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Original article

Long-term assessment of meniscal extrusion after meniscal repair

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ABSTRACT

Background: Arthroscopic meniscal repair limits the medium-term risk of radiological osteoarthritis. Magnetic resonance imaging (MRI) cannot provide an accurate assessment of meniscal healing but may show harbingers of osteoarthritis such as meniscal extrusion. The objective of this study was to assess long-term meniscal extrusion after meniscal repair.

Hypothesis: Arthroscopic meniscal suture is not followed by meniscal extrusion and can, therefore, provide good knee function in the long-term.

Methods: Consecutive patients who underwent arthroscopic meniscal suture on a stable or stabilised knee were included retrospectively. MRI was performed to measure absolute meniscal extrusion (AME), relative meniscal extrusion (RME), anterior sagittal extrusion (ASE), posterior sagittal extrusion (PSE), coronal cartilage coverage index (cCCI), and sagittal cartilage coverage index (sCCI).

Results: After a mean follow-up of 8.8 ± 0.87 years, there was no evidence of meniscal extrusion in these patients with stable or stabilised knees: AME, 1.7 ± 1.03 and 2.3 ± 0.93 mm, RME, $17 \pm 0.10\%$ and $28 \pm 0.12\%$, ASE, 2.52 ± 1.43 and 1.71 ± 2.42 mm, PSE, 0.29 ± 3.49 and 0.22 ± 2.35 mm, cCCI, $23 \pm 0.08\%$ and $20 \pm 0.09\%$, and sCCI, $49 \pm 0.10\%$ and $53 \pm 0.09\%$.

Conclusion: In the long-term after meniscal repair, osteoarthritis is limited and meniscal function seems preserved.

Level of evidence: IV, retrospective study.

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1. Introduction

Meniscal repair is indicated to treat trauma-related injuries to the peripheral meniscus with either a stable knee or a tear in the anterior cruciate ligament (ACL). Meniscal preservation aims to prevent the development of knee osteoarthritis [1]. Arthroscopic meniscal repair has been shown to limit the development of osteoarthritis in the medium-term [2]. However, follow-up did not exceed 10 years in most studies, and osteoarthritis may occur only after a longer interval.

Meniscal extrusion is defined as extension of the meniscal margin by at least 3 mm beyond the tibial margin [3]. Meniscal extrusion is strongly associated with cartilage damage [4], may herald the development of osteoarthritis, and may be related to impaired meniscal function [5–7].

Magnetic resonance imaging (MRI) fails to accurately assess meniscal healing [8], as persistent high signal of unclear meaning is common even 10 years after meniscal repair. However, MRI may detect indirect evidence or harbingers of osteoarthritis, such as meniscal extrusion and subchondral bone oedema.

The objective of this study was to evaluate the frequency of meniscal extrusion 10 years after meniscal repair on stable or stabilised knees. The working hypothesis was that meniscal extrusion is rare after meniscal repair, indicating that the procedure exerts a lasting chondroprotective effect.

2. Material and methods

Patients who underwent arthroscopic meniscal repair between January 2005 and May 2009 were included in a retrospective study. Inclusion criteria were age older than 18 years or parental consent for younger patients, meniscal lesion confirmed by arthroscopy, stable or stabilised knee, and follow-up of 6 years or more. Exclusion criteria were age older than 50 years, tears in multiple ligaments, osteoarthritis grade 3 or higher in the Ahlback classification, and degenerative meniscal lesions.

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Ligament reconstruction was performed in patients with ACL tears, who were included in the stabilised-knee group. A bone-patellar tendon-bone or semi-tendinosus/gracilis (STG) graft was harvested from the same knee. Patients whose ACL was intact were classified in the stable-knee group.

The following variables were collected before and after surgery for each patient, age, knee alignment, constitutional ligament laxity, joint motion range, IKDC score, and type of ACL reconstruction in the stabilised-knee group. The arthroscopic features of the meniscal lesion were recorded: side, type, length, number of sutures, and distance from the meniscal margin.

MRI was performed at last follow-up using the PACS system (Picture Archiving and Communication System Centrality, General Electric, Milwaukee, WI, USA). T2-weighted images were obtained. The coronal slice through the centre of the femoro-tibial compartment was used to measure absolute meniscal extrusion (AME) [9] as the extension in millimetres of the meniscal margin beyond the tibial plateau margin, without taking osteophytes into account (Fig. 1). On the same slice, relative meniscal extrusion (RME) or percentage of extruded meniscus was determined as the ratio of AME over total meniscus size in the coronal plane [10,11] (Fig. 1). The sagittal slice through the centre of the femoro-tibial compartment was identified by counting the total number of slices through the compartment and selecting the middle slice. This middle slice served to measure anterior sagittal extrusion (ASE) as the distance between the anterior meniscal margin and anterior tibial cartilage margin and posterior sagittal extrusion (PSE) as the distance between the posterior meniscal margin and posterior tibial cartilage margin [12] (Figs. 2 and 3). The same coronal and sagittal slices were used to measure the coronal cartilage coverage index (cCCI) and sagittal cartilage coverage index (sCCI) as the percentage of tibial cartilage covered by the meniscus (i.e., the ratio of tibial cartilage covered by the meniscus over total tibial cartilage) (Fig. 4). The intra-observer and inter-observer reproducibility of these measures has been assessed previously [13].

Statistical analysis: quantitative variables were described as the median and range or interquartile range (IQR) depending on

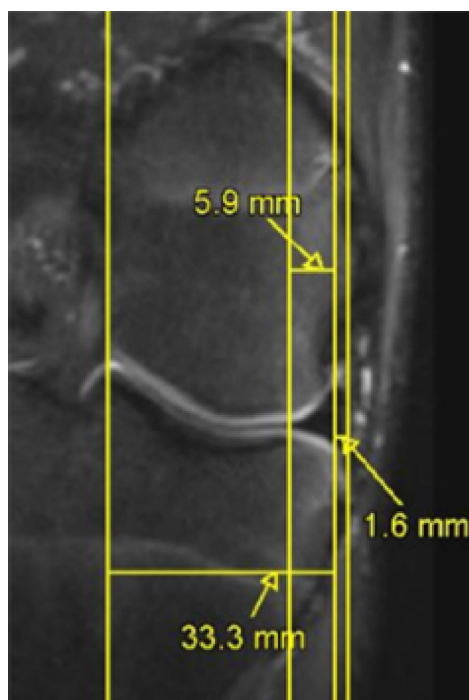


Fig. 1. Coronal slice: measurement of absolute meniscal extrusion, relative meniscal extrusion, and cartilage coverage index.

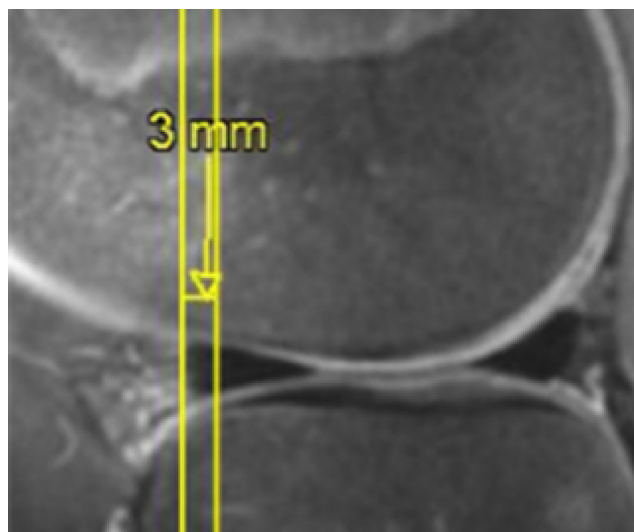


Fig. 2. Sagittal slice: measurement of anterior sagittal extrusion.

the parameters selected to report the results. Qualitative variables were described as n (%).

The clinical study variables in the stable-knee and stabilised-knee groups were compared by univariate analysis using the Mann-Whitney test or Chi² test or Fisher's exact test, as appropriate.

SAS 9.4 software (SAS Institute, Cary, NC, USA) was used for the statistical analyses. Values of $P < 0.05$ were considered significant.

3. Results

Of the 31 included patients, 11 had stable knees and 20 stabilised knees (patellar tendon graft in 15 and STG graft in 5). Mean age at surgery was 21 years (13–45) in the stable-knee group and 27 years (9–49) in the stabilised-knee group. Before surgery, radiological evidence of osteoarthritis was visible in a single patient (in the stabilised-knee group). Varus malalignment was present in 5 patients, 2 in the stable-knee and 3 in the stabilised-knee group. Mean preoperative range of passive flexion was 136° (90–150) in the stable-knee group and 135° (135–140) in the stabilised-knee group. An extension lag of 10° was noted in 6 patients (2 in the stable-knee and 4 in the stabilised-knee group). Table 1 reports the arthroscopic features of the meniscal lesions. No radial or complex tears were found.

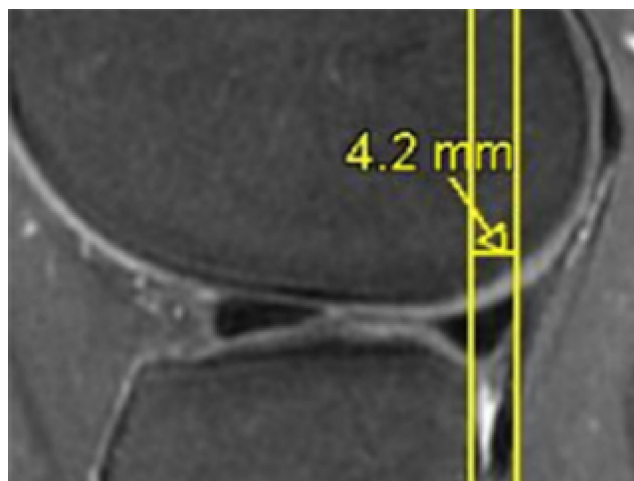


Fig. 3. Sagittal slice: measurement of posterior sagittal extrusion.

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