US 20110046678A1

(19) **United States**

(12) **Patent Application Publication**
Kwak et al.

(10) **Pub. No.: US 2011/0046678 A1**

(43) **Pub. Date: Feb. 24, 2011**

(54) **FACET JOINT PROSTHESIS**

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(21) Appl. No.: **12/940,441**

(22) Filed: **Nov. 5, 2010**

Related U.S. Application Data

(63) Continuation of application No. 11/611,420, filed on Dec. 15, 2006, now Pat. No. 7,828,824.

Publication Classification

(51) **Int. Cl.**
A61B 17/70 (2006.01)
A61B 17/88 (2006.01)

(52) **U.S. Cl.** **606/264**; 606/279

(57) **ABSTRACT**

Various methods and devices are provided for a facet replacement device. In one embodiment of the invention, a facet replacement device is provided and includes an elongate member matable to a first vertebra and a housing. The housing can have a connector formed thereon and matable to an adjacent second vertebra and an inner lumen formed therein. The housing can also include a deformable member disposed within the inner lumen and having an opening formed therein for slidably receiving at least a portion of the elongate member such that the elongate member can be angularly oriented relative to a longitudinal axis of the lumen.

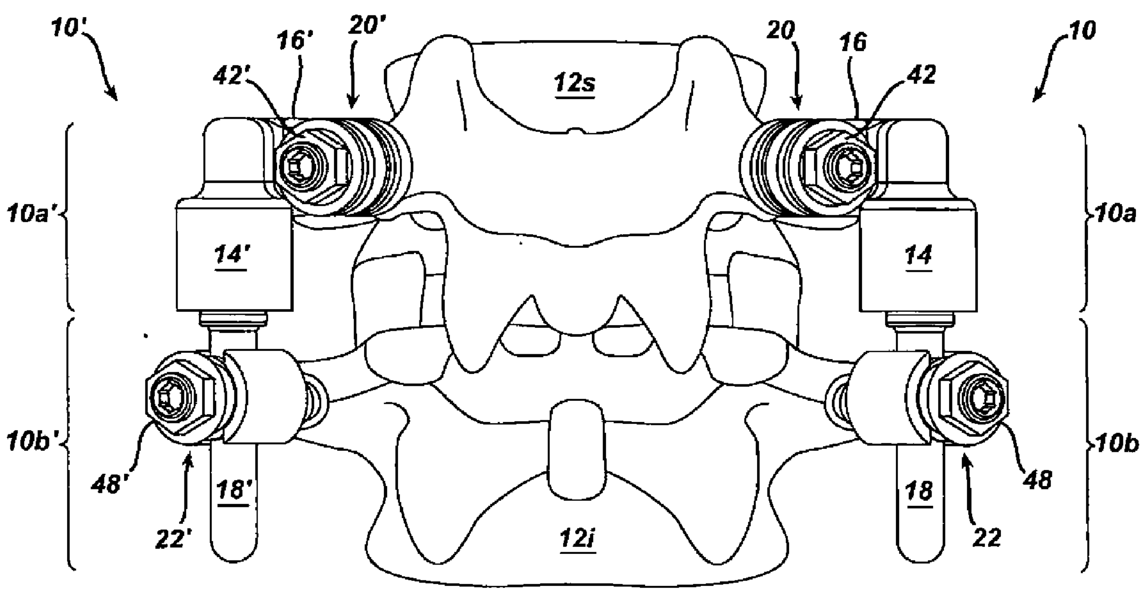


FIG. 1

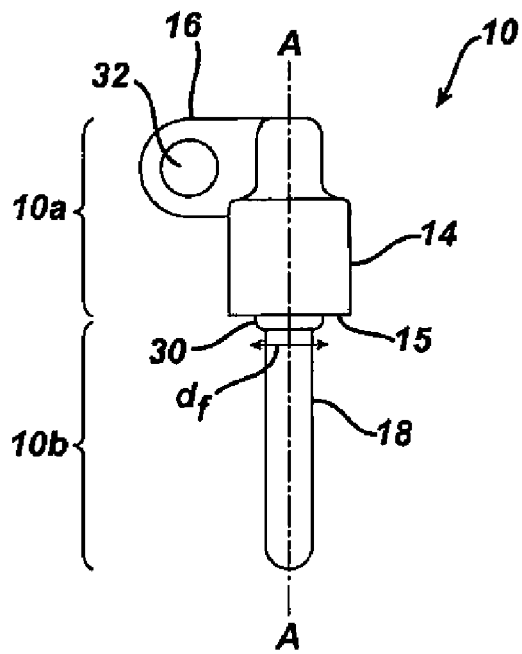
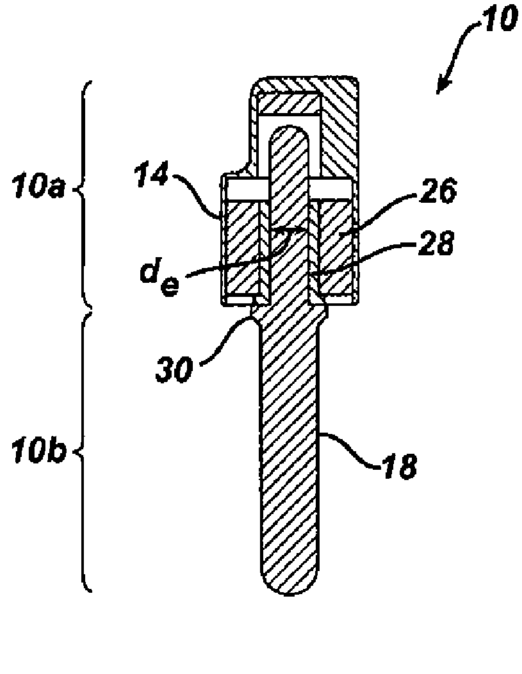
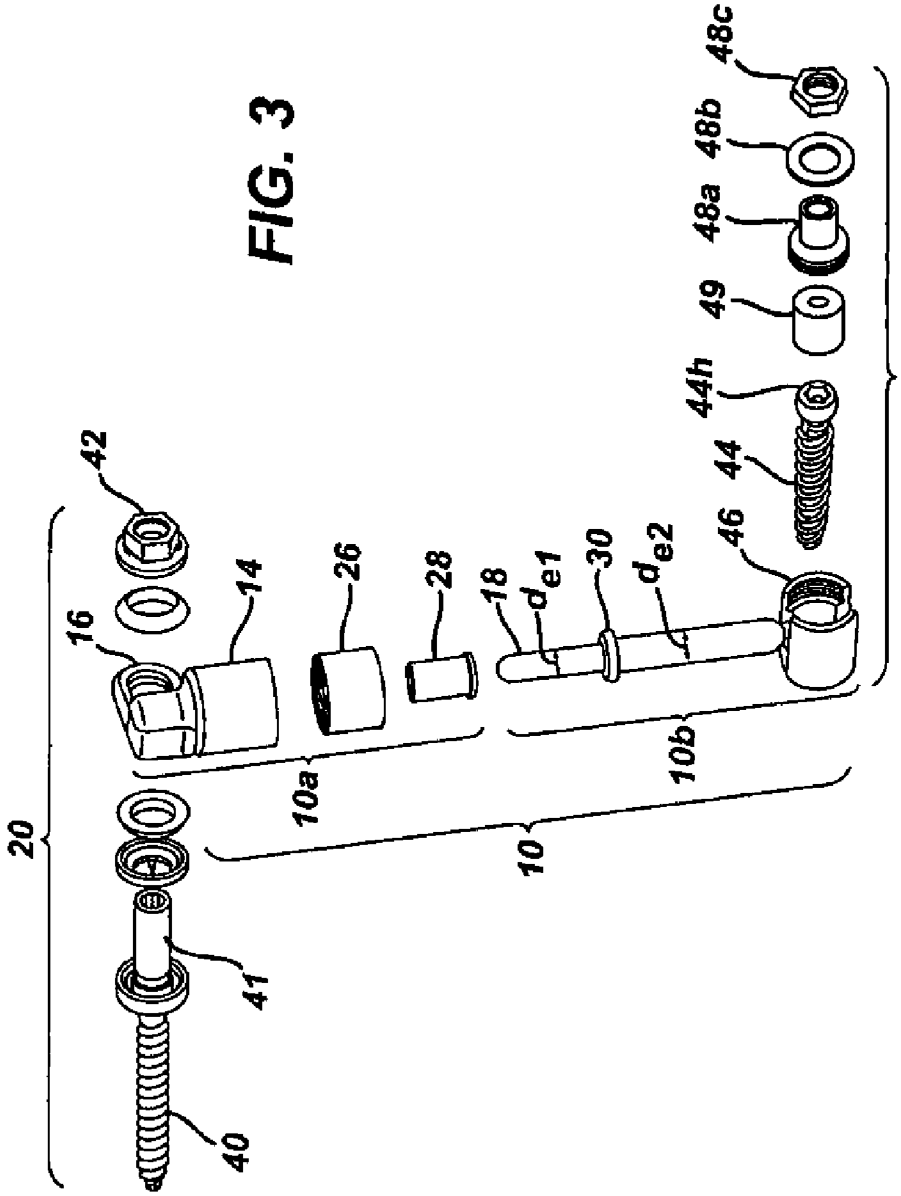


FIG. 2




20
42
16
14
26
28
18
d_{e1}
30
d_{e2}
46
44
44h
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48a
48b
48c
22
10a
10b
10
41
40

FIG. 3

FIG. 4

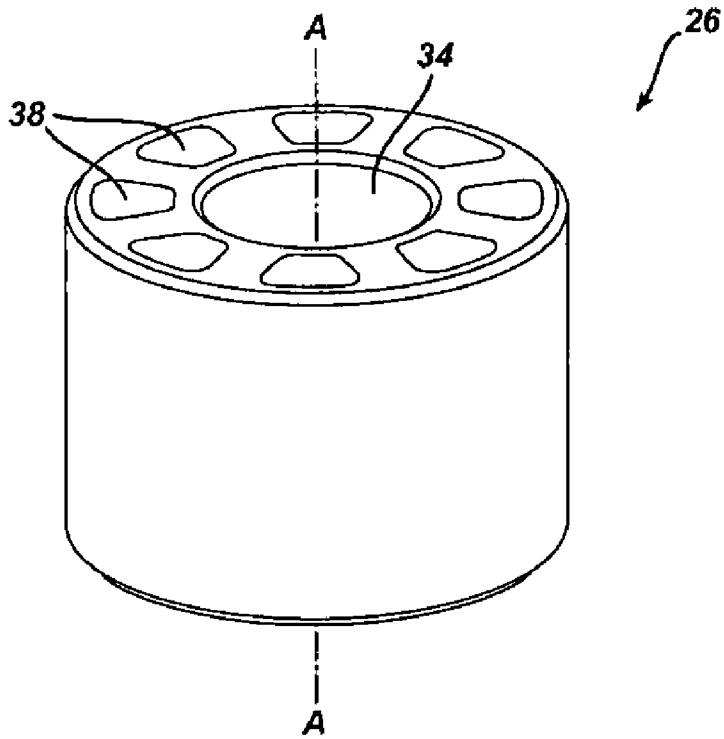


FIG. 5

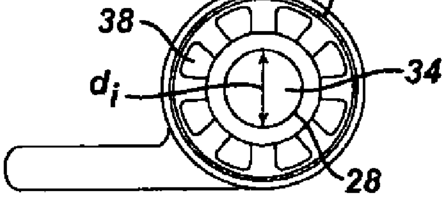


FIG. 6

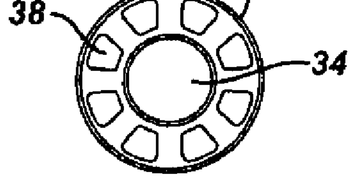


FIG. 7

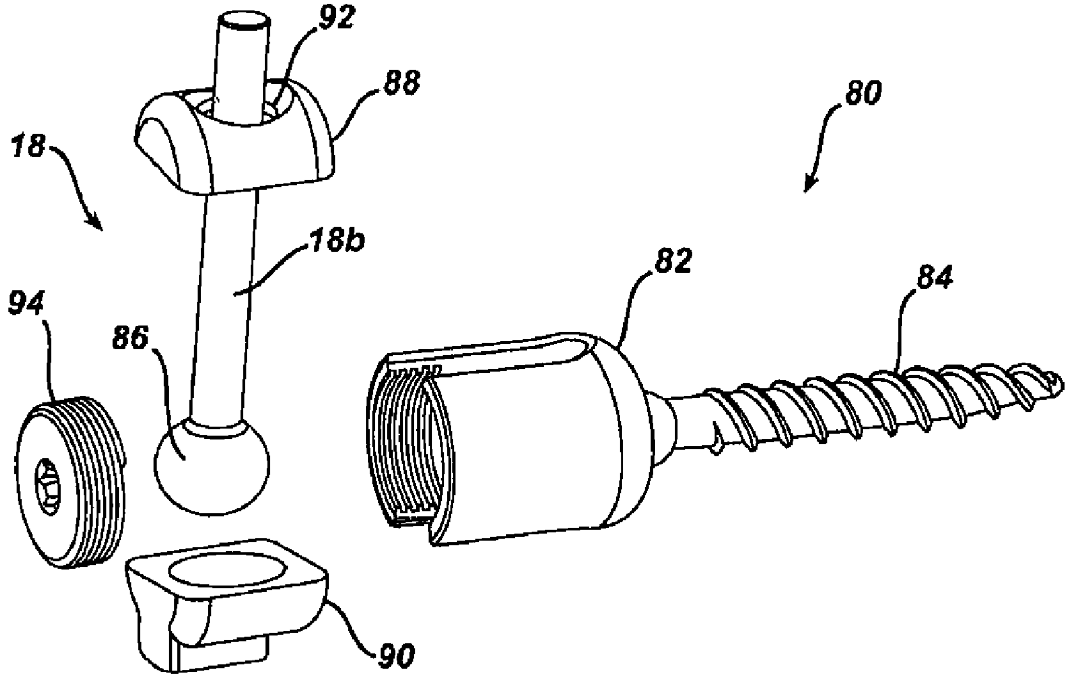
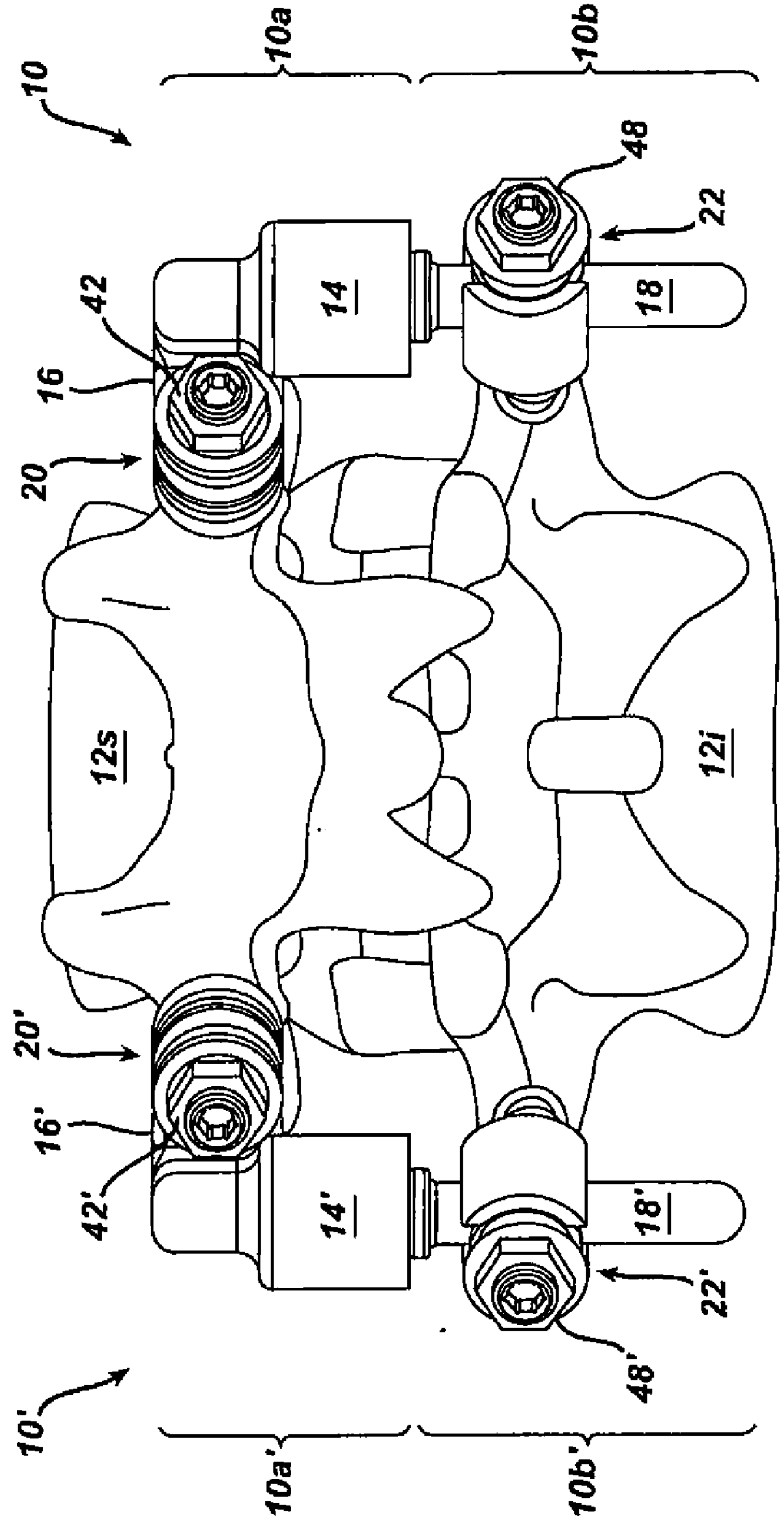


FIG. 8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14
42
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42'
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48'
10'
10a'
10b'

FIG. 9

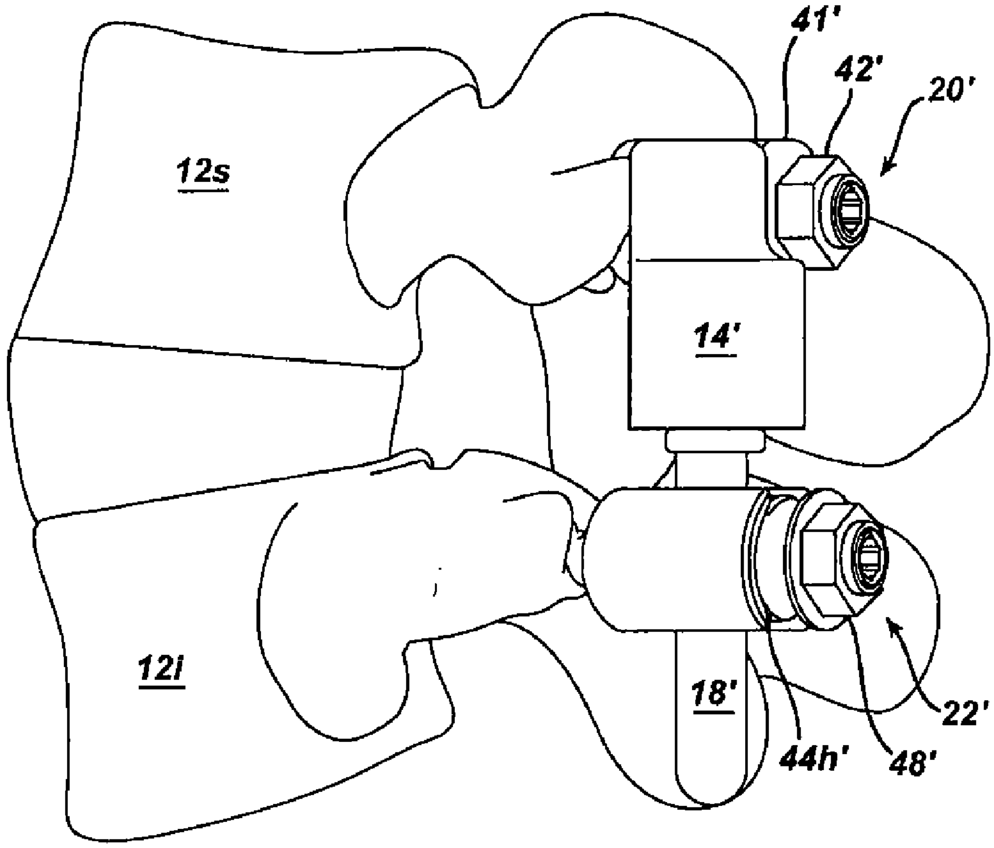
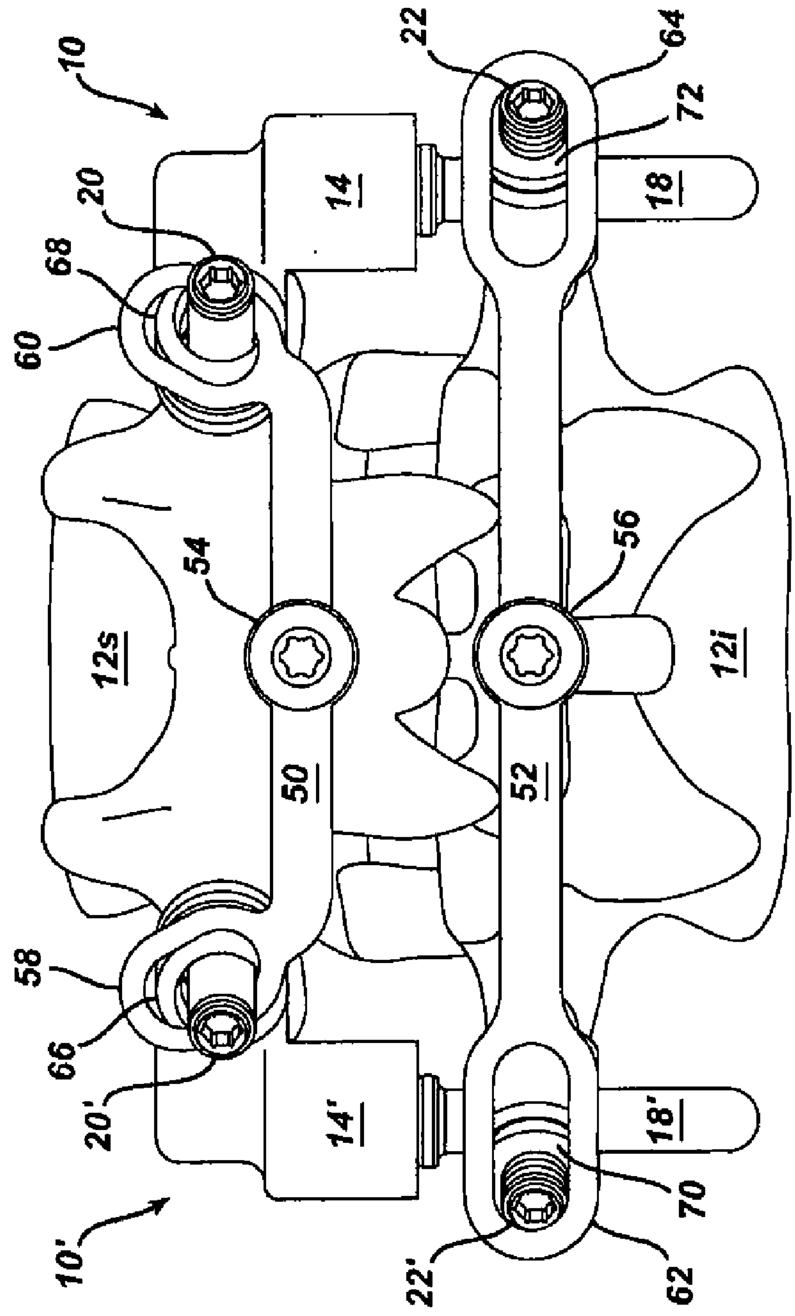


FIG. 10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FACET JOINT PROSTHESIS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation of U.S. application Ser. No. 11/611,420 filed on Dec. 15, 2006 and entitled “Facet Joint Prosthesis,” which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] The vertebrae in a patient’s spinal column are linked to one another by the disc and the facet joints, which control movement of the vertebrae relative to one another. Each vertebra has a pair of articulating surfaces located on the left side, and a pair of articulating surfaces located on the right side, and each pair includes a superior articular surface which faces upward and an inferior articular surface which faces downward. Together the superior and inferior articular surfaces of adjacent vertebrae form a facet joint. Facet joints are synovial joints, which means that each joint is surrounded by a capsule of connective tissue and produces a fluid to nourish and lubricate the joint. The joint surfaces are coated with cartilage allowing the joints to move or articulate relative to one another.

[0003] Diseased, degenerated, impaired, or otherwise painful facet joints and/or discs can require surgery to restore function to the three joint complex. Subsequent surgery may also be required after a laminectomy, as a laminectomy predisposes the patient to instability and may lead to post-laminectomy kyphosis (abnormal forward curvature of the spine), pain, and neurological dysfunction. Damaged, diseased levels in the spine were traditionally fused to one another. While such a technique may relieve pain, it effectively prevents motion between at least two vertebrae. As a result, additional stress may be applied to the adjoining levels, thereby potentially leading to further damage.

[0004] A number of devices are currently employed to correct such problems, such as artificial facet joints. None of these devices utilize geometries that allow for similar kinetics of a normal spine that would permit certain movements while resisting others.

[0005] Accordingly, there remains a need for improved systems and methods that are adapted to mimic the natural function of the facet joints.

SUMMARY

[0006] The present invention provides various methods and devices for replacing one or more facet joints in a patient’s spine. In one embodiment, a facet replacement device is provided and includes an elongate member matable to a first vertebra, and a housing having a connector formed thereon and matable to an adjacent second vertebra. The housing can include a deformable member disposed within an inner lumen formed thereon, and the deformable member can have an opening formed therein for slidably receiving at least a portion of the elongate member such that the elongate member can be angularly oriented relative to a longitudinal axis of the lumen. In use, the elongate member can be adapted to slidably translate relative to the opening in the deformable member to allow flexion, extension, and lateral bending of adjacent vertebrae coupled thereto. The opening in the elongate member can be adapted to provide limited lateral motion, thereby providing resistance to anterior-posterior shear and axial rotation after the initial small motion.

[0007] While the deformable member can have a variety of configurations, in one embodiment it has a substantially cylindrical shape. The opening formed in the deformable member can extend along a central axis of the deformable member. The deformable member can also include a plurality of holes spaced around the opening and extending substantially parallel to the central axis of the deformable member. The device can also include a bearing disposed within the opening formed in the deformable member and adapted to facilitate slidable movement of the elongate member within the opening.

[0008] The housing can also have a variety of configurations, but in an exemplary embodiment the housing is substantially rigid and has a generally cylindrical shape that surrounds the deformable member. The connector can extend laterally from the cylindrical portion of the housing. In one embodiment, the connector can include a bore formed therethrough that is adapted to receive a portion of a bone anchor for anchoring the housing to a vertebra. In certain exemplary embodiments, the bore can have an oblong shape to allow a bone anchor to be positioned within the bore at a plurality of positions.

[0009] In another embodiment, a facet replacement system is provided and includes a first component adapted to couple to a first vertebra and having a deformable member disposed therein, and a second component adapted to couple to a second adjacent vertebra and having at least a portion that is receivable within the deformable member of the first component. The second component is adapted to slidably translate relative to a longitudinal axis of the first component to allow flexion, extension, and lateral bending of adjacent vertebrae coupled thereto. The second component can also be adapted to move laterally relative to the longitudinal axis of the first component to deform the deformable member and thereby provide resistance to anterior-posterior shear and axial rotation of adjacent vertebrae coupled thereto.

[0010] In one embodiment, the first component can include a first housing adapted to mate to a first lateral side of a first vertebra, and a second housing adapted to mate to a second lateral side of a first vertebra. The second component can include a first elongate member adapted to anchor to a first lateral side of a second vertebra, and a second elongate member adapted to anchor to a second lateral side of a second vertebra. At least a portion of the first elongate member can be positioned within a first deformable member disposed within the first housing, and at least a portion of the second elongate member can be positioned within a second deformable member disposed within the second housing. The system can also optionally include a cross-connector having a first end coupled to the first housing and a second end coupled to the second housing, and/or a cross-connector having a first end coupled to the first elongate member and a second end coupled to the second elongate member.

[0011] Methods for stabilizing adjacent vertebrae are also provided, and in one embodiment the method can include coupling a first component to a first vertebra and coupling a second component to a second adjacent vertebra and positioning at least a portion of the second component within a deformable member of the first component such that the second component translates along a longitudinal axis of the deformable member to allow flexion, extension, and lateral bending of the first and second vertebrae. The second component can also move laterally relative to the longitudinal axis of the deformable member to provide resistance to anterior-posterior shear and axial rotation of the first and second vertebrae.

[0012] In one embodiment, coupling the first component to the first vertebra can include implanting an anchor in the first vertebra and mating a connector formed on the first component to the anchor, and coupling the second component to the second vertebra can include implanting an anchor in the second vertebra and mating the second component to the anchor. In one exemplary embodiment, the anchor mated to the second component can be adapted to allow the second component to pivot relative to the second vertebra. In another exemplary embodiment, coupling the first component to a first vertebra can include anchoring a first housing to a first lateral side of the first vertebra and anchoring a second housing to a second lateral side of the first vertebra, and coupling the second component to a second vertebra can include anchoring a first elongate member to a first lateral side of the second vertebra and anchoring a second elongate member to a second lateral side of the second vertebra. At least a portion of the first elongate member can be positioned within a first deformable member disposed within the first housing, and at least a portion of the second elongate member can be positioned within a second deformable member disposed within the second housing. The method can also include coupling a first end of a cross-connector to the first housing and a second end of the cross-connector to the second housing, and coupling/or a first end of a cross-connector to the first elongate member and a second end of the cross-connector to the second elongate member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0014] FIG. **1** is side view of one embodiment of a facet replacement device having a housing and an elongate member;

[0015] FIG. **2** is a cross-sectional view of the facet replacement device shown in FIG. **1**;

[0016] FIG. **3** is an exploded view of the facet replacement device shown in FIG. **1**, showing anchors for coupling the housing and elongate member to adjacent vertebrae;

[0017] FIG. **4** is a perspective view of a deformable member of the facet replacement device shown in FIG. **1**;

[0018] FIG. **5** is a top view of the deformable member of FIG. **4** disposed within the housing of FIG. **1**;

[0019] FIG. **6** is a top view of the deformable member shown in FIG. **4**;

[0020] FIG. **7** is a perspective view of an embodiment of a bone anchor for movably coupling an elongate member of a facet replacement device to a vertebra;

[0021] FIG. **8** is a front view of two facet replacement devices shown in FIG. **1** coupled to adjacent vertebrae;

[0022] FIG. **9** is a side perspective view of one of the facet replacement devices and the adjacent vertebrae of FIG. **8**; and

[0023] FIG. **10** is a front view of the facet replacement devices and adjacent vertebrae of FIG. **8**, showing first and second cross connectors mated thereto.

DETAILED DESCRIPTION

[0024] Certain exemplary embodiments will now be described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the devices and methods disclosed herein. One or more examples of these embodiments are illustrated in the accompanying drawings. Those skilled in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary embodiments and that the scope of the present invention is defined solely by the claims. The features illustrated or described in connection with one exemplary embodiment may be combined with the features of other embodiments. Such modifications and variations are intended to be included within the scope of the present invention.

[0025] Various exemplary methods and devices are provided for accommodating the natural function of the spine by allowing flexion, extension, and lateral bending of the spine, while providing resistance to anterior-posterior shear and axial rotation of the spine. A person skilled in the art will appreciate that, while the methods and devices are especially configured for use in restoring and/or replacing the facet joints and optionally other posterior elements of a patient's spine, the methods and devices can be used for a variety of other purposes in a variety of other surgical procedures.

[0026] FIGS. **1-3** illustrate one exemplary embodiment of a facet replacement device **10**. As shown, the device **10** generally includes a first member **10*a*** that can be coupled to a first vertebra, e.g., a superior vertebra, and a second member **10*b*** that can be coupled to a second adjacent vertebra, e.g., an inferior vertebra. While not shown, the first and second members **10*a***, **10*b*** can be reversed such that the first member **10*a*** can be coupled to the inferior vertebra and the second member **10*b*** can be coupled to the superior vertebra. The first and second members **10*a***, **10*b*** can also be movably coupled to one another. In particular, the first member **10*a*** can include a housing **14** with a deformable member **26** disposed therein, and the second member **10*b*** can include an elongate member **18** that is adapted to be received by the deformable member **26**. In use, the deformable member **26** and the elongate member **18** cooperate to control movement of superior and inferior vertebrae relative to one another, and in particular they can allow flexion, extension, and lateral bending of the vertebrae preferably while providing resistance to anterior-posterior shear and axial rotation of the vertebrae.

[0027] The first member **10*a*** of the device **10** can have a variety of configurations. In the illustrated exemplary embodiment, the first member **10*a*** is in the form of a housing **14** that has a generally cylindrical configuration. As shown in FIG. **2**, the housing **14** can include an inner lumen extending therethrough that is adapted to house the deformable member **26** therein. The housing **14** can also include a connector **16** (FIG. **1**) extending laterally from a sidewall of the housing **14** and adapted to mate to a vertebra, e.g., the superior vertebra, as will be discussed in more detail below. The housing **14** and connector **16** can be formed from a variety of materials, but in an exemplary embodiment the housing **14** and the connector **16** are preferably substantially rigid to facilitate rigid mating to a vertebra.

[0028] The deformable member **26** housed in the inner lumen of the housing **14** can also have a variety of configurations, but it is preferably adapted to slidably receiving at least a portion of the elongate member **18** of the second member **10*b*** to allow adjacent vertebrae mated to the first and second members **10*a***, **10*b*** to flex and extend relative to one another. The deformable member **26** is also preferably adapted to allow limited lateral motion of the elongate member **18** relative to a longitudinal axis A of the first member **10***a* to provide resistance to anterior-posterior shear and axial rotation of the adjacent vertebrae coupled to the first and second members **10***a*, **10***b*.

[0029] While the deformable member **26** can have a variety of configurations to allow flexion, extension, and lateral bending while providing resistance to lateral bending, anterior-posterior shear, and axial rotation, in the illustrated embodiment, shown in more detail in FIGS. **4-6**, the deformable member **26** has a substantially cylindrical shape with an opening **34** formed therethrough. The opening **34** can be adapted to receive the elongate member **18** and it can extend along a central axis A of the deformable member **26**, i.e., the central axis A of the device **10**. The deformable member **26** can also include one or more holes **38** spaced around the opening **34** and extending substantially parallel to the central axis of the deformable member **26**.

[0030] The holes **38** are adapted to allow the deformable member **26** to bend, elongate, and otherwise compress during movement of the adjacent vertebrae coupled to the first and second members **10***a*, **10***b*. The deformable member can also be formed from a variety of materials. In certain exemplary embodiments, the deformable member is formed from an incompressible material, such that the deformable member is capable of deforming without changing volume. Where the material is incompressible, the use of holes or openings formed in the deformable member will allow the deformable member to deform during use. Exemplary materials for the deformable member **26** include, by way of non-limiting example, biocompatible polymers such as polyurethane, polyethylene, silicone, polyesters, polypropylene, polyethylene, or any combination of and metal such as above stainless steel, titanium, Nitinol, or cobalt chrome. A person skill in the art will appreciate that any number of holes **38** having any configuration can be formed in the deformable member **26** as long as they facilitate movement of the deformable member **26**. Moreover, the deformable member **26** can have other configurations, such as a coil spring.

[0031] In use, the deformable member **26** is configured to replace the function of a facet joint. As indicated above, the deformable member **26** can provide axial translation, i.e., allowing sliding movement of the elongate member **18** within the opening **34** in the deformable member **26** along the axis A. During this movement, the deformable member **26** can rotate out of axis A and extend at an angle relative to the axis A. This causes portions of the deformable member **26** to deform, i.e., a portion of a wall of the deformable member **26** on the first lateral side will extend and a portion of a wall of the deformable member **26** on a second lateral side will compress. This allows flexion, extension, and lateral bending of the vertebrae with limited or no resistance from the deformable member **26**. The only limit to the flexion and extension of the vertebrae can be a stop member, such as a flange **30** described in more detail below, which is adapted to limit penetration of the elongate member **18** through the deformable member **26**. The deformable member **26** can also provide for anterior-posterior shear and axial rotation. During anterior-posterior shear and axial rotation, the deformable member **26** can translate out of the axis A while remaining substantially parallel to the axis A. For example, as the superior vertebrae moves in an anterior direction relative to the inferior vertebra, an anterior wall of the deformable member **26** will compress and a posterior wall of the deformable member **26** will extend, allowing for anterior-posterior shear of the adjacent vertebrae. Likewise, as the superior and inferior vertebrae axially rotate relative to one another, one wall of the deformable member **26** will compress as the opposite wall is extended.

[0032] The deformable member **26** can also include a bearing **28**, shown in FIGS. **2** and **5**, disposed within the opening **34** formed in the deformable member **26**. The bearing **28** can have a variety of configurations, but in the illustrated embodiment it has a generally hollow cylindrically shape and is disposed around the inner surface of the opening **34** in the deformable member **26**. The bearing **28** can be formed from a variety of materials, but in an exemplary embodiment it is formed from a material that resists wear as the elongate member **18** moves relative to the deformable member **26**, as will be discussed in more detail below. By way of non-limiting example, the bearing **28** can be formed from a thin sheet of metal that coats the entire opening **34** extending through the deformable member **26**. A person skilled in the art will appreciate that a number of techniques can be used to form a bearing **28** within the opening **34** in the deformable member **26**, including a coating formed on a wall of the opening **34**.

[0033] As noted above, the first member **10***a* can also include a connector **16** adapted to mate to a vertebra, e.g., the superior vertebra. While various techniques can be used to allow the connector **16** to mate to a vertebra, in the embodiment shown in FIGS. **1** and **3**, the connector **16** is in the form of a tab extending laterally outward from the cylindrical portion of the housing and having a bore **32** extending therethrough for receiving a portion of a bone anchor. The connector **16** can be offset from the central axis A of the housing **14** so the connector **16** can be anchored to a vertebra at a location that is offset from the device **10**. The bore **32** can vary in shape and size depending on the type of fastening element being used. For example, the bore **32** can have a circular shape, or it can have an oblong shape to allow a bone anchor to be positioned within the bore **32** at a plurality of positions relative to the connector **16**. Various anchors can also be used to mate the connector **16** to bone. In an exemplary embodiment, as shown in FIG. **3**, the bone anchor **20** is in the form of a bone screw having a threaded shank **40** and a head **41** adapted to extend through the bore **32** in the connector **16** and to mate with a fastening element **42**, such as a locking nut, that is adapted to lock the connector **16** of the housing **14** to the head **41**, and this to a vertebra.

[0034] The second member **10***b* of the facet replacement device **10** can also have a variety of configurations, but as indicate above and as shown in FIGS. **1-3**, the second member **10***b* can be in the form of an elongate member **18** having a substantially cylindrical shape with first and second portions **18***a*, **18***b*. The first portion **18***a* of the elongate member **18** can be adapted to extend into and slidably move through the opening **34** formed in the deformable member **26**, and the second portion **18***b* can be adapted to couple to a bone anchor for mating the second member **10***b* to a vertebra, e.g., the inferior vertebra. In an exemplary embodiment, the first portion **18***a* of the elongate member **18** has a substantially cylindrical shape with a diameter d_{e_1} that is only slightly less than an inner diameter d_i (FIG. **5**) of the opening **34** formed through the deformable member **26**. Moreover, although not shown, the elongate member **18** does not need to be straight. The elongate member can be curved following an arc; and correspondingly, the opening in member **26** could follow the same arc to receive the curved elongate member.

[0035] As noted above, the second portion **18***b* of the elongate member **18** can be adapted to couple to a bone anchor to mate the second portion **18***b* to a vertebra. In one embodiment, the second portion **18***b* can have a diameter d_{el} that is different from the diameter d_{e_1} of the first portion **18***a* to provide secure mating of the second portion **18***b* to the bone anchor. The second portion **18***b* can have a variety of configurations depending on the type of bone anchor used, but in an exemplary embodiment the bone anchor **22** is in the form of a bone screw. As shown in FIG. **3**, the bone screw is a polyaxial bone screw having a threaded shank **44** that is adapted to engage bone, and a U-shaped receiving head **46** that is configured to movably seat a head **44***h* formed on the threaded shank **44**. The U-shaped receiving head **46** is also adapted to seat the second portion **18***b* of the elongate member **18** therein. As further shown in FIG. **3**, the bone screw can include a locking element, such as a set screw **48***a*, which can mate to a nut **48***b* and washer **48***c*, for locking the second portion **18***b* of the elongate member **18** within the receiving head **46**, thereby mating the second member to the inferior vertebra. The bone screw can also include an insert, such as a compression element **49**, that is positioned between the second portion **18***b* of the elongate member **18** and the head **44***h* of the threaded shank **44**. The compression element **49** is configured to allow the second portion **18***b* of elongate member **18** to be locked within the receiving head **46**, while still allow free polyaxial movement of the threaded shank **44** relative to the receiving head **46**. As a result, the elongate member **18** and the receiving head **46** fixedly mated thereto can together pivot and polyaxially move relative to the threaded shank **44** and vertebrae within which the shank **44** is implanted, thereby accommodating for the curvature of the spine as the elongate member **18** moves relative to the deformable member **26**. A person skilled in the art will appreciate that a variety of types of bone screws can be used, including monoaxial screws. The particular type of bone anchor used may depend on the type of disc implant used, and in particular on the degrees of freedom provided by the disc implant.

[0036] FIG. **7** illustrates another embodiment of a bone anchor for movably coupling the elongate member to a vertebra. In this embodiment, the bone anchor **80** is in the form of a monoaxial screw having a receiving head **82** with a threaded shank **84** formed thereon and extending distally therefrom. The second portion **18***b* of the elongate member **18** includes a spherical member or ball **86** formed on a terminal end thereof that is adapted to be disposed within a socket formed in the receiving head **82**. In particular, the receiving head **82** can include first and second inserts **88**, **90** that are receivable therein. One of the inserts, i.e., insert **88**, can include a bore **92** extending therethrough for receiving the second portion **18***b* of the elongate member **18**, and each insert **88**, **90** can also include a concave recess formed therein. When the inserts **88**, **90** are disposed within the receiving head **82**, the ball **86** on the second portion **18***b* of the elongate member **18** will be movably capture within the recesses to allow polyaxial movement of the elongate member **18** relative to the bone anchor **80**. As further shown, a locking mechanism, such as a set screw **94**, can be used to lock the inserts **88**, **90** and the ball **86** within the receiving head **82**.

[0037] The second member **10***b* can also include other features, such as a stop member formed on a portion of the elongate member to limit movement thereof relative to the deformable member. While the stop member can have a variety of shapes and sizes, in the illustrated exemplary embodiment the stop member is in the form of a substantially circular flange **30** disposed around the elongate member **18** between the first and second portions **18***a*, **18***b*. The flange **30** can be adapted to abut against an end wall **15** of the housing **14** adjacent to the opening to limit penetration of the elongate member **18** through the deformable member **26**. Accordingly, the flange **30** preferably has an extent, e.g., a diameter d_f (FIG. **1**), that is larger than the diameter d_i (FIG. **5**) of the opening **34** in the deformable member **26**. In another exemplary embodiment, a terminal end of the elongate member **18** can also include a flange (not shown) formed thereon to prevent removal of the elongate member **18** from the deformable member **26**.

[0038] In use, one or more facet replacement devices can be coupled to one or more adjacent vertebrae. By way of non-limiting example, FIG. **8** illustrates first and second facet replacement devices **10**, **10'** coupled to adjacent superior and inferior vertebrae **12***s*, **12***i*. In particular, the first facet replacement device **10** is coupled to a first lateral side of the superior and inferior vertebrae **12***s*, **12***i*, and the second facet replacement device **10'** is coupled to a second lateral side of the superior and inferior vertebra **12***s*, **12***i*. While only two devices are shown, additional devices can be coupled to additional vertebrae located along the patient's spinal column. An artificial disc implanted can also optionally be implanted between the adjacent vertebrae **12***s*, **12***i* in conjunction with the facet replacement device **10**. A person skilled in the art will appreciate that the facet replacement devices disclosed herein can be used with a natural disc or with an artificial disc. In an exemplary embodiment, where an artificial disc is used, the disc is preferably one which allows movement of the adjacent vertebrae relative to one another. In one embodiment, an artificial disc having a ball and socket joint is used which provides one degree of freedom in the sagittal plane. By way of non-limiting example, one exemplary artificial disc for use with the present invention is described in U.S. patent application Ser. No. 11/351,710, filed on Feb. 10, 2006, and entitled "Intervertebral Disc Prosthesis Having Multiple Bearing Surfaces." In another embodiment, the artificial disc can provide two or more degrees of freedom, such as the Charité™ artificial disc manufactured by DePuy Spine, Inc.

[0039] As shown in FIGS. **8-9**, two bone screws **20**, **20'** are implanted in opposed lateral sides of a superior vertebra **12***s*, and two bone screws **22**, **22'** are implanted on opposed lateral sides of an inferior vertebra **12***i*. Once the bone screws **20**, **20'**, **22**, **22'** are implanted, the first member **10***a*, **10***a'* of each facet replacement device **10**, **10'** can be coupled to the bone screw **20**, **20'** implanted in the superior vertebra by positioning the connector **16**, **16'** such that the head **41**, **41'** of each bone screw **20**, **20'** extends through the connector **16**, **16'** in the housing **14**, **14'**. The fastening element **42**, **42'** can then be loosely threaded onto the head **41**, **41'** of each bone screw **22**, **22'** to loosely attach the housings **14**, **14'** to the bone screws **22**, **22'**. The housings **14**, **14'** can then be angularly adjusted as desired. The elongate members **18**, **18'** of the devices **10**, **10'** can be coupled to bone screws **22**, **22'** in the inferior vertebra **12***i* by inserting the elongate members **18**, **18'** through the opening in the deformable members (not shown) of the housings **14**, **14'** and positioning the second portion **10***b*, **10***b'* of the elongate members **18**, **18'** within the receiving heads **44***h*, **44***h'* of the bone screws **22**, **22'**. The fastening elements **48**, **48'** can be inserted into the receiving heads **44***h*, **44***h'* to loosely mate the elongate members **18**, **18'** to the inferior vertebra **12***i*. Once the housings **14**, **14'** and the elongate members **18**, **18'** are properly positioned, the fastening elements **42**, **42'**, **48**, **48'**

can be tightened to maintain the housings **14**, **14'** and the elongate members **18**, **18'** in a fixed position relative to the superior and inferior vertebra **12***s*, **12***i*. A person skilled in the art will appreciate that the bone screws, the housings, and the elongate members can be implanted and adjusted in any order. In one exemplary embodiment, the elongate member is positioned as desired and the housing is then positioned as necessary based on the positioning of the elongate member. Once implanted, the deformable member **26** can allow flexion, extension, lateral bending, anterior-posterior shear, and axial rotation, as previously explained, in such a way that substantially accommodates the natural function of the facet joints thereby restoring movement to the adjacent vertebrae.

[0040] Additional devices may be provided with the system described above to provide further structure to the system. In one embodiment, one or more cross-connectors can be positioned across the superior and inferior vertebrae **12***s*, **12***i* and attached to the facet replacement devices to minimize the potential for loosening of the bone anchors that mate the facet replacement devices to bone. FIG. **10** illustrates a first cross-connector **50** having opposed first and second ends **58**, **60** that are coupled to the bone anchors **20**, **20'** implanted in the superior vertebra, and a second cross-connector **52** having opposed first and second ends **62**, **64** that are coupled to the bone anchors **22**, **22'** in the inferior vertebra. Each cross-connector **50**, **52** can have a variety of configurations, but in the illustrated embodiment each cross-connector **50**, **52** has a generally elongate, plate-like configuration. The terminal end of each cross-connector **50**, **52** can include an opening **66**, **68**, **70**, **72** extending therethrough for receiving the anchors **20**, **20'**, **22**, **22'** that mate the first and second facet replacement devices **10**, **10'** to bone. The openings **66**, **68**, **70**, **72** can have any shape, but in the illustrated embodiment each opening **66**, **68**, **70**, **72** has an oblong shape to facilitate positioning of the cross-connectors **50**, **52** relative to the bone anchors **20**, **20'**, **22**, **22'**. Each cross-connector **50**, **52** can also include an attachment element **54**, **56**, such as a pin or a bone screw, to facilitate coupling to the superior and inferior vertebrae **12***s*, **12***i*. While the attachment elements **54**, **56** can be positioned in a variety of locations on the cross-connectors **50**, **52**, in the illustrated embodiment the attachment elements **54**, **56** are located at a substantial midpoint of each cross-connector **50**, **52**. As further shown in FIG. **10**, the first cross-connector **50** can have angled terminal ends **58**, **60**, while the second cross-connector **52** can have terminal ends **62**, **64** that are substantially straight. In one embodiment, the terminal ends **58**, **60** of the first cross-connector **50** are angled upward to allow the first cross-connector **50** to span laterally across the vertebra and below the spinous process while having the terminal ends **58**, **60** anchored to the pedicles of the vertebra. A person skilled in the art will appreciate that the cross-connectors **50**, **52** can have a variety of other configurations and can both be angled, straight, or have any other configuration that would allow the cross-connectors **50**, **52** to span across the vertebrae and couple to the facet replacement devices **10**, **10'** implanted in opposed lateral sides of adjacent vertebrae **12***s*, **12***i*. In use, the first and second cross-connectors **50**, **52** can be adapted to provide rotational support and to reduce the potential for loosening of the bone screws implanted in the superior and inferior vertebrae **12***s*, **12***i*. A person skilled in the art will appreciate that any number of cross-connectors can be used with the facet replacement system.

[0041] One of ordinary skill in the art will appreciate further features and advantages of the invention based on the above-described embodiments. Accordingly, the invention is not to be limited by what has been particularly shown and described, except as indicated by the appended claims. All publications and references cited herein are expressly incorporated herein by reference in their entirety.

What is claimed is:

1. A spinal implant device, comprising:
an elongate member matable to a first vertebra;
a housing matable to an adjacent second vertebra and having an inner lumen formed therein;
a deformable member disposed within the inner lumen and having an opening formed therein for slidably receiving at least a portion of the elongate member such that the elongate member can be angularly oriented relative to a longitudinal axis of the inner lumen; and
a bearing disposed within the opening formed in the deformable member, and configured to facilitate slidable movement of the elongate member within the opening.

2. The device of claim **1**, wherein the deformable member has a substantially cylindrical shape.

3. The device of claim **1**, wherein the deformable member includes a plurality of holes extending therethrough.

4. The device of claim **3**, wherein the plurality of holes are spaced around the opening and extend substantially parallel to a central axis of the opening.

5. The device of claim **1**, wherein the housing includes a generally cylindrical portion that houses the deformable member, and a connector extending laterally outward from a sidewall of the cylindrical portion of the housing.

6. The device of claim **5**, wherein the connector includes a bore formed therethrough that is adapted to receive a portion of a bone anchor for anchoring the housing to a vertebra.

7. A spinal implant system, comprising:
a first component adapted to couple to a first vertebra and having a deformable member disposed therein, the deformable member having a plurality of holes extending therethrough for allowing the deformable member to compress; and
a second component adapted to couple to a second adjacent vertebra and having at least a portion that is receivable within the deformable member of the first component, the second component being adapted to slidably translate relative to a longitudinal axis of the first component to allow flexion and extension of adjacent vertebrae coupled thereto.

8. The system of claim **7**, wherein the deformable member includes an opening formed therethrough and extending along a central axis of the deformable member.

9. The system of claim **8**, wherein the plurality of holes are spaced around the opening and extend substantially parallel to the central axis of the deformable member.

10. The system of claim **7**, further comprising a bearing disposed within the deformable member and adapted to facilitate slidable movement of the second component relative to the deformable member.

11. The system of claim **7**, wherein the first component includes a housing that houses the deformable member and a connector extending outward from the housing, the connector including a bore formed therethrough for receiving a portion of a bone anchor for anchoring the housing to a first vertebra.

12. The system of claim **7**, wherein the first component comprises a first housing adapted to mate to a first lateral side of a first vertebra, and a second housing adapted to mate to a second lateral side of a first vertebra, and the second component comprises a first elongate member adapted to anchor to a first lateral side of a second vertebra, and a second elongate member adapted to anchor to a second lateral side of a second vertebra, at least a portion of the first elongate member being positioned within a first deformable member disposed within the first housing, and at least a portion of the second elongate member being positioned within a second deformable member disposed within the second housing.

13. A method for stabilizing adjacent vertebrae, comprising:

coupling a first component to a first vertebra; and

coupling a second component to a second adjacent vertebra, at least a portion of the second component extending through a deformable member disposed within the first component;

wherein the second component translates along a longitudinal axis of the deformable member and moves laterally relative to the longitudinal axis of the deformable member to compress the deformable member.

14. The method of claim **13**, wherein a bearing disposed within the deformable member facilitates translation of the second component along the longitudinal axis of the deformable member.

15. The method of claim **13**, wherein coupling the first component to the first vertebra comprises implanting an anchor in the first vertebra and mating a connector formed on the first component to the anchor.

16. The method of claim **13**, wherein coupling the second component to the second vertebra comprises implanting an anchor in the second vertebra and mating the second component to the anchor.

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