MULTI-AXIS CONNECTIONS BETWEEN SPINAL STABILIZERS AND SCREWS

A multi-axis correction washer for use with a spinal stabilizer for internal spinal fixation. The bodies of the washers are provided in cylindrical and wedge-shaped cylindrical configurations with a passage in the center of the longitudinal axis of the cylinder and/or offset from the center axis of the cylindrical washer and a shoulder or other structure for rotatably engaging a hole in a spinal implant. The spinal implant can be a plate and screw-type, ladder-type, or monorail-type spinal fixation system. The washer is rotated to provide an infinite range of angles and screw placements relative to the central axis of the spinal column for maximum flexibility of installation and to effectively transfer the load on the spinal column to the implant, all while maintaining an angle of approximately 90° between the head of the screw and/or nut and the washer which engages the implant.
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AMENDED CLAIMS
[received by the International Bureau on 4 April 2000 (04.04.00);
original claims 1-42 replaced by new claims 1-11 (2 pages)]

1. An internal spinal stabilizer comprising:
   a first elongate member;
   a second elongate member having an aperture therein;
   means for attaching said second elongate member to said first elongate member;
   a screw for passing through said aperture for affixing said second elongate member to the vertebra of a patient; and
   a set of washers, each of said washers being provided with a passage for receiving said screw therethrough and means for engaging said second elongate member adjacent the periphery of the aperture at any one of a plurality of rotational orientations relative to said second elongate member, at least one of the washers of said set of washers comprising a cylindrical body having (a) an end defining a surface against which said screw bears that is inclined relative to the axis of the passage through the washer and (b) the central axis of the passage offset from the center of the body forming the washer, for providing a multiaxial coupling between the vertebra and the second elongate member when rotated relative to said elongate member.

2. The spinal stabilizer of claim 1 wherein the angle of the bearing surface of said washer relative to the axis of the passage through the washer is an acute angle.

3. The spinal stabilizer of claim 1 or 2 wherein at least one washer of said set of washers has a surface against which said screw bears that is angled relative to the axis of the passage through the washer and a passage with a central axis that is coincident with the center axis of the washer.

4. The spinal stabilizer of any of the preceding claims wherein the rotatable engaging means of said washers comprises a shoulder formed on each washer of said set of washers for engaging the surface of said second elongate member adjacent the periphery of the aperture, each said washer being rotatable relative to said second elongate member about a notional rotational axis which extends through the aperture on said shoulder.

5. The spinal stabilizer of any of the preceding claims wherein said second elongate member is attached to said first elongate member at approximately a 90° angle.

6. The spinal stabilizer of claim 1 wherein said second elongate member is slidably attached to said first elongate member for movement relative to said first elongate member.
7. The spinal stabilizer of claim 1 wherein said first elongate member is slidably attached to said second elongate member for movement relative to said second elongate member.

8. A method of affixing a spinal stabilizer comprising a washer, a cross-bar, and a screw to the vertebral body of a patient comprising the steps of:
   engaging the cross-bar with the washer;
   inserting the screw through an off-center passage in the washer;
   changing the axis of the screw relative to the vertebral body to which the cross-bar is affixed by rotating the washer relative to the cross-bar; and
   driving the screw into the vertebral body of the patient to tighten the screw against the washer.

9. The method of claim 8 in which the washer is engaged to the cross-bar by resting the washer on the cross-bar adjacent the periphery of an aperture in the cross-bar.

10. A method of affixing a spinal stabilizer comprising a washer having a cylindrical body with one end inclined with respect to the side walls of the cylinder and having a passage therethrough, a cross-bar, and a screw to the vertebral body of a patient comprising the steps of:
    engaging the cross-bar with the washer;
    inserting the screw through the passage in the washer;
    changing the angle of the screw relative to the cross-bar to which the washer is engaged by rotating the washer relative to the cross-bar; and
    driving the screw into the vertebral body of the patient to tighten the screw against the washer.

11. The method of claim 10 in which the washer is engaged to the cross-bar by resting the washer on the cross-bar adjacent the periphery of an aperture in the cross-bar.
STATEMENT UNDER ARTICLE 19

Submitted herewith for filing in the captioned International Application are new claims 1-11, filed under Art. 19 of the Patent Cooperation Treaty. Applicant makes the following under Article 19(1).

Claims 1-24 of the replaced sheets have been replaced by claims 1-7, written to define over the references cited in the International Search Report. Claims 1-7 are based on original claim 16 but have been narrowed by additionally reciting that the invention comprises a set of washers as described in the disclosure. At least one of the washers comprising the claimed set of washers is recited as including an inclined bearing surface and an offset passage for providing a multiaxial coupling between vertebra and spinal stabilizer. New claims 8-11 are identical to claims 25-28 of the application as filed.