

On the effect of repetitive loading on the spine of young elite athletes

Clinical and experimental studies

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligen försvaras i Aulan, Sahlgrenska Universitetssjukhuset, Blå stråket 5, fredagen den 3 juni 2016, klockan 09.00

av

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Leg läkare

Fakultetsopponent:

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Avhandlingen baseras på följande delarbeten:

- I. *Olof Thoreson MD, Adad Baranto MD, PhD, Lars Ekström BS, Sten Holm PhD, Mikael Hellström MD, PhD, and Leif Swärd MD, PhD.*
The immediate effect of repeated loading on the compressive strength of young porcine lumbar spine. Knee Surg Sports Traumatol Arthrosc (2010) 18:694-701.
- II. *Olof Thoreson MD, Lars Ekström Bs, Hans-Arne Hansson MD, PhD, Carl Todd MSc, DO, Wisam Witwit MD, Anna Swärd MD, Pall Jonasson MD, PhD, and Adad Baranto MD, PhD.*
The effect of repetitive flexion and extension fatigue loading on the young porcine lumbar spine. MRI and histological analyzes. Submitted May 2016.
- III. *Olof Thoreson MD, Karin Svensson, Pall Jonasson MD, Peter Kovac MD, Leif Swärd MD PhD, Adad Baranto MD, PhD.*
Back pain and MRI abnormalities in the thoraco-lumbar spine of elite long distance runners. A cross sectional study. Medical Research Archives (2015): Vol.2 Issue 4, 22-28.
- IV. *Olof Thoreson MD, Peter Kovac MD, Anna Swärd MD, Cecilia Agnvall PT, Carl Todd MSc, DO and Adad Baranto MD, PhD.*
Back pain and MRI changes in the thoraco-lumbar spine of young elite Mogul skiers. Submitted Dec 2015



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Introduction: The human spine is exposed to many different loads during daily activities and especially during sporting activities. The spine has different biomechanical properties during the lifetime and thereby responds differently to repetitive and sudden loads. The correlation of different motions and load exposures to spine and back problems have not yet been fully clarified.

Aim: To investigate the effect of repetitive loading of different magnitude and motion on the spine with both clinical and experimental studies. To investigate the prevalence of LBP and the amount and type of spinal abnormalities on MRI in the spine that young elite athletes in mogul skiing and long distance running are subjected to due to the repetitive loading in their sports compared to non-athletic controls. To investigate the failure and fatigue responses in young porcine Functional Spinal Units (FSU) due to repetitive loading.

Methods and results: The prevalence of LBP and spinal abnormalities were investigated in two cross sectional studies, with young long distance runners and mogul skiers compared to matched control groups with questionnaires and MRI assessment. The results displayed significantly higher lifetime LBP in runners (45%) than the corresponding controls (12%) while no significance was seen between the skiers (50%) and their control group (42%). The mogul skiers had significantly more MRI abnormalities in mean than the control group (7.3 vs 3.8, $p < 0.023$) and no significant difference was seen between the runners and controls (5.6 vs 9.2).

The fatigue and failure response of young porcine FSUs were investigated in two experimental motion settings. The results displayed that the FSUs were resilient towards the induced fatigue loading in both axial and flexion-extension motions. The endplate and the growth zone displayed corresponding histological and MRI changes and fractures as fatigue and failure responses.

Conclusion: LBP is common among young athletes and the frequency of spinal abnormalities seem to increase with greater spinal load magnitude. Repetitive loading of the young porcine spine cause fatigue and failure responses mainly localized in the growth zone and the endplate.

Keywords: spine, intervertebral disc, athlete, young adult, low back pain, magnetic resonance imaging, porcine, repetitive loading, failure, fatigue

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