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## 7th World Congress of Biomechanics

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#### Presentation Abstract

Session: Thursday General Poster Session

Presentation: Relationship between Knee Adduction Moment during Gait and Cartilage Mechanical Properties in Patients with Severe Knee Osteoarthritis

Presentation Time: Thursday, Jul 10, 2014, 9:00 AM - 5:00 PM

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**Abstract:** **INTRODUCTION:** Mechanical loading is suggested to play a key role in development and progression of knee osteoarthritis (OA) by diminishing compositional and mechanical quality of joint cartilage. The knee adduction moment is widely used as an indicator of knee joint loading in the frontal plane during dynamic activities. Although gait loading parameters have been correlated with cartilage morphology [1], they have never been associated with cartilage mechanical properties. Therefore, the aim of this study was to analyze potential relationships between knee loading parameters during gait and compressive properties of knee cartilage of patients with severe OA.

**METHODS:** Eleven patients with severe knee OA undergoing knee replacement (KR) (total KR n=7; unicompartmental KR medial n=2, lateral n=2) were subjected to gait analysis before surgery. 3D kinematics and kinetics were collected using a 10 infrared camera system and 2 force plates. Knee joint adduction moment was calculated by inverse dynamics and 1<sup>st</sup> and 2<sup>nd</sup> peaks during stance phase were analyzed. During KR surgery, cartilage samples of the tibia plateau were collected and mechanical creep indentation tests were performed at central load-bearing regions. Two steps of compressive stress (0.011 and 0.028 MPa) were applied for 500 seconds each. Total creep of each loading step normalized to cartilage thickness ( $C_{norm}$ ) and aggregate modulus ( $H_A$ ) were determined for both medial and lateral tibia plateaus. Correlation coefficients were calculated between knee adduction moment and mechanical properties ( $C_{norm}$  and  $H_A$ ) for medial and lateral tibia plateaus, respectively.

**RESULTS:** For the medial plateau, stresses of 0.011 and 0.028 MPa resulted in mean  $C_{norm}$  of  $13.3 \pm 9.7\%$  and  $19.3 \pm 13.2\%$ , respectively, and an  $H_A$  of  $0.18 \pm 0.07$  MPa was determined. For the lateral plateau, mean  $C_{norm}$  of  $10.0 \pm 4.8\%$  and  $13.9 \pm 6.8\%$  were observed for the two steps of stress, respectively, and an  $H_A$  of  $0.20 \pm 0.07$  MPa was calculated. Mean knee adduction moment was  $0.31 \pm 0.19$  N m/kg for the 1<sup>st</sup> peak and  $0.26 \pm 0.19$  N m/kg for the 2<sup>nd</sup> peak. No significant correlations were found between knee adduction moment (1<sup>st</sup> and 2<sup>nd</sup> Peaks) and material properties ( $C_{norm}$  and  $H_A$ ) neither for the medial nor the lateral tibia plateaus.

**CONCLUSION:** Although joint mechanical load has been considered a risk factor for OA progression, cartilage compressive properties are not related to knee adduction moment during gait in patients with severe OA. High variability was observed in material properties indicating a complex relationship between joint loading and tissue changes during degenerative processes of articular cartilage.

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