

Technical note

Cervical Deuk Laser Disc Repair®: A novel, full-endoscopic surgical technique for the treatment of symptomatic cervical disc disease

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Abstract

Background: Cervical Deuk Laser Disc Repair® is a novel full-endoscopic, anterior cervical, trans-discal, motion preserving, laser assisted, nonfusion, outpatient surgical procedure to safely treat symptomatic cervical disc diseases including herniation, spondylosis, stenosis, and annular tears. Here we describe a new endoscopic approach to cervical disc disease that allows direct visualization of the posterior longitudinal ligament, posterior vertebral endplates, annulus, neuroforamina, and herniated disc fragments. All patients treated with Deuk Laser Disc Repair were also candidates for anterior cervical discectomy and fusion (ACDF).

Methods: A total of 142 consecutive adult patients with symptomatic cervical disc disease underwent Deuk Laser Disc Repair during a 4-year period. This novel procedure incorporates a full-endoscopic selective partial decompressive discectomy, foraminoplasty, and posterior annular debridement. Postoperative complications and average volume of herniated disc fragments removed are reported.

Results: All patients were successfully treated with cervical Deuk Laser Disc Repair. There were no postoperative complications. Average volume of herniated disc material removed was 0.09 ml.

Conclusions: Potential benefits of Deuk Laser Disc Repair for symptomatic cervical disc disease include lower cost, smaller incision, nonfusion, preservation of segmental motion, outpatient, faster recovery, less postoperative analgesic use, fewer complications, no hardware failure, no pseudoarthrosis, no postoperative dysphagia, and no increased risk of adjacent segment disease as seen with fusion.

Key Words: Cervical radiculopathy, Deuk Laser Disc Repair®, endoscopic spine surgery, intervertebral disc degeneration, intervertebral disc displacement, minimally invasive spine surgery

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INTRODUCTION

Deuk Laser Disc Repair is a novel full-endoscopic, anterior cervical, trans-discal, motion preserving, “implant and biologic free”, laser assisted, outpatient surgical

procedure proven to safely treat symptomatic cervical disc diseases including spondylosis, stenosis, herniations, bulges, and annular tears.^[4-6] Anterior endoscopic cervical discectomy has been previously described as safe^[13,15,16,18] but with significant inconsistency regarding operative

indication, technique and outcomes.^[1,8,10,14,17] Deuk Laser Disc Repair incorporates a selective partial discectomy of displaced nuclear fragments, both interposed within the annular tear and fully herniated, while preserving the structure and functional integrity of the remaining spinal disc. Foraminoplasty allows nerve root decompression while annular debridement promotes natural healing of the disc annulus by removing abnormal tissue with the laser.

A total of 142 adult patients received cervical spine Deuk Laser Disc Repair at our surgery center between April 2008 and April 2012. All patients treated had symptomatic cervical disc herniations that failed conservative management. Patients having either contained or non-contained disc herniations found on magnetic resonance imaging (MRI) and symptoms related to the injured disc(s) were offered surgical treatment. Their target symptoms included neck pain, arm pain, and radicular complaints such as numbness, paresthesias, and weakness. All patients were candidates for anterior cervical discectomy and fusion (ACDF) but refused and opted for the endoscopic procedure. Institutional review board approval was obtained. Data from all cases was reviewed retrospectively including intraoperative blood loss, perioperative complications, emergency room visits, hospital admissions, and volume of disc material removed. Custom instruments are required for this surgical procedure.

Operative technique

All patients received appropriate medical clearance and informed consent for general endotracheal anesthesia. After intubation, patients are positioned supine on a carbon fiber operating table with the neck in slight extension. The neck is prepped and draped in an aseptic fashion for a standard anterior approach. Intraoperative fluoroscopy is used in the anterior/posterior and lateral planes for real-time localization and image guidance throughout surgery. A custom 18 gauge spinal needle is introduced on the side of the neck contralateral to the most symptomatic upper extremity and passed through a plane between the carotid sheath laterally and the midline visceral structures medially. Under fluoroscopic guidance, the needle tip is placed in the anterior midline of the appropriate spinal disc between the longus coli muscles. The spinal needle is advanced to the center of the disc and up to 1 ml of a contrast dye and indigo carmine mixture is injected. The resulting chromodiscogram allows better endoscopic visualization of degenerated disc fragments and symptomatic annular tears [Figure 1].

Next, a guide wire is inserted through the lumen of the custom spinal needle under fluoroscopic guidance until the tip reaches the posterior margin of the nuclear-annular junction of the symptomatic disc. If the posterior margin of the disc is not well visualized fluoroscopically in the lateral projection due to anatomic constraints

the procedure may not be performed at that level due to risk of injury to the spinal cord or nerve roots. The spinal needle is then removed over the guide wire and a 4 mm horizontal skin incision is made with a #11 scalpel where the guide wire meets the skin surface. Next, a dilator is placed over the guide wire and gently advanced through the anterior longitudinal ligament into the disc space. The guide wire is removed and the tip of the dilator is further advanced under fluoroscopic guidance to its final position at the base of the disc herniation near the posterior annulus. Next, a 4 mm cannula is passed over the dilator so that the distal tip of the cannula is docked in the disc near the posterior margin of the vertebral body at the base of the herniation. The dilator is removed and a 3 mm diameter 0° endoscope is introduced into the cannula allowing direct visualization of the posterior longitudinal ligament, posterior vertebral endplates, annulus, neuroforamina, and herniated disc fragments [Figure 2]. Surgical instruments including R. Wolf (Germany) endoscopic graspers and a straight firing Holmium-YAG laser fiber are used to complete the disc repair [Figure 3]. The rigid endoscope used projects fiber optic images using a high definition video platform allowing excellent spatial resolution and real time imagery. Osteophytes are seen as bony protuberances coming off the posterior endplates and uncinat process encroaching on the central canal and neuroforamen. They can be vaporized individually using the 20 W setting on the laser within a few seconds. Continuous cold saline antibiotic irrigation is used during the entire endoscopic procedure. Upon completion of the spinal disc repair, the endoscope and cannula are removed from the disc space to allow primary closure of the wound with suture and steri strips. The patient is extubated, placed in a rigid cervical collar, and recovered in a standard fashion. Collected disc material is sent to the pathologist for review [Figure 4].

RESULTS

All patients were successfully treated with cervical Deuk Laser Disc Repair. There were no postoperative complications [Table 1]. Average operative blood loss was less than 5 ml. Average volume of disc material removed was reported by pathology in only two-third of the cases and was found to be 0.09 ml. All surgeries were performed in a licensed, office-based surgery center by the same surgeon. All patients were discharged home the same day as the procedure. There were no hospital admissions or emergency department visits related to the surgery.

DISCUSSION

Deuk Laser Disc Repair is a novel endoscopic alternative to traditional ACDF or arthroplasty for the safe and effective treatment of symptomatic cervical degenerative disc diseases. The cervical Deuk Laser Disc Repair

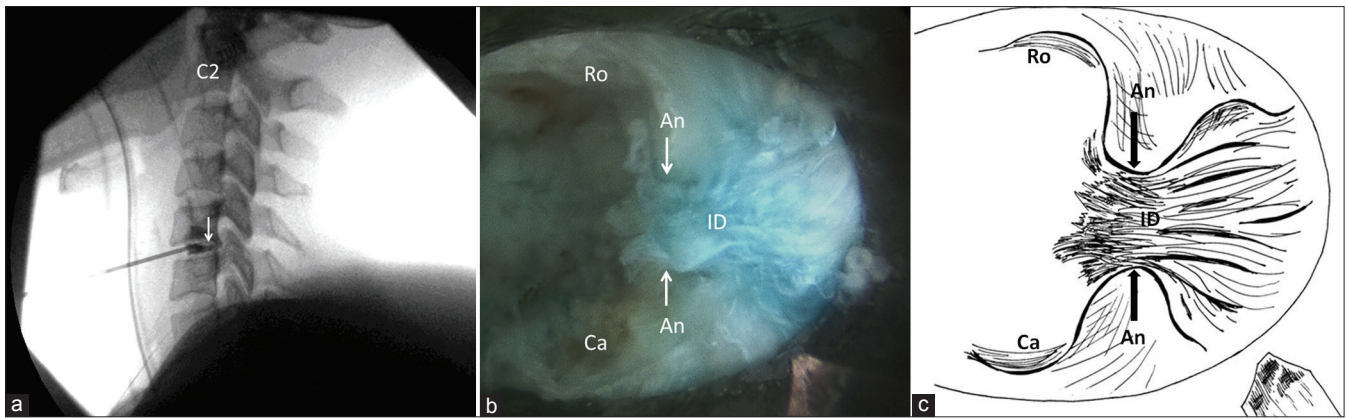


Figure 1: (a) Lateral intraoperative fluoroscopic image during cervical chromodiscography demonstrates C5-6 posterior annular tear with interposed disc material (arrow). (b) Intraoperative endoscopic image and (c) drawing demonstrate posterior annulus (An) with tear (arrows) and collagenized herniated nucleus pulposus (interposed disc, ID). Rostral (Ro) and caudal (Ca) endplates are visible

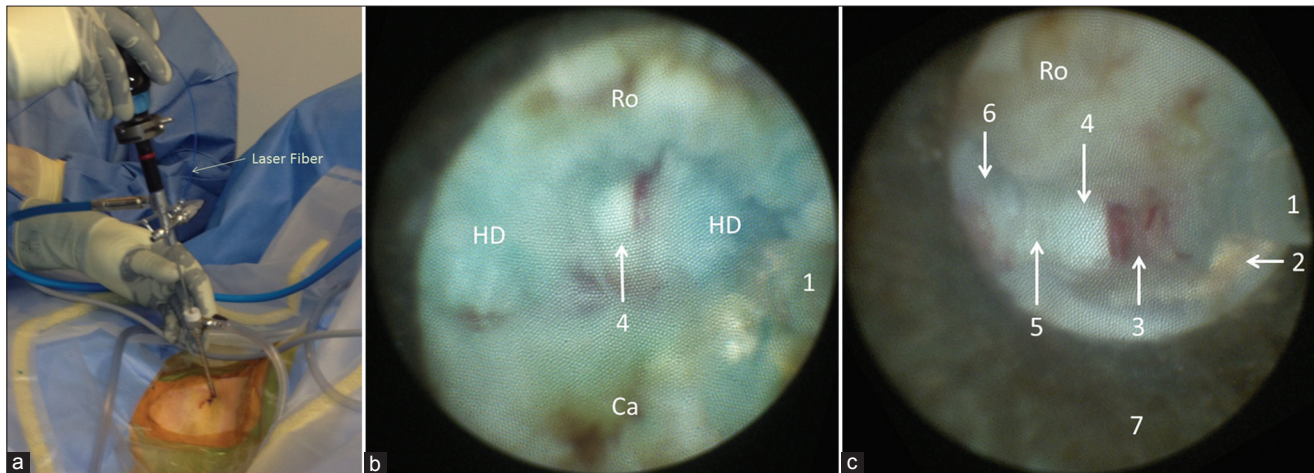


Figure 2: (a) Intraoperative photograph demonstrating anterior cervical approach and endoscope rigged with camera, laser fiber, irrigation and suction. (b) Endoscopic trans-discal view of the posterior disc shows laser fiber (1), herniated disc fragments (HD), rostral (Ro) and caudal (Co) endplates and dura of the lateral spinal cord (4). (c) Normal foraminal anatomy after Deuk Laser Disc Repair®. Herniated disc fragments have been removed endoscopically to reveal a decompressed foramen (3) and dura of the lateral spinal cord (4). The base of the unciniate process (2) is visible through the cannula (7). Also seen is the lateral border of the posterior longitudinal ligament (5) and debrided posterior annulus (6)

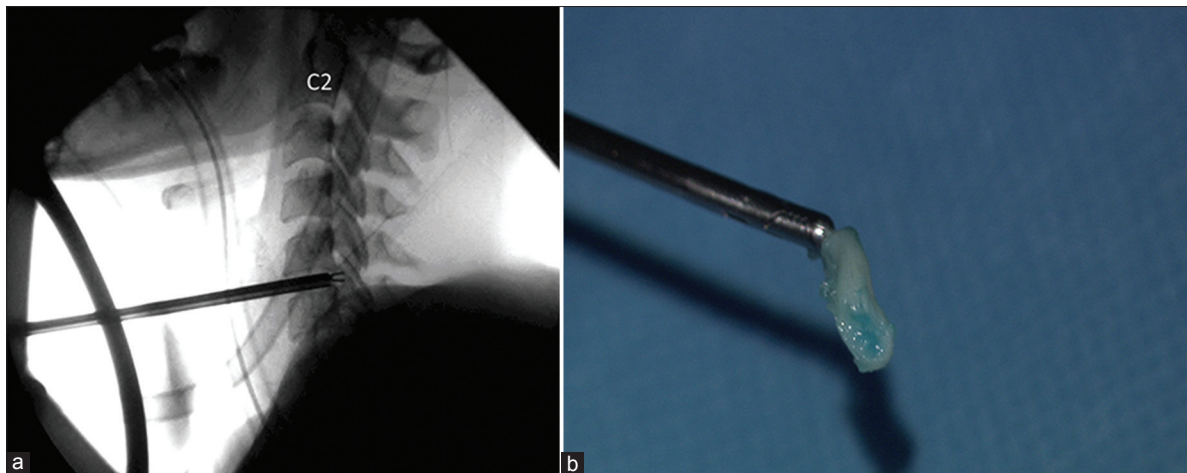


Figure 3: (a) Lateral intraoperative fluoroscopic image demonstrates the use of surgical graspers through the cannula to aid in the removal of herniated disc fragments endoscopically released by Holmium-YAG laser. (b) Photograph of grasper with cervical disc fragment

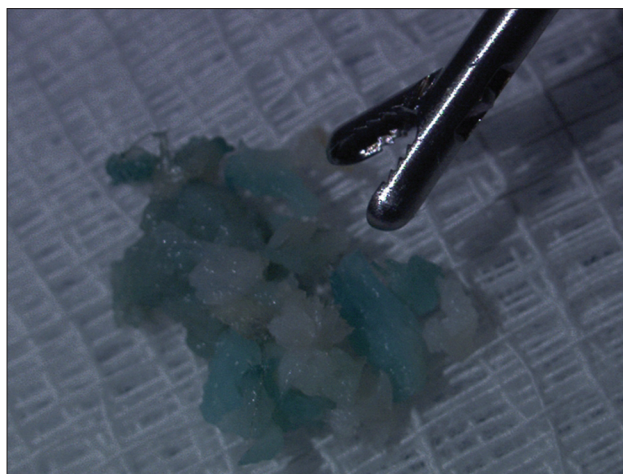


Figure 4: Photograph of multiple fragments of herniated disc material collected after removal during endoscopic cervical Deuk Laser Disc Repair®

Table 1: Incidence of perioperative complications for Cervical Deuk Laser Disc Repair®

New Neurological Deficit	0
Surgical Site Infection	0
Dysphagia/Hoarseness	0
Vascular Injury	0
Morbidity	0
ER or Hospital Admission in 30 days	0

encompasses three distinct endoscopic procedures: A selective partial discectomy, annular debridement, and foraminoplasty. During the discectomy, only the herniated fragment(s) and interposed disc material are selectively removed. The average volume of disc material removed was 0.09 ml or approximately 5% of the total normal cervical disc volume. Because this endoscopic approach does not require the removal of the intervertebral disc to reach the posterior disc–osteophyte complex there is no postoperative iatrogenic instability or deformity as is expected after discectomy with ACDF or arthroplasty. Therefore, interbody devices, fusion, implants, and biologics are not necessary to stabilize the operative segment. This surgery allows for decompression of both central and foraminal neural structures safely under direct endoscopic visualization. Using endoscopically guided laser energy, abnormal tissue along the annular tear is debrided while form and function are restored to the neuroforamina by removing disc–osteophyte complexes. Symptomatic posterior annular tears with interposed and herniated disc material are better visualized endoscopically by staining with acidophilic vital dyes during intraoperative nucleography. The safety of the Holmium-YAG laser has been well documented in the literature for use in spinal procedures^[2,3,7,9,11,12] and this may be related to the 0.5 mm accuracy of its vaporizing beam.

Potential benefits of Deuk Laser Disc Repair for symptomatic cervical disc disease include lower cost, smaller incision, nonfusion, preservation of segmental motion, outpatient, faster recovery, less postoperative analgesic use, fewer complications, no hardware failure, no pseudoarthrosis, no postoperative dysphagia, and no increased risk of adjacent segment disease as seen with fusion. Future studies will assess the clinical effectiveness of this novel procedure to treat cervical myelopathy, radiculopathy, discogenic neck pain, and cervicogenic headaches.

Reviewers comments and authors responses

The reviewers of this technical note submission had several comments and questions, we would like to further address here with clarification of several key points. One reviewer was concerned about the follow up period for the reported outcomes in this technical paper. The range of follow up is between 4 years and 4 months for the outcomes reported in this paper. Another reviewer requested further clarification on the indications for surgery on the treated disc(s). In this study, all patients that underwent the Deuk Laser Disc Repair surgery had structurally abnormal discs on MRI, symptoms and/or physical exam findings directly attributed to the discs treated, and additional diagnostic testing including medial branch blocks, electromyogram–nerve conduction study (EMG–NCS), CT scans and discography when necessary to confirm the source of the patient’s symptoms. All patients failed multimodality conservative management including therapy for at least 6 weeks and injections before they were considered for surgery.

Another reviewer comments “Furthermore, what does it mean they were offered surgery? Isn’t it the job of the surgeon to ‘select’ appropriate patients for surgery based on significant clinical and neurodiagnostic criteria?” and “Patients were all offered ACDF but opted for endoscopy; this clearly occurred secondary to surgeon preferences as otherwise how would patients even know to choose this alternative?” In response, it is our practice to offer patients multiple reasonable treatment options and never insist on one treatment only for their condition. If the patient meets clinical and radiographic criteria for surgical treatment of their symptomatic cervical disc disease, we will inform them of all reasonable treatment options including ACDF, artificial disc, foramenotomy, continued conservative management or endoscopic Deuk Laser Disc Repair. We discuss the pros and cons of each treatment option including chance of success, risks, recovery, return to work, cost, bracing, postoperative pain, durability of the treatment, types and frequency of complications, and other relevant considerations. Ultimately, we insist that the properly informed patient chose their own treatment.

Another comment was the following: “The target patient population had a myriad of complaints: neck/arm pain,

radicular complaints, numbness, paresthesias, and weakness; where are the focal neurological deficits?" Our response is that this submission is a "technical note"; however, we agree that patient reported outcomes are the primary endpoint to validate any new surgical technique. We look forward to presenting additional Deuk Laser Disc Repair patient reported outcomes data in the near future that will address this concern.

One reviewer commented that "The study was performed retrospectively. This is not an optimal study design. Additionally, the lack of a control group undergoing ACDF is also a shortcoming. I would, furthermore, like to see the results for the population without focal neurological deficits or radiographic findings (those with black discs) who were treated without surgery." The focus of this technical paper is to introduce a new technique for treating symptomatic cervical disc disease and describe the key components of the procedure, which we have done. We agree that a randomized prospective blinded study comparing ACDF to Deuk Laser Disc Repair is needed in the future to compare outcomes and cost; however, a control group is not needed to describe a new surgical technique.

One reviewer raised concerns over the safety of the anterior cervical endoscopic approach as evidenced in their comments. "This is shocking as the likelihood of encountering major vascular (carotid/ext. jugular), visceral (esophagus), or respiratory (trachea) structures is tremendous; this could potentially result in extreme bleeding/vascular laceration/requirement for repair etc., contamination of the wound/visceral fistula, and airway complications." We agree and we feel all surgery has the potential to be dangerous for the reasons listed when the surgeon does not have the proper experience and training to perform the procedure safely. Though this anterior approach has been performed worldwide hundreds of thousands of times by select surgeons, like any other surgery complications can be severe and life threatening. We would not recommend this type of surgery be performed by any spine surgeon that has not successfully completed an anterior cervical endoscopic fellowship training program.

Another comment made by a reviewer was "In such a large series of patients undergoing this procedure, the complete lack of complications must be questioned." We believe that the minimally invasive nature of this procedure helps to reduce the risk of complications typically associated with cervical disc surgery. Many spine surgery complications are related to implant or biologic use and since the Deuk Laser Disc Repair is performed without any implants or biologics there would obviously be fewer complications. As well, Deuk Laser Disc Repair is performed in the ambulatory setting, which is well known to have fewer complications than hospital-based

procedures.

Another comment with respect to the volume of disc removed was "The authors state the average amt. of disc (removed in only 2/3 of cases-why?) was 0.09 ml. With 1/3 having no specimen, and 2/3 having only an average of 0.09 ml, one must question the validity of this procedure in removing symptomatic disc material." The authors are very pleased with the fact that only 5% of the total disc volume is being removed during this surgery as our goal is to preserve the structural and functional integrity of the disc. We reported that one-third of the pathology reports did not mention the volume of disc received in the specimen we sent due to variation in the pathologist preparing the report. In every surgical case, roughly the same amount of collected disc-osteophyte material was sent to the pathology group in formaldehyde but some of the pathologists did not include the total volume of disc material sent over in their report. We are unable to acquire that additional data at this time.

Another comment was "All procedures were performed in an office based surgery center by the same surgeon. I have great reservations about the safety/efficacy of an outpatient setting for anterior cervical surgery. I would also want to ask who owns that center." The center is part of a multispecialty group practice with seven physicians, all use the surgical suite. As addressed with earlier references in this paper, the surgical approach has a well documented safety record and complications are rare when the surgery is performed by an experienced surgeon. Our experience of 142 patients and counting had no complications. There is certainly a trend across the United States and already established in other countries toward moving spine surgery to the outpatient setting to help control costs and improve patient satisfaction and safety.

REFERENCES

1. Chiu JC, Clifford TJ, Greenspan M, Richley RC, Lohman G, Sison RB. Percutaneous microdecompressive endoscopic cervical discectomy with laser termodiskoplasty. *Mt Sinai J Med* 2000;67:278-82.
2. Choy DS, Fejos AS. Cervical disc herniations and percutaneous laser disc decompression: A case report. *Photomed Laser Surg* 2004;22:423-5.
3. Choy DS. Percutaneous laser disc decompression: A 17-year experience. *Photomed Laser Surg* 2004;22:407-10.
4. Deukmedjian AJ, Cianciabella AJ, Cutright JM. Deuk Laser Disc Repair® is an effective treatment for Arm Pain from Cervical Disc Herniation. AANS 2012 Annual Meeting, published abstract #22463.
5. Deukmedjian AJ, Cianciabella AJ, Cutright JM. Deuk Laser Disc Repair® is an effective treatment for Neck Pain from Cervical Disc Herniation. AANS 2012 Annual Meeting, published abstract #22468.
6. Deukmedjian AJ, Cianciabella AJ, Cutright JM. Deuk Laser Disc Repair® is an effective treatment for Radicular Symptoms from Cervical Disc Herniation. AANS 2012 Annual Meeting, published abstract #22469.
7. Haufe SM, Mork AR, Pyne M, Baker RA. Percutaneous laser disc decompression for thoracic disc disease: Report of 10 cases. *Int J Med Sci* 2010;7:155-9.
8. Hellinger S. The fullendoscopic anterior cervical fusion: A new horizon for selective percutaneous endoscopic cervical decompression. *Acta Neurochir Suppl* 2011;108:203-7.

9. Knight MT, Ellison DR, Goswami A, Hillier VF. Review of safety in endoscopic laser foraminoplasty for the management of back pain. *J Clin Laser Med Surg* 2001;19:147-57.
10. Lee SH. Comparison of percutaneous endoscopic discectomy to open anterior discectomy for cervical herniations. *Internet J Minim Invasive Spinal Technol* 2001;17-19.
11. Li J, Yan DL, Zhang ZH. Percutaneous cervical nucleoplasty in the treatment of cervical disc herniation. *Eur Spine J* 2008;17:1664-9.
12. Li K, Qin H, Chen J. Clinical application of percutaneous laser disc decompression in the treatment of cervical disc herniation. *Zhongguo Xue Fu Chong Jian Wai Ke Za Zhi* 2007;21:465-7.
13. Miccoli P, Berti P, Raffaelli M, Materazzi G, Conte M, Faldini A. Minimally invasive approach to the cervical spine: A proposal. *J Laparoendosc Adv Surg Tech A* 2001;11:89-92.
14. Plum FA, Selby RM, Vizzone JP. Arthroscopic anterior discectomy of the cervical spine. *Arthroscopy* 2008;24:612-4.
15. Rubino F, Deutsch H, Pamoukian V, Zhu JF, King WA, Gagner M. Minimally invasive spine surgery: An animal model for endoscopic approach to the anterior cervical and upper thoracic spine. *J Laparoendosc Adv Surg Tech A* 2000;10:309-13.
16. Takayasu M. Less invasive surgery for cervical spine. *Brain Nerve* 2009;61:637-44.
17. Tzaan WC. Anterior percutaneous endoscopic cervical discectomy for cervical intervertebral disc herniation: Outcome, complications, and technique. *J Spinal Disord Tech* 2011;24:421-31.
18. Yao N, Wang C, Wang W, Wang L. Full-endoscopic technique for anterior cervical discectomy and interbody fusion: 5-years follow-up results of 67 cases. *Eur Spine J* 2011;20:899-904.

Commentary

This paper has generated a great deal of controversy among our reviewers. The authors are describing a technical procedure that has been done by others elsewhere. It is controversial from many aspects that the reader will learn from the paper, but, one in particular, that it is novel and varies from the standard approaches used. This work needs to be exposed to others to repeat, and verify. *Surgical Neurology International* has always been open to controversy and new ideas. At the end of the paper the authors have responded directly to the

questions and criticisms of the technique. Unless new ideas are published, they cannot receive the scientific evaluation of others that is necessary to justify their use or be discarded.

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