral channel **46** and tibial channel **64** are preferably in alignment and oriented along an axis **67** generally parallel to the axis **33** of a natural anterior cruciate ligament **11**. The prosthetic implant **40** is now ready to have an anterior cruciate ligament substitute implanted.

The types of anterior cruciate ligament substitutes that can be used in the present invention include allografts, autografts, xenografts and synthetic grafts. Allografis include ligamentous tissue harvested from cadavers and appropriately treated, disinfected, and sterilized. Autografts consist of the patients own ligamentous tissue harvested either from the patellar tendon or from the hamstring. Xenografts include ligamentous tissue harvested from one mammalian species and transplanted into or grafted onto another species, genus, or family (such as from porcupine to a human). Synthetic grafts include grafts made from synthetic polymers such as polyurethane, polyethylene, polyester and other conventional biocompatible, bioabsorbable or nonabsorbable polymers and composites.

Referring to FIG. **9**, an anterior cruciate ligament substitute **80** is threaded down into the femoral channel **46** and the tibial channel **64**. There are numerous methods and instruments known in the art that may be utilized to thread the anterior cruciate ligament substitute **80**, which include the use of a suture passer (such as those disclosed in U.S. Pat. Nos. 5,746,754; 5,439,467; and 5,462,562), a graft-passing wire (such as that disclosed in U.S. Pat. No. 6,623,524), or a ligature carrier (such as that disclosed in U.S. Pat. No. 6,245,073 col. 2 lines 23-25) U.S. Pat. Nos. 5,746,754; 5,439,467; 5,462,562; 6,623,524; and 6,245,073 are hereby incorporated by reference in their entirety. Alternatively, the second end **82** of the ligament substitute **80** is passed down into the upper opening **48** of the femoral channel **46** until it exits the lower opening **47** of the femoral channel **46**. A threading instrument **95** having a proximal handle **96** and a distal notched end **97** for engaging the ligament substitute **80** or a leading guide wire **83** attached to the ligament substitute **80** is provided. The distal end **97** of the threading instrument **95** is inserted into the lower opening **65** of the tibial channel **64** and is moved forward and out of the upper opening **66** of the tibial channel **64**. Once the ligament substitute **80** is engaged in the distal notched end **97**, the threading instrument **95** is withdrawn from the tibial channel **64**, thereby pulling the guide wire **83** and passing the second end **82** of the ligament substitute **80** down through the upper opening **66** of the tibial channel **64** and out the lower opening **65** of the tibial channel **64**. At that time, the guide wire **83** is removed from the threading instrument **95**. The first end **81** of the ligament substitute **80** is anchored to the femur **15** using a conventional securing device such as cross-pins, femoral fasteners, endobuttons, screws, or staples. In a preferred embodiment, the first end **81** of the ligament substitute **80** is anchored to the exterior surface **19** of the femur **15** at the medial aspect of the posterior lateral femoral condyle with a self-anchoring umbrella anchor **90**, as shown. Ideally, the ligament substitute **80** is coated with a substance that facilitates bone ingrowth into the ligament substitute **80**, such as a hydroxyaptite (HA) coating. Then, the second end **82** of the ligament substitute **80** is placed in tension by the surgeon while the second end **82** is anchored to the bone of the tibia **20**, thereby biasing the tibia **20** and femur **15** together. The second end **82** of the ligament

substitute **80** may be anchored to the tibia **20** at the tibial anterior medial plateau, as shown, using a conventional securing device such as tibial fasteners, screws and washers, or staples. Alternatively, the ligament substitute **80** may be anchored from within the femur **15** and/or tibia **20** bone through use of a conventional securing device such as cross pins (such as those described in U.S. Pat. No. 7,032,599, col. 2, lines 42-62), or screws.

Referring to FIG. **10**, there is shown a prosthetic knee implant **40** constructed in accordance with a preferred embodiment. The first end **81** of the ligament substitute **80** is disposed longitudinally through the femoral channel **46** and anchored to the exterior surface **19** of the femur **15**, and the second end **82** of the ligament substitute **80** is disposed longitudinally through the tibial channel **64** and anchored to the exterior surface **22** of the tibia **20** with a self-anchoring umbrella anchor **90**. In the preferred embodiment, the ligament substitute **80** is oriented generally parallel to the axis **33** of the natural anterior cruciate ligament **11**.

A surgical kit useful in practicing the method of total knee arthroplasty of the present invention is anticipated by the inventor. Such a kit would include the components previously described above. More specifically, the kit is seen to have a femoral component **41** including a replacement medial condyle **42** and a replacement lateral condyle **43**, a tibial component **60** including a surface portion **61** adapted to slidably engage the femoral component **41** upon flexion and extension of the femoral component **41**, an anterior cruciate ligament substitute **80**, and means to anchor the ligament substitute **80** to the femur **15** and tibia **20**, such as staples, screws or self-anchoring umbrella anchors **90**. The tibial component **60** further includes a center portion **62** that defines an aperture **63** through the tibial component **60** substantially at its center. The kit would further include at least one drill guide component (**51**) cooperatively shaped to engage the apertures (**44**) and (**63**) of the femoral and tibial components **41** and **60**.

As will be apparent to one skilled in the art, various modifications can be made within the scope of the aforesaid description. Such modifications being within the ability of one skilled in the art for a part of the present invention and are embraced by the claims below. For example, the inventor anticipates variations in the types of anchors used, the depth to which any ligament substitute end might be anchored inside bone, the degree and manner in which tension might be applied to a ligament substitute, and the placement of the apertures in the femoral and tibial components for drilling. The priority in the steps of anchoring the ligament ends, whether above on the femur or below on the tibia, may be varied in accordance with the surgeon's experience and the particular operating situation is also anticipated.

Having set forth the nature of the invention, what is claimed is:

1. A method of total knee joint replacement in the leg of a mammal, comprising the steps of:

a. replacing at least a portion of the lower femur with a prosthetic joint component, said femoral component including a medial and lateral condyle and further including a recess between said condyles defining an access way into the lower femur;

b. replacing at least a portion of the upper tibia with a prosthetic joint component, said tibial component including a surface portion for receiving the surfaces of said femoral condyles and arranged for slidably supporting said same, said tibial component further including an aperture formed at its center;

c. engaging a drill alignment guide to said femoral component between said medial and lateral condyles and drilling a longitudinal tunnel through the femur and intersecting the medial aspect of the posterior lateral femoral condyle;

d. engaging a drill alignment guide to said tibial component and extending the femoral tunnel through said tibial aperture by drilling a longitudinal tunnel from the tibial anterior medial plateau of the tibia into said tibia and through said tibial aperture;

e. threading an anterior cruciate ligament substitute into said femoral tunnel and into said tibial tunnel and anchoring a first end of said ligament substitute to bone leaving a free end;

f. applying tension to said free end; and,

g. anchoring said free end to bone under tension such that said femur and said tibia are biased together.

2. The method as recited in claim **1**, wherein said steps of drilling through said femur and tibia are accomplished such that the two tunnels form an axially aligned segment.

3. The method as recited in claim **2**, wherein said tibial drilling step is done such that said tibial tunnel forms an angle of approximately 63 degrees with respect to medial joint line of the tibia.

4. The method as recited in claim **1**, **2**, or **3**, wherein said femoral drilling step is done such that said femoral tunnel forms an angle of approximately 63 degrees with respect to the knee joint line bisecting said knee joint.

5. The method as recited in claim **1**, **2**, or **3**, further comprising the steps of:

a. prior to said step of replacing said upper portion of said tibia with a tibial component, forming said aperture in the center of said tibial component by calculating the position of the longest path across the upper surface of said tibial component, calculating the shortest path across the upper surface of said tibial component, noting the intersection point of said shortest path and said longest path on said upper surface of said tibial component, and forming said aperture at said intersection point such that said aperture is positioned at the center of said upper surface.

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