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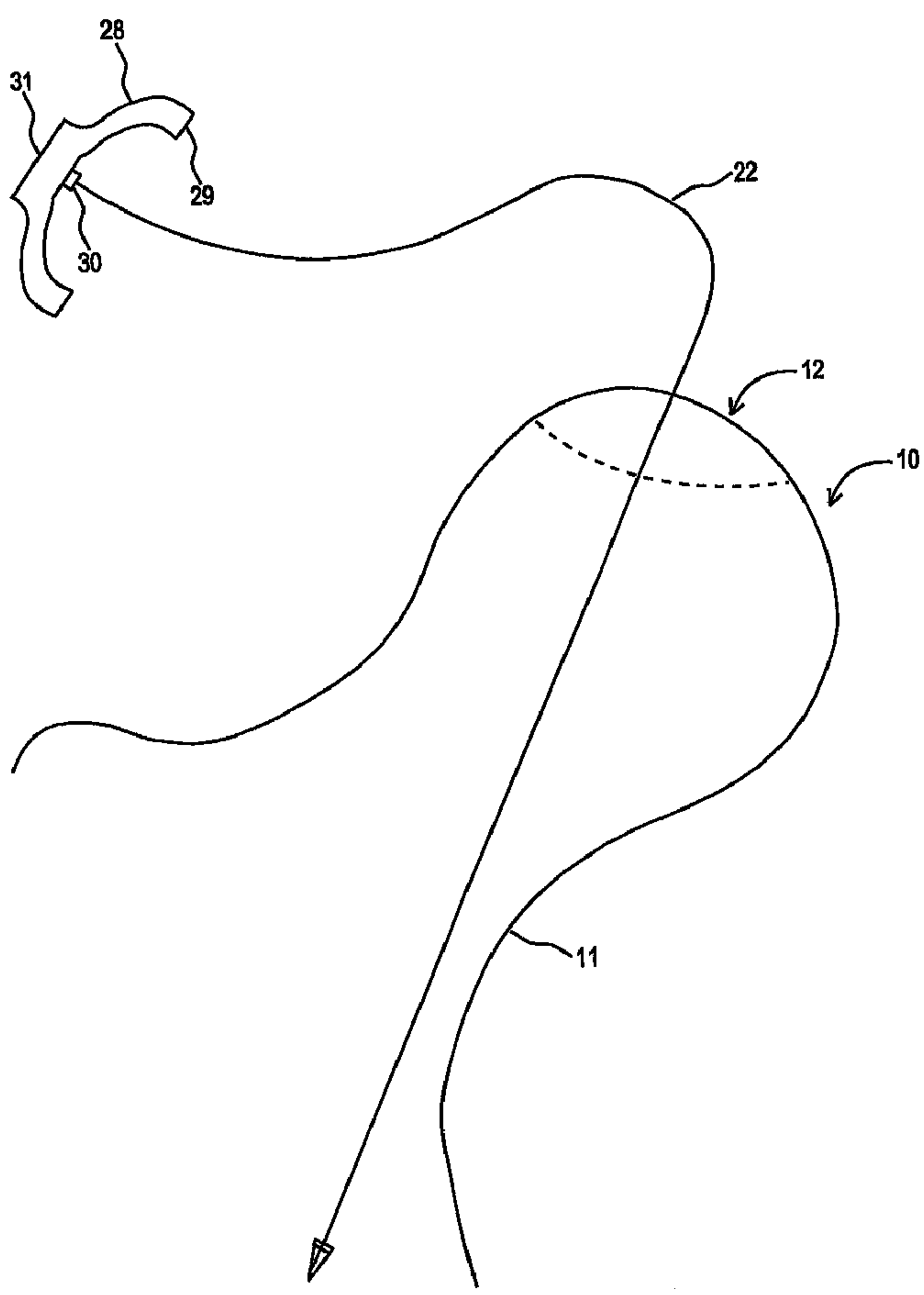
(54) Title: RETROGRADE DELIVERY OF RESURFACING DEVICES



(57) Abrégé/Abstract:
A method according to one embodiment may provide access to an articular surface of a bone. The method includes forming a passage through at least a portion of the bone. The passage provides an opening in the articular surface. The method further

(57) Abrégé(suite)/Abstract(continued):
includes inserting a tether through the passage. The tether inserted through the passage can be coupled to at least one device from an insertion site remote from the articular surface. The tether can be withdrawn through the passage to convey the device to a location proximate the articular surface.

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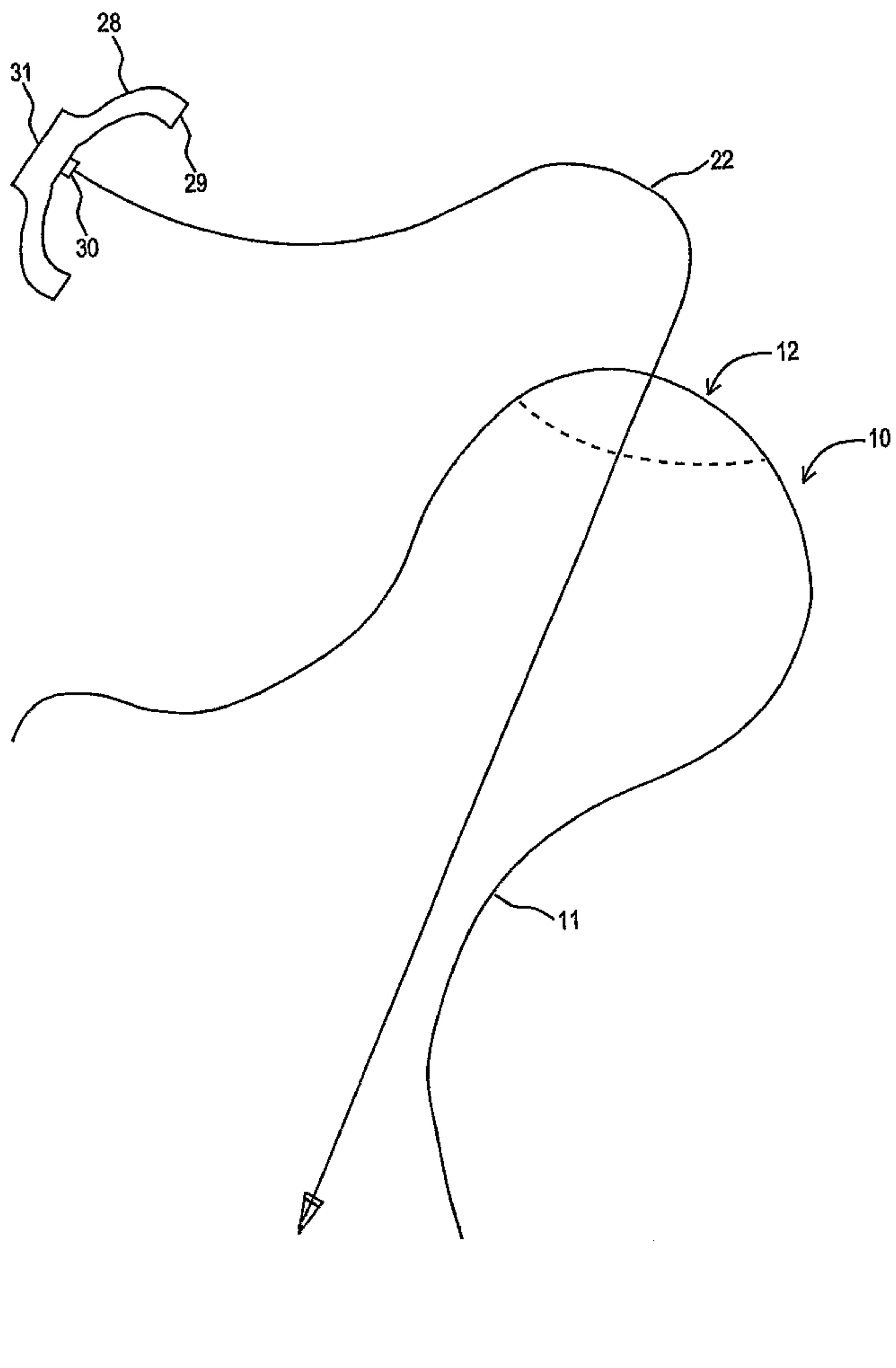

(57) **Abstract:** A method according to one embodiment may provide access to an articular surface of a bone. The method includes forming a passage through at least a portion of the bone. The passage provides an opening in the articular surface. The method further includes inserting a tether through the passage. The tether inserted through the passage can be coupled to at least one device from an insertion site remote from the articular surface. The tether can be withdrawn through the passage to convey the device to a location proximate the articular surface.

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Retrograde Delivery of Resurfacing Devices

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. provisional patent application Serial No. 60/523,810, filed on November 20, 2003, the entire disclosure of which is incorporated herein by reference.

FIELD

The present disclosure is directed at a system and method of repairing a defect in an articular joint surface.

BACKGROUND

Articular cartilage, found at the ends of articulating bone in the body, is typically composed of hyaline cartilage, which has many unique properties that allow it to function effectively as a smooth and lubricious load bearing surface. Hyaline cartilage problems, particularly in knee, hip joints, and should joints, are generally caused by disease such as occurs with rheumatoid arthritis or wear and tear (osteoarthritis), or secondary to an injury, either acute (sudden), or recurrent and chronic (ongoing). Such cartilage disease or deterioration can compromise the articular surface causing pain and eventually, loss of joint movement. As a result, various methods have been developed to treat and repair damaged or destroyed articular cartilage.

For smaller defects, traditional options for this type of problem include leaving the lesions or injury alone and living with it, or performing a procedure called abrasion arthroplasty or abrasion chondralplasty. The principle behind this procedure is to attempt to stimulate natural healing. The bone surface is drilled using a high speed rotary burr or shaving device and the surgeon removes about 1mm of bone from the surface of the lesion. This creates an exposed subchondral bone bed that will bleed and will initiate a fibrocartilage healing response. One problem with this procedure is that the exposed bone is not as smooth as it originally was following the drilling and burring which tends to leave a series of ridges and valleys, affecting the durability of the fibrocartilage response. Further, although this procedure can provide good short term results, (1-3 years), fibrocartilage is seldom able to support long-term weight bearing and is prone to wear, soften and deteriorate.

Another procedure, called Microfracture incorporates some of the principles of drilling, abrasion and chondralplasty. During the procedure, the calcified cartilage layer of the chondral defect is removed. Several pathways or "microfractures" are created to the subchondral bleeding bone bed by impacting a metal pick or surgical awl at a minimum number of locations within the lesion. By establishing bleeding in the lesion and by creating a pathway to the subchondral bone, a fibrocartilage healing response is initiated, forming a replacement surface. Results for this technique may be expected to be similar to abrasion chondralplasty.

Another means used to treat damaged articular cartilage is a cartilage transplant. Essentially, this procedure involves moving cartilage from an outside source or other knee or from within the same knee into the defect. Typically, this is done by transferring a peg of cartilage with underlying bone and fixing it in place with a screw or pin or by a press fit. Although useful for smaller defects, large defects present a problem, as this procedure requires donor pegs proportionate to the recipient bed. Large diameter lesions may exceed the capacity to borrow from within the same knee joint and rule out borrowing from another source.

Larger defects, however, generally require a more aggressive intervention. Typically treatment requires replacing a portion or all of the articular surface with an implant or prosthetic having an outer layer that that is polished or composed of a material that provides a lubricious load bearing surface in approximation of an undamaged cartilage surface. Replacement of a portion, or all, of the articular surface requires first cutting, boring, or reaming the damaged area to remove the damaged cartilage. A recess to receive an implant or prosthetic is formed at the damaged site. The implant or prosthetic is then secured to the bone in an appropriate position in the recess.

The treatment and/or replacement procedure often requires direct access to the damaged surface of the cartilage. While the most commonly damaged portions of some joints may easily be accessed for repair using a minimally invasive procedure some joints are not nearly as accessible. For example, the superior or medial femoral head, the medial humeral head, the glenoid, etc. do not permit direct access sufficient to carry out replacement of the articular surface in a minimally invasive manner. In fact, repair of such obstructed joints often requires an invasive procedure and necessitates complete dislocation of the joint. Procedures of such an invasive nature may be painful and require an extended recovery period.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of the claimed subject matter will be apparent from the following detailed description of exemplary embodiments consistent therewith, which description should be considered in conjunction with the accompanying drawings, wherein:

FIG. 1 depicts a femoral head having a target site for receiving a prosthetic implant;

FIG. 2 illustrated the formal head of FIG. 1 having a passage drilled there-through consistent with the present disclosure;

FIG. 3 shows the use of a wire inserted through the femoral head shuttling devices to the target area; and

FIG. 4 depicts a reamer employed via a drive shaft extending through the passage in the femoral head.

DETAILED DESCRIPTION

As a general overview, the present disclosure may provide a system and method for replacing at least a portion of an articular surface of a joint. The present disclosure may allow instruments and/or other devices to be delivered to a target area, e.g. an articular surface or portion thereof, within a joint. According to one aspect, the present disclosure may allow instruments and/or other devices to be delivered to a target area that is obscured from direct frontal or axial access. Furthermore, consistent with the system and method herein, the instruments and/or devices delivered to the target area may be used to perform a diagnostic and/or therapeutic procedure on a target area obscured from direct frontal or axial access. According to one embodiment, a method is provided for repairing a defect in an articular surface of a joint. The method herein may be useful, for example, for repairing defects on portions of an articular surface of a joint that are obstructed from direct access by mating joint surfaces and/or other anatomical features. Such obstructed articular surfaces may be accessed and/or repaired without requiring complete dislocation of the joint. Accordingly, the present disclosure may provide a less invasive system and method for repairing an articular joint surface.

Embodiments of the present disclosure are described in the context of repairing a region of the articular surface of a femoral head. Specifically, the illustrated and described embodiment is directed at the retrograde access, implant site preparation, and delivery of a prosthetic resurfacing device to the femoral head. Those having skill in the art will appreciate, however, that the principles herein may be utilized for accessing target areas other than the femoral head and may be used in connection with procedures other than prosthetic resurfacing of an articular surface. Without intending to limit the claimed subject, in addition to providing retrograde delivery of implants, diagnostic devices, surgical instruments, etc., to the superior or medial femoral head, the method herein is equally suitable for retrograde delivery to sites such as, cut not limited to, the medial humeral head, tibial surface and patella. Similarly, the method herein may be used for thru-bone delivery of prosthetic implants, diagnostic devices, surgical instruments devices, etc. to sites such as the glenoid, acetabulum, trochlear groove, etc.

Referring to FIG. 1, the system is depicted with reference to a femoral head 10. A region of the articular surface of the femoral head 10 to be replaced, i.e., the target area 12, is indicated by broken lines. According to one embodiment, a method herein may include drilling a passage along a predetermined working axis 13 through the femur 11 towards the target area 12 on the femoral head 10. The passage through the femur 11 may provide access to the target area 12 of the femoral head 10. In the case of the illustrated embodiment, the origin of the drill site may be on the body of neck of the femur 11 directed toward the target area 12 on the femoral head 10.

The passage through the femur 11 may be oriented generally normal to the articular surface of the femoral head 10 in the vicinity of the target area 12. As shown in FIG. 1, a drill guide 14 may be used to orient an access passage generally normal to the target area 12 of the articular surface of the femoral head 10. The drill guide 14 may include a locating ring 16 and a drill bushing 18. The drill bushing 18 may be connected to the locating ring 16 by an arm 15 of the drill guide 14. The arm 15 of the drill guide 14 may orient the drill bushing 18 in a generally coaxial relationship relative to the locating ring 16 along the working axis 13. As depicted, the locating ring 16 may include a generally annular member. As such, when the locating ring 16 is disposed on the arcuate surface of the femoral head 10, the locating ring 16 may attain an orientation generally normal to the surface of the femoral head 10. The coaxial orientation of the drill bushing 18 and the locating ring 16 may allow a passage to be drilled through the femoral head 10, and guided by the drill bushing 18, to be substantially normal to the articular surface of the femoral head 10 at the target area 12. Consistent with the present disclosure, a drill axis defined by the drill bushing 18 may have an orientation that is not normal to the femoral head 10 in the target area 12.

Turning to FIG. 2, a passage 20 is shown provided through the femur 11, extending trough the femoral head 10 in the region of the target area 12. As discussed above, the passage 20 may be formed by drilling through the femur 11 using a drill bit guided by the drill bushing 18 of the drill guide 14. A tether 22, such as a wire, suture, thread, etc., may be inserted through the passage 20 so that the tether 22 may extend from the femoral head 10. The tether 22 may be advanced though the passage 20 with the aid of a guide pin 24. For example, the guide pin 24 may be a cannulated rod and the tether 22 may be at least partially disposed in a lumen of the guide pin 24. According to an alternative embodiment, the guide pin 24 may simply be a rod that may be used to push, or otherwise advance, the tether 22 through the passage 20. As shown, the tether 22 may include a loop 26 on the distal end thereof. The loop 26 or feature may be used for attaching instruments, devices, etc., to the tether 22. Accordingly, various attachment features other than a loop may suitably be employed herein.

The tether 22 may be used to ferry, shuttle, or otherwise convey various diagnostic devices, surgical instruments, prosthetic devices, etc. from a remote insertion site, e.g., exterior to the joint, to the target area 12. In one embodiment, the tether 22 may be used to convey instruments, devices, etc., to the target area 12 without requiring direct and/or axial access to the target area 12. For example, referring the FIG. 3, the tether 22 may be coupled to a reamer 28 outside of the joint. The reamer 28 may include a body 31 and one or more cutting features 29 and may be used for excising a portion of the femoral head 10 in the region of the target area 12. The tether 22 may be advanced or pulled through the femur 11 and out from the joint area to allow the reamer 28 to be attached to the tether 22 at the remote insertion site. Advancing the tether 22 from femoral head 10 may include pulling the distal end of the tether 22 completely from the body of a patient, e.g., in an embodiment in which the remote insertion site it outside of the patient. The loop 26 at the distal end of the tether 22 may be coupled to a cooperating feature 30 on an underside of the reamer 28. The reamer 28 may be conveyed to the target area 12 by withdrawing the tether 22 back through the passage 20, thereby pulling and or guiding the reamer 28 to the target area 12. Withdrawing the tether 22 back through the passage 20 may transport the reamer 28 to the target area 12 and/or may generally center the attachment feature 30 of the reamer 28 relative to the passage 20.

Turning to FIG. 4, once the reamer 28 has been transported to the target area 12, the reamer 28 may be coupled to a drive shaft 32 disposed extending at least partially through the passage 20. In one embodiment, the drive shaft 32 may be a cannulated shaft that may be threaded over the tether 22. The reamer 28 and the drive shaft 32 may include cooperating features allowing the driveshaft 32 to transmit torque to the reamer 28. The cooperating features of the drive shaft 32 and the reamer 28 may include torque transmitting features such as cooperating a cooperating socket and plug, e.g., a mating hex shaft and hex socket. Consistent this variety of torque transmitting coupling the wire 22 may be used to pull the reamer 28 towards in the drive shaft 32 in order to maintain the connection between the cooperating features of the drive shaft 32 and the reamer 28. Alternatively, the cooperating features of the drive shaft 32 and the reamer may be releasably securable to one another. According to one such embodiment, the cooperating features of the drive shaft 32 and the reamer 28 may include cooperating threaded components that screw together, cooperating snap-fit features, etc.

At least a portion of the femoral head 10 in the general region of the target area 12 may be excised by rotatably driving the reamer 28 and pulling the reamer 28 into the femoral head 10. The reamer 28 may be rotatably driven manually and/or using a drive motor, for example using a drill. The reamer 28 may be pulled into the femoral head 10 by withdrawing the drive shaft 32, in an embodiment in which the drive shaft 32 and the reamer 28 are releasably secured to one another. Additionally, and/or alternatively, the reamer 28 may be pulled into the femoral head by withdrawing or pulling on the tether 22, which may, in some embodiments, remain coupled to the reamer 28 during the excision operation.

In addition to conveying the reamer 28 to the target area 12, the tether 22 may also be used to transport various other devices and/or instruments to the target area 12. Devices and/or instruments transported to the target area 12 by the tether 22 may also be centered about the passage 20 through the femur 11 similar to the reamer 28. For example, in an embodiment consistent with the present disclosure, also in the general context of an articular surface repair procedure, the tether 22 may be used to shuttle or transport an anchoring device, such as a screw, to the target area 12. The screw may be provided having an internal driving feature, e.g., a hex socket feature, a Torx™ socket, etc. The tether 22 may be threaded through a cannulated driver which may be inserted through the passage 20. The tether 22 may be used to convey the screw to the target area 12 and center the screw relative to the passage 20. The driver may be engaged with the driving feature of the screw and a holding force may be applied to the screw via the tether 22, thereby maintaining the engagement between the driver and the screw. With the driver and the screw maintained in engagement with one another, the screw may be threadably driven into the passage 20 at the target area 12.

In a related manner, the tether 22, alone and/or in conjunction with various suitably configured shafts and/or driving elements extending through the passage 20, may be used to transport and operate or install other instruments and devices. Ultimately, the tether 22 may be used to shuttle a prosthetic implant to the target area 12 and install the implant into an implant site, such as may be created using the reamer 28.

Consistent with the foregoing disclosure, a system and method may be provided for replacing at least a portion of an articular surface of a joint that is obscured from axial approach. According to one aspect, a method herein may permit the retrograde delivery of instruments and devices from an insertion site to a target area on the articular surface. According to an embodiment, the method may include drilling a passage from an accessible region of a bone removed from a target articular surface. The passage may extend toward the target articular surface. A tether, such as a wire, may be introduced through the passage, and positioned having a distal end extending from a distal opening of the passage at the target articular surface. The distal end of the tether may be coupled to a prosthetic device, a surgical instrument, diagnostic device, etc. The tether may then be drawn back toward the articular surface, thereby transporting/carrying the prosthetic device, surgical instrument, diagnostic device, etc. to the articular surface.

According to another aspect, after the a prosthetic device, surgical instrument, diagnostic device, etc., has been transported to the articular surface, the prosthetic device, surgical instrument, diagnostic device, etc. may be engaged by a shaft or pin extending through said passage to said articular surface. The shaft or pin may be used for applying a rotational and/or axial force to the prosthetic device, surgical instrument, diagnostic device, etc. Using this methodology, a procedure may be performed on a target are without direct axial or frontal access to the target area.

Those having skill in the art will appreciate that the method herein may be used for transporting numerous additional instruments, devices, etc. to a working surface having impeded direct axis. Further is should be understood that a variety of pins, shafts, catheters, etc. may be inserted through the passage for acting on, interacting with, or co-acting with instruments and/or devices transported to a target area consistent with above aspects of the disclosure. Finally, it should also be understood that the embodiments disclosed herein are susceptible for use in procedures in addition to the repair of articular cartilage at a joint. Accordingly, it should be understood that the embodiments that have been described herein are but some of the several contemplated within the scope of the claimed subject matter, and are set forth here by way of illustration, but not of limitation. It is obvious that many other embodiments, which will be readily apparent to those skilled in the art may be made without departing materially from the spirit and scope of the claimed subject matter.

What is claimed is:

1. A method for accessing an articular surface of a bone comprising:

forming a passage through at least a portion of said bone, said passage providing an opening in said articular surface;

inserting a tether through said passage; and

conveying at least one device from an insertion site remote from said articular surface to a location proximate said articular surface.

2. The method according to claim 1 wherein forming said passage comprises positioning a locating ring of a drill guide on said articular surface and drilling a hole through said bone, said hole guided by a drill bushing of said drill guide.

3. The method according to claim 1, wherein conveying at least one device comprises coupling a distal end of said tether to a cooperating feature on said device and withdrawing said tether through said passage.

4. The method according to claim 3 wherein said distal end of said tether comprises a loop.

5. The method according to claim 1, wherein said device comprises a reamer, said method further comprising disposing a drive shaft extending at least partially through said passage and coupling said drive shaft to said reamer.

6. An apparatus for excising at least a portion of an articular surface, said apparatus comprising:

a reamer body and at least one cutting feature on said reamer body; and

a feature capable of being coupled to a tether for conveying said reamer to said articular surface.

7. An apparatus according to claim 6, further comprising a feature capable of being coupled to a drive shaft for rotatably driving said reamer.

8. An apparatus according to claim 7, wherein said feature capable of being coupled to a drive shaft comprises hex socket.

9. A system for creating an implant site on an articular surface of a bone comprising:

a drill guide comprising a locating ring positionable on said articular surface, a drill bushing defining a drill axis, and an arm orienting said locating ring and said drill bushing in a predetermined angular and positional relationship;

a drill bit capable of bring received at least partially through said drill bushing along said drill axis for drilling a passage through said bone and providing an opening on said articular surface;

a tether deployable through said passage drilled through said bone by said drill; and

a reamer for excising an implant site in a portion of said articular surface, said reamer capable of being coupled to said tether and capable of being conveyed to said articular surface by said tether.

10. A system according to claim 9, wherein said arm of said drill guide orients said locating ring and said drill bushing in a coaxial relationship.

11. A system according to claim 9, wherein a distal end of said tether comprises a loop capable of coupling to a device for conveying said device to said articular surface.

12. A system according to claim 9, where said reamer is capable of being conveyed to said articular surface by coupling said reamer to said tether and withdrawing said tether through said passage drilled through said bone.

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FIG. 1

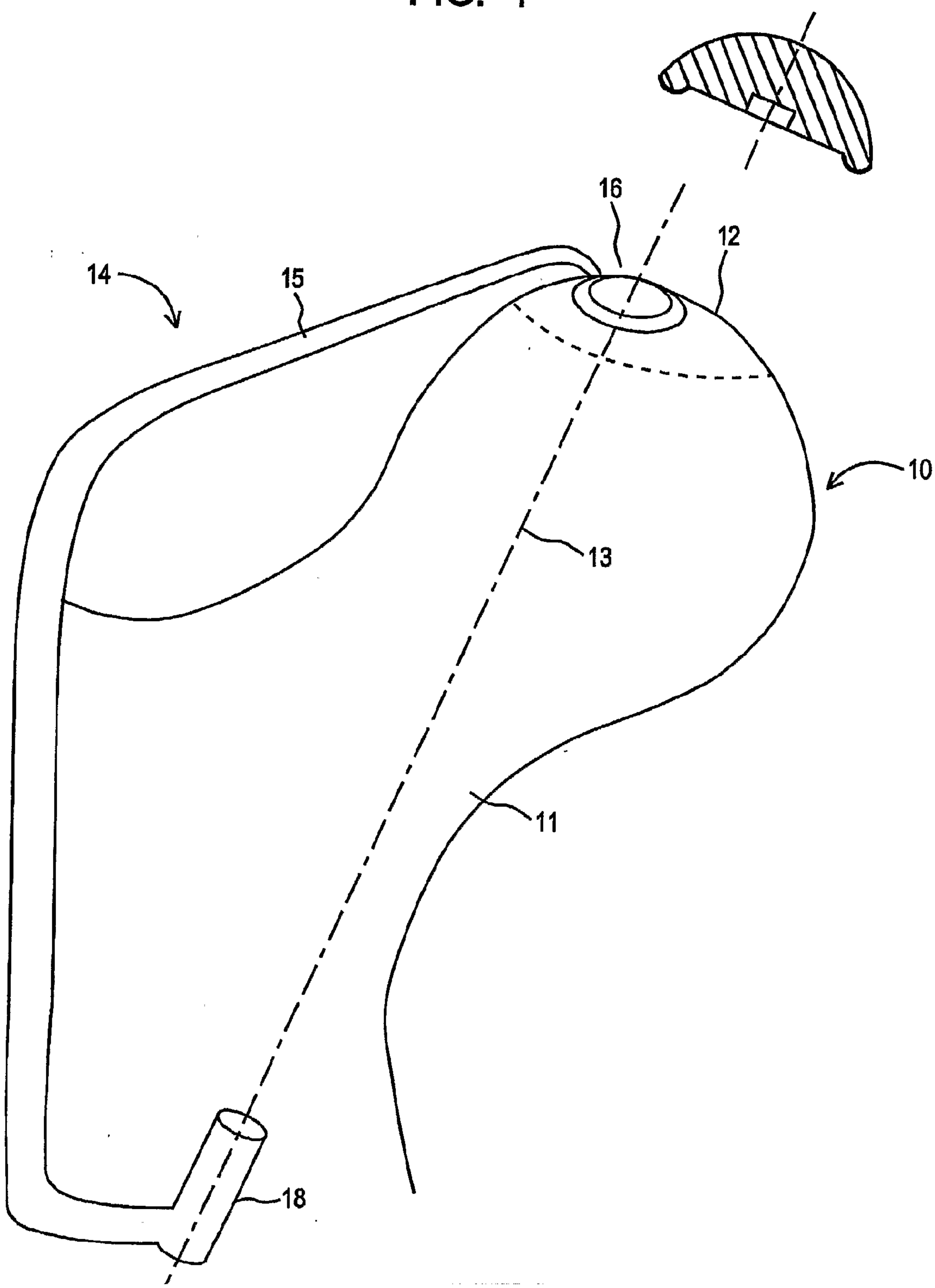

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FIG. 2

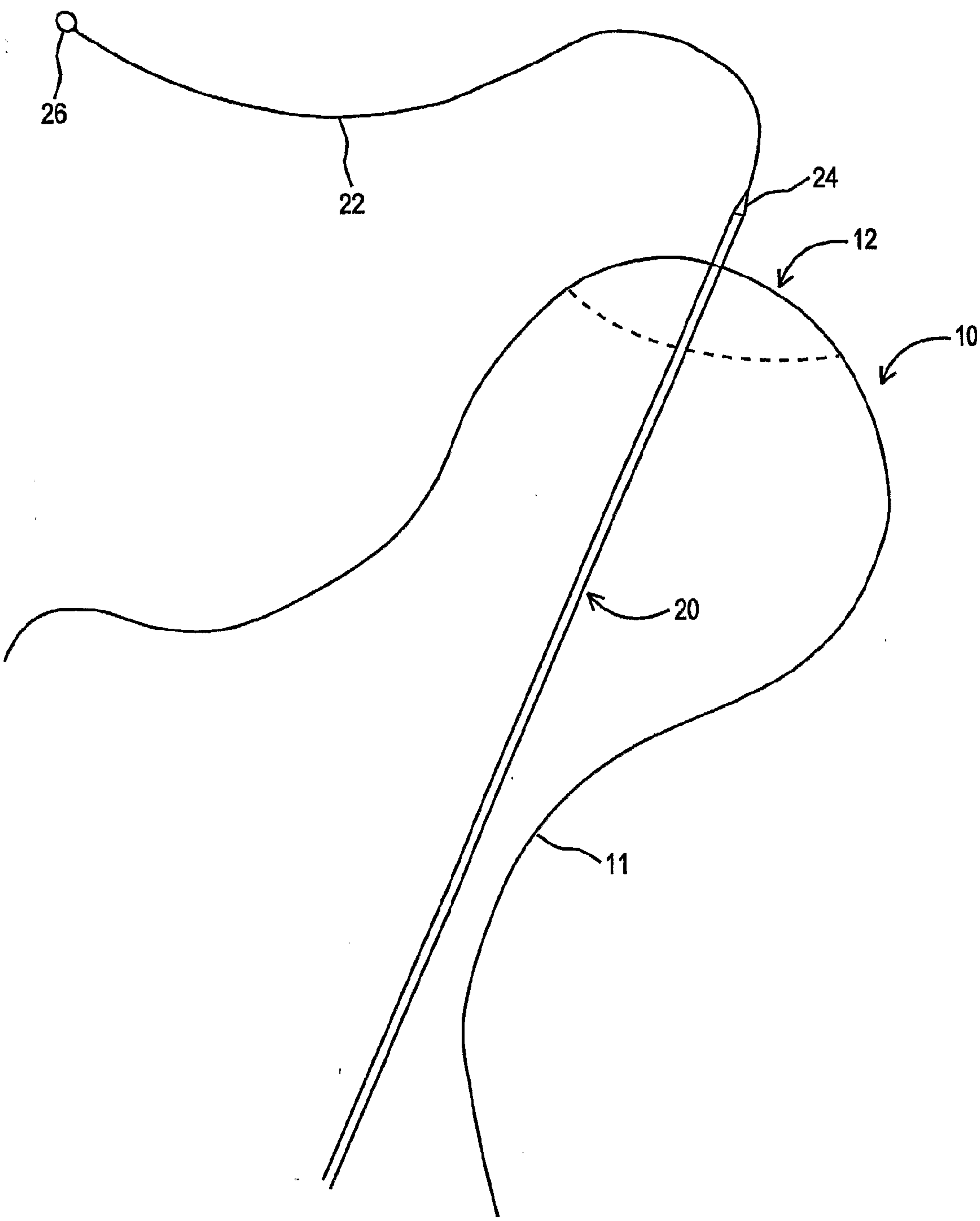


FIG. 3

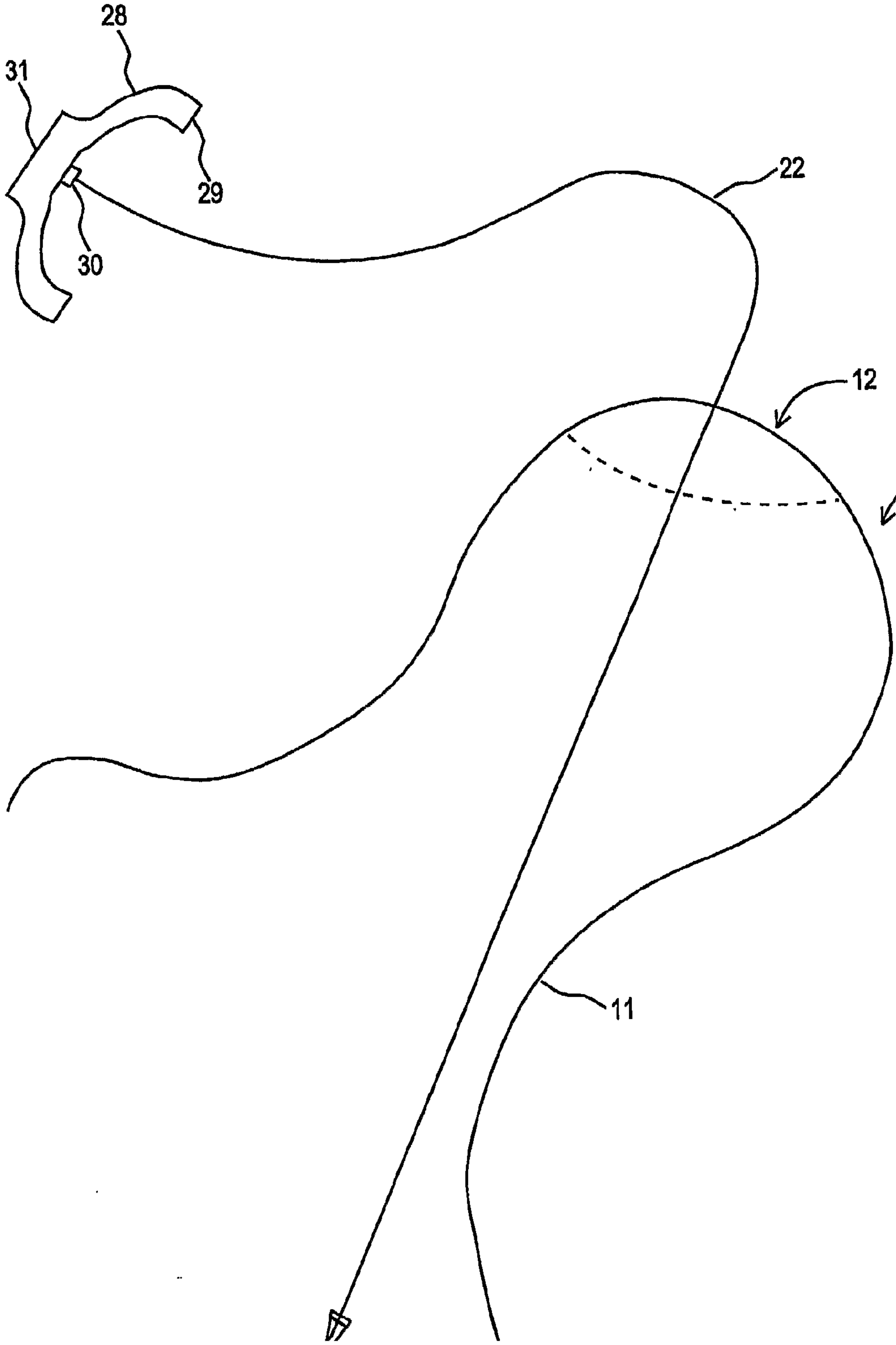
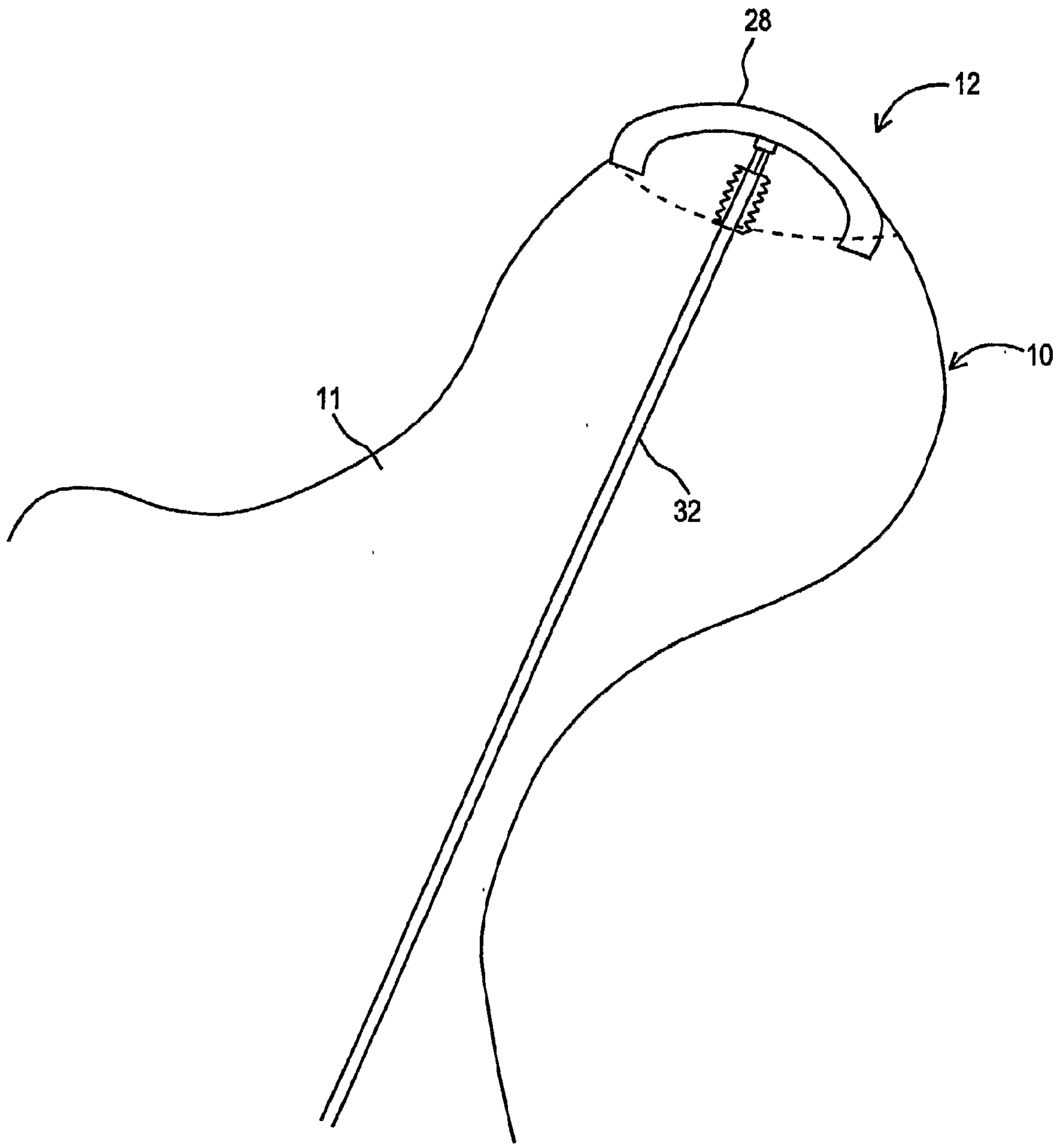
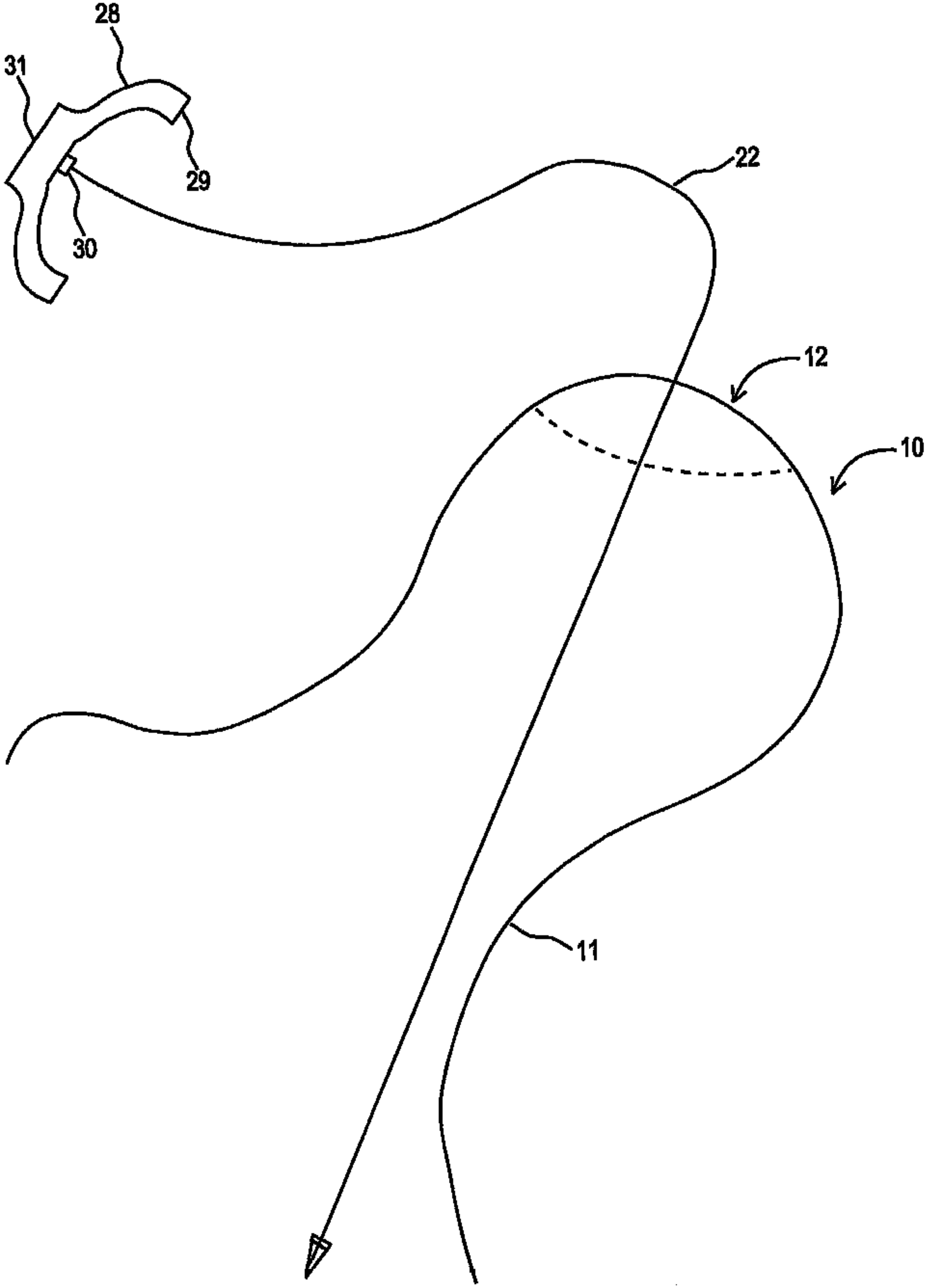


FIG. 4





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