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(54) **MINIMALLY INVASIVE FACET JOINT  
HEMI-ARTHROPLASTY**

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(57) **ABSTRACT**

A minimally invasive facet joint hemi-arthroplasty method using a unique metallic overlay, instrumentation and surgical protocol to resurface the superior facet of the inferior vertebrae limited to the facet joints located on the lumbar spine, Occiput-C1 through L5-S1. Using related new instrumentation and a surgical protocol invented to prepare the joint, a metallic overlay is mechanically crimped in place without the use of cement or pedicle screws. Permanent fixation occurs when bone in-grows onto a rough, porous surface on the inside of the implant. This hemi-arthroplasty method resurfaces half of the facet joint to provide for smooth, pain free joint articulation in deteriorated or diseased spinal facet joints without the need for major surgery or rehabilitation at considerably less risk to the patient. This procedure may also be used to prophylactically resurface the joint to minimize or eliminate future deterioration caused by the additional stress to facet joints from disc replacements or instrumented vertebral fusion. Instrumentation includes a newly invented planer, director probe with slap-hammer, vertebral separator, osteotome, broach, crimper and facet joint prosthetic implant for use in surgically resurfacing facet joints located from Occiput-C1 through L5-S1 using a minimally invasive outpatient facet joint hemi-arthroplasty method developed specifically for that purpose.

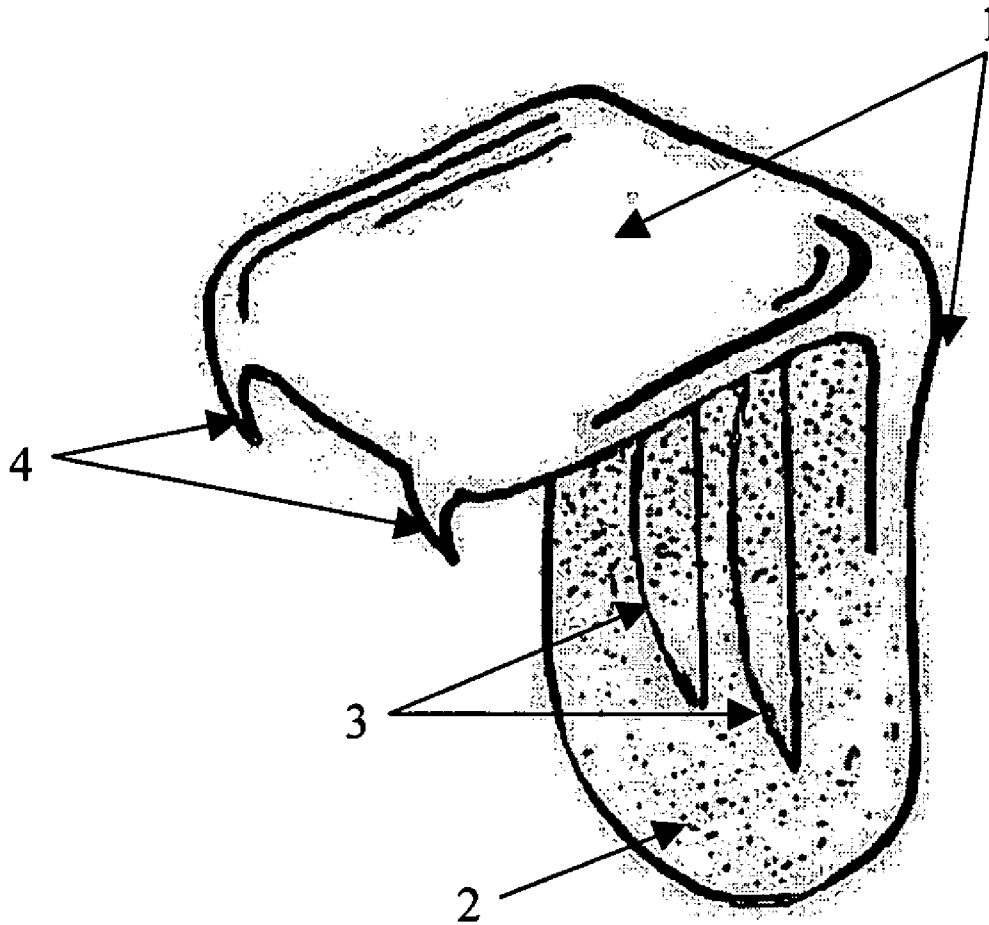
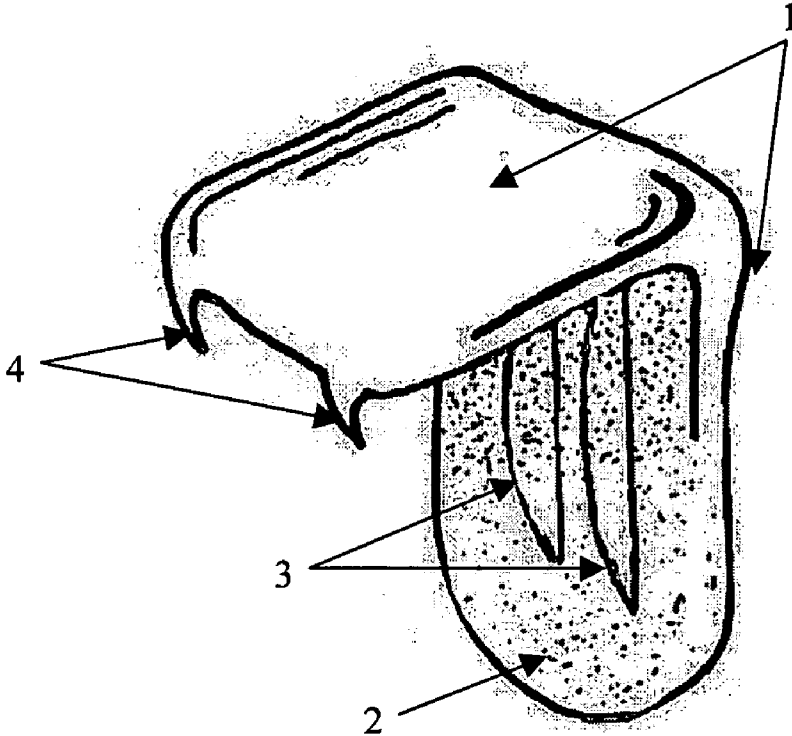
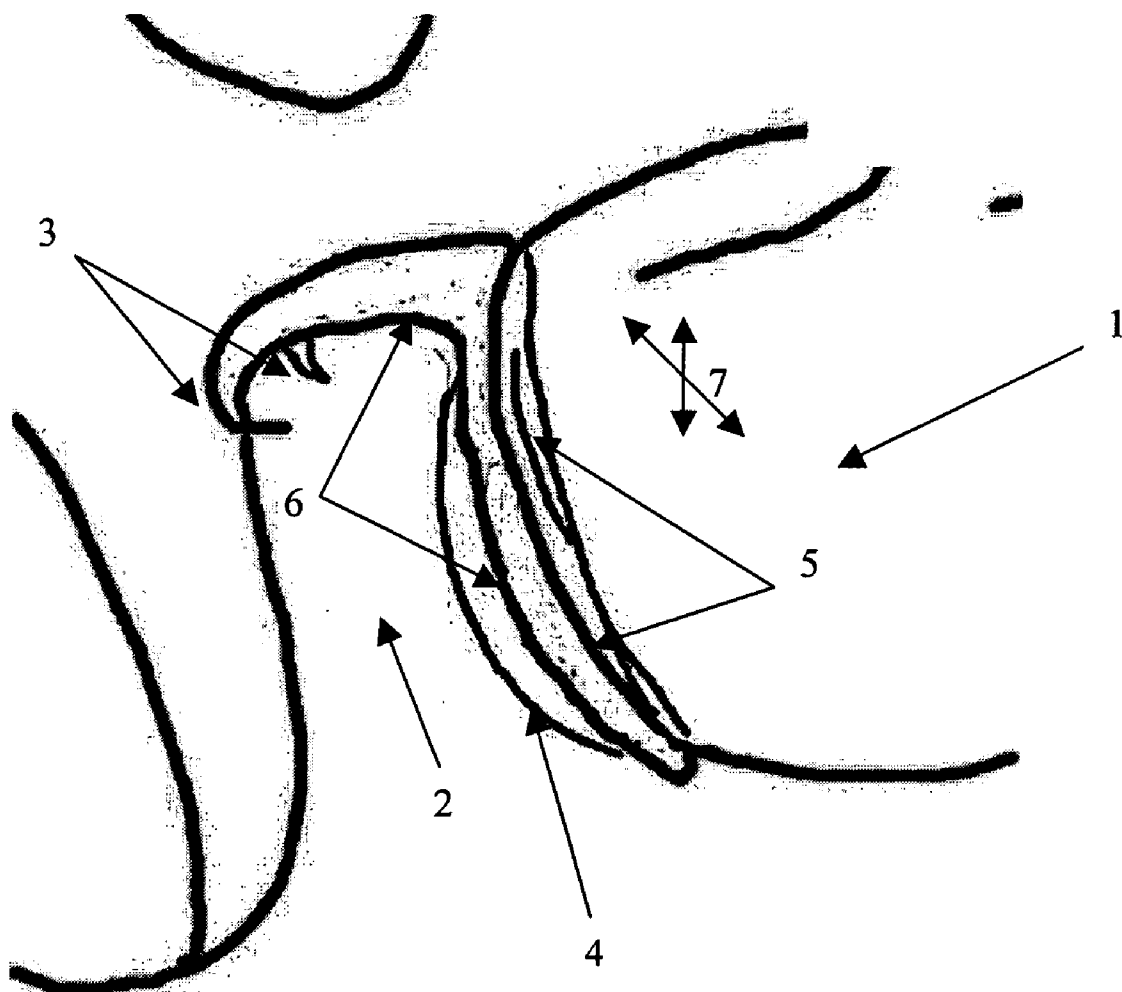


Figure 1



# Figure 2



**MINIMALLY INVASIVE FACET JOINT  
HEMI-ARTHROPLASTY**

**CROSS REFERENCE TO RELATED  
APPLICATIONS**

[0001] Not Applicable

**STATEMENT REGARDING FEDERALLY  
SPONSORED RESEARCH OR DEVELOPMENT**

[0002] Not Applicable

**REFERENCE TO SEQUENCE LISTING, A  
TABLE, OR A COMPUTER PROGRAM LISTING  
COMPACT DISK APPENDIX**

[0003] Not Applicable

**BACKGROUND OF THE INVENTION**

[0004] The present invention relates generally to minimally invasive spine surgery and, more particularly, a unique pre-made, pre-shaped metallic implant implanted using an arthroscopic type portal or classic open surgical method to achieve a spinal facet joint hemi-arthroplasty to resurface any or all of the forty-eight superior facets of the inferior Occiput-C1 through L5-S1 vertebrae. The use of pre-shaped metallic overlay for facet joint resurfacing of diseased, painful, deteriorated or overstressed joints offers three distinct advantages over larger prosthetic implants, which are presently used in facet arthroplasty procedures: (1) using a thin metallic overlay allows for minimally invasive insertion that is safer, less traumatic and requires far less recovery time compared to a prosthetic; (2) the overlay does not require the use of cements, pedicle screws or other fixation methods that can work their way loose over time; and, (3) the implant has two fins to provide lateral stability and two teeth to provide temporary fixation and a rough or porous inner surface amenable to bone in growth providing permanent natural fixation. The implant also has a polished outside that allows for smooth, natural, pain free articulation of the joint.

[0005] The implant and method are specifically designed for use in an arthroscopic type portal for stand-alone procedures and may also be used in classic open surgery. This implant provides a unique, stronger and superior resurfacing and may be used for, but not limited to: (1) an adjunct to instrumented vertebral fusion when implanted in the two facet joints immediately above and below the two joints adjoining the instrumentation thereby eliminating the risk of collateral post-operative facet joint pain resulting from additional stress placed on facet joints, (2) when used to resurface adjoining facet joints directly above and below a disk replacement by eliminating the risk of collateral post-operative facet joint pain resulting from additional stress placed on facet joints by the disk replacement, and, (3) as a stand-alone treatment for diseased, painful or deteriorated facet joints.

**BRIEF SUMMARY OF THE INVENTION**

[0006] The invention accomplishes its goal of resurfacing a painful, diseased or deteriorated spinal facet joints by providing a method, resurfacing implant and instrumentation to replace the joint surface with a small metal on bone overlay. The overlay, constructed of cobalt chrome or such

other biocompatible metal or metallic alloy appropriate for joint hemi-arthroplasties, is one size for adults and one size for children, similarly sized for different facet joints or groups of joints in the spine and are attached to the joint using a straightforward process without the need for screws or cements and with the aid of custom designed instruments. The facet joint may be accessed using an arthroscopic type portal eliminating the need for open surgery, hospitalization and long recovery periods. The procedure may also be performed as an adjunct other procedures such as instrumented fusion and disc replacement in a traditional open surgery. Because the side that attaches to bone is porous, the bone heals onto it, permanently fixing it into place. A uniquely designed set of blades and teeth provides temporary fixation to the joint and prevents migration. A unique crimping system allows the implant to be fixed into place, holding it firmly until bone in growth is complete. The side making contact with the joint is highly polished providing a smooth, virtually frictionless surface that undergoes virtually no wear and tear. The inside is rough or porous providing an amenable surface for bone in growth.

[0007] According to one broad aspect of the invention, the system comprises a surgical technique, uniquely designed instrumentation and a unique metallic prosthetic overlay. The metallic overlay is generally shaped to the natural contour of the bone it resurfaces and is highly polished on the outside to provide frictionless articulation of the joint and rough or porous on the inside to promote and provide a surface to allow the natural bone to grow into the overlay, providing a permanent fixation. In the interim between implantation and bone in-growth, the overlay is mechanically crimped into place using two teeth opposed to each other and one to two blades on the inside of the implant that bite into the bone to prevent lateral migration. The overlay is further held into place by the natural pressure of the inferior and superior sides of the joint as they come together in their natural position.

[0008] The system includes any number of instruments allowing preparation of the joint and the implant to be placed using a minimally invasive surgical arthroscopic technique to access to the joint that include a director probe to determine the correct facet joint angle, a separator to assist with separation of the vertebrae to improve access to the joint, an osteotome to make a small cut in the bone to prepare the surface for the implant, a broach to prepare the bone to match the implant shape, an impactor to impact the implant into place and a crimp to fix the implant to prevent migration prior to healing and a unique implant. By way of example only, the director may include a planer blade or rasp to remove any bone spurs or overgrowth and to flatten the facet joint surface in preparation for implant placement.

**BRIEF DESCRIPTION OF SEVERAL VIEWS OF  
THE DRAWING**

[0009] Many advantages of the present invention will be apparent to those skilled in the art with a reading of this specification in conjunction with the attached drawings, wherein like reference numerals are applied to like elements and wherein:

[0010] **FIG. 1** represents an inside view of the implant showing the teeth and blades used for temporary fixation.

[0011] **FIG. 2** represents a properly completed procedure and the resultant facet resurfacing using the device.

DETAILED DESCRIPTION OF THE  
INVENTION

[0012] In the United States alone, about 10% of the entire population will suffer from back pain sometime in the next 12 months. More people will contract back pain in the next year than any other injury or disease except the common cold and flu. About one third will not recover and have to live with persistent, disabling symptoms. The number is cumulative year after year.

[0013] One of the root causes of back pain, particularly persistent and disabling back pain, are facet joints, small joints located behind adjacent vertebrae in the spine that allow for spinal motion.

[0014] Present surgical solutions available for the millions of people with facet joint dysfunctions are complex, invasive, high-risk operations requiring pedicle screws for fixation and significant reduction or elimination of natural joints and replacement with prosthetic apparatus such as those described in U.S. Pat. Nos. 6,610,091, 6,579,319, 6,565,605, 6,132,464, 6,113,637 and U.S. Patent Application 2003/0028250. In general, the present art requires prolonged recovery times, from 6 to 24 months, and offers uncertain outcomes. High risk equates to frequent litigation, which forces non-surgical symptomatic treatment while the disease or consequences of injury progressively worsen.

[0015] With the advent of new, safer and less invasive surgical techniques and technology, the growth of spine surgery now outpaces every other orthopedic surgery segment. Its growth is further fueled by an enormous demand.

Facet Joint Hemi-Arthroplasty solves these problems in two ways:

[0016] 1. It can be a minimally invasive, low risk, fast (about 20 minutes per joint in an outpatient setting compared to about three hours in a hospital followed by a three day stay), and has a recovery time measured in a few weeks (compared to 6 to 24 months); and,

[0017] 2. It promises a high success rate, does not preclude other surgical options, and is non-limiting and permanent.

[0018] The present invention is directed at overcoming, or at least improving upon, the disadvantages of the prior art by achieving the following:

[0019] Reversal of the risk/benefit ratio of present procedures versus the invention;

[0020] A stand-alone minimally invasive procedure versus major open surgery;

[0021] It can also be employed as an adjunct to major open surgery in concert with long fusion and with disc replacement surgery to strengthen adjacent facet joints.

[0022] Outpatient versus inpatient surgery (about 20 minutes per joint versus hours);

[0023] Reduced morbidity;

[0024] Reduced blood loss;

[0025] Reduced time under anesthesia;

[0026] Reduced risk;

[0027] Recovery time dramatically reduced;

[0028] Minimal scarring that decreases the risk of failed back syndrome and improves revision surgery outcome;

[0029] Reduced risk of post operative infection by significantly reducing operating room time and soft tissue destruction;

[0030] Prolonging the functional life of long segment fusions and disc replacement.

[0031] No preclusion of other surgical or non-invasive treatment options; and,

[0032] Projected high success rate by utilizing accepted procedures facilitated through a new arthroscopic technique and resurfacing implant.

[0033] It is anticipated that the availability of this method, instrumentation and implant will increase the number of surgeries performed because they offer the first safe outpatient surgical solution to a predominant cause of joint pain. The inventor also expects that virtually all patients receiving this procedure will be able to walk the same day as surgery and be fully functional within a few weeks. Present surgical solutions require hospitalization of about three days and six to twenty-four months' recovery.

[0034] Aside from the obvious positive clinical outcome, the significant favorable financial impact on disability, worker's compensation and health care insurers is considerable.

[0035] Spinal facet implant units are calculated per joint. Each patient has two joints per spinal segment and six segments (T12 to L1 through L5-S1) in the lumbar spine, or twelve lumbar, fourteen cervical and twenty-eight thoracic joints. Each surgery is likely to involve multiple joints, with a probable average of 4 per patient.

[0036] The invention accomplishes its goal of reducing, preventing or eliminating spinal facet joint pain by providing a method, resurfacing implant and instrumentation to replace the joint surface with a small metal on bone overlay. The overlay, constructed of cobalt chrome, a material previously approved by the FDA for other joint hemi-arthroplasty, or such other metallic construction as may be safely used, is one size for adults and one size for children, may be similarly sized for different joints and is attached to the joint using a straightforward process without the need for screws or cements with the aid of custom designed instruments. The joint may be accessed using an arthroscopic type portal eliminating the need for open surgery, hospitalization and long recovery periods (unless the procedure is performed as an adjunct other procedures such as instrumented fusion and disc replacement in a traditional open surgery). Because the side that attaches to bone is porous, the bone heals onto it, permanently fixing it into place. A uniquely designed set of blades and teeth prepares the joint and a unique crimping system allows the implant to be fixed into place, holding it firmly until bone in growth is complete. The side making contact with the joint is highly polished providing a smooth, virtually frictionless surface that undergoes virtually no wear and tear. The resurfacing implant is a securely fixed porous hemi-arthroplasty of the facet joints of the spine.

[0037] According to one broad aspect of the invention, the system comprises a surgical technique, uniquely designed instrumentation and a unique metallic prosthetic overlay.

The metallic overlay is generally shaped to the natural contour of the bone it resurfaces and is highly polished on the outside to provide frictionless articulation of the joint and rough and porous on the inside to promote and provide a surface to allow the natural bone to grow into the overlay, providing a permanent fixation. In the interim between implantation and bone in-growth, the overlay is mechanically crimped into place using two teeth opposed to each other that bite into the bone and to prevent migration. The overlay is further held into place by the natural pressure of the inferior and superior sides of the joint as they come together in their natural position.

[0038] The system includes any number of instruments allowing preparation of the joint and the implant to be placed using a minimally invasive surgical arthroscopic technique to access to the joint that include a director probe to determine the correct facet joint angle, a separator to assist with separation of the vertebrae to improve access to the joint, an osteotome to make a small cut in the bone to prepare the surface for the implant, a broach to prepare the bone to match the implant shape, an impactor to impact the implant into place and a crimp to fix the implant to prevent migration prior to healing and a unique implant. By way of example only, the director may include a planer blade or rasp to remove any bone spurs or overgrowth and to flatten the facet joint surface in preparation for implant placement.

[0039] FIG. 1 illustrates the device, which is variably sized to accommodate different spinal facet joints. Its outer surface (1) is highly polished to create a virtually frictionless surface and designed to face the superior facet. The device itself is implanted into the inferior facet. The inner surface (2), facing the inferior facet, is rough or porous providing an amenable surface for bone in growth. The inner blades (3), which rest into the bone in pre-prepared slots, prevent lateral movement. The teeth (4) are crimped into the joint to provide additional fixation and to prevent migration.

[0040] FIG. 2 illustrates the device in situ with the polished side (5) facing the superior facet (1) and the rough or porous side (6) facing the inferior facet (2). The polished side (5) creates a direct metal to bone contact, effecting a durable resurfacing. Crimped teeth (3) provide additional fixation and prevent migration while blades (4) provide lateral fixation. The natural pressure provided by the joint adds to the stability of the implant allowing for unrestricted, natural motion (7).

I claim:

1. A metallic overlay constructed of cobalt-chrome or any other biocompatible metal or metallic alloy presenting a smooth, polished surface on its outside allowing for virtually frictionless joint articulation and rough or porous construction on its inside that is amenable to natural bone in growth to provide a permanent fixation. Said inlay is generally shaped to fit the natural contour of the facet joint and sized to fit any or all of the forty-eight facet joints located vertebral segments Occuput-C1 through L5-S1.
2. The Device of claim 1 has a porous inner surface made of the same material as the device.
3. The Device of claim 1 has a porous inner surface made of a different material as the device.
4. The Device of claim 1 wherein said component contains one or more fins on its inner portion to provide lateral fixation.
5. The Device of claim 1 wherein said component contains one or more teeth that may be crimped into the cortical bone to prevent migration of the Device.
6. The Device if claim 1 wherein said component is constructed of a non-metallic, non-degradable biocompatible material presenting the same durability as its metallic version.

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