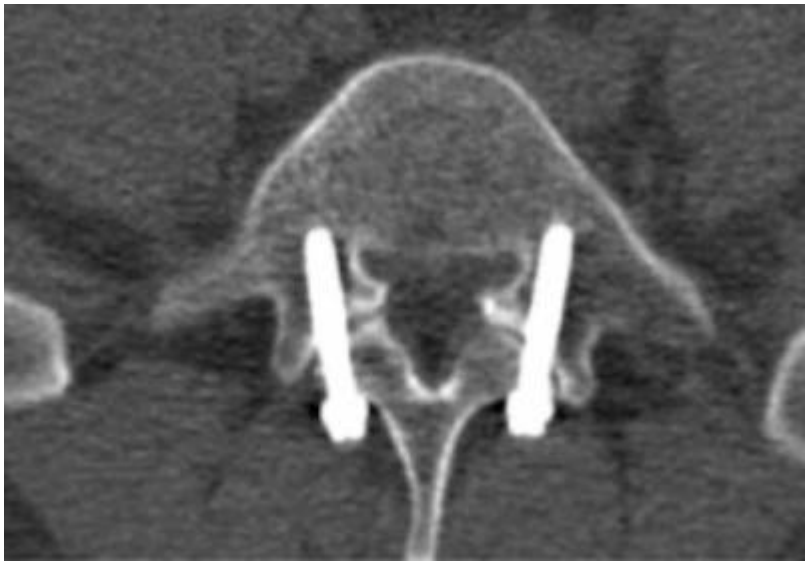
Lumbar transfacet screw fixation



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Transfacet fixation (TFF) is a minimally invasive technique that involves the placement of screws across the facet joint and into the pedicle, to attain improved stability in the spine [1)]

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see Transfacet OLLIF

see Transfacet Minimally Invasive Transforaminal Lumbar Interbody Fusion

see also Percutaneous Lumbar Transfacet Screw Fixation

A biomechanical study was conducted to assess the stabilization performance of transfacet pedicle screw fixation.

Facet screw fixation is an alternative to pedicle screw fixation that permits the use of a minimally invasive strategy. It is not known whether facet screw fixation can provide stability equivalent to pedicle screw fixation during cyclical loading. Therefore, transfacet pedicle screw fixation and standard pedicle screw fixation techniques were compared biomechanically.

Lumbar motion segments were tested under short-term and long-term cyclic loading conditions. For the short-term phase, specimens were tested intact for six cycles (to 400 N or 4 Nm) in compression, flexion, extension, lateral bending, and torsion. The specimens then were instrumented with bilateral semicircular interbody spacers and pedicle screw instrumentation or transfacet pedicle screws, and the testing sequence was repeated. For the long-term phase, 12 specimens were instrumented in a similar manner and loaded to 6 Nm of flexion bending for 180,000 cycles.

For the short-term phase, both fixation systems had significantly greater stiffness and reduced range of motion, as compared with the intact state. No differences were observed between the fixation systems except in flexion, wherein transfacet pedicle screw specimens were significantly stiffer than traditional pedicle screw specimens. For the long-term phase, the stiffness and range of motion did not significantly increase or decrease over repetitive cycling of the instrumented specimens. Furthermore, no significant difference between the fixation systems was observed

The stability provided by both transfacet pedicle screw fixation and traditional pedicle screw fixation was not compromised after repetitive cycling. In this model, transfacet pedicle screw fixation appears equivalent biomechanically to traditional pedicle screw fixation [2)].

Advantages

Cortical Bone Trajectory for Lumbar Pedicle Screw Placement and non-pedicular fixation may be preferred in certain lumbar degenerative cases, particularly among patients with osteoporosis. Limitations of non-pedicular techniques include their reliance on intact posterior elements and the lack of 3-column fixation of the spine. As a result, transfacet and translaminar screws are infrequently used as the primary method of fixation. CBT, transfacet, and translaminar screws are effective in augmenting interbody fixation and have been shown to significantly improve fusion rates and clinical outcomes compared with stand-alone anterior lumbar interbody fusion.

Cortical Bone Trajectory for Lumbar Pedicle Screw Placement and transfacet screws require less-extensive exposure and paraspinal muscle dissection compared with traditional pedicle screws and may therefore reduce blood loss, postoperative pain, and length of hospital stay. In addition, several methods of non-pedicular fixation such as translaminar screw fixation and fusion mass screws have trajectories that are directed away from or posterior to the spinal canal, potentially decreasing the risk of neurologic injury. CBT, transfacet, and fusion mass screws can also be used as salvage techniques when traditional lumbar pedicle screw placement fail.

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The mediolateral trajectory of the screws, away from the dural sac and neural structures, explains the lower incidence of cerebrospinal fluid leakage and neurologic deficits reported in the literature in comparison with pedicle screw fixation [4] [5] [6] [7] [8] [9] [10] [11] [12].

Case series

A total of 25 patients between May 2015 and June 2016 affected by radiologically demonstrated one-level Lumbar spinal stenosis (LSS) with facet joint degeneration and grade I spondylolisthesis were included in this prospective study. All the patients underwent laminectomy, foraminotomy, and one-level facet fixation (Facet-Link, Inc., Rockaway, New Jersey, United States). Pre- and postoperative clinical (Oswestry Disability Index [ODI], Short Form 36 [SF-36]) and radiologic (radiographs, magnetic resonance imaging, computed tomography) data were collected and analyzed.

Mean follow-up was 12 months. The L4-L5 level was involved in 18 patients (72%) and L5-S1 in 7 patients (28%); the average operative time was 80 minutes (range: 65-148 minutes), and the mean blood loss was 160 mL (range: 90-200 mL). ODI and SF-36 showed a statistically significant ($p < 0.05$) improvement at last follow-up.

Lumbar transfacet screw fixation is a safe and effective treatment option in patients with single-level LSS, facet joint degeneration, and mild instability [13].

Clinical records gathered from August 2009 to January 2014 were retrospectively reviewed. We identified 83 patients who underwent placement of 176 consecutive percutaneous transfacet screws while in the prone or lateral position. Accuracy of screw placement was assessed on computed tomography (CT) by entry point and end point. Hardware failure was assessed by radiography or CT. Clinical complications were assessed during regular follow-up visits.

Entry point accuracy was 91.4%. Seven cases of intra-articular screw placement and 1 para-articular screw placement were detected on CT. End-point accuracy was 82.8%. There were 16 cases of pedicle breach from 1 to 3 mm on CT. There were 2 screw fractures and 1 case of a Kirschner-wire fracture that were clinically inconsequential. One patient had new nondisabling leg numbness. One patient with new radicular leg pain required removal of a screw.

The technique of percutaneous lumbar transfacet screw fixation can be performed accurately and safely with patients in the prone and lateral positions. Entry point inaccuracies were more common at rostral levels due to facet orientation. End-point inaccuracies (pedicle breaches) were more common

in the intervertebral foramen where 2 clinical complications occurred [14].

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