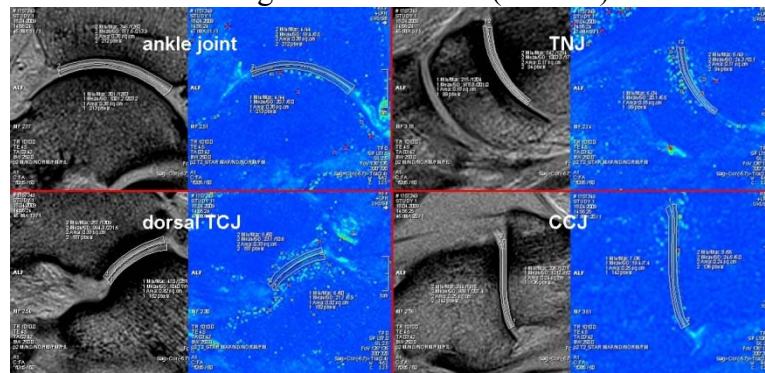


Accompanying mobile MRI T2*-mapping of ankle- and hindfoot joint cartilage on 22 endurance athletes during a transcontinental footrace over 4,500 km using a 40-tonnes truck trailer.

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Introduction. Despite the knee joint, nearly nothing is known about ankle and backfoot joint cartilage adaption during endurance running on marathon distances. There are even no MR investigations on ultra runners published regarding these joints. The TransEurope FootRace 2009 was a unique ultra-endurance footrace over 4,500 km through 6 countries from the South of Italy to the North Cape. 67 ultra runners took the challenge. They were accompanied by a research team with a mobile MRI on a 40-tonnes truck day by day, when running 70.1 km per stage over 9 weeks (64 stages) without any day rest.

Methods. According to a randomization plan 22 of the participants got repeated MRI on ankle and backfoot joints in regular intervals (before start, at km 594, 1218, 2162, 3007, 3673 and 6-7 months after race) over these 9 weeks of multistage ultra marathon (MSUM). The total equipment, including an external diesel generator for



independence from electricity, has to build up and down daily, following the subjects to their next stage finish line. For ankle and backfoot joints measurements on the mobile magnethom (1.5T, Avanto®, Siemens) the following protocols were used: TIRM sag: TE 60; TR 11320, IR 120, / protone density weighting: TSE fs tra; TE 32, TR 5830, ST 4, / StarMap® (Siemens) flash sag: T2*weighting GRE, TE 4,5, TR 1010, ST 2,5 (Figure 1).

Figure 1: T2*-mapping of ankle joint, talonavicular (TNJ), talocalcaneal (TCJ) and calcaneocuboidal (CCJ) joint.

Results.

Compared to start, there are significant increases of mean T2* values detectable in all cartilage layers of ankle, talocalcaneal joints, calcaneocuboidal joint and talonavicular joint. Significance is evaluated for all measurement intervals during the MSUM ($p < 0.05$). Over the time, we found relevant decreasing of mean T2* values in the ankle joints cartilages during the MSUM (Figure 2). In the backfoot joints mean T2* value decreases in follow-up were seen also, but not on a significant level. Changes regarding morphological criteria like volume or thickness of cartilage layers were not seen for any of the investigated joints during whole MSUM.

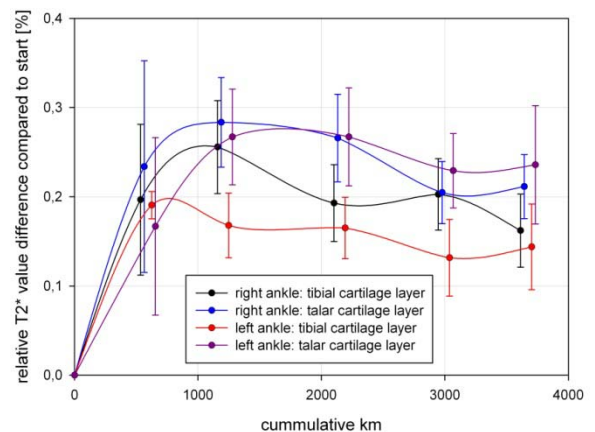


Figure 2: T2*-mapping of ankle joint (mean, SE)

Discussion. In literature recovery of superficial cartilage layer hydration due to single marathon running burden beneath 24 hrs for femorotibial joint is shown. Our results show hyperhydration (T2* value increase) of the cartilage in ankle and all backfoot joints due to ultramarathon burden. But the capability of cartilage hydration seems to decrease, when there is a daily endurance running burden of nearly two marathons over weeks. In general, quantitative T2* value decrease is described in degenerative cartilage processes. Our results indicate, that the longer a MSUM is, the higher is the tendency for degenerative processes in cartilages of ankle and backfoot joints. Although a critical border of T2* value loss seems not to be reached in trained ultra runners, when running through a continent.