

# ROLE AND LIMIT OF BIOMECHANICAL MODELING IN THE STUDY OF MEDICAL DEVICES

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*Introduction* – Although it is only a part of their therapeutic effect, the mechanical effect of compression or contention medical devices (CCMD) is always claimed by the manufacturers. However, the mechanism between the pressure application zone and the targeted organ is complex. It involves a purely passive mechanical effect and mechanisms related to the tonic postural system. Various strategies can be implemented to show the effectiveness of a mechanical action; among them, biomechanical modeling is able to consider complex mechanical effects before any clinical trial.

*Objective* – This work aims to describe the contributions of a biomechanical modeling in understanding the action of CCMD using as an illustration the lumbar belt treatment of chronic and sub-chronic back pain.

*Material and Methods* – Three successive models are described: a finite elements model of the intervertebral discs, coupled with a low intensity X-ray imaging, a finite elements model of the entire trunk, including the spine but also the soft tissue of the abdomen and finally a purely analytical model based on external measurements of the trunk shape.

*Results* – These three models correspond to different questioning: the first shows that the use of lumbar belts changes the pressure in the back of intervertebral discs and therefore pain. The second allows knowing the most important parameters on posture – trunk shape, belt properties – from the others – abdominal tissues. Finally, the third model specifies the mechanical efficiency of a given lumbar belt on a specific patient.

*Discussion/Conclusion* – Each of the three proposed models answers to a specific question and cannot substitute for the other. The finite elements model used in the first two models is tedious to implement due to the geometry, obtained by segmentation of medical images, and calculation time can be high. However, this is a rich method, accurately describing the studied mechanical system and leading to detailed results. The analytical approach used in the third model requires more approximation, but its lower calculation time allows deployment in research and development units and clinics.