IN VITRO CHARACTERIZATION OF LOAD TRANSFER IN CERVICAL DISC REPLACEMENT ARTHROPLASTY

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Introduction

Degenerative cervical pathologies are growing, and the conventional treatment in cervical and lumbar is a fusion procedure. This kind of procedure involves a replacement of the disc using a static solution, such as cement, screws, or an implant. This replacement is associated with some potential complications such as, for example, a pathology of the adjacent segment or loss of mobility in the spine region [1, 2]. Cervical disc arthroplasties were developed as an alternative to fusion, and several prosthesis concepts are available in the market [3].

The present in vitro study analyzed the load transfer in adjacent vertebras using the Mobi-C concept in the cervical region in comparison with the intact condition.

Materials and methods

An experimental model was created to mimic the cervical spine in a tensile tester machine to test the natural and prosthetic disc (figure 1). The C5 and C6 vertebrae were chosen for this study because they are located in the lower part of the cervical spine where loads applied are higher. Different materials are used in this system including the vertebrae, support pieces, the Mobi-C disc, a natural disc model, ligaments, and tri-axial strain gauges. The assembly can mimic the neutral, flexion of 10 degrees and extension of 10 degrees of the spine. Strain gauge sensors were used to evaluate the deformation in the anterior and posterior facets of the vertebral body of each vertebra.

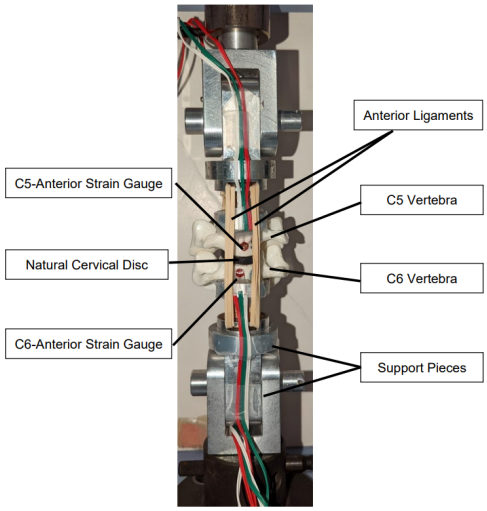

Figure 1: Experimental apparatus to study the cervical disc arthroplasty (intact condition).

Results

When comparing the natural and prosthetic models, it was concluded that the assembly with the natural discs distribute the load applied to the system less evenly across the vertebral body than the prosthetic disc. The difference between the highest strain value and the lowest is 517.53 µm/m for the natural disc model and 205.75 µm/m for the prosthetic disc model.

The disparity between values in different sensors is noticeably higher in the natural disc than in the prosthetic disc (figure 2). The main conclusion was that the prosthetic disc distributes the load of the cervical spine on the vertebral body more than the natural disc model due mainly to its geometry and fixation region.

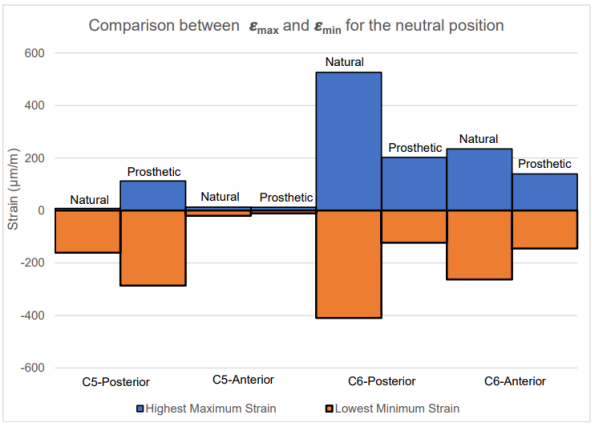

Figure 2: Comparison of natural joint and implanted cervical prosthesis.

Conclusions

The strain analysis in the experimental assembly suggests that the Mobi-C implant transfers the load mainly around the vertebra center and can promote bone loss in the external cortical of adjacent vertebras.

References

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