

dGEMRIC Evaluation 9 to 20 Years after Autologous Chondrocyte Implantation in the Knee

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INTRODUCTION: Cartilage lesions in knee due to acute or chronic trauma are often associated with impairment. Autologous Chondrocyte Transplantation (ACT), first introduced in 1987 in Sweden, has been the gold standard treatment for cartilage lesions. The aim of the study was to assess the long-term status of isolated cartilage lesions in the knee after ACT using delayed Gadolinium Enhanced Magnetic Resonance Imaging (dGEMRIC).

METHODS: MRI were performed on a 1.5T Philips system using a transmit/receive body coil. Indirect MRI arthrography was performed after injection of 30 ml of double dose of Gadolinium (Magnevist). All patients were given the same dose. The patients exercised for about 15 minutes after the injection. MRI was performed 90 minutes after the contrast injection. dGEMRIC scans were obtained using a 3D T1 TFE scan from the ACI region with TR /TE -7.4/3.6 ms, flip angle 20 degrees, TFE factor 15, and a water-fat shift 0.87 pixels. The inversion time (TI): 96, 150, 350, 650 and 1650ms. T1 maps were obtained by utilizing a custom-written software program MRIMapper (copyright Beth Israel Deaconess Medical Center and MIT). For each knee T1 map image data set, two regions of interest (ROI) were evaluated - ROI 1 in the implant and ROI 2 in adjacent native tissue. The ratio of ROI 1/ROI 2 was recorded.

RESULTS: Scans were obtained from 31 patients (5 bilateral lesions) total of 36 lesion sites, representing an f/u period of 9.5 to 18.5 years post-implant. Six scans were uninterpretable due to poor image data or cartilage too thin to evaluate. The mean ROI index ratio (ROI 1/ROI 2) was 0.96 (range 0.59-1.28). In 20/30 (67%) cases the ROI ratio was greater than 0.90. The analyses revealed a tendency for better ROI ratio in the cases without OCD and without a history of subchondral bone surgery ($p=0.10$ and $p=0.08$ respectively). There was no statistically significant association between the ROI ratio and the clinical scores.

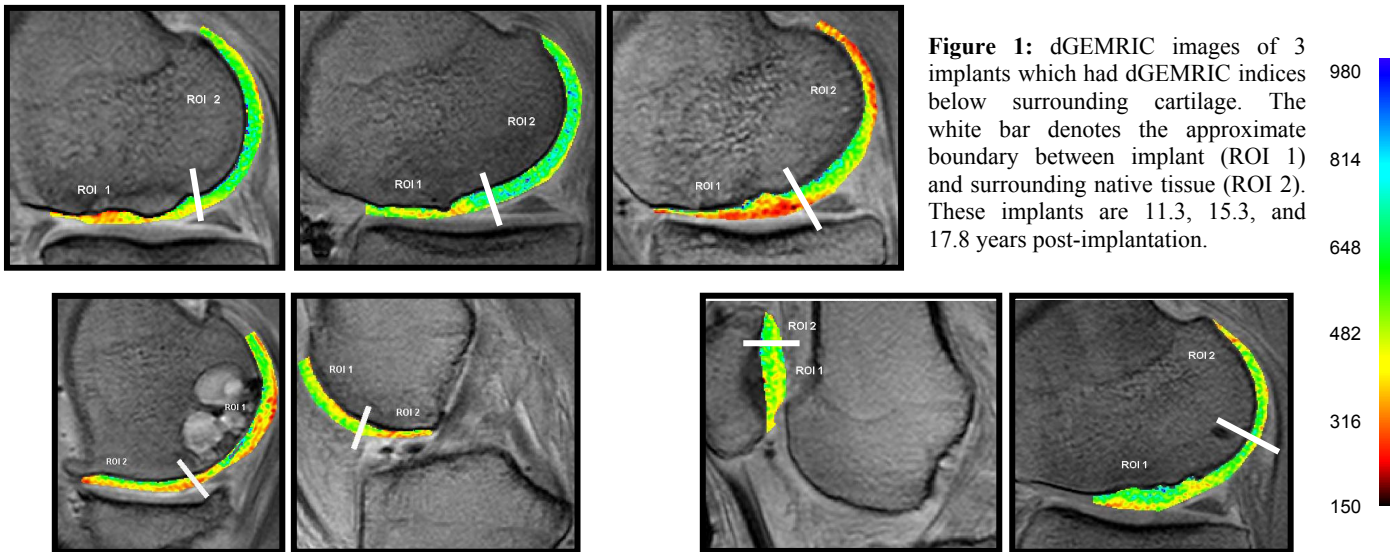


Figure 1: dGEMRIC images of 3 implants which had dGEMRIC indices below surrounding cartilage. The white bar denotes the approximate boundary between implant (ROI 1) and surrounding native tissue (ROI 2). These implants are 11.3, 15.3, and 17.8 years post-implantation.

Figure 2 (left, above): Some of the implants had mixed areas of high and low dGEMRIC indices similar to surrounding native tissue. These implants are 11.7 and 14.5 years post-implantation.

Figure 3 (right, above): Examples of dGEMRIC images where the implant had values close to surrounding native tissue; these implants are 12.9 and 11.6 years post-implantation.

DISCUSSION: The dGEMRIC technique has been used in ACI follow up studies [1, 2, 3]. This is the first report of a long-term follow-up of cartilage implants utilizing dGEMRIC. In the majority the dGEMRIC indices were comparable to surrounding tissue. (Direct comparisons between the absolute value of dGEMRIC between patients could not be performed as all the patients had the same contrast dose; relative values within an individual should not be affected.) In this study, ROI 2 cannot automatically be considered to be a true “control” given the time lapse since the trauma / surgery to the knee and may be influenced by aging. On the other hand, comparable indices to native tissue indicate the implant is doing at least as well as the surrounding tissue. In the present study the most striking finding is that in many of the knees, the repair tissue appears to be comparable to the surrounding native tissue with relatively thick cartilage and/or dGEMRIC values comparable to surrounding native cartilage even more than 10 years after the implantation.

REFERENCE: [1] Gillis A, et al. Invest Radiol 2001; 36:743-8. [2] Kurkijarvi JE, et al. Osteoarthritis Cartilage 2007; 15:372-8. [3] Vasara AI, et al. Clin Orthop Relat Res 2005; 233-42.