A New Procedure for Total Nucleus Removal from the Posterior Approach

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INTRODUCTION: A traditional discectomy aims at removing primarily herniated nerve compressing tissue. Contrary, nuclear replacement devices require as much nucleus material removed as possible in order to optimize the positioning and size of the device as well as associated load transfer capabilities while minimizing endplate disruption [1, 2]. Therefore, total nucleus removal (TNR) is a requisite for a successful clinical outcome. However, until now, a method for TNR from the posterior approach has not been available. The purpose of the study was to document and develop a method for posterior monoportal TNR.

METHODS: Twelve human cadaveric discs were used in an iterative posterior monoportal approach to document the capability of a wide range of instruments in removing nucleus tissue from various anatomical zones. New instruments were developed if zones could not be reached using traditional surgical instruments. The thoroughness of each step was evaluated using an imaging balloon filled with contrast medium and taking fluoroscopic images from multiple directions. A templating technique, assessing the shape and volume of the nucleus cavity, was used to guide the TNR procedure. The implant used was a two-part in situ curable polyurethane, which is implanted through a 5.5mm annulotomy under controlled pressure while in liquid form and being contained within a polyurethane expandable balloon (Disc Dynamics, Inc., DASCOR™).

RESULTS: Performing a posterior monoportal TNR while maintaining a minimal annulotomy proved difficult with traditional nucleotomy instruments. Consequently a surgical map of the nucleus (Figure 1) was created, based on a given instruments ability to reach a particular zone. Furthermore visualization techniques for intraoperative assessment of the procedure were developed. With a specific sequence of fluoroscopic views and the measurement of calibrated pictures, important target criteria could be controlled. Measurement in the human cadaver studies demonstrated that TNR could be accomplished and the nucleus replacement device accurately conformed to the size and shape of the nucleotomy space, as predicted by intraoperative measurements and calculations.

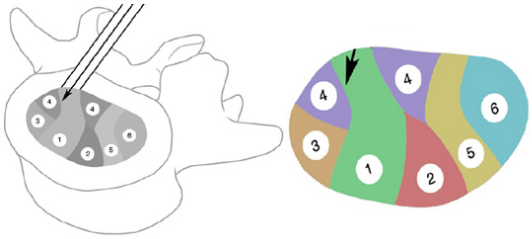

Fig. 1: Surgical map for TNR from a posterior approach

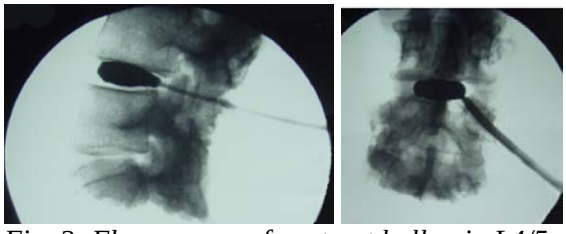

Fig. 2: Fluoroscopy of contrast ballon in L4/5 of a posterior TNR approach

DISCUSSION & CONCLUSIONS: A posterior TNR using a monoportal approach presents technical challenges due to anatomical limitations, particularly at the lower lumbar levels. By utilizing a mapping technique for nucleus removal combined with fluoroscopic imaging of a contrast-filled balloon, remaining nucleus material was identified and systematically removed. Experimental findings have demonstrated the technique's reliability which is currently being adopted in a prospective multi-center clinical study.

REFERENCES: [1] Q.B Bao, H.A Yuan (2002) *Spine* **11**:1245-47. [2] U. Fernstrom (1966) Acta Chir Scand **355**:154–9.