Dynamic stabilization

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Lumbar degenerative scoliosis is a common condition that often causes significant pain and functional disability in older adults. If patients are profoundly symptomatic, open instrumented spinal fusion can improve symptoms in most patients but is associated with substantial perioperative morbidity, particularly in elderly patients. A number of radiographic alignment parameters have been found to be strongly associated with health-related quality of life (HRQOL) outcomes and have been used to refine indications for surgery and goals for postoperative realignment. Even in cases in which alignment objectives are obtained, complications such as proximal junctional failure and pseudarthrosis can compromise long-term outcomes and lead to additional surgery.

A number of surgical techniques have been recently proposed in an attempt to reduce surgical morbidity or provide a more durable result compared with currently utilized techniques. Many of these procedures were greeted with substantial initial enthusiasm, but longer-term evaluation has tempered the early excitement, particularly in cases with rigid or more complex adult deformity.

Dynamic stabilization has recently been proposed as an alternative to instrumentation and fusion for the treatment of adult scoliosis. Di Silvestre and colleagues reported retrospective clinical and radiographic outcomes in elderly patients (mean age 68.5 years, range 61–78 years) with degenerative lumbar scoliosis (DLS) and associated spinal stenosis, who underwent dynamic stabilization (Dynesys system) without fusion combined with decompressive laminectomy. The mean preoperative scoliosis was 16.9° (range 12°–37°) and the mean scoliosis at final follow-up measured 11.1° (range 4°–26°). The mean improvement for the Oswestry Disability Index (ODI) was 51.6% (p = 0.01). Four patients (13.8%) were found to have an asymptomatic radiolucent line around screws of the S-1 level. Six patients (20.7%) had minor complications and 2 patients (6.8%) incurred major complications. It was concluded that dynamic stabilization with pedicle screws in addition to decompressive laminectomy resulted in a safe procedure in elderly patients with DLS and stenosis.

Lee and colleagues similarly report in the present study a retrospective evaluation of 28 patients (mean age 65.3 years) with spinal stenosis and DLS who were treated with decompressive surgery and nonfusion stabilization with the Dynesys system. During the period of study, 44 patients underwent surgical intervention for mild to moderate DLS, 28 patients were treated with nonfusion dynamic stabilization, and 16 patients underwent traditional fusion surgery. It was noted that the selection criteria for nonfusion and fusion surgery were not homogenous and patients who underwent fusion surgery were excluded from the analysis. It was further noted that instrumented spinal fusion surgery was indicated in moderate to severe disc degeneration, moderate to severe foraminal stenosis, moderate to severe spondylolisthesis, spondylotic spondylolisthesis, and in cases with intraoperative facet violation. The mean preoperative Cobb angle measurements for the scoliosis were 13.7° ± 3.4° (range 10°–20.8°) with the final follow-up measurements being 3.9° ± 3.0° (range 0°–10.3°). The mean preoperative ODI was 57.7% ± 17.7% (range 24%–80%) and the final mean postoperative ODI was 35.5% ± 17.7% (range 2%–66%). There were 8 early perioperative complications and 7 late complications, including a radiolucent line around the screws in 4 patients (14.2%).

Current management of surgical adult spinal deformity can be improved. Some of the improvement in care will result from a better understanding of how clinical and radiographic factors affect outcome. It has been demonstrated that an appropriate radiographic assessment using 36-inch radiographs is critical in determining the severity of deformity. Determining the pelvic tilt and pelvic incidence–lumbar lordosis mismatch, combined with assessing the sagittal vertical axis, can accurately predict patient disability and provide a guide for patient...
assessed for appropriate therapeutic decision-making. For instance, it has been demonstrated that the Scoliosis Research Society–Schwab classification reflects severity of disease state based on multiple measures of HRQOL and significantly correlates with the important decision of whether to pursue operative or nonoperative treatment. Improvement in care can also result from novel surgical techniques such as minimally invasive approaches and dynamic stabilization, but defining the spectrum of patients where these treatments are appropriate is just beginning. Both of the studies evaluating dynamic stabilization include patients with only mild scoliosis. The patients in the present study had excellent sagittal balance and dynamic stabilization, but its role in the treatment of cases with anything beyond mild deformity has not been defined. A larger prospective study with a greater spectrum of deformity and longer follow-up duration is needed to better define the role of dynamic stabilization in patients with adult spinal deformity. (http://thejns.org/doi/abs/10.3171/2014.5.SPINE14390)

Disclosure

Dr. Smith has served as a consultant to Biomet, NuVasive, Globus, Medtronic, and DePuy, and has received support of non-study-related clinical or research effort from DePuy/ISSGF. Dr. Shaffrey has served as a consultant to Biomet, Globus, Medtronic, NuVasive, and Stryker; has direct stock ownership in NuVasive; and is both a patent holder for and has received royalties from Biomet, Medtronic, and NuVasive.

References


Response

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We appreciated the editorial from Drs. Shaffrey and Smith and completely agree with their opinions with regard to the present study. Given that DLS is a complex spinal disease associated with degenerative changes, deformity, and sagittal and coronal imbalance, surgical indications and techniques in an attempt to correct this condition are various and controversial among experienced spine surgeons.

In current surgical practices, we have extended surgical indications for nonfusion dynamic stabilization in consideration of the faults associated with fusion surgery. Our purpose during nonfusion dynamic stabilization surgery is symptomatic relief from degenerative stenosis and the maintenance of internal strength levels using nonfusion stabilization devices, but this does not restore normal spinal curvature. Hence, we undertook decompression with patients suffering from lumbar stenosis with mild to moderate lumbar scoliosis (< 30°) and mild global malalignment at symptomatic segments and applied a nonfusion stabilization technique (Dynesys) to the decompressed segments. We were also able to achieve similar clinical and radiological outcomes through relatively short segment stabilizations of decompressed segments.

In critical surgical indications, nonfusion dynamic stabilization surgery was performed in cases with mild to moderate degenerative conditions of stenosis, disc degeneration, scoliosis, and global imbalance. Otherwise, existing dynamic stabilization devices have limitations, and the long-term effects of these types of surgery have not been fully investigated, especially considering...
instrument failures such as screws loosening and the effects of adjacent segments. We nonetheless performed fusion surgery on patients with severe scoliosis (> 30°), abnormal sagittal balance issues, or pelvic incidence mismatches. Although nonhomogeneity of the underlying degenerative status existed, a comparative study of surgical outcomes between nonfusion and fusion surgeries was not conducted. Nonfusion dynamic stabilization has several advantages over fusion surgery and can maintain the functional integrity of the spine, but the definite surgical roles and indications pertaining to nonfusion dynamic stabilization have not been confirmed. Within our surgical practice, we have confirmed the efficacy of nonfusion dynamic stabilization surgery for mild DLS in elderly patients. Therefore, investigations of the potential use of surgery for a broader spectrum of degenerative lumbar diseases with long-term follow-up are necessary to define the role of nonfusion dynamic stabilization surgery and to develop additional physiological devices.

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