The Contribution of the Thoracolumbar Fascia to the Spine's Stiffness

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HYPOTHESIS In many cases of back pain, no specific diagnosis can be made [2]. The present study suggests that the thoracolumbar fascia and its extensions may play a role in explaining certain cases of undiagnosed back pain. Fascia represents one of the many structures that contribute to the static equilibrium of joints, which means that it contributes to the mechanical stiffness of joints. Because joints have stiffness properties, if a joint is subjected to a displacement, a restoring force is produced by the joint structures. The structure that contributes the most to the joint's stiffness will likely suffer the first traumatic consequences. The objective of this study was to determine if the thoracolumbar fascia contributes significantly to the spine's stiffness in forward flexion.
METHODS A simplified model of the spine was built with MSC.Adams to determine the contribution of the lumbodorsal fascia to the apparent stiffness of the spine in passive forward flexion. The posterior structures that could contribute the most to the spine's stiffness were included in the model (Fig. 1). These structures are the posterior ligaments, the passive extensor muscles, and the posterior lumbodorsal fascia. The intervertebral discs were also included in the model. Since each structure was represented as a linear spring, conservative approximations were made according to the literature to evaluate the stiffness of each spring. The input to the model was a forward force of 10N to the top vertebrae, and the output was the total displacement of the top vertebrae. From this data, the contribution of each structure to the apparent stiffness of the spine in forward flexion was evaluated.
RESULTS Results suggest that the thoracolumbar fascia and its extensions could contribute as much as the posterior ligaments to the stiffness of the spine in forward passive flexion. Although other posterior structures are much stiffer than the fascial tissue, the results of this study can be attributed to the fact that the posterior fascia possesses the largest moment arm in generating passive tension in forward flexion of the spine [1].
CONCLUSIONS The thoracolumbar fascia has the potential to be the posterior structure that contributes the most to the stiffness of the spine in forward flexion. The fascia could therefore be subjected to traumatism if the spine is displaced in a way that exceeds its mechanical limits. This finding could have clinical applications in the way back pain is diagnosed, treated and prevented.

REFERENCES

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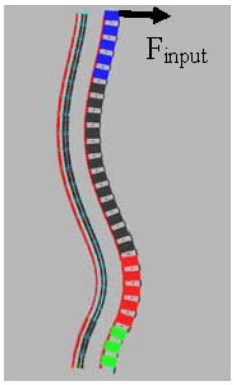

Fig. 1: Biomechanical model of the spine and the structures contributing to its passive stiffness in forward flexion.