DIN - DEPARTMENT OF INDUSTRIAL ENGINEERING

PhD Course in Mechanics and Advanced Engineering Sciences (DIMSAI)

PHD STUDENT POSTER - *2016/2017* **Curriculum number *II*** **Cycle *XXXII***

Candidate: *Maria Luisa Ruspi* **Supervisor:** *Luca Cristofolini*

DEVELOPMENT AND APPLICATION OF METHODS FOR THE BIOMECHANICAL CHARACTERIZATION AND OPTIMIZATION OF IMPLANTABLE DEVICES FOR THE SPINE

INTRODUCTION

Severe spinal deformities are treated with surgeries fixing the vertebrae using a system of pedicle screws and posterior rods in order to reestablish the physiological curvature of the spine. The percentage of failures for this type of intervention is about 25-30%.

AIMS

The aim of this study is to understand the biomechanical behavior of untreated and treated segments of spine in order to give information to reduce the percentage of failures that occur after the surgeries using the Digital Image Correlation (DIC).

CONCLUSIONS

- Applicability of DIC system on complex specimens, to examine in detail the biomechanics of spine in terms of displacement and strain of vertebral body, intervertebral disc, ligaments and posterior rods
- Application of DIC in studying the biomechanical behavior of human untreated and treated spines and in the different surgical techniques

PLANNING NEXT RESEARCH

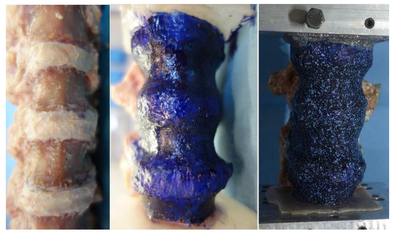
1. Elaboration of data acquired on human spine to evaluate the effect of each sequence of surgical intervention
2. Analyse the biomechanical effect of the different loading rates on segments of spine

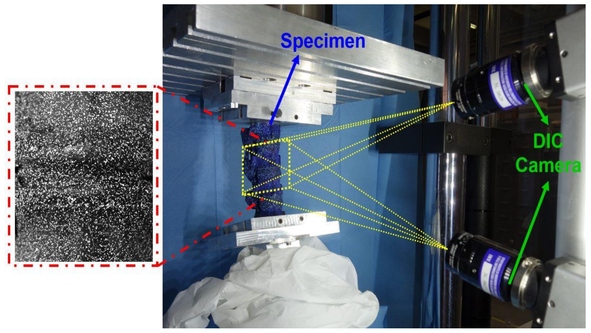
CONTACTS

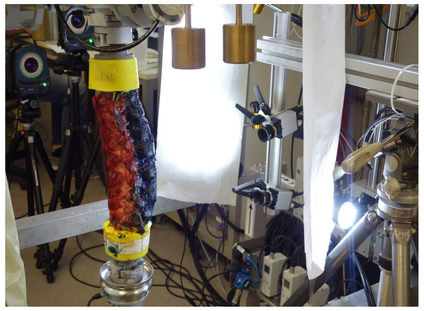
Maria Luisa Ruspi
Department of Industrial Engineering
marialuisa.ruspi2@unibo.it
Via Terracini 24
40131-Bologna, Italy

EXPERIMENTAL PROCEDURE OF 1st YEAR

DIC consists of the acquisition of pictures of a specimen which is deformed by a load and calculates the strain distribution following the movement of the surface of the specimen. The specimen must be prepared with a high contrast speckle pattern.





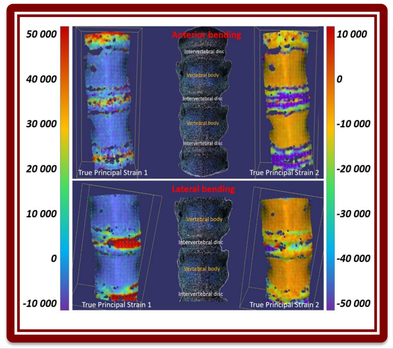


***In vitro* tests:**

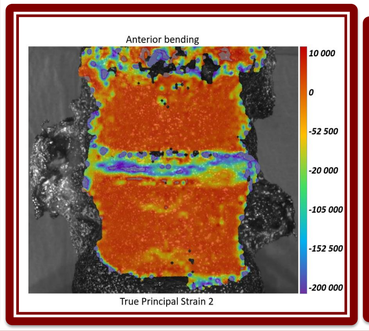
1. Pre-test on rigid block
2. Pilot porcine
3. Human uni-axial load*
4. Human multi-axial load*

RESULTS & DISCUSSION OF 1st YEAR

Pilot porcine

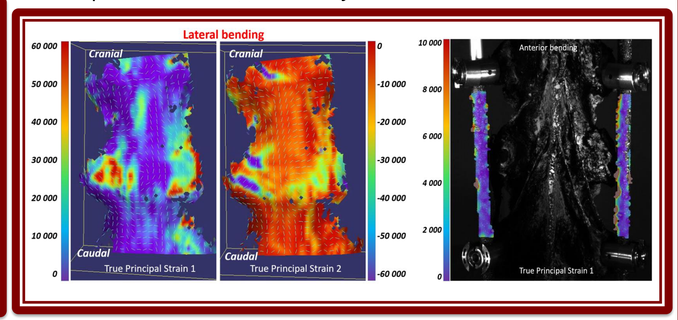


Human uni-axial



Human multi-axial*

*In collaboration with Politecnico di Milano, IRCCS Galeazzi Orthopaedic Institute, Laboratory of Ulm



REFERENCES

1. **Ruspi M. L.** et al. «Full-field in vitro investigation of hard and soft tissue», Muscle, Ligaments and Tendons Journal, 2017, in press
2. Palanca, M., Miguel M., **Ruspi M. L.** et al., «Full-field strain distribution in multi-vertebrae spine segments» , MEP, 2017 , under revision
3. **Ruspi M. L.** et al., «Effect of surgical interventions on the spine», under preparation

ALMA MATER STUDIORUM - UNIVERSITÀ DI BOLOGNA
IL PRESENTE MATERIALE È RISERVATO AL PERSONALE DELL'UNIVERSITÀ DI BOLOGNA E NON PUÒ ESSERE UTILIZZATO AI TERMINI DI LEGGE DA ALTRE PERSONE O PER FINI NON ISTITUZIONALI