# SPINE STABILITY AFTER TREATMENT OF DEGENERATED INTERVERTEBRAL DISCS WITH PERCUTANEOUS CEMENT DISCOPLASTY

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## Introduction

Low back pain can be caused by nerve compression due to stenosis of the foramen associated with intervertebral disc degeneration. Invasive surgical solutions are not suitable for old patients with comorbidities. A minimally invasive approach, percutaneous cement discoplasty, has been recently developed for the polymorbid patients [1]. The mechanical impact on the spine stabilization and surrounding tissues have not been investigated yet. This *in vitro* study aimed at: (1) testing the stabilization of human spine segments after discoplasty by monitoring the disc height and the range of motion (ROM), (2) preventing complications by assessing the strains on the specimen surface, (3) relating the surgery quality to the biomechanical stability of the spine segments.

## Methods

27 fresh-frozen human cadaveric lumbar FSUs were obtained from 15 donors (35-86 y.o., 63-132 kg) after ethical approval. The soft tissues were removed, leaving the ligaments intact. The specimens were potted with the intervertebral disc horizontal and prepared with a water-based white-on-blue speckle pattern in order to measure surface strains with Digital Image Correlation (DIC) [2]. The specimens were mechanically tested in flexion and extension under 50% body weight axial load combined to an offset. The ROM, the stiffness, and the disc height were measured. Disc surface images were recorded and analysed by a 3D-DIC system using optimized parameters. Cement distribution within the disc and surface contact with the endplates were analysed from CT scan segmentations. The specimens were tested under two conditions:

(i) Simulated degeneration: the intervertebral disc manually emptied through an incision in the annulus.

(ii) Discoplasty: after acrylic cement injection (Mendec Spine, Tecres, Italy).

## Results and Discussion

Discoplasty increased the disc height by 34% in flexion and 35% in extension compared to the degenerated conditions, thus increasing the width of the foramens. On the contrary, discoplasty only impacted the ROM in flexion with a 27% reduction with respect to nucleotomy condition. Discoplasty was associated with a 37% increase of stiffness in flexion and a reduced neutral zone. The highest strains were exhibited in the disc after nucleotomy. Cement injection resulted in a restrained gradient over the disc, with a localization of compressive strains along the endplates.

## Conclusion

Similarly to clinical observations, discoplasty recovered the disc height, thus rehabilitating the neuroforamen area. The large volumes of cement improved spine stability in flexion resulting in stiffer segments. Disc tissue underwent reduced deformations which concentrated on the endplates.

## References

1. Varga *et al*, Der Ortho, 44:1-8,2015.
2. Palanca *et al*, MEP, 52: 76-83, 2018.

## Acknowledgements

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## Ethical approval

The entire study was approved by the bioethical committee of University of Bologna, protocol 76497 of 1st June 2018. The specimens were obtained through ethically-approved International donation programs.