Conclusions: The aim of this study was to investigate whether cartilage undergoes complex changes in matrix composition (water, proteoglycan, and collagen content) during the late stage of degeneration. These complex deviations from the normal matrix composition are hypothesized to correlate with changes in thermal analysis. Based on previous studies, we hypothesized that thermodynamic findings clearly differentiate normal and Osteoarthritic (OA) human hyaline cartilage and physicochemical transformations may provide information on the role of water content in osteoarthritis.

Methods: In order to conduct the thermoanalytical study, 51 samples were collected. During arthroplasty procedures performed at the Orthopedic Department, University of Szeged, 16 OA, 24 RA human hyaline cartilage samples were obtained and normal cartilage from 11 knee. The mean age of the RA patients was 61 years (SD=5.2), of the OA patients was 64 years (SD=5.7) while the average age of the normal group was 64 years (SD=4.2). The state of the hyaline cartilage was determined intraoperatively. After the operation, a disc (5mm in diameter) was removed under sterile conditions and only the remaining full thickness cartilage was used. All tissues were yielded in accordance to legal regulations. The calorimetric properties of samples were determined by differential scanning calorimetry, samples were heated from 0 to 80 °C. The thermogravimetric analysis was performed with the use of a MOM Derivatograph. These techniques measure net changes in enthalpy and weight as a result of many reactions taking place simultaneously and are particularly useful for indicating the temperature range and the rate of thermal processes as well as giving considerable information on physical and chemical changes. Relatively little has been published on the thermal properties of human hyaline cartilage.

Results: It was found, that the average total water content of intact (normal) cartilage is 79.21%, which was probably the interstitial water and the difference was supposedly bound on the surface. To remove the cartilage extracellular water content 41.89 kJ/M energy was needed. Cartilage obtained from RA femoral head had a lower water content of 72.64%. Extraction of the cartilage fluid content needed 53 kJ/M energy. Total water content of the osteoarthritic samples was 84.15%, 49.03 kJ/M energy was used. Cartilage obtained from RA femoral head had a lower water content of 72.64%. Extraction of the cartilage fluid content needed 53 kJ/M energy. Total water content of the osteoarthritic samples was 84.15%, 49.03 kJ/M energy was used for the removal of the fluid content.

With the rise of temperature an endothermic reaction was observed in all of the cases. The enthalpy change of the process initiated by the temperature change showed marked differences between the normal and pathological groups.

Conclusions: Characterization of the altered metabolism in cartilage that promotes disease progression should lead to future treatment options that can prevent structural damage. Since damaged articular cartilage has a very limited potential for healing, prevention is fundamental in treatment. However, prevention is not possible without the knowledge of the basic pathomorphological mechanism leading to cartilage degeneration. Further investigation is needed to examine the effectiveness of currently used for resolving cartilage matrix degeneration. Thermal techniques are still developing and many new variants and applications are reported each year. Combined techniques with microscopy or spectroscopic instruments are of obvious value to the pharmaceutical scientist.
Conclusions: This study is consistent with the hypothesis that endogenous TGF-β signaling is involved in gene expression and protein synthesis of PRG4 in response to mechanical injury. While injury significantly increased TGF-β gene expression, inhibition of the TGF-β type-I receptor suppressed PRG4 gene expression and protein release. Injury did not appear to affect the ability of the blocker to suppress PRG4 gene expression. Yet, there is a trend towards dose dependence of the ability of the blocker to suppress PRG4 protein release in the presence of injury. The PRG4 protein concentration in the conditioned medium of injured cartilage explants tracks closely with values in the literature (−0.1 μg/(disc·day)).

Meniscus, Muscle, Tendon & Ligament Biology

466
LOW-INTENSITY ULTRASOUND ENHANCES TENDON GRAFT-BONE INTERFACE HEALING IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION. A BIOCHEMICAL AND IMAGE ANALYSIS IN HUMAN

K.N. Malizos1,2, L.K. Papaetheodorou1,2, M.E. Hantes3, K. Grafanaki4,5, A.H. Karantanas6, C. Stathopoulos7,5

1 Univ. of Thessalia, Larissa, Greece; 2Inst. of BioMed. Res. & Technology (BIOMED), Larissa, Greece; 3Orthopaedic Dept., Univ. of Thessalia, Larissa, Greece; 4Dept. of Biochemistry & Biotechnology, Univ. of Thessalia, Larissa, Greece; 5Inst. of BioMed. Res. & Technology, Larissa, Greece; 6Dept. of Radiology, Sch. of Med., Univ. of Crete, Crete, Greece; 7Dept. of Biochemistry & Biotechnology, Univ. of Thessalia, Larissa, Greece

Purpose: The present study investigates the effect of low-intensity pulsed ultrasound (LiUS) during ligamentization process on the healing at tendon graft-bone interface through biochemical and imaging analysis.

Methods: Sixty patients who underwent arthroscopically assisted anterior cruciate ligament (ACL) reconstruction using semitendinosus and gracilis tendon autograft were selected for the study. LiUS (200-μsec bursts of 1 MHz sine waves with pulse repetition rates of 1 KHz and average intensity of 30 mW/cm²) was applied daily in 30 patients (study group) for 20 days, while 30 patients didn't receive LiUS (control group). Blood samples were collected pre-operatively and 1, 2, 3 and 6 weeks post-operatively. The serum levels of TGF-β1, IGF, OPG, sRANKL, procollagen I and NTX from both groups were measured using ELISA. Multiple Direction Computer Tomography (MDCT) in different time periods were used to monitor the progress of healing in both groups postoperatively. MDCT with MPR in 3 planes evaluated the direct integration by means of quantitative measurement of HU and qualitative evaluation of the degree of the cross sectional ossification.

Results: Analysis of the serum levels of all the factors showed statistically significant alterations in the study group compared to the control group. Interestingly, IGF and OPG levels were found elevated, sRANKL was decreased and TGF-b1 exhibited a bimodal profile in the study group. Imaging analysis supported the biochemical findings, indicating a faster healing rate and a more efficient ligamentization process after ultrasound treatment.

Conclusions: Our results suggest that LiUS enhances the healing rate of the tendon graft-bone interface in ACL reconstruction, possibly by affecting the expression levels of significant genes.

467
SPECIFIC FACTORS INFLUENCE IMPROVEMENTS IN FUNCTION AND ACTIVITY LEVELS AFTER PARTIAL MENISCECTOMY

W.G. Rodkey1, K.K. Briggs1, J.R. Steadman2

1Steadman Hawkins Res. Fndn., Vail, CO; 2Steadman Hawkins Clinic, Vail, CO

Purpose: Partial meniscectomy is the current standard of care for torn menisci not suitable for repair. Arthroscopic partial meniscectomy is the most commonly performed orthopaedic surgical procedure. The purpose of this study was to determine what specific factors influence longevity of improvements in function and activity levels following arthroscopic partial meniscectomy.

Methods: Six hundred forty (640) knees which had undergone isolated partial meniscectomy were identified from a clinical database. One hundred ninety-three (193) knees had partial lateral meniscectomy, 342 had partial medial meniscectomy, and 105 had partial medial and lateral meniscectomy. Average age was 52 years (range, 15 to 79) with 207 females and 433 males. Patients were excluded if they had concurrent ACL reconstructions or microfracture for chondral defects. Lysholm function and Tegner activity scores were collected for a minimum of 8 years after the index partial meniscectomy.

Results: For all knees, Lysholm scores improved significantly from preoperative (54) to 1 year postoperative (76) (p < 0.001). Lysholm scores did not change from year 1 to year 5. At year 6, average Lysholm score decreased to 69, and by year 8, the score decreased further to 63. When comparing degenerative knees to non-degenerative knees, the non-degenerative group had greater improvement and maintained it longer. Medial meniscus patients maintained their improvement at 6 and 7 years while the lateral meniscus group showed less improvement and decreased at years 6 and 7. Anatomic location of meniscus tear (anterior, middle or posterior thirds) was not associated with changes in improvement of Lysholm or Tegner scores. Tegner activity levels improved significantly from preoperative (3.6) to 1 year postoperative (4.7) (p < 0.001). This improvement was maintained at years 2, 3, and 4. There was no significant difference between preoperative Tegner and year-5 Tegner scores (4.0) (p > 0.05). This same finding was also seen at years 6, 7, and 8. In degenerative knees, there was less improvement, and levels declined at years 6, 7, and 8.

Conclusions: Patients who undergo partial meniscectomy can expect 4 to 5 years of improved function and activity levels. Knee function continues to improve up to 5 years, but it decreases as activity levels decrease. Patients who delay treatment or have degenerative changes experience a decrease in function and activity levels sooner. Meniscectomy provides a short term improvement in function and activity levels, but long term improvement seems unlikely. Our findings confirm that specific factors such as which meniscus (medial or lateral) undergoes meniscectomy, chronicity of the tear, and preexisting degenerative changes might be expected to influence longevity of improvements after partial meniscectomy.