Fascia is Able to Contract and Relax in a Smooth Muscle-like Manner

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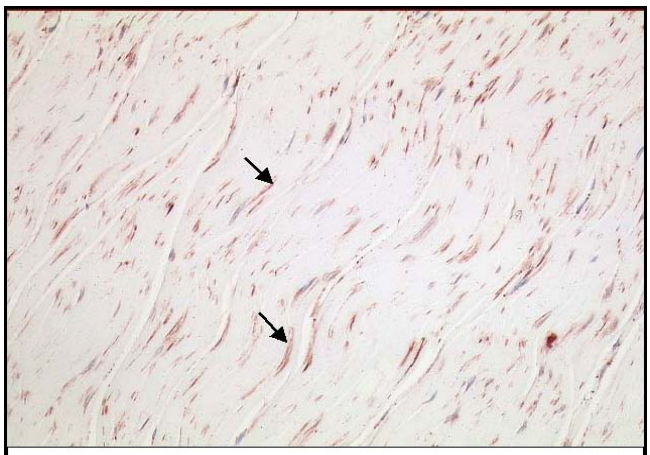
HYPOTHESIS Clinical observations from osteopaths and acupuncturists suggest that fascia may be able to autonomously change its stiffness. This study examined the hypothesis that fascia – due to the presence of smooth muscle-like fibroblasts (myofibroblasts) – can actively contract and thereby influence musculoskeletal dynamics.

METHODS Fascia pieces were stained immunohistochemically with the monoclonal myofibroblast marker alpha-smooth muscle actin. Samples of lumbodorsal fascia, plantar fascia and fascia lata from 32 human bodies were used.
Additionally mechanographic force measurements were conducted using strips of fresh rat lumbodorsal fascia and human fascia lata. Force differences between maximal tissue contraction and relaxation were hypothetically calculated for the cross sectional area of all lumbar fasciae at the level of L4/L5 in an average human body.

RESULTS Immunohistochemistry: Myofibroblasts were present in all tissues. Their density in the lumbodorsal fascia was significantly higher than in plantar fascia or fascia lata ($p<0.05$).
Mechanographic tests were performed in an organ bath under isometric strain, checking the response to pharmacological stimulation. Stimulation with the myofibroblast agonist mepyramine elicited active tissue contractions lasting up to 2hrs. Stimulation with the smooth muscle relaxant glyceryl trinitrate induced relaxation. Unviable control tissues did not react, indicating that a cellular mechanism caused the response. The maximal observed force difference (3.6mN/mm^2) if applied to the human lumbar area would predict a total contraction force of >5N.

CONCLUSIONS Fascia is populated by myofibroblasts and is therefore able to actively contract and relax over a period of minutes or hours. This capacity seems to be especially expressed in human lumbodorsal fascia. The potential tonus changes in this fascia are strong enough to be palpable and to impact musculoskeletal dynamics; such as through gamma motor regulation. This suggests that fascial tonicity may be an important and previously overlooked factor influencing low back stability. It also offers interesting implications for fascia-directed therapies like acupuncture, osteopathy, or Rolfing.



Typical immunohistochemical section from human lumbar fascia. Arrows indicate examples of stress fiber bundles containing alpha smooth muscle actin (a marker for myofibroblasts), which are stained in dark red. Length of image 225 µm.

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