

Quantitative assessment of cartilage injury with patellar instability using T2 mapping: regional variations and associated clinical factors

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INTRODUCTION:

Patellar instability frequently affects adolescents and young adults, often resulting in altered joint loading and progressive cartilage degeneration. Cartilage injury occurs in 32-96% in knees with patellar instability, and [common areas of chondral loading include the lateral facet due to lateralization of the patella, as well as medial facet due to dislocation events](#). T2 mapping is a novel imaging sequence on magnetic resonance imaging (MRI) that offers a non-invasive approach to assess cartilage matrix integrity. This study aimed to identify regional patterns of cartilage degeneration in knees with patellar instability and to determine the relationship with clinical and morphologic risk factors.

METHODS:

This prospective study included patients with recurrent patellar instability who underwent knee MRI with T2 mapping sequences. Axial T2 mapping was performed with a slice thickness of 3 mm, capturing five contiguous images centered on the patella. On each image, the patellar cartilage was manually segmented into medial, central, and lateral regions of interest (ROIs) (Figure 1). T2 values were calculated as the mean of each regional ROI across all slices. T2 values reflect cartilage water content and collagen matrix organization, with elevated T2 values indicating early matrix degeneration. To aid in clinical interpretation, each regional T2 value was further classified as “normal” or “abnormal” using a previously validated threshold of 47 milliseconds. Associations between abnormal T2 values and these clinical or morphologic variables were explored to identify potential predictors of focal cartilage degeneration.

RESULTS:

Forty patients (mean age 25.3 ± 8.8 years; 77.5% female) were included. T2 values significantly differed across regions: medial 56.0 ± 12.0 ms, central 45.0 ± 13.0 ms, and lateral 44.0 ± 12.0 ms ($p < 0.0001$). The medial region showed greater T2 values than both central and lateral regions ($p < 0.0001$ for both) (Figure 2). Abnormal cartilage was identified in 80% of medial, 43% of central, and 30% of lateral regions. Central cartilage degeneration was associated with older age ($p = 0.008$) and a longer duration from initial dislocation to MRI ($p = 0.004$). Each additional year since first dislocation increased the odds of central degeneration (OR 1.2). In contrast, the number of dislocations showed no such association. Medial cartilage degeneration was correlated with lower Kujala scores (OR 1.1). No significant clinical predictors were found for lateral cartilage abnormality, or within the remaining clinical or morphologic risk factors.

DISCUSSION AND CONCLUSION:

T2 mapping sequences on MRI identified significantly elevated medial cartilage T2 values in patients with patellar instability. Degeneration in the central cartilage were found to increase with each additional year since first dislocation. Further studies are recommended to identify and modulate the progression of subclinical chondral changes to optimize patellar stabilization procedures in minimizing the risk of posttraumatic osteoarthritis.

