

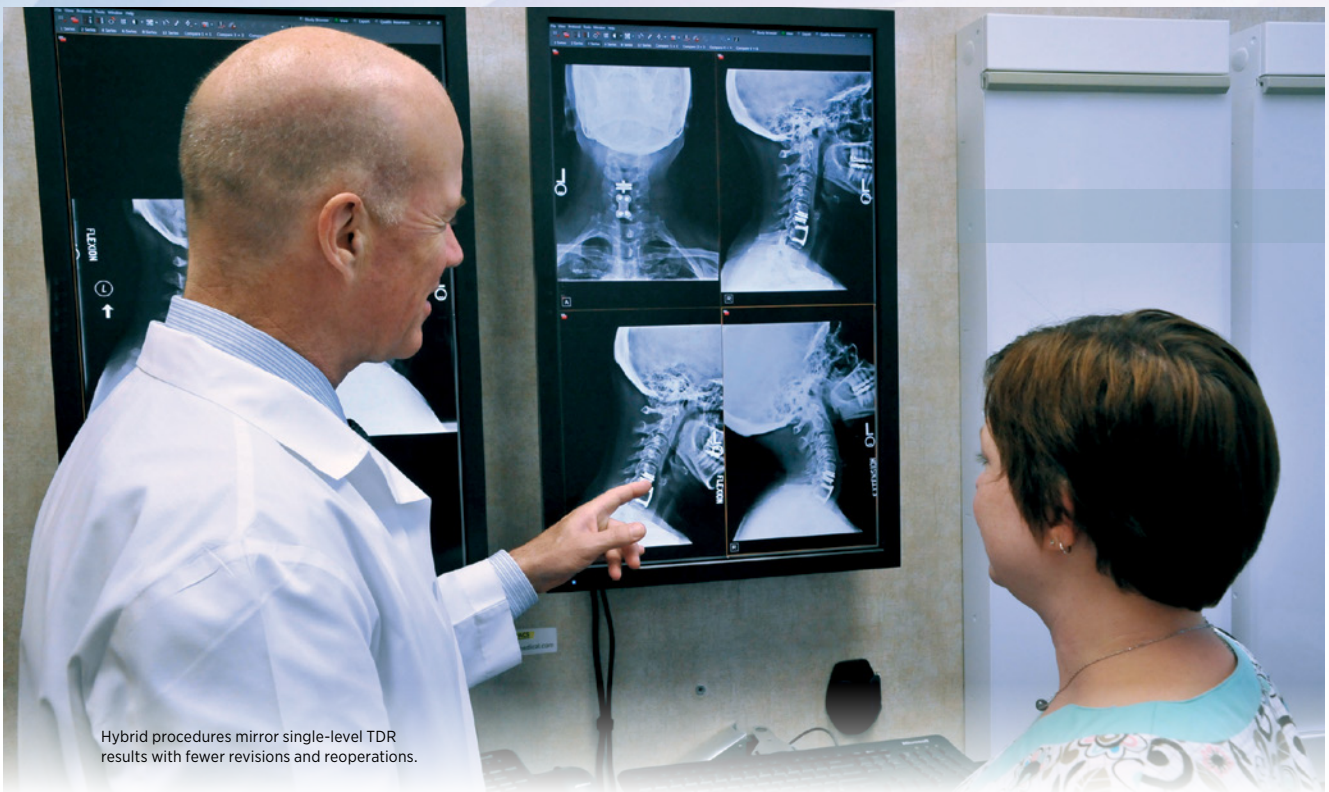
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**Midwest
Spine Institute:**
*Pioneers in Motion
Preservation*



Hybrid procedures mirror single-level TDR results with fewer revisions and reoperations.

Midwest Spine Institute: Pioneers in Motion Preservation

By Marian Deegan

THE STRENGTH AND flexibility of the spine is central to quality of life, but age, disease and degeneration take their toll. Nearly eight of every 10 people will experience back problems. Historically, back treatments have focused on controlling pain. Today, when conservative, nonoperative therapies fail, advances in spine surgery offer improved options not only to control pain but also to improve post-operative recovery and preserve patient mobility.

Glenn R. Buttermann, MD, MS, FAAOS, of Midwest Spine Institute, has been at the forefront of back pain research, motion preservation techniques and surgical device development. He sat down with *MD News Minnesota* to discuss the history of spine surgery, treatment advances for maintaining function, and the significance of recent FDA approvals of new, multilevel total disc replacement techniques for the cervical spine.

Innovative Motion Preservation Therapy

“My training and practice in both childhood and adult deformities sensitized me to motion preservation issues,” Dr. Buttermann explains. “Most fellowships focus on primary spine problems; I was fortunate to have an orthopedic residency and fellowship geared toward revision surgery, during which I was introduced to complex adjacent segment and transitional problems under the mentorship of brilliant orthopedic minds such as David Bradford, MD, and James Ogilvie, MD. I learned an approach emphasizing patient mobility. Instead of fusing the entire spine of scoliosis patients, I was taught to fuse only the apical segments of a curvature, leaving the levels above and below mobile. This approach preserved the best quality of life for the patient.”

Dr. Buttermann performs about 300 surgeries a year, using devices and techniques he helped develop.

“I believe firmly in a conservative approach,” he says. “Fewer than 15 percent of the patients I treat ultimately receive surgical treatment. When surgery is appropriate, we can offer treatments that didn’t exist 15 years ago, including less-invasive surgical procedures and total disc replacement devices that improve patient mobility. Midwest Spine is proud to play a role in developing treatments that improve our patients’ outcomes.”

Spinal degenerative disc disease is subject to different treatment protocols based on whether the diseased disc is in the cervical, thoracic or lumbar spine, how many discs or levels require repair, and the overall condition of the patient.

“A normal disc has a hydrophilic center that absorbs water like a compressible sponge,” Dr. Buttermann explains. “This center is contained by a thick, fibrous annulus tissue. When the disc is injured or degenerates, it can collapse, which may cause pain and loss of range of motion.”

Spinal fusion combines two vertebrae in the spine, sacrificing the diseased disc as well as mobility in the portion of the fused spine. This procedure can reduce pain, but over 10 years there is a 25 percent chance that additional surgery will be necessary because fusion shifts stress to the discs above and below the fused bones and can cause them to prematurely disintegrate.

Artificial or total disc replacement (TDR) surgery, in lieu of fusion, removes the diseased spinal disc pad between the bones and replaces it with a mechanical device. The disc replacement device mimics the function of the disc. This approach reduces pain and preserves the patient's natural range of motion. TDR surgery may also reduce the need for additional follow-up surgery because it does not shift strain to adjacent discs.

Indications for TDR Surgery

The best candidates for both fusion and disc replacement are patients with a sub-acute disc herniation in the cervical spine and a chronic central herniation in the lumbar spine. An anterior surgical approach is used for both surgeries, avoiding damage to back muscles and improving long-term outcomes. Fusion outcomes tend to remain stable until the five-year mark, when a percentage of patients begin to develop problems with adjacent discs above or below the fusion. Whether TDR outcomes will have better long-term outcomes than fusion remains to be seen, though the results to date offer promise.

"Total disc replacement is fairly new, and quality studies to analyze surgery outcomes are still in progress," Dr. Buttermann explains. "As we gather outcome data over time, we hope total disc replacement will offer improvement over fusion in minimizing disc deterioration above and below the point of surgery. With five-year TDR outcomes, we are already seeing a substantially lower rate of secondary surgery compared with fusion outcomes."

FDA surgical indications distinguish between the cervical and lumbar spine.

"In the cervical spine, a radiculopathy or myelopathy is approved for TDR, but in the lower spine, neither is," Dr. Buttermann says.

The rationale for the differing indications is complex, but one factor contributing to more use of TDR in the cervical spine is availability of properly sized disc devices.

"Spinal discs are more oblique and square than they are round, and it's critical that each disc device fits correctly between the vertebrae," Dr. Buttermann says. "One of the challenges we face centers around manufacturer resources to make the range of disc sizes and shapes needed to fit both the cervical and lumbar spine. Numerous disc sizes exist for cervical spine replacement, but we still lack the range of disc shapes needed for the low back."

The most common surgery performed on the cervical spine is a two-level procedure; two discs, or motion segments, of the spine are diseased. The next most common cervical spine problem involves disease in three levels of discs.

"Ironically, the first disc implants were approved for single-level disease only — which is the least common cervical spine surgery," Dr. Buttermann points out. "We could also perform a hybrid procedure for multilevel disc disease, using disc replacement for one level and fusing the other levels."

These limitations have lifted with the FDA's recent approval of a disc replacement treatment for a multilevel procedure. So far, only a handful of multilevel disc replacements have been performed in Minnesota, and Dr. Buttermann and his colleagues are among those who have performed them.

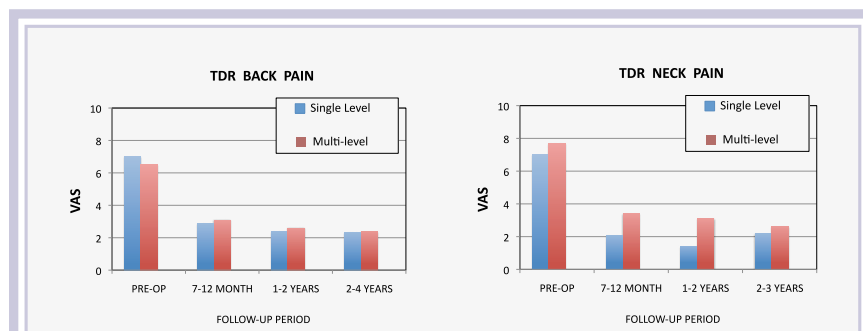


Advantages of TDR

Data shows that both fusion and TDR surgeries deliver pain relief, particularly in multilevel cases. However, TDR eliminates the fusion risk of nonunion, which occurs when the fused bones don't heal properly.

"Nonunion is a greater risk for patients who are smokers and those in multilevel surgeries," Dr. Buttermann explains. "TDR may benefit both groups."

TDR also expands surgical eligibility to patients with osteoporosis who are at risk of fusion surgery failure.



- + Maintained range of motion in cervical TDR and lumbar TDR
- + Fewer revisions/reoperations for cervical TDR and lumbar TDR than for fusion
- + Improved outcomes better or equivalent for cervical TDR vs. fusion
- + Improved outcomes for lumbar TDR compared with fusion



Back: Louis C. Saeger, MD; Daryll C. Dykes, MD; Glenn R. Buttermann, MD; Mark A. Janiga, MD; Daniel W. Hanson, MD.
Middle: Mark K. Yamaguchi, MD; Lynn M. Miller, MD; Stefano M. Sinicropi, MD. Front: Thomas V. Rieser, MD

“We don’t have enough disc sizes yet to offer these patients lumbar TDR,” Dr. Buttermann says, “but we can address their cervical spine issues. Correct disc size enables us to fill the entire endplate of the vertebra with the prosthesis. This distributes the load correctly so the device won’t become loose or subside.”

Recovery times after TDR are significantly shorter compared with fusion. A patient with a one-level lumbar disc replacement typically returns to work in two months, versus five months after fusion surgery. Patients who undergo a hybrid lumbar procedure are usually back at work at four months, versus six months following fusion.

Tracking Function as well as Pain Outcomes

Unlike hip and knee, spine surgery patient outcome measurements have traditionally focused on pain and not on function.

“Spine outcome measurements are lagging,” Dr. Buttermann says. “At Midwest Spine, we have conducted comprehensive screening assessments for function as well as pain for the last 20 years. Minnesota opted to require these assessments only last year. We know from our data that although fusion decreases post-operative pain, functional

outcomes of a fused spine are only satisfactory. Disc replacement patients, however, experience a significant improvement in both pain and function scores.”

Dr. Buttermann attributes successful pain outcomes in part to surgery techniques.

“For fusion surgery, it’s about not only putting the screws in the right place but also making sure the fusion takes,” he says. “Some surgeons experiment with fusion substitution products. I’m more conservative. I use the patient’s own bone or a product proven to deliver true bone healing.”

Pioneering Research to Improve Mobility

“My interest in research began as an orthopedic resident,” Dr. Buttermann explains. “I saw patients who received fusions for pediatric or arthritic conditions. Because the fusions shifted stress to the next joint above or below the fused joint, they did not do well long term. I was interested in finding a better solution. I started developing disc replacement ideas for lumbar spine during my training, testing a device that replaced the inside of the disc in animal studies. The promise in those early studies is being borne out in the TDR outcome data we are seeing now.”

Today, Dr. Buttermann is working on minimally invasive motion preservation techniques to treat deformities. These patients tend to be young, so motion preservation is a priority.

“With an indication like scoliosis, a newer device we are using enables us to go in through the side versus the front or back,” he says. “With this technique, we can perform three- or four-level fusions through an incision only 6 centimeters long while simultaneously correcting the scoliosis and preserving motion for these patients. Postoperative MRIs demonstrate the reduction in muscle injury, and outcomes have demonstrated a significant decrease in pain as well, compared with traditional approaches.”

Because many minimally invasive and scoliosis procedures are dependent on interoperative CT scans that expose patients to radiation, Dr. Buttermann is also developing a device to move spine surgery toward zero radiation.

“My scoliosis patients are mostly children,” he explains. “We already know that there’s an increased rate of breast cancer in scoliosis patients from clinic X-rays alone — not to mention exposure from multiple CT scans during surgery. I am in the process of patenting a device for the spine that replaces a screw. My device is just as strong, but, unlike a screw, it can be inserted and positioned without radiation. It may also have a functional advantage in that it can be placed using direct visualization — there are no worries about screws impinging the spinal cord or aorta. These inventions help us safely achieve and improve the life-changing results we want for our patients.”

A healthy spine is integral to quality of life. When spine health declines, quality of life hinges on motion preservation and pain relief. At Midwest Spine Institute, Dr. Buttermann and his colleagues are dedicated to clinical research and treatment that constantly advance patient options and improve patient outcomes.

“I’m a big outcomes guy,” Dr. Buttermann says. “Our data tells us what’s working to reduce pain and improve function — those results matter. The most rewarding part of my job is helping my patients maintain mobility so they can live their lives doing the things they love.” ■