

Longitudinal T2 Relaxation Times following Treatment for Juvenile Idiopathic Arthritis

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Introduction:

Juvenile Idiopathic Arthritis (JIA) is an auto-immune disease that affects 113 children per 100,000 under the age of 16 in the United States [1]. Synovial inflammation is a hallmark of this disease and the aim of therapeutic strategies is the amelioration of synovitis. Reducing the inflammation reduces swelling and pain in the affected joints. The hypothesis that controlling the inflammation does not change cartilage T2 relaxation time was the emphasis of this study. T2 relaxation times in the knees of healthy and children with JIA were evaluated longitudinally for 3 years.

Materials and Methods:

MR images of the knee were obtained from 18 children in the sagittal plane. MR images and clinical evaluation were obtained in 11 children (7 girls and 4 boys, (mean age \pm sd was 9.6 ± 3.0 y.o) with JIA at enrollment, 3 months, 12 months, 24 months and 36 months. These children were treated [disease duration – less than 6 months] with intra-articular corticosteroids, methotrexate or etanercept after enrollment. MR images and clinical evaluation were obtained in 7 healthy children (6 girls and 1 boy, 10.2 ± 4.6 y.o) at enrollment, 12 months, 24 months and at 36 months. Images were acquired either at 1.5 or 3 Tesla.

A multi-slice multi-echo (MSME) spin echo imaging technique was performed to calculate the T2 relaxation time maps for both groups with a repetition time (TR) of 1500 msec, echo time (TE) of 9, 18, ...99 msec, 4 mm slice thickness, 90° flip angle, NEX = 1, matrix of 256 x 160, 14 x 14 cm field of view. T1-weighted spin echo images (TR/TE = 300/10 msec) were acquired for JIA children during the first year before and after intravenous administration of contrast agent (Magnevist - 0.2 ml /kg of body weight) to measure synovial inflammation.

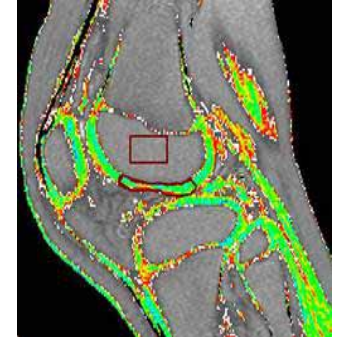


Figure 1: T2 spatial variation in a 9 y.o. boy (JIA) during enrollment with ROIs investigated.

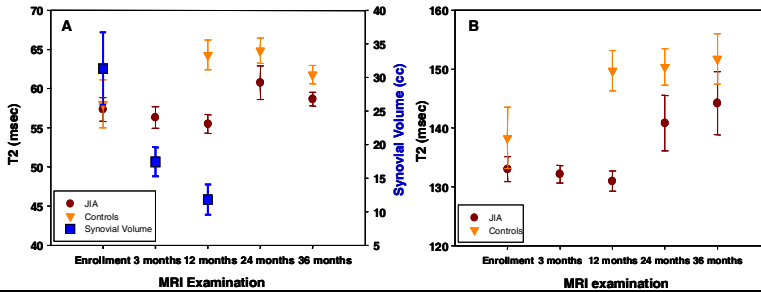


Figure 2: Variation in the average T2 values for healthy and JIA children over 3 years: A. femoral weight bearing cartilage and synovial volume B. femoral

Results and Discussion:

The spatial variation of the femoral weight bearing cartilage and the bone were averaged for all the subjects at each time point and compared to enrollment for both groups for both cartilage and the epiphysis, Figures 2a and 2b respectively. Figure 2a also shows the measured synovial volume for JIA children. The synovial volume decreased from 31.3 cc (enrollment) to 17.4 cc (3 months) and then to 11.8 cc at 12 months post treatment. There was no significant difference between the average femoral weight bearing cartilage and bone between the JIA and healthy children at any time point (ANOVA, Dunnett T3). There was significant decrease in synovial volume at 12 months (Table).

Conclusion:

The T2 values for the children with JIA were lower than the healthy children at enrollment and increased towards the T2 values of healthy children possibly indicating change due to treatment. However, in an earlier study Kight et al [2] demonstrated that the T2 values were higher for children with JIA when compared to the healthy children. However, the disease duration at enrollment was between 2 and 7 years [2] considerably longer than the 6 months in the present study. Treating the synovial inflammation did not affect the T2 relaxation time of immature cartilage in children with JIA.

References:

- <http://www.emedicine.com/oph/topic675.htm>
- Kight et al., Arthritis Rheum. 2004 Mar; 50(3):901-5.
- Rajagopal A et al, Proc. Intl. Soc. Mag. Reson. Med. 14 (2006), 62.

ROI	12 Months	24 Months	36 Months
Cartilage Control	0.457	0.349	0.817
Cartilage JIA	1.000	0.988	0.992
Bone Control	0.406	0.328	0.320
Bone JIA	0.994	0.811	0.632
Synovial Volume (JIA)	0.028	-	-