

## Longitudinal femorotibial cartilage thickness increase in young athletes at the end of adolescence

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max 2750 (currently 2736)

**Background/Purpose:** Anterior and posterior cruciate ligament (ACL/PCL) rupture is considered a scientifically valuable “model” of pre-radiographic knee osteoarthritis (KOA), in which preventive therapy (by surgery, drugs, or physiotherapy) can be tested. This is because of the high incidence of KOA after the injury, and the precise set-point of the trauma, from which longitudinal observations can be made. Quantitative measurement of cartilage thickness change with MRI provides a powerful and sensitive tool for longitudinal analysis of structural cartilage change before, during, and after the onset of radiographic KOA. Because ACL/PCL rupture frequently occurs in young athletes, the purpose of this study was to explore the normal longitudinal subregional femorotibial cartilage thickness change in such subjects, specifically at the end of adolescence.

**Methods:** The knees of the dominant leg (the one used for take off) of 18 young volleyball athletes (Olympiastützpunkt Berlin) was examined. One participant was retrospectively excluded because of a history of ACL rupture, and one because of an imaging artefact. The age range (n=16; 8 female, 8 male) was 15-17 y at baseline. MR images were acquired with a FLASH 3D VIBE with water excitation (1.5 x 0.31 x 0.31mm<sup>3</sup> resolution), at baseline and two years later. Femorotibial cartilage thickness was measured by manual segmentation, using the above images and commercially available software (Chondrometrics GmbH, Ainring, Germany). Cartilage thickness data were computed in the medial (MFTC) and lateral femorotibial compartment (LFTC), in tibial and femoral cartilages, and in 16 femorotibial subregions.

**Results:** Amongst the 16 subjects, 11 displayed open epiphyses at baseline, and all participants closed epiphyses at 2 year follow-up. In the MFTC, a cartilage thickness increase of  $+114 \pm 126 \mu\text{m}$  (mean  $\pm$  standard deviation) or  $+3.3 \pm 3.7\%$  was observed, with a standardized response mean (SRM= mean /standard deviation of change) of  $+0.90$ . This increase was less in the LFTC ( $+2.3 \pm 2.5\%$ ; SRM  $+0.93$ ); and it was greater in the weight-bearing medial femur ( $+4.4 \pm 3.7\%$ ; SRM  $+1.19$ ) than in the medial tibia ( $+2.0 \pm 4.3\%$ ; SRM  $+0.46$ ). The greatest increase was observed in the internal aspect of the medial femur ( $+5.5 \pm 5.8\%$ ; SRM  $+0.94$ ) whereas no relevant change was seen in the internal aspect of the medial tibia ( $-0.5 \pm 6.6\%$ ; SRM  $-0.07$ ). Over the two years, the subchondral bone area (tAB) increased by  $0.8 \pm 1.5\%$  in the MFTC and by  $1.2 \pm 1.2\%$  in the LFTC.

**Conclusion:** A substantial increase in femorotibial cartilage thickness (and subchondral bone area) was observed in young athletes towards the end of adolescence (i.e. a period during which the epiphyseal line is closing). This increase needs to be taken into account when measuring cartilage thickness change in young subjects after ACL/PCL rupture. Clinical trials investigating the potential benefit of preventive therapy in young adults with cruciate ligament rupture should hence include a healthy reference cohort of the same age, in order to be able to differential pathological (post traumatic) changes from those occurring physiologically.