

## Biomechanical evaluation of the newly developed decompression surgery: Transforaminal ventral facetectomy

<b>University:</b> University of Toledo	
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<p><b>Need and Industrial Relevance:</b> Background: Transforaminal percutaneous endoscopic surgery has been established recently (Yeung. Mt Sinai J Med. 2000). Figure 1 demonstrates the endoscopic surgery. The 8 mm skin incision is made about 10 cm away from the midline; then, a cannula is inserted just beneath the herniated fragment. Under the guidance of the endoscopic view, the fragment can be removed. Under the local anesthesia, all procedure was possible. Thanks to the development of the high speed drill, endoscopic decompression surgery has become possible (Sairyo et al. J Med Invest 2014). Foraminal stenosis as well as lateral recess stenosis is the type of the lumbar spinal stenosis, and usually spinal fusion with decompression would be recommended to treat these pathology. The foraminal stenosis was the first to be decompressed with the endoscopic systems (Yeung. SAS J. 2007). Then, the percutaneous endoscopic transforaminal ventral facetectomy (PEVF) was developed in 2017 (Sairyo et al. J Med Invest 2017). Using the PEVF, foraminal and lateral recess stenosis can be simultaneously decompressed, and it may not necessitate additional fusion. However, the biomechanical effects of the PEVF are not clear.</p>	
<p><b>Project Aims (including Hypotheses):</b> To elucidate the biomechanical effects of the PEVF using the finite element model. Figure 2 demonstrates the CT scans before and after the PEVF. Please note that the ventral aspect of the facet joint is removed.</p>	
<p><b>Methods:</b> using our platform Finite Element technology/Models we first , we will create the following surgical model. 1) 50% PEVF (50% resection of the superior articular process(SAP)); 2) 100% PEVF (100% resection of the SAP); 3) 50% laminectomy with 50% medial facetectomy. Most of the patients who need the PELF are elderly patients; therefore, we will create the disc degeneration within the models. 1) Normal disc; 2) 50% disc collapse; 3) 100% disc collapse</p> <p>Thus, total 9 models will be created. Under the follower loading, flexion, extension, lateral bending and rotation will be applied with 15 Nm. Von Mises stresses and motion will be computed and compared. With these investigations, the biomechanical effects of the newly developed surgical method of PEVF will be revealed.</p>	
<p><b>Milestones:</b></p> <ul style="list-style-type: none"> <li>• Developed the first finite element model – Dec 31, 2017</li> <li>• Prepare the remaining models and start computing data – July 31, 2018</li> <li>• Finish data analysis – August 31, 2018</li> </ul>	

**Deliverables (must include):**

Quarterly presentation updates:

- December 2017 – conference call
- Spring 2018 – Spring Symposium @ UT (conference call option for non-UT teams)
- June 2018 – conference call
- September 2018 – Fall Symposium @ UCSF (conference call option for non-UCSF teams)

Final written report including results – November 2, 2018

Specific work product (e.g. protocols, material, device, database)

Publications: Abstracts and manuscripts

**General Budget Outline:**

Personnel	\$	25,000
Supplies/computer, etc.	\$	5,000
Software license fee	\$	2,000
Total Direct	\$	32,000
Indirects (10%)	\$	3,200
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Total	\$	35,200

**Start Date:** October 15, 2017

**End Date:** September 30, 2018)

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Fig 1. Percutaneous Endoscopic Discectomy (PED)

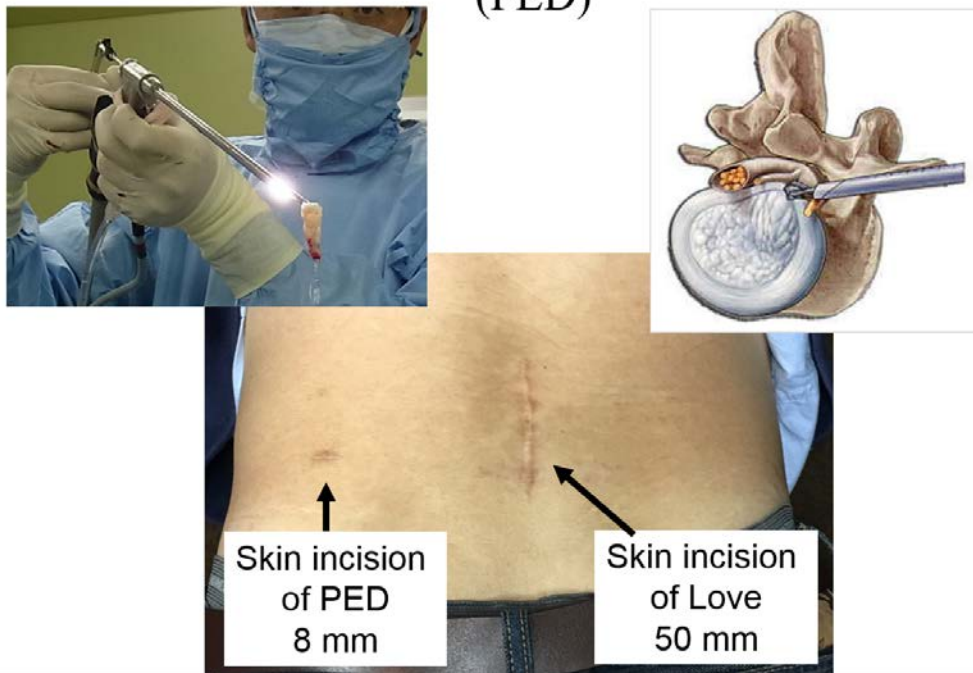
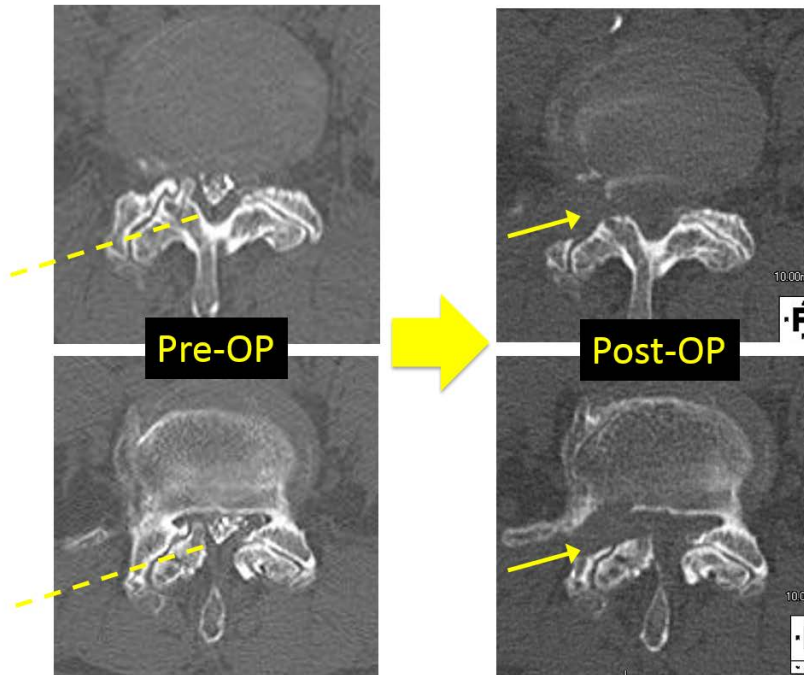


Fig. 2 Percutaneous Endoscopic Ventral Facetectomy



References:

- 1) Yeung A. The evolution of percutaneous spinal endoscopy and discectomy: state of the art. Mt Sinai J Med. 2000 Sep;67(4):327-32.
- 2) Sairyo K. et al. State of the art: Transforaminal approach for percutaneous endoscopic lumbar discectomy under local anesthesia. J Med Invest. 2014;61(3-4):217-25.
- 3) Yeung A. The Evolution and Advancement of Endoscopic Foraminal Surgery: One Surgeon's Experience Incorporating Adjunctive Technologies. SAS J. 2007 Aug 1;1(3):108-17.
- 4) Sairyo K. et al. A new concept of transforaminal ventral facetectomy including simultaneous decompression of foraminal and lateral recess stenosis: Technical considerations in a fresh cadaver model and a literature review. J Med Invest. 2017;64(1.2):1-6.