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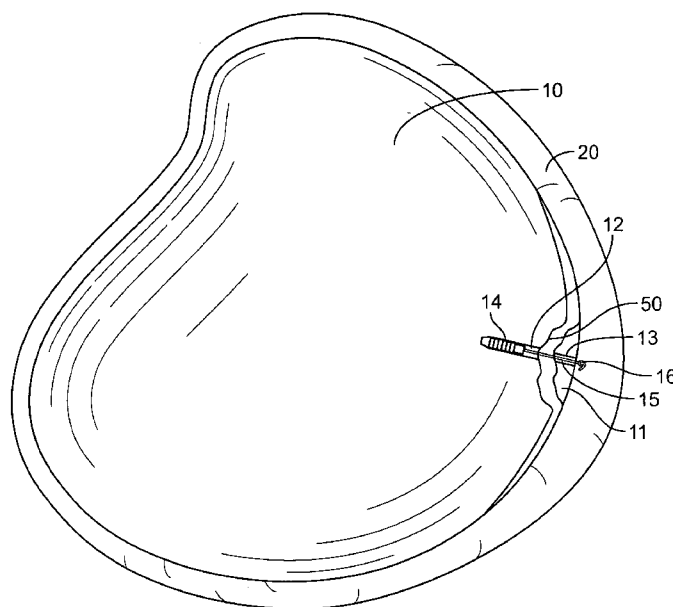


FIG. 1

(57) Abstract: In one embodiment, the present invention is a method for repairing tissue, comprising the steps of drilling a through-hole (13) through a bone fragment (11); drilling a bore hole (12) at least partially into a bone (10) at a reattachment location (50) where the bone fragment (11) is to be reattached; implanting a first filamentary fixation device (14) into the bore hole (12), the first filamentary fixation device (14) having at least a first filament end (15) extending therefrom; passing the first filament end (15) out of the bore hole (12) and through the through-hole (13) through the bone fragment (11); positioning the bone fragment (11) onto the bone (10) at the reattachment location (50); and securing the first filament end (15) to fixedly secure the bone fragment (11) at the reattachment location (50).



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IMPLANT AND METHOD FOR GLENOID AND LABRUM REPAIR

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of the filing date of U.S. Provisional Application No. 61/773,450, filed March 6, 2013, entitled Implant And Method For Glenoid And Labrum Repair, the disclosure of which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] Various shoulder injuries may result from dislocations, falling, throwing, or lifting. A common shoulder injury includes the separation of labrum tissue from the anterooinferior region of the glenoid bone of the scapula following a shoulder dislocation, also known as a Bankart lesion.

[0003] Arthroscopic stabilization for surgical treatment of shoulder instability has grown in popularity over the past decade. In particular, labrum anchors have been employed to repair torn labrum tissue. For example, a labrum anchor may be inserted into the glenoid, and a suture or like material that is attached to the labrum anchor is used to reattach the torn labrum tissue to the glenoid.

[0004] Such a repair is complicated, however, in a "bony Bankart lesion," where a fragment of the glenoid bone itself also detaches from the main body of the glenoid along with the labrum tissue. Traditionally, such bone fragments were merely tucked under the labrum tissue, and upon reattachment of the labrum tissue, the fragment was pressed against the glenoid main body in the hope that bone fusion would occur. However, such repairs commonly do not result in sufficient contact between the main body and fragment of the glenoid to promote fusion. This repair is commonly referred to as a "bony Bankart" repair in which a typical Bankart repair, as is known in the art, is used to secure the labrum tissue to the glenoid which, in turn, is also intended to secure the bone fragment to the glenoid.

[0005] In light of the known complications of such injuries, and the limitations of known surgical repairs, there is a need for an improved method of repair.

BRIEF SUMMARY OF THE INVENTION

[0006] Generally, the present invention includes various embodiments for fixedly securing a bone fragment to a location on a bone. Specifically, the location on the bone is a reattachment location, i.e., where the bone fragment separated from the bone. The various apparatus, systems, kits, and methods disclosed herein relate to the reattachment of a bone fragment to the bone, specifically, as to the various exemplary embodiments disclosed herein, to the reattachment of a bone fragment to the glenoid.

[0007] Accordingly, in one embodiment, the present invention is directed to a method for repairing tissue, comprising the steps of drilling at least one through-hole in or through a bone fragment and a corresponding bore hole for each through-hole in or through a bone at a reattachment location; implanting a filamentary fixation device having at least one filament end; passing the filament end(s) out of the bore hole(s) and through the through-hole(s), positioning the bone fragment at the reattachment location, and securing the filament end(s) to fixedly secure the bone fragment at the reattachment location.

[0008] In another embodiment, the present invention is directed to a method for repairing tissue, comprising the steps of drilling a through-hole in or through a bone fragment; drilling a bore hole at least partially into a bone at a reattachment location where the bone fragment is to be reattached; implanting a first filamentary fixation device into the bore hole, the first filamentary fixation device having at least a first filament end extending therefrom; passing the first filament end out of the bore hole and through the through-hole through the bone fragment; positioning the bone fragment onto the bone at the reattachment location; and securing the first filament end to

fixedly secure the bone fragment at the reattachment location.

[0009] The present invention also provides for the use of a filamentary device which can have first and second filament ends extending therefrom, wherein the step of passing can include passing both the first and second filament ends out of the bore hole and through the through-hole of the bone fragment. The securing step can also include tying the first and second filament ends together to form a knot to fixedly secure the bone fragment at the reattachment location.

[0010] Furthermore, the present invention may provide for the drilling of a second bore hole at least partially into the bone at a location spaced apart from the reattachment location; implanting a second filamentary fixation device in the second bore hole, the second filamentary fixation device having at least a third filament end extending therefrom; passing the third filament end out of the bore hole and through a soft tissue to be reattached to the bone; and tying a knot in the third filament end to secure the soft tissue to the bone. Further still, the present invention may provide for the drilling of a third bore hole at least partially into the bone at a location spaced apart from the reattachment location and in a direction opposite of the second bore hole; implanting a third filamentary fixation device in the third bore hole, the third filamentary fixation device having at least a fourth filament end extending therefrom; passing the fourth filament end out of the bore hole and through the soft tissue to be reattached to the bone; and tying a knot in the fourth filament end to secure the soft tissue to the bone.

[0011] Further still, the present invention can provide for the passing of the first and second filament ends of the first filamentary fixation device through the soft tissue, tying together in a knot one of the first and second filament ends with the third filament end, and tying together in a knot the other of the first and second filament ends with the fourth filament end, such that the soft tissue is compressed

to the bone along the lengths of the first, second, third and fourth filament ends between the respective knots.

[0012] The present invention recognizes that at least one of the first, second and third filamentary fixation devices can be a suture anchor formed entirely of suture, wherein the step of implanting may include deploying the suture anchor formed of suture from a relaxed position, in which the suture anchor formed from suture could move into and out of the bore hole, to a compressed position, in which the suture anchor formed from suture can be fixedly secured within the bore hole.

[0013] The present invention also recognizes that the bore holes can have a larger diameter than the through-holes.

[0014] In a further embodiment, the present invention is directed to a method for repairing a glenoid and labrum, comprising the steps of drilling a through-hole in or through a bone fragment of the glenoid; drilling a bore hole at least partially into the glenoid at a reattachment location where the bone fragment is to be reattached; implanting a first filamentary fixation device into the bore hole, the first filamentary fixation device having at least a first filament end extending therefrom; passing the first filament end out of the bore hole and through the through-hole through the bone fragment; positioning the bone fragment onto the bone at the reattachment location; and securing the first filament end to fixedly secure the bone fragment at the reattachment location. Also, the bore hole of this method may have a larger diameter than the through-hole.

[0015] Additionally, the first filamentary fixation device can have first and second filament ends extending therefrom, wherein the step of passing may include passing both the first and second filament ends out of the bore hole and through the through-hole of the bone fragment. This embodiment may also provide for the securing step including tying the first and second filament ends together to form a

knot which can secure the fragment at the reattachment location.

[0016] The present invention, in this embodiment, can also provide for the additional steps of drilling a second bore hole at least partially into the glenoid at a location spaced apart from the reattachment location; implanting a second filamentary fixation device in the second bore hole, the second filamentary fixation device having at least a third filament end extending therefrom; passing the third filament end out of the bore hole and through labrum to be reattached to the glenoid; and tying a knot in the third filament end to secure the labrum to the glenoid. Additionally, this embodiment can include the further steps of drilling a third bore hole at least partially into the glenoid at a location spaced apart from the reattachment location and in a direction opposite of the second bore hole; implanting a third filamentary fixation device in the third bore hole, the third filamentary fixation device having at least a fourth filament end extending therefrom; passing the fourth filament end out of the bore hole and through the labrum to be reattached to the glenoid; and tying a knot in the fourth filament end to secure the labrum to the glenoid. Furthermore, the method can also include passing the first and second filament ends of the first suture anchor through the labrum, tying together in a knot one of the first and second filament ends with the third filament end, and tying together in a knot the other of the first and second filament ends with the fourth filament end, such that the labrum is compressed to the glenoid along the lengths of the first, second, third and fourth filament ends between the respective knots.

[0017] Continuing with this embodiment, the method may also provide for at least one of the first, second and third filamentary fixation devices can be a suture anchor formed entirely of suture, wherein the step of implanting includes deploying the suture anchor formed of suture from a relaxed

position, in which the suture anchor formed from suture could move into and out of the bore hole, to a compressed position, in which the suture anchor formed from suture is fixedly secured within the bore hole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 illustrates an exemplary embodiment of the presently disclosed method.

[0019] FIG. 1a is an enlarged view of the exemplary embodiment shown in FIG. 1.

[0020] FIG. 2 illustrates another exemplary embodiment of the presently disclosed method.

[0021] FIG. 3 illustrates yet another exemplary embodiment of the presently disclosed method.

[0022] FIG. 4 illustrates still another exemplary embodiment of the presently disclosed method.

[0023] FIG. 5 illustrates yet another embodiment of the present invention.

DETAILED DESCRIPTION

[0024] The present invention, generally, is a method for repairing a break or fracture in hard tissue and, optionally, repairing torn soft tissue attached or adjacent thereto. In the various embodiments, examples, and illustrations herein, the glenoid bone and labrum of the shoulder will be discussed as the hard and soft tissue, respectively, though the methods described herein may be used at other anatomical locations. As used herein, "proximal" or "proximally" means closer to or towards an operator, e.g., surgeon, while "distal" or "distally" means further from or away from the operator.

[0025] As used herein, the term "filament" or "filamentary" is defined as a suture or other thread-like material. Such filaments may be constructed of synthetic material (e.g., PLGA, UHMWPE (ultra high molecular weight polyethylene), polyester, PEEK, Nylon, polypropylene, or the like, or blends thereof) or of organic material (silk, animal tendon, or the like or blends thereof between organic materials or blends thereof with synthetic materials).

Alternatively, filaments may include thin metal wires. While any of these materials may be used, it is preferable, and is disclosed herein, that the various filaments or filamentary aspects of the present invention be constructed out of suture, such as UHMWPE or polyester or blends thereof.

[0026] Furthermore, the term "suture anchor" may be any suture anchor known in the art, though it is preferred that a "filamentary fixation device," commonly referred to as an all-suture suture anchor, be used. One such all-suture suture anchor for use in these methods is the IconixTM line of filamentary fixation devices (Howmedica Osteonics Corp., Mahwah, NJ). Such all-suture suture anchors are also disclosed in U.S. Provisional App. No. 61/679,336, filed August 3, 2012, U.S. Application Nos. 13/303,849, filed November 23, 2011, 13/588,586, filed August 17, 2012, and 13/588,592, filed August 17, 2012, and U.S. Patent Nos. 5,989,252 and 6,511,498, the entireties of which are incorporated by reference herein as if fully set forth herein and all of which are assigned to the same entity as the present application.

[0027] In one embodiment, as illustrated in FIGS. 1 and 1a, the method concerns the repair of a tear in the labrum 20 which, in some circumstances, also necessitates the reattachment of a bone fragment 11 which fractured or detached from the glenoid 10, typically due to the force of the labrum 20 tearing from the glenoid 10. The detachment of the bone fragment creates a bony Bankart lesion 50 (hereinafter "lesion"), which is also the preferred reattachment location 50, and thus lesion 50 and reattachment location 50 are considered to be interchangeable when discussing the various embodiments of the present invention. The bone fragment 11 typically remains attached to the labrum 20, as illustrated.

[0028] Continuing with this embodiment, and with reference to FIG. 1, a bore hole 12 is prepared in the glenoid 10 and a through-hole 13 is drilled completely through the bone

fragment 11. Preferably, in preparing the through-hole 13 and bore hole 12, the bone fragment 11 can be reduced to a position in the reattachment location 50, in a position intended for final fixation, and a relatively small drill or the like can be used to form the through-hole 13. The drill should pass completely through the bone fragment 11 and into the underlying glenoid 10. Thus, the drill also forms a pilot hole or mark on the glenoid for preparation of the bore hole 12. The operator then can remove the bone fragment 11 from the reattachment location 50 and a relatively larger drill can be used to prepare the bore hole 12 using the pilot hole as a guide. In a preferred embodiment, an approximately 1.4mm diameter drill bit is used to prepare the through-hole 13, and this drill bit can drill to a hard stop at a depth of about 20mm which should be sufficient to pass completely through the bone fragment 11 and into the glenoid 10. The larger drill, used to form the bore hole 12, also has a hard stop at a depth of about 20mm, and has a diameter of about 2.3mm. While these drill bit (and thus, through-hole and bore hole) sizes are preferred, any diameter drill bits may be used as desired by the operator, even a single drill bit to create both the through-hole 13 and bore hole 12 of a similar diameter. However, it should be noted that the through-hole 13 has a smaller diameter than the bore hole 12 in the preferred embodiment as care should be exercised to limit the risk of the bone fragment 11 cracking or breaking apart should too large a drill bit be used. Also, the larger 2.3mm drill bit should be used for the bore hole 12 because, as discussed further below, a bore hole 12 of such a diameter is necessary for implantation of filamentary fixation devices, such as all-suture suture anchors 14, discussed above, in the bore hole 12. Such filamentary fixation devices are preferred for use in the present invention because, for example, if a traditional hard suture anchor were used, an even larger bore hole 12 would be required.

[0029] Once the through-hole 13, and optionally bore hole 12, is formed, a shuttle (not shown) can be positioned through the through-hole 13 in a position capable of moving a first filament (discussed below) into and through the through-hole 13. The shuttle may be any material or structure as known in the art, such as a thin wire loop, a length of suture either having a loop on one end or folded over itself forming a loop configuration, or the like.

[0030] Once the through-hole 13 and bore hole 12 are drilled, and the shuttle is positioned through the through-hole 13, a filamentary fixation device, such as all-suture suture anchor 14, is implanted into the bore hole 12 and deployed (as is disclosed in the various patent filings incorporated by reference above). Anchor 14 includes at least a first filament end 15 extending therefrom, whereupon the filament end 15 is passed out of the bore hole 12 and through the through-hole 13 using the shuttle (not shown), as such shuttles are known in the art. Once the at least one filament end 15 is positioned through the through-hole 13, the bone fragment 11 is once again positioned in the reattachment location 50 and the filament end 15 is secured to fixedly secure the bone fragment in the reattachment location 50. Preferably, the filament end 15 is secured by tying a knot 16 which fixedly secures the fragment 11 to the glenoid 10, along with the labrum 20 attached or adjacent to the fragment 11, as illustrated in FIG. 1. The knot 16 should be of a sufficient size to prevent the knot 16 from falling into the through-hole 13

[0031] Additionally, in another embodiment, as illustrated in FIG. 2, the anchor 14 may include a first filament end 15a and a second filament end 15b. First and second filament ends 15a, 15b may be two portions of a single length of filament which is passed through anchor 14 (as in the various patent filings incorporated by reference above), or they may be individual filaments each tied or otherwise secured to the anchor 14 and/or one another. Similar to the above

embodiment, the first and second filament ends 15a, 15b may be passed through the through-hole 13 in the bone fragment 11 and secured to fixedly secure the fragment 11 to the glenoid 10 at the reattachment location 50. Preferably, the filament ends 15a, 15b are secured to one another by tying a knot 16a which fixedly secures the fragment 11 to the glenoid 10, along with the labrum 20 attached or adjacent to the fragment 11, as illustrated in FIG. 2. Knot 16a should be of a sufficient size to prevent the knot 16a from falling into the through-hole 13.

[0032] In a further embodiment of the present invention, as illustrated in FIG. 3, a method includes preparing a bore hole 12a extending completely through the glenoid 10 to an opposite side and preparing a through-hole 13a extending completely through the bone fragment 11. The through-hole 13a can be prepared as discussed above, and, upon removal of the bone fragment 11 from the reattachment location 50, the bore hole 12a can be prepared also as above, though a longer drill bit is required having a length sufficient to extend through the entirety of the glenoid 10. With the various bore and through-holes 12a, 13a formed, a filamentary fixation device 14, having at least one filament end 15 extending therefrom, is implanted into and through the through-hole 13a until it is positioned at the open end of the bore hole 12a opposite the open end at the reattachment location 50. The filament end 15 is positioned through the through-hole 13a and through the bore hole 12a (using the shuttle, discussed above). The anchor 14 can be deployed outside the bore hole 12a such that it is positioned on the surface of the glenoid 10 and cannot migrate into bore hole 12a. The filament end 15 (or ends) are tensioned and secured to fixedly secure the fragment 11 to the reattachment location 50. In this embodiment, rather than a knot 16, 16a, as above, a button anchor, suture clamp, or the like, as known in the art, is used (generally, element 18) to fixedly secure the filament end 15, and thus the fragment 11. It is

envisioned that this embodiment could also include a knot, in place of element 18. In yet another variation, it is also envisioned that the knot (or element 18) and anchor 14 could be swapped such that the anchor 14 is positioned on the fragment 11 and the knot (or element 18) is positioned on the opposite side of the glenoid 10.

[0033] In yet another embodiment of the present invention, a method, as illustrated in FIG. 4, includes preparing first and second bore holes 12, 112 extending into the glenoid 10 and two through-holes 13, 113 extending completely through the bone fragment 11. These bore holes 12, 112 and through-holes 13, 113 can be prepared in the same manner as discussed above. Also, as above, both through-holes 13, 113 can accommodate a shuttle (not shown) for passing an at least one filament end 15, 115 extending from first and second filamentary fixation devices 14, 114. The at least one filament end 15, 115 may then be passed out of respective bore holes 12, 112 and through the respective through-holes 13, 113 and secured such that the fragment 11 is fixedly secured to the reattachment location 50. Preferably, a knot 16b can be tied from the two filament ends 15, 115 such that the bone fragment 11 and adjacent labrum tissue 20 is fixedly secured to the glenoid 10 by the lengths of the filament ends 15, 115. It should be noted that the filament ends 15, 115 extend through the through-holes and out past any soft tissue (i.e., labrum 20) attached to the fragment 11. Thus, tying the two filament ends 15, 115 together may have the added benefit of forming a "suture bridge" over a portion of the labrum 20 which may provide additional securement of the fragment 11 and soft tissue 20. Alternatively, each filament end 15, 115 may be tied in an individual knot 16, each having a sufficient size to prevent the knot from falling into its respective through-hole 13, 113.

[0034] Illustrated in FIG. 5 is another method for the repair of tissue. A first filamentary fixation device 14 is positioned in the same manner as described above with

reference to FIG. 2, such that filament ends 15a, 15b extend through the bone fragment 11 (and past labrum tissue 20). A second filamentary fixation device 214 is implanted and deployed in a bore hole 212 at a location spaced apart from the reattachment location 50. At least a third filament end 215, extending from anchor 214, is passed out of the bore hole 212 and through the labrum 20. This implantation of the second anchor 214 is known in the art as is typically performed during a Bankart repair. It should be noted that either of the first and second anchors 14, 214 can be implanted first, followed by the other of the anchors. In one example, the second anchor 214 is implanted first in situations where the above-disclosed IconixTM line of filamentary fixation devices are used. This order is preferred because certain of these devices come pre-assembled with two separate filaments (collectively, four filament ends 15) in a single anchor 14. Thus, upon implantation and deployment of the anchor 214, one of the two filaments can be removed from the anchor 214 and used as the shuttle (not shown) for passage of filament end 15 through through-hole 13 in the fragment 11.

[0035] Once the first anchor 14 is implanted and deployed in bore hole 12, and the filament ends 15a, 15b extend out and through the through-hole 13, the filament ends 15a, 15b may be secured to fixedly secure the fragment 11 at the reattachment location 50. For example, a knot 16 may be formed in the filament ends 15a, 15b to fixedly secure the fragment 11 in place. Similarly, once the second anchor 214 is implanted and deployed in bore hole 212, and the at least third filament end 215 extends out and through the tissue 20, the filament end 215 may be secured to fixedly secure the tissue 20. For example, a knot 216 may be tied to fixedly secure the tissue 20.

[0036] Once the various filaments 15a, 15b, 215 are secured, preferably by knots 16, 216, a tail 215', extending from knot 216 may be positioned along the surface of tissue

20 and towards knot 16. If there are additional filaments other than the third filament 215 used to form knot 216, any other tails (not shown) extending from knot 216 may be cut or otherwise removed. Similarly, a tail 15a' from one of the filament ends 15a, 15b, secured via knot 16, is positioned along the surface of tissue 20 and towards knot 216. Tail 15a' and tail 215' may then be secured to one another, such as via knot 416, to form a "suture bridge" between knots 16 and 216. Such a suture bridge configuration may provide better engagement of the tissue 20 and bone fragment 11 to the glenoid 10, which thus may result in a better rehabilitation and long-term result.

[0037] Optionally, though preferably, a third filamentary fixation device 314 may be implanted and deployed into a third bore hole 312 at a location spaced apart from the reattachment location 50, as illustrated in FIG. 5. At least a fourth filament end 315, extending from anchor 314, is passed out of the bore hole 312 and through the labrum 20. As with the second anchor 214, the fourth filament end 315 may be secured to fixedly secure the tissue 20. For example, a knot 316 may be tied to fixedly secure the tissue 20.

[0038] As with the relationship between the first and second anchors 14, 214 above, the first and third anchors 14, 314 are similarly integrated. Specifically, once the various filaments 15a, 15b, 315 are secured, preferably by knots 16, 316, a tail 315', extending from knot 316 may be positioned along the surface of tissue 20 and towards knot 16. If there are additional filaments other than the fourth filament 315 used to form knot 316, any other tails (not shown) extending from knot 316 may be cut or otherwise removed. Similarly, a tail 15b' from one of the filament ends 15a, 15b, secured via knot 16, is positioned along the surface of tissue 20 and towards knot 316. Tail 15b' and tail 315' may then be secured to one another, such as via knot 516, to form a "suture bridge" between knots 16 and 316.

[0039] As such, FIG. 5 illustrates a preferred embodiment suitable to repair and reattach soft tissue 20 and a bone fragment 11. It is envisioned that other alternative embodiments, similar to the embodiment of FIG. 5, may also be performed and may also result in a successful repair. For example, more than just three anchors 14, 214, 314 may be used, and may in fact be necessary where a large soft tissue tear, and/or a particularly large bone fragment, has detached from the bone 10.

[0040] As to any of the above embodiments, it is envisioned that the number, orientation, configuration, and the like may be manipulated and changed as required for a particular anatomy, desire of the operator, characteristics of the patient, and the like. For example, the number of bore holes 12 and through-holes 13 prepared, the number of anchors 14 implanted, as well as the number of suture ends 15 extending from each anchor 14 may vary as needed. In addition, it is to be understood that the suture ends 15 may secure the bone fragment 11 to the glenoid 10 through a variety of securement features such as knots 16, as illustrated, buttons, suture clamps, suture retainers, or the like. Further still, it to be understood that each bore hole 12 and its corresponding through-hole 13 may be partially or completely drilled through, respectively, the bone and bone fragment as needed. Lastly, it is to be understood that the present invention may employ any combination of the elements disclosed in the several aforementioned embodiments.

[0041] Additionally, the various embodiments disclosed herein may be positioned, particular to labrum/glenoid repair, in any position around the joint as required. For example, in a particularly common anatomical position, the labrum tear and bone lesion/detachment may occur at a location of around 4 o'clock to 5 o'clock (using the "clock face" directional system as is well-known in the art). As such, using the embodiment of FIG. 5, the second anchor 214

would be positioned at about 3 o'clock and the third anchor 314 would be positioned at about 6 o'clock.

[0042] While filamentary fixation devices are the preferred embodiment of anchor 14, it is envisioned that traditional suture anchors may be used for any or all of the various anchors disclosed in the above embodiments.

[0043] The present invention also includes certain embodiments of kits and systems for the repair of tissue.

[0044] In one embodiment, the present invention may include a system including at least one filamentary fixation device having at least one filament end, and associated instrumentation for the repair of tissue. For example, the instrumentation can include at least one drill bit, a device inserter, and a cannulated guide adapted to accept the drill, fixation device and inserter, or both, therethrough. Such instrumentation may be similar to such systems disclosed in U.S. Application Nos. 12/460,310 and 12/821,504, each of which are incorporated by reference herein as if fully set forth herein, as well as the '336 Provisional Application and the '586 and '592 Applications, incorporated by reference above. The system may include a plurality of fixation devices of varying size, number of filament ends associated with each device, color, and the like. Or, each of the plurality of devices can be substantially the same.

[0045] In another embodiment, the present invention includes a kit for the repair of tissue including a plurality of filamentary fixation devices, each device having at least one filament end associated therewith. The kit may also include an instrument for insertion, implantation and deployment of the device at a surgical site, such as in a bore hole in bone. The kit may also include at least one drill for preparing a bore hole in bone. Preferably, the kit may include two drills for preparation of the bore hole in bone and a through-hole through a bone fragment, wherein the drill for preparing the bore hole has a larger diameter than the drill for preparing the through-hole. Each of the

plurality of fixation devices can vary as to size, number of filament ends associated with each device, color, and like characteristics. Or, each of the plurality of devices can be substantially the same. The kit may further include a shuttle.

[0046] In another embodiment, the present invention includes a system for the repair of tissue including at least one filamentary fixation device and associate filament end or ends, at least one instrument for insertion of the filamentary fixation device, and a surgical procedure. The surgical procedure may include instructions or protocol for using the filamentary fixation device and instrument to repair tissue. The protocol may include aspects of any of the above-discussed embodiments, though other variations are also envisioned within the scope of the present invention.

[0047] In an associated embodiment, the present invention includes a method of providing instructions or information to practice any of the various methods of performing tissue repair described herein. For example, the method may include supplying a surgical protocol, or like document, to provide step-by-step instructions for performing any of the method embodiments of the present invention.

[0048] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

CLAIMS

1. A method for repairing tissue, comprising the steps of:

drilling a through-hole in a bone fragment;

drilling a bore hole at least partially into a bone at a reattachment location where the bone fragment is to be reattached;

implanting a first filamentary fixation device into the bore hole, the first filamentary fixation device having at least a first filament end extending therefrom;

passing the first filament end out of the bore hole and through the through-hole through the bone fragment;

positioning the bone fragment onto the bone at the reattachment location; and

securing the first filament end to fixedly secure the bone fragment at the reattachment location.

2. The method of claim 1, wherein the first filamentary fixation device has first and second filament ends extending therefrom, wherein the step of passing includes passing both the first and second filament ends out of the bore hole and through the through-hole of the bone fragment.

3. The method of claim 2, wherein the securing step includes tying the first and second filament ends together to form a knot to fixedly secure the bone fragment at the reattachment location.

4. The method of claim 3, further comprising drilling a second bore hole at least partially into the bone at a location spaced apart from the reattachment location; implanting a second filamentary fixation device in the second bore hole, the second filamentary fixation device having at least a third filament end extending therefrom; passing the third filament end out of the bore hole and through a soft tissue to be reattached to the bone; and tying a knot in the third filament end to secure the soft tissue to the bone.

5. The method of claim 4, further comprising drilling a third bore hole at least partially into the bone at a location spaced apart from the reattachment location and in a direction opposite of the second bore hole; implanting a third filamentary fixation device in the third bore hole, the third filamentary fixation device having at least a fourth filament end extending therefrom; passing the fourth filament end out of the bore hole and through the soft tissue to be reattached to the bone; and tying a knot in the fourth filament end to secure the soft tissue to the bone.

6. The method of claim 5, further comprising passing the first and second filament ends of the first filamentary fixation device through the soft tissue, tying together in a knot one of the first and second filament ends with the third filament end, and tying together in a knot the other of the first and second filament ends with the fourth filament end, such that the soft tissue is compressed to the bone along the lengths of the first, second, third and fourth filament ends between the respective knots.

7. The method of claim 6, wherein at least one of the first, second and third filamentary fixation devices is a suture anchor formed entirely of suture, wherein the step of implanting includes deploying the suture anchor formed of suture from a relaxed position, in which the suture anchor formed from suture could move into and out of the bore hole, to a compressed position, in which the suture anchor formed from suture is fixedly secured within the bore hole.

8. A method of repairing a glenoid and labrum, comprising the steps of:

drilling a through-hole in a bone fragment of the glenoid to be reattached;

drilling a bore hole at least partially into the glenoid at a reattachment location where the bone fragment is to be reattached;

implanting a first filamentary fixation device into the bore hole, the first filamentary fixation device having at least a first filament end extending therefrom;

passing the first filament end out of the bore hole and through the through-hole of the bone fragment;

positioning the bone fragment onto the glenoid at the reattachment location; and

securing the first filament end to fixedly secure the bone fragment at the reattachment location.

9. The method of claim 8, wherein the first filamentary fixation device has first and second filament ends extending therefrom, wherein the step of passing includes passing both the first and second filament ends out of the bore hole and through the through-hole of the bone fragment.

10. The method of claim 9, wherein the securing step includes tying the first and second filament ends together to form a knot to secure the fragment at the reattachment location.

11. The method of claim 10, further comprising drilling a second bore hole at least partially into the glenoid at a location spaced apart from the reattachment location; implanting a second filamentary fixation device in the second bore hole, the second filamentary fixation device having at least a third filament end extending therefrom; passing the third filament end out of the bore hole and through labrum to be reattached to the glenoid; and tying a knot in the third filament end to secure the labrum to the glenoid.

12. The method of claim 11, further comprising drilling a third bore hole at least partially into the glenoid at a location spaced apart from the reattachment location and in a direction opposite of the second bore hole; implanting a third filamentary fixation device in the third bore hole, the third filamentary fixation device having at least a fourth filament end extending therefrom; passing the fourth filament end out of the bore hole and through the labrum to be

reattached to the glenoid; and tying a knot in the fourth filament end to secure the labrum to the glenoid.

13. The method of claim 12, further comprising passing the first and second filament ends of the first suture anchor through the labrum, tying together in a knot one of the first and second filament ends with the third filament end, and tying together in a knot the other of the first and second filament ends with the fourth filament end, such that the labrum is compressed to the glenoid along the lengths of the first, second, third and fourth filament ends between the respective knots.

14. The method of claim 13, wherein at least one of the first, second and third filamentary fixation devices is a suture anchor formed entirely of suture, wherein the step of implanting includes deploying the suture anchor formed of suture from a relaxed position, in which the suture anchor formed from suture could move into and out of the bore hole, to a compressed position, in which the suture anchor formed from suture is fixedly secured within the bore hole.

15. The method of claim 8, wherein the bore hole has a larger diameter than the through-hole.

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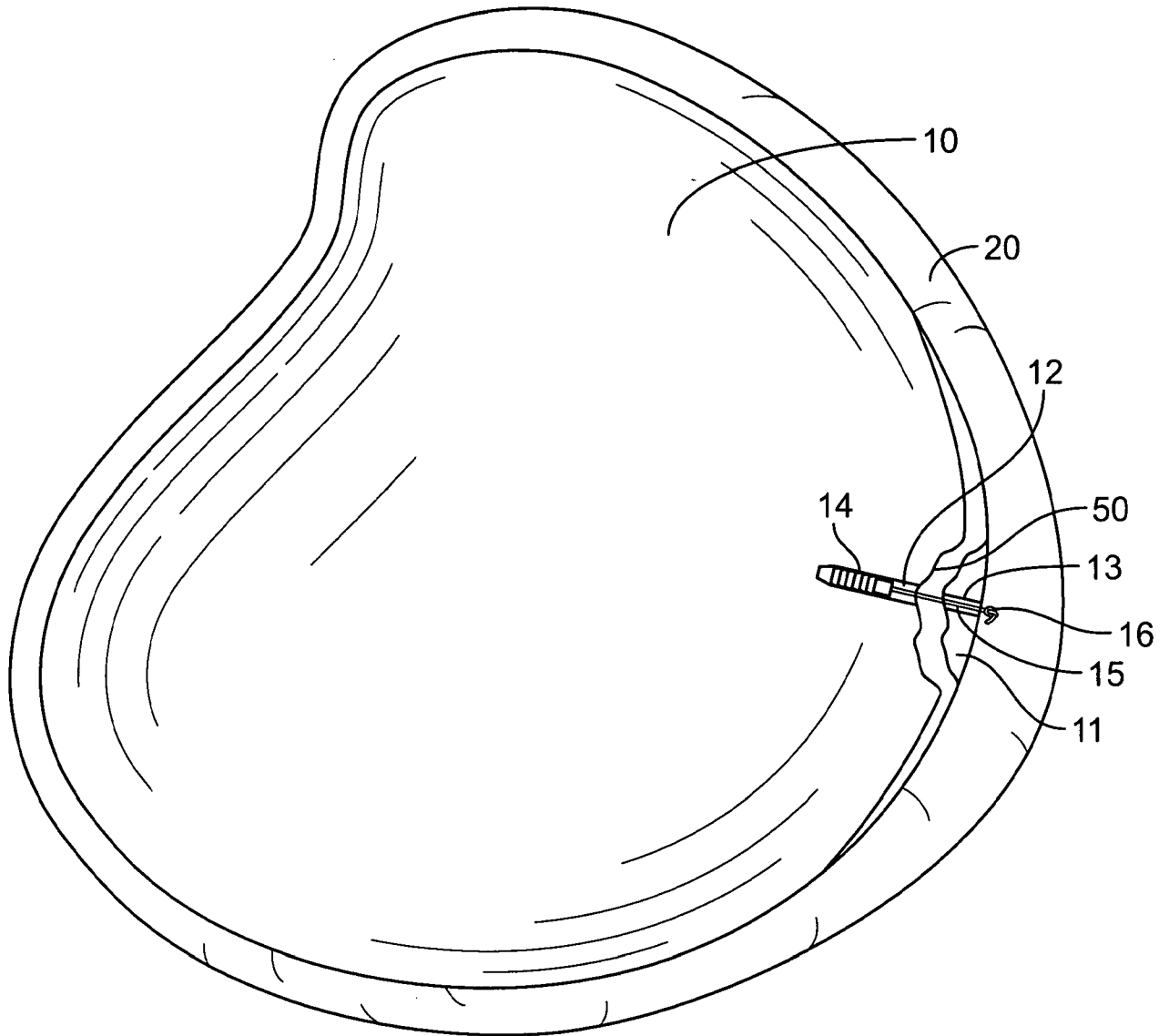


FIG. 1

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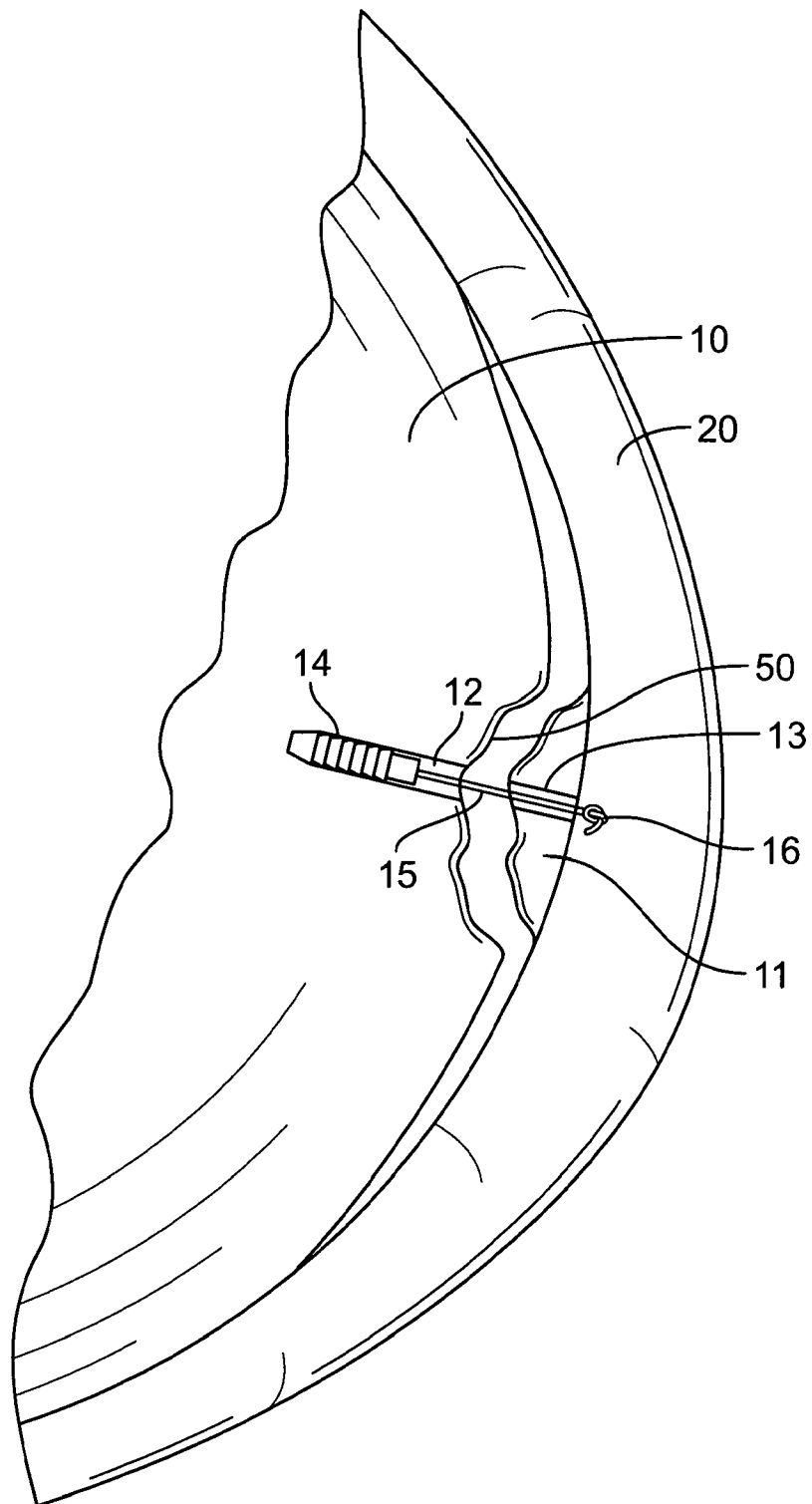
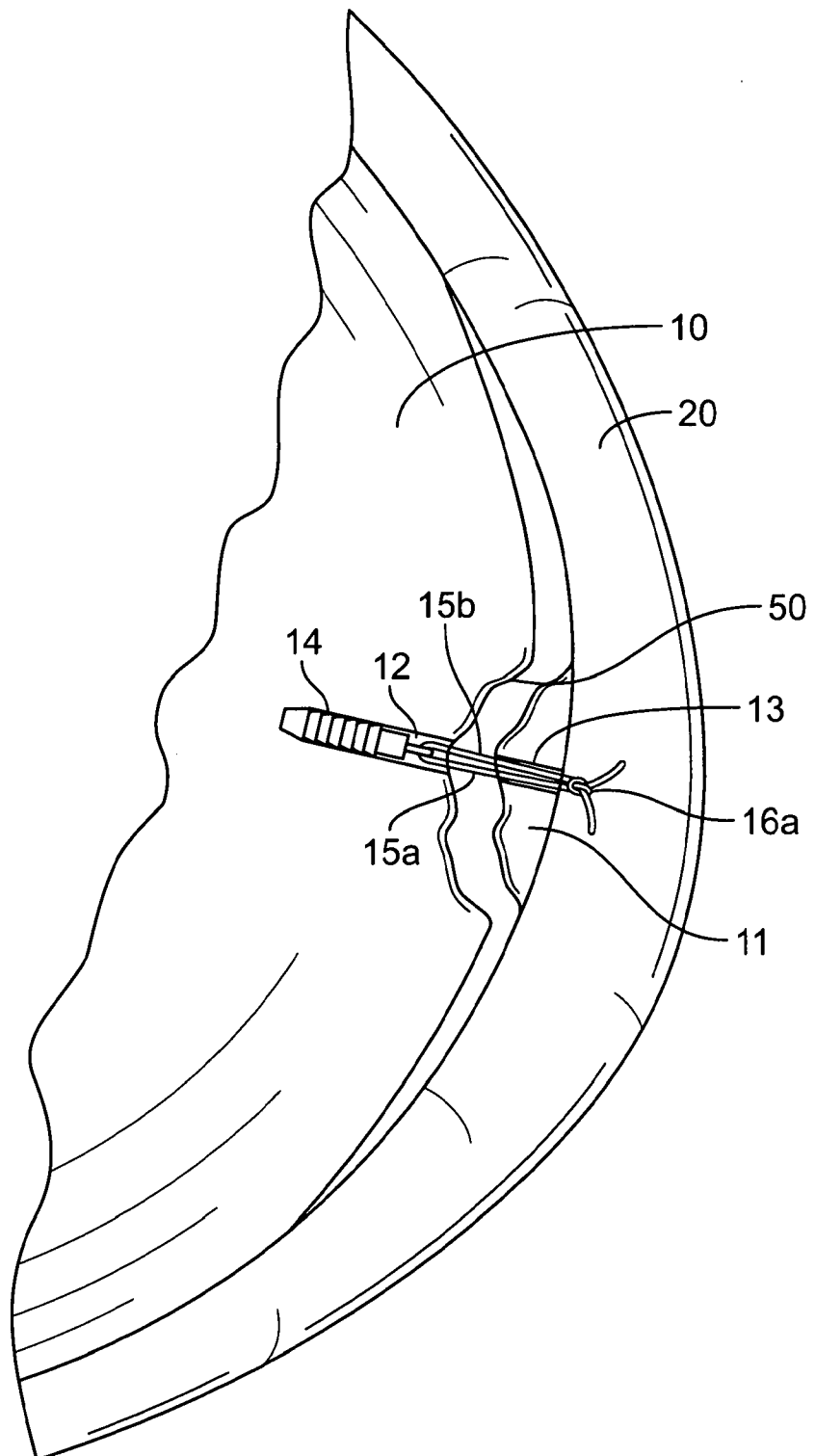


FIG. 1A

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**FIG. 2**

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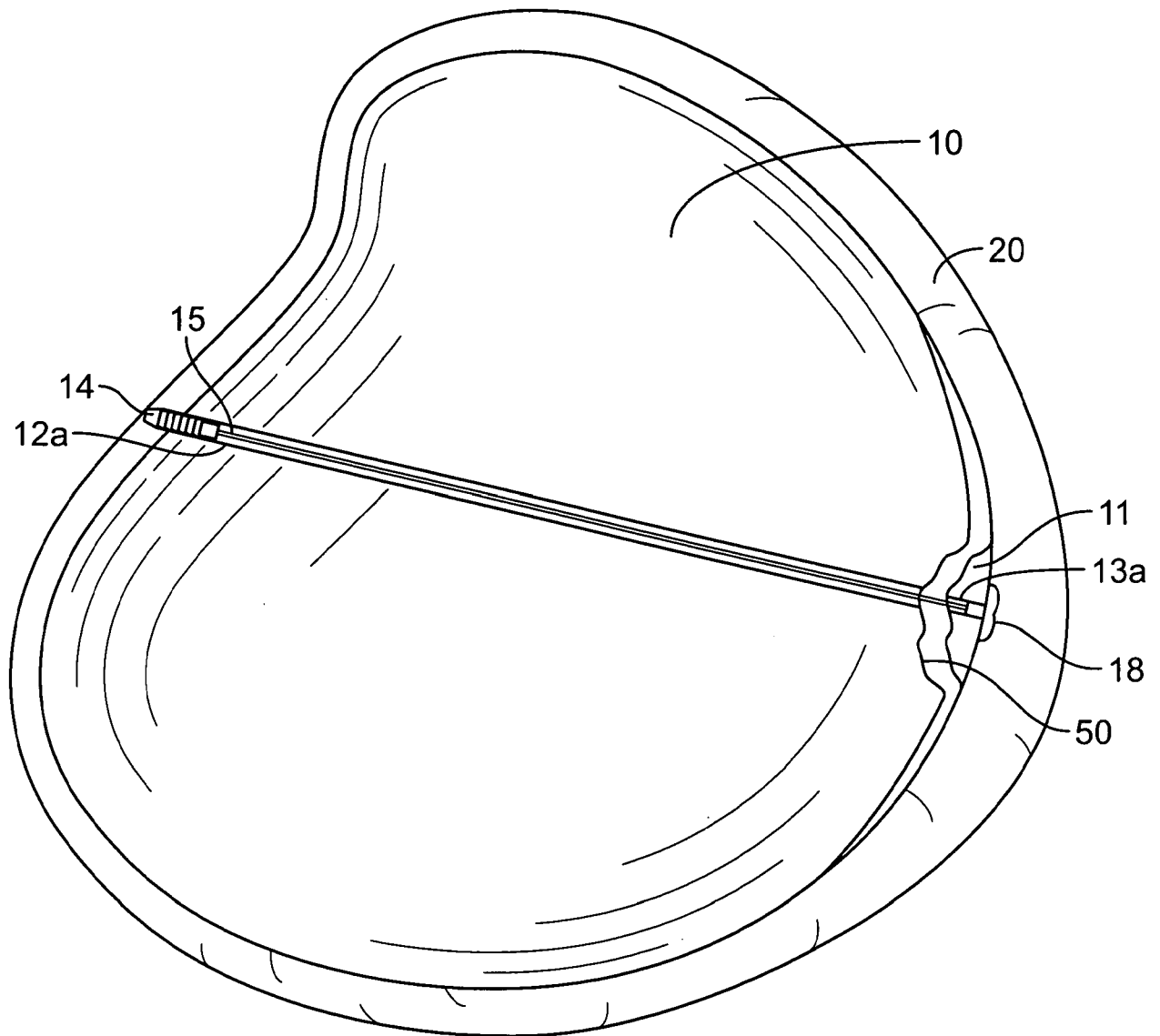
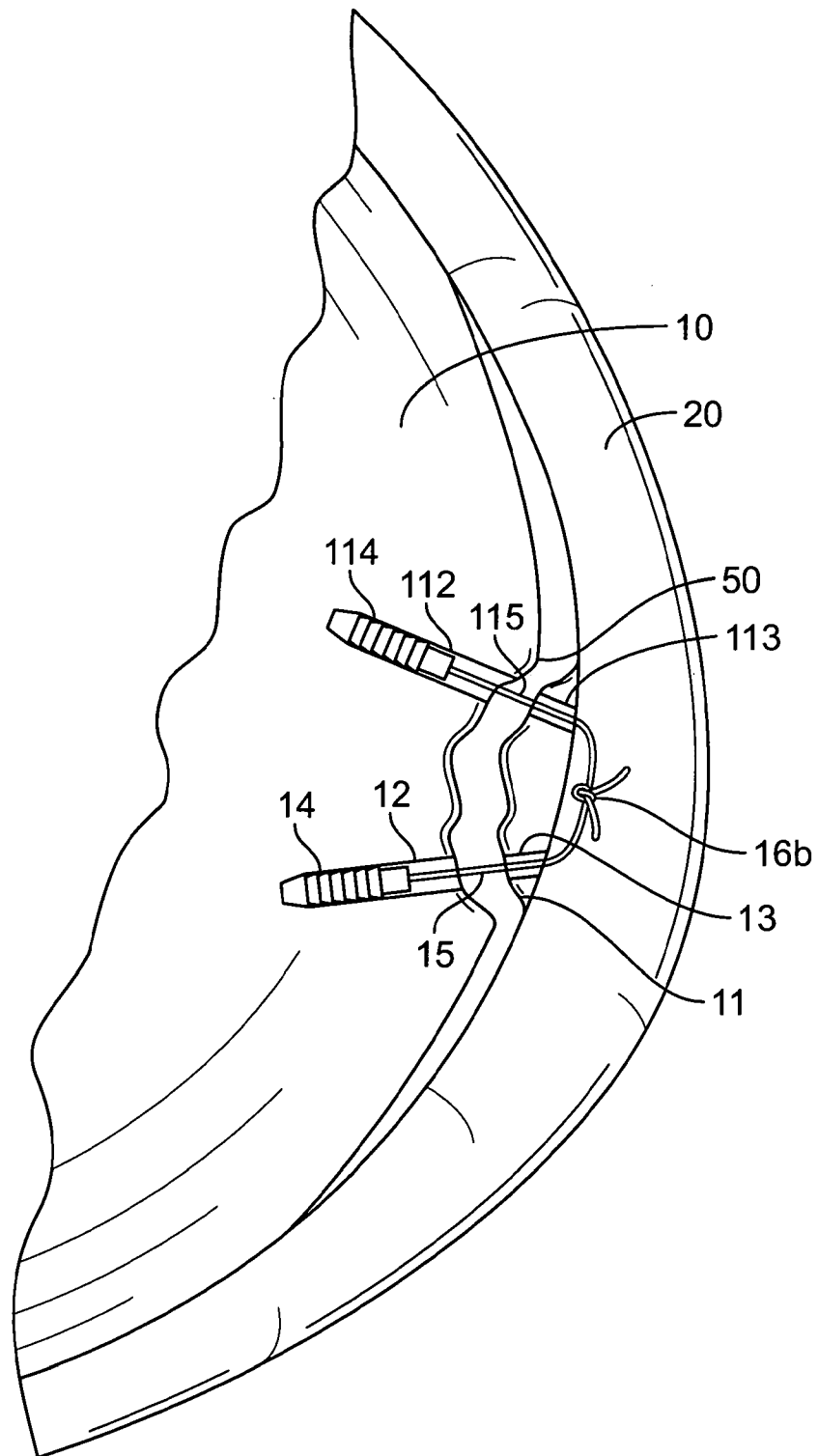
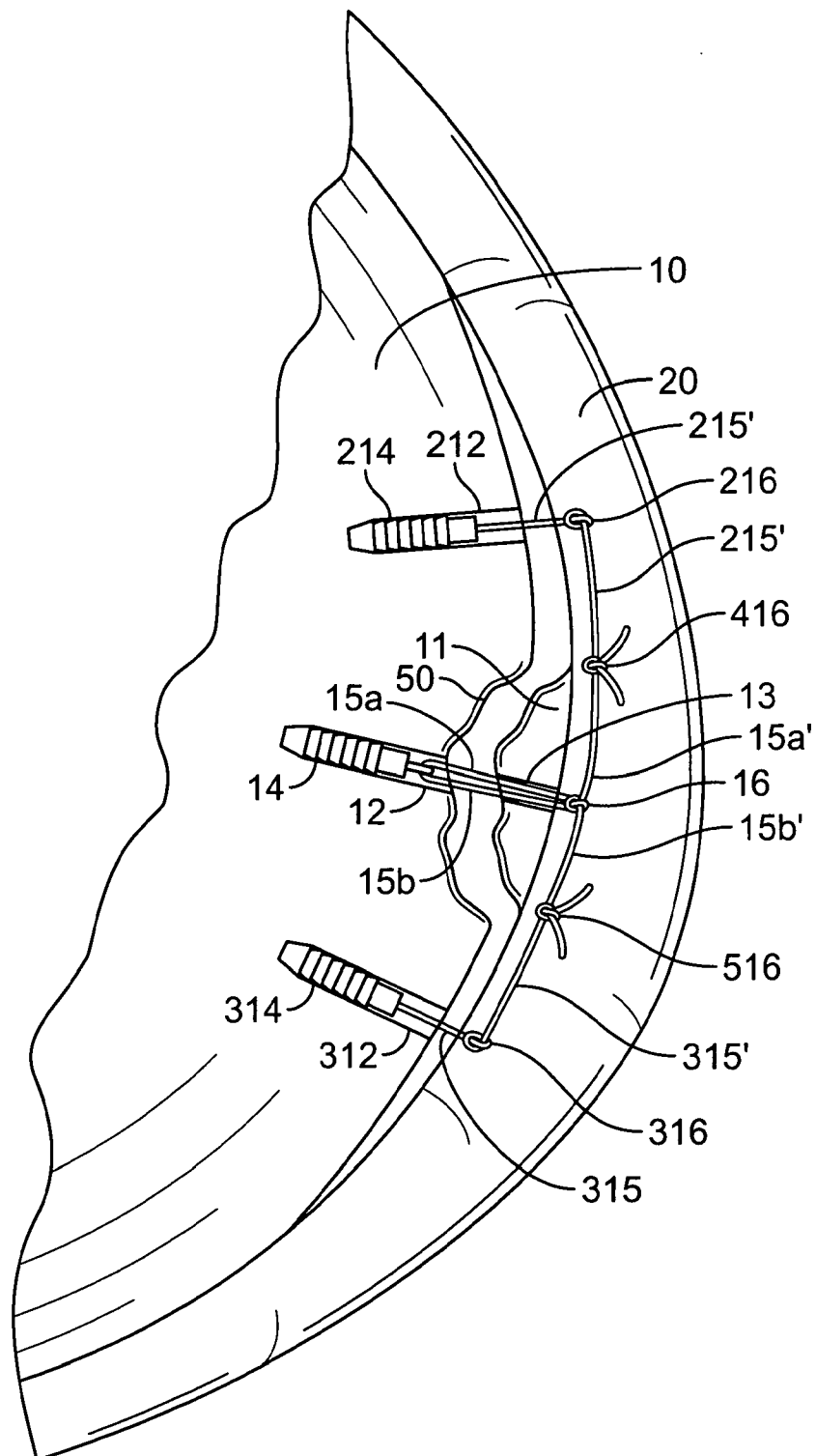


FIG. 3

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**FIG. 4**

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**FIG. 5**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/021231

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61B 17/58 (2014.01)

USPC - 606/87

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - A61B 17/58, 17/68 (2014.01)

USPC - 606/86R, 87, 232; 623/22.11

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

CPC - A61B 17/0401 (2014.02)

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

PatBase, YouTube, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/0046625 A1 (BOILEAU et al) 24 February 2011 (24.02.2011) entire document	1-15
A	US 6,083,522 A (CHU et al) 04 July 2000 (04.07.2000) entire document	1-15
A	WO 97/22301 A1 (BRAMLET) 26 June 1997 (26.06.1997) entire document	1-15
A	US 2011/0264141 A1 (DENHAM et al) 27 October 2011 (27.10.2011) entire document	1-15

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Date of the actual completion of the international search

06 June 2014

Date of mailing of the international search report

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