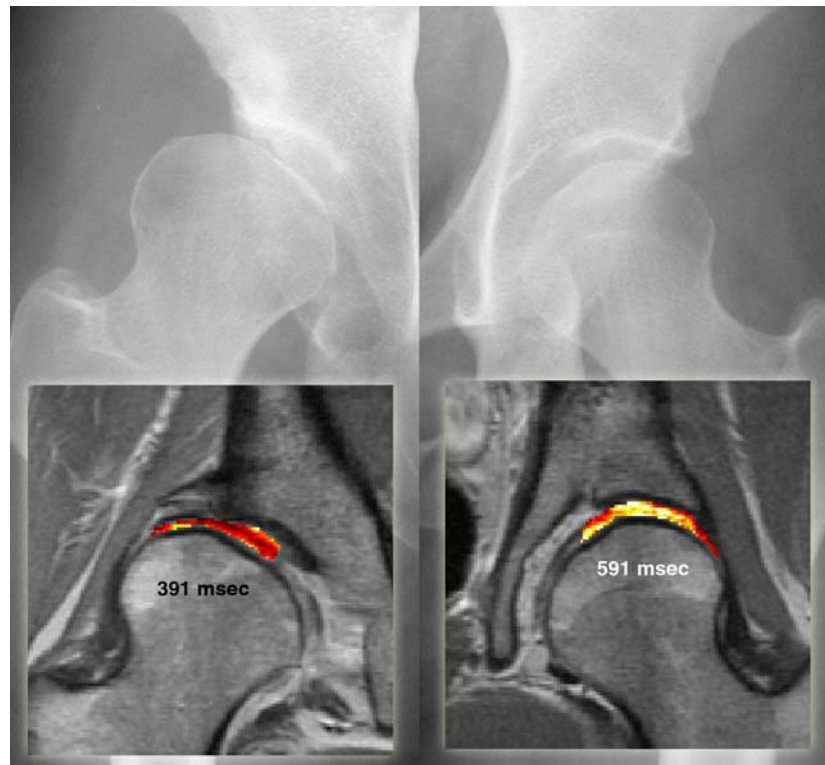




Application of delayed Gadolinium Enhanced MRI of Cartilage (dGEMRIC) to Assessing Early Osteoarthritis in Dysplastic Hips

In early osteoarthritis, the charge extracellular matrix is degraded and lost. The delayed Gadolinium Enhanced MRI of Cartilage technique is designed to indirectly measure the early loss of charge density in cartilage by measuring the change in T1 relaxation time that occurs with partitioning of the charged gadolinium into cartilage.

We have applied this technique to look at the early osteoarthritis that develops in hip dysplasia. Furthermore, we have utilized this technique to determine the changes that may occur in the hip articular cartilage after pelvic osteotomy.



LOW
GAG

HIGH
GAG

Figure 1. dGEMRIC image of a hip with dysplasia on the right side and normal morphology on the left side. With more arthritis, the glycosaminoglycans (GAGs) are lost, as indicated by the darker red and black areas. The hip with dysplasia has more arthritis on dGEMRIC scan.

We have found that, unlike x-ray measures of osteoarthritis, dGEMRIC index correlates with patient's symptoms. Furthermore, when dGEMRIC index is used as an early measure of osteoarthritis, we have determined that in severely dysplastic hips arthritis may develop quite early, under age 30 years, and will progress with time.

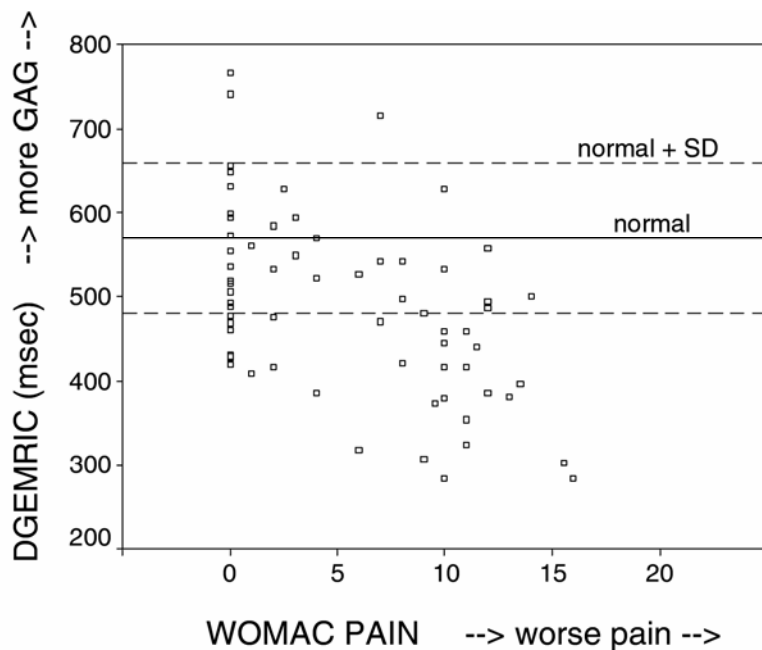


Figure 2. Significant correlation was found between dGEMRIC index and pain in dysplastic hips.

Pelvic osteotomy is effective in treating the pain associated with dysplastic hips; however, the result can be unpredictable when moderate to advanced arthritis is already present. As a measure of early changes of osteoarthritis, we postulated that dGEMRIC index may be a better predictor of failure after osteotomy than x-rays. We have determined that the dGEMRIC index and the presence of joint subluxation on x-rays are independent predictors of failure after osteotomy. These two factors are better predictors of failure than traditional x-ray measures of osteoarthritis such as the Tönnis grade.

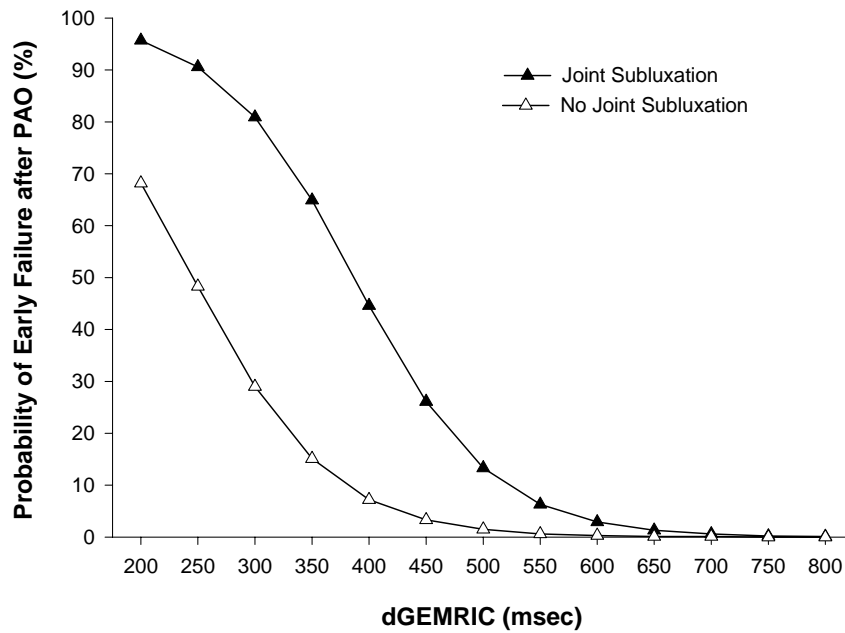


Figure 3. Estimated risk of failure after pelvic osteotomy. Risk depends on the presence of joint subluxation on AP pelvic radiograph and on the pre-operative dGEMRIC index.

dGEMRIC, as a sensitive measure of early arthritis, can be used to monitor changes in articular cartilage after osteotomy. We hypothesized that the osteoarthritis in dysplastic hips is mechanical in origin and may be halted or reversed with the improvement in joint mechanics after osteotomy. When patients after osteotomy were followed using serial dGEMRIC scans, we have found that in hips with mild to moderate OA, there is a trend towards improvement in the articular cartilage after osteotomy.

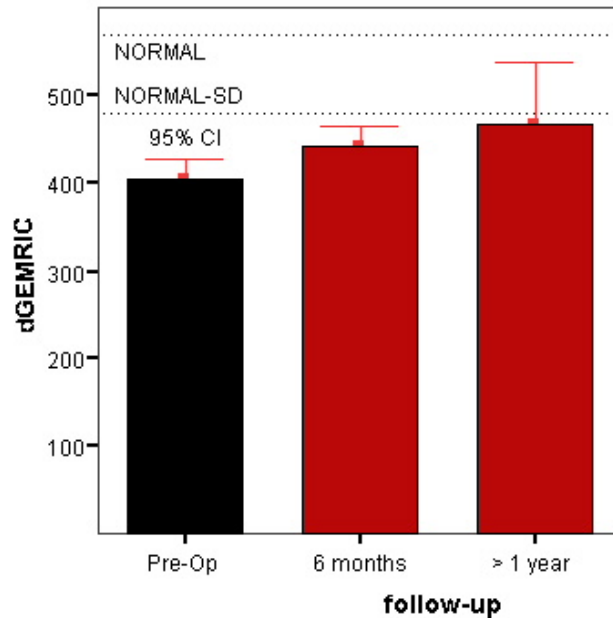


Figure 4. Pre and post-operative dGEMRIC index after pelvic osteotomy for hip dysplasia. Hips with moderate osteoarthritis on MRI shows steady improvement in articular after osteotomy.

From these data, we can conclude that a) osteoarthritis in moderate to severely dysplastic hips can occur quite early and will be progressive, b) the presence of significant arthritis on dGEMRIC scan is predictive of failure after osteotomy, and c) pelvic osteotomy is able to reverse early osteoarthritis.

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