

T2 Mapping and Functional Outcome of Patients With Medial Knee Osteoarthritis After the use of Unloader Bracing

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Summary:

Medial unloader bracing provides small, subjective improvements in patients with unicompartmental osteoarthritis; these improvements are likely not due to physiological changes in articular cartilage.

Abstract:

Introduction:

Osteoarthritis (OA) is a debilitating and costly disease, affecting 27 million Americans and costing over \$60 billion annually. Most clinical treatments are aimed at minimizing pain and maintaining quality of life as opposed to altering disease processes. Unloader knee braces improve mechanical alignment and provide a non-invasive, conservative form of treatment for patients with mild to moderate OA. However, previous studies have not identified a quantifiable, sustained benefit to this treatment. The purpose of this study was to evaluate the effect of unloader bracing on patients with unicompartmental, medial knee OA using quantitative T2 mapping MRI in attempt to elucidate whether bracing results in physiological articular cartilage changes.

Methods:

Seven patients with Kellgren-Lawrence grade 1 or 2 OA of the medial compartment (4 males, 3 females) were scanned at baseline and following a 3-month period of unloader knee bracing. All knees were imaged at 3.0 Tesla in the sagittal plane using a Discovery MR750 scanner and an 8-channel transmit-receive knee coil. Cartilage was manually segmented in five regions of interest (ROIs) in the medial femur using OsiriX: medial anterior femur (MAF), medial central femur (MCF), medial posterior femur (MPF), medial anterior tibia (MAT), medial posterior tibia (MPT). T2 fit maps were generated and T2 relaxation times were measured pre- and post-bracing. Patients completed a daily bracing diary to document the amount of time for which the brace was worn, along with the Knee Osteoarthritis Outcome Score (KOOS) and Visual Analog Scale (VAS) questionnaires at baseline and at 3-months follow-up. Braces also included iButton technology, which acquired temperature readings every 20 minutes to objectively document hours of brace-wear.

Results:

According to bracing diaries, braces were worn for an average of 35.7 hours per week versus 28.1 hours according to the iButton sensor. Daily bracewear was also overestimated by patient diaries versus the iButton sensor (5.09 vs. 4.15 hrs per day). The average T2 relaxation time of articular cartilage of the medial femur pre-bracing was 35.88 ± 4.24 ms versus 40.54 ± 4.77 ms post-bracing ($p=0.150$). In the medial tibia, the average T2 relaxation time of cartilage was 40.97 ± 5.11 ms pre-bracing vs. 38.49 ± 5.87 ms post-bracing ($p=0.814$). There were no significant results when the regions were further subdivided (MAF, MCF, MPF, MAT, MPT). Improvements were seen in the VAS pain score (2.4 pre-bracing vs. 1.2 post-bracing) as well as the KOOS pain, daily living, function, and quality of life sub-scores following the bracing period, however these results did not reach statistical significance ($p>0.05$).

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Discussion and Conclusion:

Existing literature fails to provide a consensus regarding the use of unloader bracing for unicompartmental knee OA. Two recent studies suggest small, subjective improvements following unloader bracing. Our results support these findings, indicating that there may be a subjective benefit to unloader bracing in patients with medial knee OA. However, this is likely not due to physiological changes in cartilage. We saw no significant differences in the T2 relaxation times of medial articular knee cartilage after a 3-month bracing period. An overestimation of brace wear with patient diaries versus the iButton temperature sensor was also observed.