The Akt signaling pathway is activated in porcine patello-femoral joint cartilage after cyclic compression

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Introduction:
Protein kinase B (Akt) dependent signaling pathways induced by mechanical loading have been identified in a variety of tissues. However, there is no evidence for a potential regulation of Akt in cartilage mechanotransduction. This study was conducted in order to determine whether or not Akt in chondrocytes is regulated by mechanical loading. In addition, the time course of Akt activation was characterized in response to cyclic compression and the frequency of the load applied.

Methods:
Patello-femoral joints of fifteen 3-month-old pigs (42 ± 2 kg) were loaded in compression at 500 N for 150 s either dynamically at 12 Hz (n = 5) or 1 Hz (n = 5) or statically (n = 5) using a custom-designed loading frame. Left-side knees served as intervention, right-side as unloaded control. Cartilage samples were harvested at different times after mechanical loading. Immunohistochemistry on cartilage specimens was carried out to detect phospho-Akt and staining pattern was semi-quantitatively analyzed. A paired ttest was used (SPSS, $p<0.05$) to determine significant differences between loaded and unloaded cartilage samples.

Results:
A downregulation of Akt phosphorylation was seen in cartilage 300 s after mechanical loading, whereas Akt phosphorylation remained unchanged in unloaded specimens. In addition, regulation of Akt appeared to change with the frequency of loading, presenting different patterns in Akt phosphorylation with static and dynamic loading. Variations in Akt Dhosnhorvlation were detected in different zones of cartilage.

Discussion:
Akt signaling in porcine patello-femoral joint cartilage is dependent upon frequency of loading and the time interval between loading and cartilage harvest.

Conclusion:
We conclude that Akt might play a role in cartilage mechanotransduction.