METHOD OF PREPARING FOR AN ARTIFICIAL INTERVERTEBRAL IMPLANT USING TOOL

Inventors: James F. Zucherman, San Francisco, CA (US); Ken Y. Hsu, San Francisco, CA (US); Charles J. Winslow, Walnut Creek, CA (US); Scott A. Yerby, Montara, CA (US); Steve Mitchell, Pleasant Hill, CA (US); John Flynn, Concord, CA (US)

Correspondence Address:
FLIESLER MEYER, LLP
FOUR EMBARCADERO CENTER
SUITE 400
SAN FRANCISCO, CA 94111 (US)

Assignee: St. Francis Medical Technologies, Inc., Alameda, CA

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Abstract
This invention relates to tools for preparing vertebral bodies in the spine for the implantation of an artificial vertebral disk replacement and related method. A first tool is disclosed that prepares the vertebral bodies for implantation by cutting offset channels in the vertebral bodies. The second tool holds two plates of the implant during the implantation process. This invention also relates to an artificial vertebral disk replacement, a method of operation, and a method of implanting.
EXPOSE SPINE

REMOVE DISK

INSERT IMPLANT

CLOSE WOUND

FIG. - 9
METHOD OF PREPARING FOR AN ARTIFICIAL INTERVERTEBRAL IMPLANT USING TOOL

CLAIM OF PRIORITY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0007] U.S. Pat. No. 5,258,031 to Salib et al. discloses another prosthetic disc with a ball that fits into a socket.

[0008] U.S. Pat. Nos. 5,425,773 and 5,562,738 are related patents to Boyd et al. that disclose a disk arthroplasty device for replacement of the spinal disk. A ball-and-socket device are provided to enable rotation.

[0009] U.S. Pat. No. 5,534,029 to Shima discloses an articulated vertebral body spacer with a pair of upper and lower joint pieces inserted between the vertebrae. An intermediate layer is provided to allow for movement between the upper joint piece and the lower joint piece.


[0012] None of these solutions provide an implant that restores a wide range of natural movement.

[0013] Accordingly, what is needed is an implant for alleviating such conditions and that restores natural movement.

SUMMARY OF THE INVENTION
[0014] The present invention includes embodiments that are directed to a set of tools used to implant an intervertebral disk replacement, and a method of placing the implant between vertebral bodies of the spine. A first tool is provided for use in preparing the vertebral bodies for the implant. A second tool is provided for installing the implant between the vertebral bodies.

[0015] Other aspects, objects, features, and elements of the other embodiments of the invention are described or are evident from the accompanying specification, claims and figures.

BRIEF DESCRIPTION OF THE DRAWINGS
[0016] FIG. 1A is a posterior view of an embodiment of the assembled implant of the invention. FIG. 1B is a cross-section of the device shown in FIG. 1A. FIG. 1C is a posterior view of two bottom plates of the implant of the embodiment of the invention. FIGS. 1D and 1E are posterior views of the embodiment of the implant of the invention shown in FIG. 1A illustrating the operation of the device in bending to the left and bending to the right, respectively.

[0017] FIG. 2A is a side view of the implant of FIG. 1A showing the implant in flexion. FIG. 2B is a side view of the implant showing the implant in extension. FIG. 2C is a partial cross-sectional view of a side view of the implant of an embodiment of the invention. FIG. 2D is a partial cross-sectional view of an alternative embodiment of the implant of the invention having a protuberance adjacent the socket.

[0018] FIG. 3A is a top view of a portion of an embodiment of the assembled implant of the invention. FIG. 3B is a top view of an embodiment of the implant of the invention
showing a rotation to the right. FIG. 3C is a top view of an embodiment of the implant of the invention showing a rotation to the left.

[0019] FIG. 4A is a perspective view of a ball portion of the embodiment of the implant of the invention. FIG. 4B is a perspective view of a socket portion of the embodiment of the implant of the invention.

[0020] FIG. 5A is a posterior view of the embodiment of the implant of the invention after being implanted between two vertebral bodies. FIG. 5B is a side view of the embodiment of the implant of the invention after being implanted between two vertebral bodies.

[0021] FIG. 6 is a rear view of an alternate embodiment of the invention having two plates.

[0022] FIG. 7A is a top view of an embodiment of a cutting tool of the invention used to prepare the vertebral bodies for the implant. FIG. 7B is a side view of the embodiment of the cutting tool of the invention. FIG. 7C is a distal end view of an embodiment of the cutting tool of the invention. FIG. 7D is a top view of the cutting portion of an alternative embodiment of the cutting tool of the invention showing blade protectors. FIG. 7E is a side view of the cutting portion of an alternative embodiment of the cutting tool of the invention showing the blade protectors.

[0023] FIG. 8A is a side view of an embodiment of the implant insertion tool of the invention. FIG. 8B is a top view of the embodiment of the implant insertion tool of the invention. FIG. 8C is a distal end view of the embodiment of the implant insertion tool of the invention. FIG. 8D is a top view of an embodiment of the implant insertion tool holding an embodiment of the implant.

[0024] FIG. 9 is a block diagram illustrating the steps of a method for inserting the implant between vertebral bodies.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

[0025] The following description is presented to enable any person skilled in the art to make and use the invention. Various modifications to the embodiments described will be readily apparent to those skilled in the art, and the principles defined herein can be applied to other embodiments and applications without departing from the spirit and scope of the present invention as defined by the appended claims. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein. To the extent necessary to achieve a complete understanding of the invention disclosed, the specification and drawings of all patents, patent publications, and patent applications cited in this application are incorporated herein by reference.

[0026] Turning now to FIG. 1A, a posterior view of an intervertebral implant 100 is depicted having a four-piece configuration. Although, as will be appreciated by those of skill in the art, other configurations, such as a two-piece configuration or a three-piece configuration, are possible without departing from the scope of the invention. As depicted, the intervertebral implant 100 has a pair 130 of first plates 110. Each first plate 110 has a first surface 112 and a second surface 114. The first surface 112 is configured to abut an end plate surface of a vertebral body. A keel 116 can be provided on the first surface 112 to anchor the first surface 112 into the vertebral body upon implantation. One or more additional protrusions 118 can also be provided that act as a detent or catch, thus providing a further mechanism to prevent the first plate 110 from moving relative to the vertebral body once implanted.

[0027] The intervertebral implant 100 also has a pair 132 of second plates 120. The second plates 120 have a first surface 122 and a second surface 124. The first surface 122 is configured to abut an end plate surface of a vertebral body. As with the first plate 110, a keel 126 can be provided on the first surface 122 to anchor the first surface 122 into the vertebral body upon implantation. One or more additional protrusions 128 can also be provided that act as a detent or catch, again providing a further mechanism to prevent the second plate 120 from moving relative to the vertebral body once implanted.

[0028] FIG. 1B depicts the pair 130 of upper plates 110 and the pair 132 of lower plates 120 in cross-section. Each upper plate 110 has a socket 136 that has a first elongated sidewall 150, a corresponding second elongated sidewall 152 (shown in FIG. 3B), an end wall 154, and an open end 156. The open ends 156 of each of the first plates 110 are oriented so that the open ends 156 face each other. The lower plates 120 each have a ball 134. As illustrated in FIG. 1B, the ball 134 is an elongated ball. Each of the plates 110, 120 has a first end 138, 141 and a second end 139, 143, respectively. The ends 139 of the first plate 110 face each other and the ends 143 of the second plate 120 also face each other. The ends 138, 141 are curved and convex, as shown in FIG. 3A, so that the implant 100 has a configuration that correlates to the curved shape of a vertebra.

[0029] As shown in FIG. 1C, the ball 134 has four sides: a first elongated sidewall 140, a second elongated sidewall 142, a third end wall 144, and a fourth end wall 146. The third end wall 144 is flush with the end 143 of the plate 120 of the implant. The third end wall 144 has a profile height 160 and the fourth end wall 146 has a profile height 162. Comparing the profile heights 160, 162 to each other at the same point on the second surface 124 of the second plate 120, the overall profile height of the third end wall 144 is greater than the fourth end wall 146 (i.e., 160 > 162). Thus, it is evident that the upper surface 135 of socket 136 slopes downwardly from the end wall 144 to the end wall 146. Together, balls 134 comprise a ball structure having a high surface where the third end walls 144 abut each other and slope to a lower surface adjacent to fourth end walls 146. Also, preferably, the upper surfaces 135 are barrel shaped and have a “U” shaped profile along a cross-section that is perpendicular to the page of FIG. 1C (parallel the sagittal plane on implantation). The sloping upper surface 135, as will be explained later, allows the pair 130 of upper plates 110 to easily slide, or rock, side-to-side on the ball structure and slide, or ride, forward and backward with enough looseness of fit to allow for some twisting in order to emulate the motion of the vertebral bone and intervertebral disk tissue. This arrangement, thus, has a sliding or translating pivotal point. Further, as indicated in FIG. 1C, the edges are eased or rounded to allow for further range of motion of the pair 130 of plates 110 relative to the pair 132 of plates 120. As will be appreciated by those of skill in the
Further, although the ball 134 is depicted such that the third end wall 144 is flush with the second end 143, those of skill in the art will appreciate that the ball 134 could also be configured such that the third end wall 144 was recessed relative to the end 143 of the second plate. In such a configuration, the third end wall 144 and the end 143 would not be flush.

FIGS. 1D and 1E illustrate posterior views of the implant 100 showing the clearance for left and right lateral bending. Typically, left and right lateral bending ranges from 3.5°. As evident from these figures (and FIG. 1B), the length L1 of the ball 134 can be less than the length L2 of the socket 136. Further, as shown, the open ends 156 of the sockets facilitate movement of the balls 134 within the socket 136 to accommodate side-bending movement.

As shown in FIG. 2A, the second plate 120 can also have channels 264, 265 or a groove adjacent the ball 134. The channels 264, 265 can be configured such that it surrounds a portion of the ball 134 or the entire ball 134. As will be explained below, the channel allows the sides of the ball 134 to be made more perpendicular so as to create a greater blocking wall thus preventing the socket of the upper plate 100 from moving too much anteriorly or posteriorly relative to the lower plate 120.

Either one or both of the keels on the first surface 116 and the second surface 126 can have one or more posteriorly pointing teeth 266 to enable it to more securely engage the vertebral body into which it is implanted. As can be seen in FIG. 2A, the protrusions 128, as well as the additional protrusions 118 (FIG. 1A) can also have posteriorly pointing teeth in order to lock the implant 100 in position in the vertebrae.

FIG. 2B is an alternate side view of the intervertebral implant 100 wherein the plates 110, 120 are shown and the ball-and-socket joint is positioned in such a way that the axial extension 274 (i.e., backward bending) in a preferable range of up to about 5°.

FIG. 2C is a cross-section of the side view of the intervertebral implant 100 showing the mating of the ball 134 to the socket 136. FIG. 2D illustrates an alternate embodiment of the first plate 110 wherein the socket 136 has ridges 268, 269 forming a protuberance that extends into the channel 264, 265 respectively on the second plate 120. As will be appreciated by those of skill in the art, the protuberances 268, 269 can extend partially into the channel, such as the configuration shown, or can have a channel conforming shape such that when the ball-and-socket joint are moved to achieve flexion 272 or extension 274 the protuberance or ridge 268, 269 extends into the channel 264, 265. This embodiment allows the surfaces 114 and 115 of the first plate 110 and the second plate 115 to be flat and non-sloping as shown while still allowing for the implant to emulate forward and backward bending and allow for blocking of the motion of the socket relative to the ball.

FIG. 3A, a top view of one-half of the intervertebral implant 100 is shown. Each of the top first plate 110 and the bottom second plate 120 have a bore 376 for receiving a pin of an implant tool. The keel 116 on the first plate 110 is positioned so that it does not align in the same plane with the keel 126 on the second plate 120. As will be explained in further detail later, the non-alignment allows for the implant including the keels to be properly positioned between the vertebrae in such a way to accommodate the motion of the nerves as the nerves extend out from the between adjacent vertebrae. Additionally, the length of ball 134 from the third end wall 144 to the fourth end wall 146 is shorter than the length of the socket 136 from the end wall 154 to the open end 156 as discussed before.

FIGS. 3B and 3C show the relative rotation of the upper first plate 110 to the lower second plate 120 to achieve rotation about a central axis 378. This rotation results in a 5°-6° rotation about the axis (i.e., 3° of torso twisting in each direction).

FIG. 4A shows a perspective view of a second plate 120 of the intervertebral implant 100. The second surface 124 of the second plate 120 with the ball 134 and channels or grooves 264, 265 extending thereabout. As illustrated in FIG. 4A, the channels 264, 265 are formed on two sides of the ball 134. However, as will be appreciated by those of skill in the art, the channels 264, 265 can alternately surround the ball 134.

FIG. 4B shows a perspective view of the first plate 110. The first plate 110 has a second surface 114, as described above, and, extending therefrom is the socket 136 therein. The socket 136 of FIG. 4B is configured to mate with the ball 134 of FIG. 4A, as described above.

FIG. 5A illustrates a posterior view of the implant shown in FIG. 1A implanted between vertebral bodies in a spine. FIG. 5A illustrates the spinal column 500 and the cauda equina 504 (a collection of lumbar and sacral nerve roots that fill the caudal end of the spinal cord) with individual nerves 506 exiting the cord between lumbar vertebrae. The implant 100 is positioned between two vertebral bodies 520, 521 such that the keels 116, 126 do not interfere with the cauda equina 504 and the exiting nerve 506. As can be seen in FIG. 5A, the keel 116 of the upper first plates 110 are close together and inboard of the keel 126 of the lower second plate 120. This allows the lower keels 126 to be clear of the nerves 506 as the nerves exit from between the adjacent vertebrae.

FIG. 5B illustrates a side view of the implant 100, such as that shown in FIG. 1A, implanted between vertebral
bodies 520, 521. The implant 100 is implanted so that the ball-and-socket joint enables about a 5° extension (backward bending) and about a 10° flexion (forward bending). In this view the ball and socket arrangement crosses the centerline 50 of the implant 100 and extends in a posterior 282 direction. In this embodiment, the ball-and-socket arrangement can be more centered on the centerline 50 or extend from a position when the implant 100 crosses the centerline 50 and extends in an anterior 282 direction. Further, in another preferred embodiment, the ball can be approximately bisected by the centerline.

[0043] FIG. 6 illustrates a rear view of an alternate embodiment of the implant shown in FIG. 1A. The implant 600 of FIG. 6 is in the form of a two-piece implant 600 having a first plate 610 and a second plate 620. The first plate 610 has a first surface 612 that contacts the vertebral body and has one or more keels 616 and detents 618 for anchoring the first plate 610 into the vertebral body. The implant 600 also has a second plate 620 that has a first surface 622 that contacts the vertebral body and has one or more keels 626 and detents 628 for anchoring the second plate 620 into the vertebral body. The second surface 614 of the first plate 610 has a socket 632 formed therein while the second surface 624 of the second plate 620 has a ball 630. This implant 600 moves in much the same way as implant 100 described above.

[0044] As will be appreciated by those of skill in the art, implant 100 is predominantly designed for a posterior implantation method. However, implant 100 can also be implanted from an anterior direction. Implant 600 is designed for predominantly an anterior implantation approach.

[0045] Further, a combination of the two embodiments shown in FIG. 1A and FIG. 6 can be used to create a three-piece implant as will also be appreciated by those of skill in the art. For example, the first plate 610 of FIG. 6 with its socket 632 can be combined with two-second plates 120 of FIG. 1A to form an implant. Similarly, the second plate 620 of FIG. 6 and its ball 630 can be combined with two first plates 110 from FIG. 1A to achieve an implant. Neither of these configurations depart from the scope of the invention. It is also to be understood that the implant 100, 600 can be comprised of any suitable biocompatible material, such as titanium.

[0046] Turning now to FIGS. 7 and 8 and the tools for preparing the vertebral bodies and implanting the implant 100 as described. FIG. 7A depicts a top view of a cutting tool 700 used to prepare the vertebral bodies for the implant 100 and FIG. 7B depicts a side view of tool 700. The cutting tool 700 has a handle 710 at its proximal end for controlling the tool during operation. As will be appreciated by those of skill in the art, the handle 710 can be removable or affixed to the cutting end.

[0047] The distal end 702 of the tool 700 is forked to form two prongs or tines 705, 706. The end of each tine 705, 706 has a beveled edge 716 at its distal most end. Each tine 705, 706 also has an inner blade 712 located on an inner upper side and an outer blade 714 located on an outer lower side (shown in FIG. 7C). Preferably the inner blades 712 are coplanar with the surface of the inner side of the tine and the outer blades 714 are coplanar with the outer side of the tines. The inner blades 712 are oriented to cut a space in a first intervertebral body for the first surface keel 116 of the implant and the outer blades 714 are oriented to cut a space in the facing intervertebral body for the second surface keel 126. The orientation of the blades is such that each of the cuts made for the keels of the implant are offset and avoid the nerves in the cauda equina or exiting the cauda equina.

[0048] FIG. 7C is a view of the distal end of the cutting tool 700 showing the beveled edges 716 of the tines 705, 706 and the inner blades 712 and outer blades 714. The distance 722 between the inner blades 712 is less than the distance 724 between the outer blades and the height h of the tines approximates the distance between two vertebral bodies or the height of the disk space. The blades 712, 714 extend above and below the tines or the height of the tines. As can be seen in FIG. 7C, the beveled sides of the distal end 716 extend and form at least one of the beveled sides of the blades 712, 714.

[0049] FIG. 7D depicts an enlarged top view of the tines 705, 706 of the distal end of cutting tool 700 with the beveled distal edges 716. FIG. 7E is an enlarged side view of the distal end of cutting tool 700. FIGS. 7D and 7E show the retractive blade protector 720 for the blade 712 positioned in a retracted position. As the cutting tool is inserted between vertebral bodies, the retractive blade protector 720 moves in a posterior direction 715 (i.e., toward the handle 710) to expose the inner blade 712 and the outer blade 714 and to enable the blades to cut into the vertebral bodies. These protectors 720 can be spring biased as desired in order to cover the blade 712, 714 as the tool 700 is inserted past the nerves. The protectors 720 are urged in a posterior direction as the blades 712, 714 are urged into the vertebral bodies in order to cut channels for the keels. Springs 721 provide the desired bias to keep the protectors 720 in a forward position covering the blades 712, 718.

[0050] As will be appreciated by those of skill in the art, the tool shown in FIG. 7 can be modified such that instead of cutting keel-receiving channels in the upper and lower vertebral bodies at the same time, two tools are provided so that only one vertebral body is cut for keel-receiving channels at a time. For example, a first tool having two tines as described above could be provided having a pair of inner blades located on an upper surface of the tines. A second tool could be provided having tines as described with a pair of outer blades located on the lower surface of the tines. Optionally, the second tool can have a guide corresponding to the location of the first blade on the first tool to ensure that the second cut is optimally aligned with the first cut. In use, a pair of channels can be cut into the inner vertebral body using the first tool. Thereafter a second pair of channels can be cut into the lower vertebral body. Alternate arrangements are also possible, for example, where the first tool has a pair of outer blades and the second tool has a pair of inner blades, or where the first tool has upper and lower blades on a first tine (e.g., right tine) and the second tool has upper and lower blades on a second tine (e.g., left tine).

[0051] FIG. 8A depicts the implanting tool used to insert the implant 100 of FIG. 1A between vertebral bodies. FIG. 8A is a side view of the implantation tool 800 that has a handle 810 and an implant holder 820. The implant holder 820 has an implant conforming surface 824 and two pins 822.
for holding a first plate 110 and a second plate 120 of a first half of the implant 100. The conforming surface 824 is curved to follow the convex outer edges 138, 139 of the plate 100, 120, respectively (shown in FIG. 3A). The implant 100 nests within a conforming surface 824 and is held by pins 822. FIG. 8c shows the distal view of the end of the tool with two pins 822, 823 for securing the first and second plate of the implant. The tool can be rotated by the user 180° to implant the other half of the implant.

[0052] Where an implant such as that shown in FIG. 6 is implanted, the implant conforming surface 824 of the implant tool would have a mirror image conforming surface provided to capture the implant 600. An additional series of pins, for a total of four, can be provided for holding a first plate 610 and a second plate 620 of the implant 600, if required. The implant 600 would nest within the conforming surface of the “U” shaped cavity.

[0053] A variety of kits can be assembled that include an implant 100 (or 600) sized for a particular patient. The kit could also include several cutting tools 700 and several implanting tools 800 or a single handle that cooperates with cutting ends 702 and implantation ends 820.

[0054] FIG. 9 is a block diagram showing the steps for implanting an implant. In order to implant the implant of FIG. 1A, the spine is exposed posteriorly 910. The intervertebral disk to be replaced is partially or completely removed 920. The cutting tool 700 is inserted between the vertebral bodies to create channels in the bodies to receive the keels of the implant. Nerves can be retracted and then the implant holder 810 is used to insert the implant between the vertebral bodies 930, lining the keels up with the channels created by the cutting tool 700. Next, the nerves are retracted in the other direction and the other plates 100, 120 are attached to the tool and are implanted. The implant first and second plates 110, 120 are now inserted between the vertebrae, and the keel are placed in the channels prepared by the cutting tool 700. Once the implant is inserted, the wound is closed 940.

[0055] In order to implant the implant of FIG. 6, the spine is exposed anteriorly 910. The intervertebral disk to be replaced is either partially or completely removed 920. The cutting tool 700 is inserted between the vertebral bodies to create channels in the bodies to receive the keels of the implant. The implant is then inserted into an implant holder and the implant tool is used to insert the implant between the vertebral bodies 930, lining the keels up with the channels created by the cutting tool 700. Once the implant is inserted, the wound is closed 940.

[0056] The foregoing description of embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations will be apparent to the practitioner skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention and the various embodiments and with various modifications that are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalence.

What is claimed is:

1. A method of implanting an implant between adjacent vertebral bodies comprising the steps of:
   a. simultaneously preparing a first slot in an upper vertebral body and a second slot in a lower vertebral body; and
   b. implanting keels of an implant in the first slot and the second slot.
2. The method of claim 1 wherein the step of preparing further comprises inserting a cutting tool having an upper blade protruding therefrom to form the first slot and a lower blade protruding therefrom to form the second slot.
3. The method of claim 1 wherein the step of preparing further comprises inserting a cutting tool having a pair of times between the upper and lower vertebral bodies, each time having a first blade protruding from an inner surface and a second blade protruding from an outer surface.
4. The method of claim 1 wherein the step of preparing further comprises inserting a cutting tool having an upper blade protruding therefrom to form the first slot and a lower blade protruding therefrom to form the second slot, the cutting tool having a beveled leading edge.
5. The method of claim 1 wherein the step of preparing further comprises inserting a cutting tool having an upper blade protruding therefrom to form the first slot and a lower blade protruding therefrom to form the second slot, wherein the cutting tool includes a retractable blade protector configured to expose at least one of the upper and lower blade when inserted between the vertebral bodies.
6. The method of claim 1 wherein the step of preparing further comprises removing the cutting tool from between the upper and lower vertebral bodies to allow the implant to be inserted therebetween.
7. The method of claim 1 wherein the step of implanting further comprises inserting an implantation tool between the vertebral bodies, wherein the implantation tool is adapted to hold the implant, the implantation tool including a curved surface to at least partially contour an outer edge of the implant.
8. A method of implanting an artificial disk between adjacent vertebral bodies comprising the steps of:
   a. distracting an upper vertebral body and a lower vertebral body and simultaneously cutting a first slot in the upper vertebral body and a second slot in the second vertebral body; and
   b. inserting an implant between the upper and lower vertebral bodies, wherein a first keel of the implant is inserted into the first slot and a second keel of the implant is inserted into the second slot.
9. The method of claim 8 wherein the step of distracting further comprises inserting a cutting tool between the upper and lower vertebral bodies, the cutting tool having an upper blade protruding therefrom to form the first slot and a lower blade protruding therefrom to form the second slot.
10. The method of claim 8 wherein the step of distracting further comprises inserting a cutting tool having a pair of times between the upper and lower vertebral bodies, each time having an upper blade protruding from an inner surface and a lower blade protruding from an outer surface.
11. The method of claim 8 wherein the step of distracting further comprises inserting a cutting tool having an upper blade protruding therefrom to form the first slot and a lower blade protruding therefrom to form the second slot, the cutting tool having a beveled leading edge.

12. The method of claim 8 wherein the step of distracting further comprises inserting a cutting tool having an upper blade protruding therefrom to form the first slot and a lower blade protruding therefrom to form the second slot, wherein the cutting tool includes a retractable blade protector configured to expose the upper and lower blade when inserted between the vertebral bodies.

13. The method of claim 8 wherein the step of distracting further comprises removing the cutting tool from between the vertebral bodies to allow the implant to be inserted therebetween.

14. The method of claim 8 wherein the step of inserting further comprises inserting an implantation tool between the vertebral bodies, wherein the implantation tool is adapted to hold the implant, the implantation tool including a curved surface to at least partially contour an outer edge of the implant.

15. A method of implanting an artificial disk between adjacent vertebral bodies comprising the steps of:
   a. selecting a cutting tool having an upper blade protruding therefrom and a lower blade protruding therefrom;
   b. inserting the cutting tool between an upper vertebral body and a lower vertebral body, wherein the upper blade forms a first slot in the upper vertebral body and the lower blade forms a second slot in the lower vertebral body; and
   c. inserting an implant between the upper and lower vertebral bodies, wherein a first keel of the implant is inserted into the first slot and a second keel of the implant is inserted into the second slot.

16. The method of claim 15 wherein the cutting tool further comprises a pair of tines, wherein each tine includes the upper blade protruding from an inner surface and the lower blade protruding from an outer surface.

17. The method of claim 15 wherein the cutting tool further comprises a beveled leading edge.

18. The method of claim 15 wherein the cutting tool further comprises a retractable blade protector configured to expose the upper and lower blade when inserted between the upper and lower vertebral bodies.

19. The method of claim 15 further comprising the step of removing the cutting tool from between the vertebral bodies to allow the implant to be inserted therebetween.

20. The method of claim 15 wherein the implant is inserted between the vertebral bodies using an implantation tool, the implantation tool adapted to hold the implant along a curved surface, wherein the curved surface at least partially contours an outer edge of the implant.