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ATLANTIC  
UNIVERSITY**

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Announces the Ph.D. Dissertation Defense of

**UTPAL K. DHAR**

for the degree of Doctor of Philosophy (Ph.D.)

**Laminectomy and Minimally Invasive Surgery for Human Lumbar  
Spine.**

**July 2, 2025; 11.45am**

**EW, Room # 187**

**777 Glades Road**

**Boca Raton, FL**

**Join Zoom Meeting**

**<https://fau-edu.zoom.us/j/84357409384?pwd=MEVFob3xH3eAiX53QZqLcPwDldOUil.1>**

**Meeting ID: 843 5740 9384**

**Passcode: Gd8LGZ**

**DEPARTMENT:**

Ocean and Mechanical Engineering

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**PH.D. SUPERVISORY COMMITTEE:**

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**ABSTRACT OF DISSERTATION**

Lumbar spinal stenosis (LSS), disc degeneration disease (DDD), and spondylolisthesis are among the most common conditions affecting the human lumbar spine. Various surgical methods are available to treat these disorders. Laminectomy and minimally invasive surgery (MIS) are among the most commonly used procedures for their management. LSS refers to a narrowing of the space within the spinal canal, which can occur at any level but is most common in the lumbar spine. Spondylolisthesis is defined as an anterior translation of upper vertebra relative to the lower one and frequently occurs at the L5-S1 level. Degenerative Disc Disease is a condition characterized by the gradual loss of hydration and elasticity in the intervertebral discs of the spine, leading to reduced disc height, disc bulging, and in some cases, herniation. The traditional bilateral pedicle screw system has been used for the treatment of various lumbar spine conditions including advanced degenerative disc disease. However, there is an ongoing need to develop more effective and less invasive techniques. Open laminectomy and minimally invasive laminectomy (MIL) procedures are the most common surgical gold standard techniques for treating LSS. The aim of this dissertation is to draw comparisons between open laminectomy and various MIL techniques. The MIL variation comprises microendoscopic decompression laminotomy, unilateral partial hemilaminectomy, and microendoscopic laminectomy. In this dissertation, the range of motion (ROM), von Mises stresses, and stability were compared. MIL involves less bone and ligament removal, resulting in shorter hospital stays and lower reoperation and complication rates than open laminectomy. It improves the quality of health-related living standards and reduces postoperative pain. Biomechanical studies suggest that laminectomy and facetectomy increase annulus



stress and ROM, leading to segmental instability. Theoretically, MIL means less tissue injury, pain, and faster recovery in the short term, although the long-term results depend on the adequacy of the decompression procedure and tend to be independent of MIL or open laminectomy. While studying the minimally invasive surgery, transdiscal screw system was compared with traditional bilateral screw system for low/high-grade spondylolisthesis and degenerative disc degeneration. Generally, transdiscal screw system exhibited biomechanical superiority over traditional bilateral pedicle screw system.

#### **BIOGRAPHICAL SKETCH**

Born in Chittagong, Bangladesh

B.S., Bangladesh University of Engineering and Technology, Bangladesh 2008.

M.S., Politecnico Di Milano, Italy, 2012

PhD, Florida Atlantic University, USA, 2025

#### **CONCERNING PERIOD OF PREPARATION**

#### **& QUALIFYING EXAMINATION**

**Time in Preparation: 2021-2025**

**Qualifying Examination Passed: Fall 2021**

#### **Published Papers:**

**Dhar, U.K.**, Menzer, E.L., Lin, M., O'Connor, T., Ghimire, N., Dakwar, E., Papanastassiou, I.D., Aghayev, K., Tsai, C.T. and Vrionis, F.D., 2024. Open laminectomy vs. minimally invasive laminectomy for lumbar spinal stenosis: a review. *Frontiers in Surgery*, 11, p.1357897.

**Dhar, U.K.**, Sultan, H., Aghayev, K., Tsai, C.T. and Vrionis, F.D., 2024. Biomechanical assessment of anterior plate system, bilateral pedicle screw and transdiscal screw system for high-grade spondylolisthesis: a finite element study. *Frontiers in Bioengineering and Biotechnology*, 12, p.1491420.

**Dhar, U.K.**, Menzer, E.L., Lin, M., Hagerty, V., O'Connor, T., Tsai, C.T. and Vrionis, F.D., 2023. Factors influencing cage subsidence in anterior cervical corpectomy and discectomy: a systematic review. *European Spine Journal*, 32(3), pp.957-968.

**Dhar, U. K.**, Kamran Aghayev, Hadi Sultan, Saahas Rajendran, Chi-Tay Tsai, and Frank D. Vrionis. 2025. "Finite Element Analysis of Biomechanical Assessment: Traditional Bilateral Pedicle Screw System vs. Novel Reverse Transdiscal Screw System for Lumbar Degenerative Disc Disease" *Bioengineering* 12, no. 6: 671.

Aghayev, K., **Dhar, U.K.**, Tsai, C.T., Ahmedov, M. and Vrionis, F.D., 2024. Sacrolumbar Interbody Fusion (SLIF): Feasibility, Technical Nuances, Biomechanical Assessment, And Clinical Outcomes. *Spine Surgery and Related Research*, 8(4), pp.448-457.

Lin, M., Paul, R., Liao, X., Doulgeris, J., Menzer, E.L., **Dhar, U.K.**, Tsai, C.T. and Vrionis, F.D., 2023. A New Method to Evaluate Pressure Distribution Using a 3D-Printed C2-C3 Cervical Spine Model with an Embedded Sensor Array. *Sensors*, 23(23), p.9547.

Lin, M., Doulgeris, J., **Dhar, U.K.**, O'Corner, T., Papanastassiou, I.D., Tsai, C.T. and Vrionis, F.D., 2023. Effect of graded posterior element and ligament removal on annulus stress and segmental stability in lumbar spine stenosis: a finite element analysis study. *Frontiers in Bioengineering and Biotechnology*, 11, p.1237702.

Lin, M., Paul, R., **Dhar, U.K.**, Doulgeris, J., O'connor, T.E., Tsai, C.T. and Vrionis, F.D., 2023. A review of finite element modeling for anterior cervical discectomy and fusion. *Asian spine journal*, 17(5), p.949.

#### **Conference:**

**Dhar U.K.**, Kamran Aghayev, Chi-Tay Tsai, Frank D. Vrionis, O'Connor TE. Novel Sacro-lumbar interbody fusion (SLIF) technique. Feasibility, technical nuances and clinical outcomes. 2024 SMISS Annual Meeting, Las Vegas, NV.

#### **In preparation:**

Cage subsidence effect in different internal fixation system for degenerative disc degeneration and spondylolisthesis.