Board #282  June 1 9:30 AM - 11:00 AM  
**Dynamic Changes Of Doppler Signal During Tendon Scraping**  
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(No relationships reported)

Midsubstance Achilles tendinosis and patellar tendinosis are degenerative lesions that impede athletic performance and activities of daily living. Tendon scraping (TS) is a minimally invasive procedure to accelerate pain relief by disrupting neovascularity and neoinnervation hypothesized as responsible for pain. The original description uses color Doppler (CD) to identify the region with increased blood flow but does not comment on how CD changes during TS. Others propose that TS is complete when Doppler flow is absent. Our observation is that CD is absent after a small volume injection of local anesthesia, before scraping is begun.

**PURPOSE:** This case series reports changes in CD during TS to better inform technical understanding of this procedure.

**METHODS:** Six patients (male=4, female=2) with 5 cases of Achilles and 1 case of patellar tendinosis presented to the Sports Medicine Clinic. Ultrasound identified diseased tendon, and all patients had increased CD prior to the procedure. A 25-gauge 1.5-inch needle was advanced from lateral to medial to the tendon-fat pad interface. Doppler was left on during anesthetic administration. Once local anesthesia was administered, a stab incision was made with an 11 blade scalpel. A 14-gauge 2-inch needle was then advanced under ultrasound guidance in identical fashion. The bevel was turned to make contact with the tendon surface. The fat pad was separated by pulling it away from the tendon in an anterior-posterior direction and then semi-circular, cranial-caudal sweeps were made to complete fat pad separation until the needle moved with unrestricted motion.

**RESULTS:** In all six patients, CD was absent after injecting 1-3 mL of lidocaine. Though only 1 needle pass was made, CD was completely absent throughout the length of the tendon. No complications occurred.

**CONCLUSION:** The most important finding of this work is that CD is absent after a small injection of local anesthetic, demonstrating that CD cannot be used to determine TS completion. CD is still a useful pre-procedure guide to identify the tendon region needing treatment, but it cannot be used as a marker of effective scraping / devascularization. A superior marker of procedure completion is freedom of needle motion demonstrating tendon separation from adjacent fat pad.

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Board #283  June 1 9:30 AM - 11:00 AM  
**Mesenchymal Stem Cells Injection As A Therapy In A Rat Model Of Collagenase-induced Tendinopathy**  
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Tendinopathy represents 30 to 50% of sports-related injuries. Yet, a significant proportion of patients do not respond to the first-line conservative management with progressive loading and strengthening exercises program. Recently, Mesenchymal Stem Cells (MSC) have emerged as a potential regenerative treatment in tendinopathy.

**PURPOSE:** The aim of the present study is to determine whether the injection of MSC and/or Celastrol-conditioned MSC promote histopathological healing in a rodent Achilles tendinopathy model.

**METHODS:** Eighteen Sprague-Dawley rats (36 Achilles tendons) were injected with collagenase type 1A (25 international units) in each Achilles tendons under echographic guidance. After one week, rats were randomly and equally assigned to receive a repeat injection, also under echographic guidance, with either: 1) 60 μL of Phosphate-Buffered Saline (PBS: vehicle); 2) 2.4M
MSC derived from rat bone marrow aspirate or; 3) 2.4M MSC conditioned with celastrol, a HSP90 inhibitor and antioxidant. The outcome measurements were histopathological changes assessed after Hematoxylin Eosin Saffron, Bleu Alcian and Factor VIII staining of Achilles tendons. Each item of the semi-quantitative modified Bonar score (tenocytes morphology, cellularity, vascularity, abundance of mucin in fundamental substance and collagen organization) was assessed by a blinded experienced pathologist at 4 weeks (4 rats/8 tendons per group) and at 12 weeks (2 rats/4 tendons per group).

RESULTS: There were no statistically significant differences between groups, both at 4 weeks and 12 weeks (α > 0.05). However, at 12 weeks, there was a trend towards more improvement and better Modified Bonar Scores in the tendons treated with MSC (0.48 ± 0.46) and conditioned-MSC (1.51 ± 0.81) compared to tendons injected with vehicle (2.26 ± 1.90).

CONCLUSION: No difference was found in Modified Bonar Scores in tendon specimens injected with PB-saline compared to MSC and celastrol-conditioned MSC at 4 weeks. The number of rats per group that was observed until 12 weeks for pathologic analysis was insufficient to draw any conclusion. Nevertheless, these results underline that we need to host rats for a longer period for pathologic analysis. We are currently expanding this experiment with a larger number of rats to be assessed at 12 weeks.

Modeling Elbow Valgus Torque From Throwing Distance With 54,701 Collegiate Baseball Throws


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The scalability and usability of inertial measurement units (IMU’s) allows for biomechanical research to be conducted on datasets that are orders of magnitude larger than traditional motion-capture equipment allows for. From a clinical rehabilitation perspective, there is a large need to better understand the effects of throwing distance on elbow valgus torque in a real-world setting.

PURPOSE: To develop a framework for the prediction of elbow valgus torque at specific long-toss distances in college baseball players.

METHODS: 30 players from a NCAA baseball team were fitted with a motusTHROW sensor and sleeve (Rockville Centre, NY, USA) that measures peak elbow valgus torque. The sensor was worn during all training in 2018, resulting in a total of 238,611 anonymized throws captured. Of this, 54,701 throws were tagged with a long-toss distance (30-300 ft). A 3rd order polynomial regression and one-way ANOVA were performed to test for differences in elbow torque between throwing distances with Tukey post-hoc tests used to for p-value calculation.

RESULTS: A strong relationship was found between the throwing distance and elbow torque from the 3rd order polynomial (torque = 1.18*10^-7x^3 - 8.90*10^-5x^2 + 2.41*10^-2x + 0.55, p < 0.001). The ANOVA showed all but 7 of 35 distance relationships had statistically significant differences: 80-90 ft, 210-240/270/300 ft, 240-270/300 ft, and 270-300 ft (p < 0.001).

CONCLUSION: There was a strong cubic relationship between throwing distance and elbow torque. The cubic regression formula allows for clinicians to estimate peak valgus torque in the throwing arm from distance alone. This relationship can be used to better design return-to-throw programs.