

## **High Resolution Ultrasound to Document Tissue Repair after Prolotherapy: Tendon, Ligament and Medial Meniscus Case Reports with MRI Correlation.**

**Chief Investigator: Bradley D. Fullerton M.D.**

### **Abstract:**

High resolution ultrasound imaging of musculoskeletal tissue is increasing in popularity due to the ability to visualize tissue in real time motion and superior resolution of highly organized tissue such as tendon. Prolotherapy, defined as injection that causes growth of normal cells or tissue, has been a controversial procedure for decades, but is currently gaining in popularity amongst Physiatrists and other musculoskeletal physicians. This Clinical Note describes imaging of traumatic/degenerative musculoskeletal disease and growth in tissues that have been poorly responsive to non-surgical intervention.

### **Introduction:**

Prolotherapy has been defined as “injection of growth factors or growth factor stimulators”<sup>1</sup> and as “injection that causes growth of normal cells or tissue”<sup>2</sup>. The term Prolotherapy was coined by George Hacket, MD in the 1940’s and ‘50’s to imply proliferation of normal tissue<sup>3</sup>, but the procedure has been described by other terms, such as Sclerotherapy, Regenerative Injection Therapy and Stimulated Ligament Repair. The proliferant solution varies according physician training and preference. Commonly reported proliferants include 10-15 % Dextrose, P2G (Phenol, Glycerin and Glucose) and Morrhuate Na. Proponents of Prolotherapy have claimed that the procedure induces new growth and repair of fibrous tissues which stabilizes joints, decreases pain and lessens or resolves disability. There is a paucity of evidence to support this claim and controlled studies in non-specific low back pain have had mixed results<sup>4</sup>. Opponents of Prolotherapy have proposed that improvements are related to the placebo-effect.<sup>5</sup> Evaluation of these soft tissues have mostly depended on subjective clinical skills, rating scales and patient reports of pain relief or increased function, rather than more objective imaging. One recent study reported full return to sport in 22 out of 24 elite athletes with chronic groin pain and inability to participate in sport<sup>6</sup>. High resolution ultrasound now provides an accessible, inexpensive method for serial studies of these tissues to objectively evaluate tissue quality. Prolotherapy involves injections of small amounts (0.5 to 1 ml) of the proliferative solution at multiple entheses points for tendon, ligament and fascia. The procedure usually involves 3-6 treatment sessions over several

months<sup>7</sup>. All ultrasound imaging was performed by the author using a DIASUS musculoskeletal ultrasound machine with 10-22 MHz, 8-16 MHz and 5-10 MHz linear array probes. For these case reports and daily office practice, a method was developed to reproduce patient/joint position, probe position and machine settings at each follow-up ultrasound study. MRI's were obtained before and after completion of all treatments to provide further objective evidence of tissue changes.

### **Case 1:**

#### **Patellar Tendinosis with partial tear**

34 year old male with no significant medical history presented with intermittent, progressively worsening medial and anterior knee pain over the past 3 years. The pain worsens with sitting, playing tennis & volleyball; it has prevented him from jogging over the past year. Exam was significant for tenderness over the medial joint line and medial collateral ligament without crepitus; while tenderness over the quadriceps tendon insertion and patellar tendon origin was associated with crepitus. McMurray's sign, patellar ballotment and ligament laxity testing was negative. An MRI ordered by a previous physician revealed "thickening of the medial collateral ligament consistent with an old injury, but not abnormal signal at this time" and "tendinosis and partial tearing of the patellar tendon at its insertion on the patella with associated reactive edema within the bone marrow of the patella" (**Figure 1&2**). Ultrasound examination confirmed the MRI findings (**Figure 3&4**) and also revealed degenerative changes in the quadriceps tendon.

Treatment sessions involved injection of the Dextrose Prolotherapy solution at entheses points that were tender to palpation; these included MCL origin and insertion, quadriceps tendon insertion, patellar tendon origin,



Figure 1

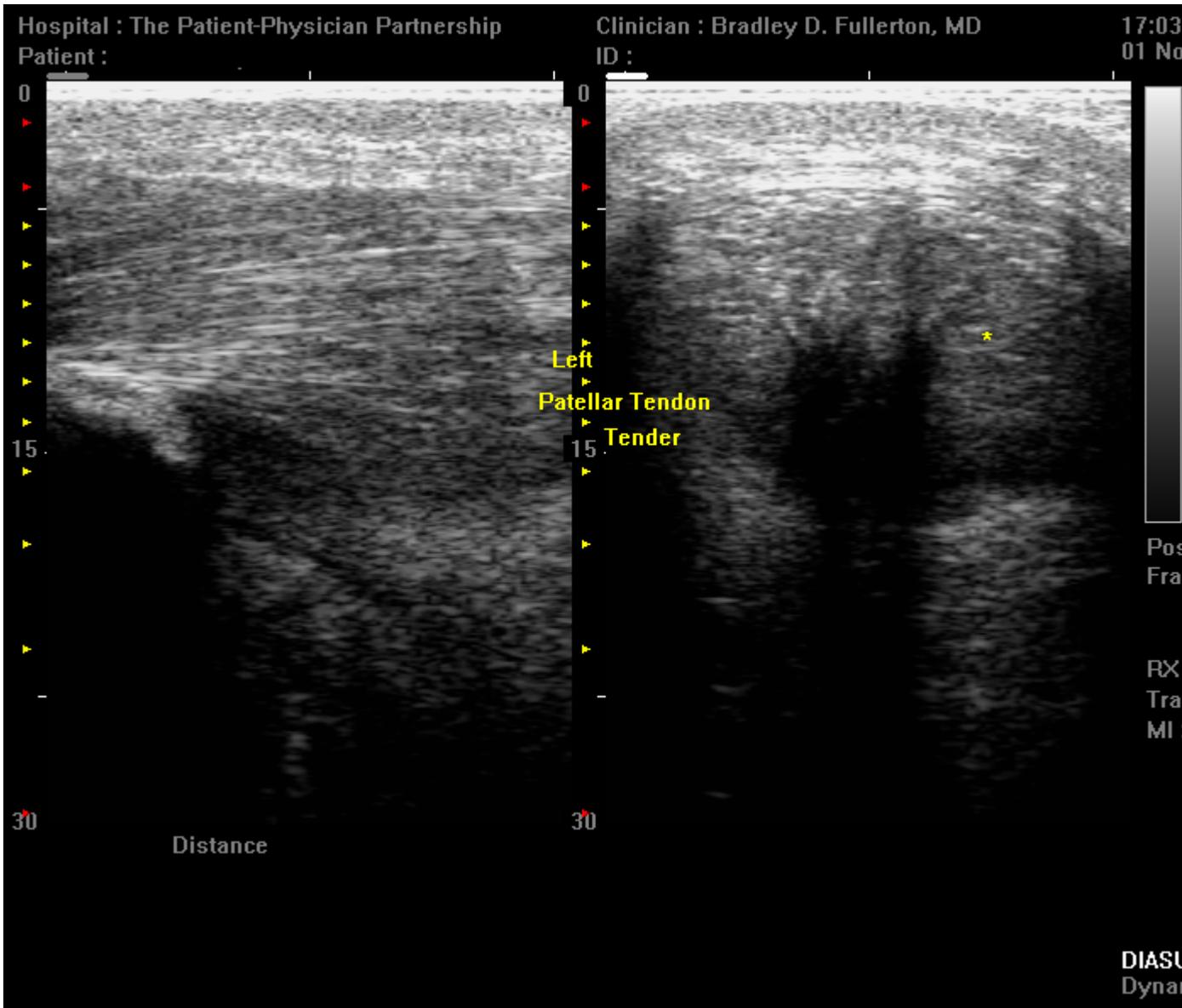


Figure 2



Figure 3

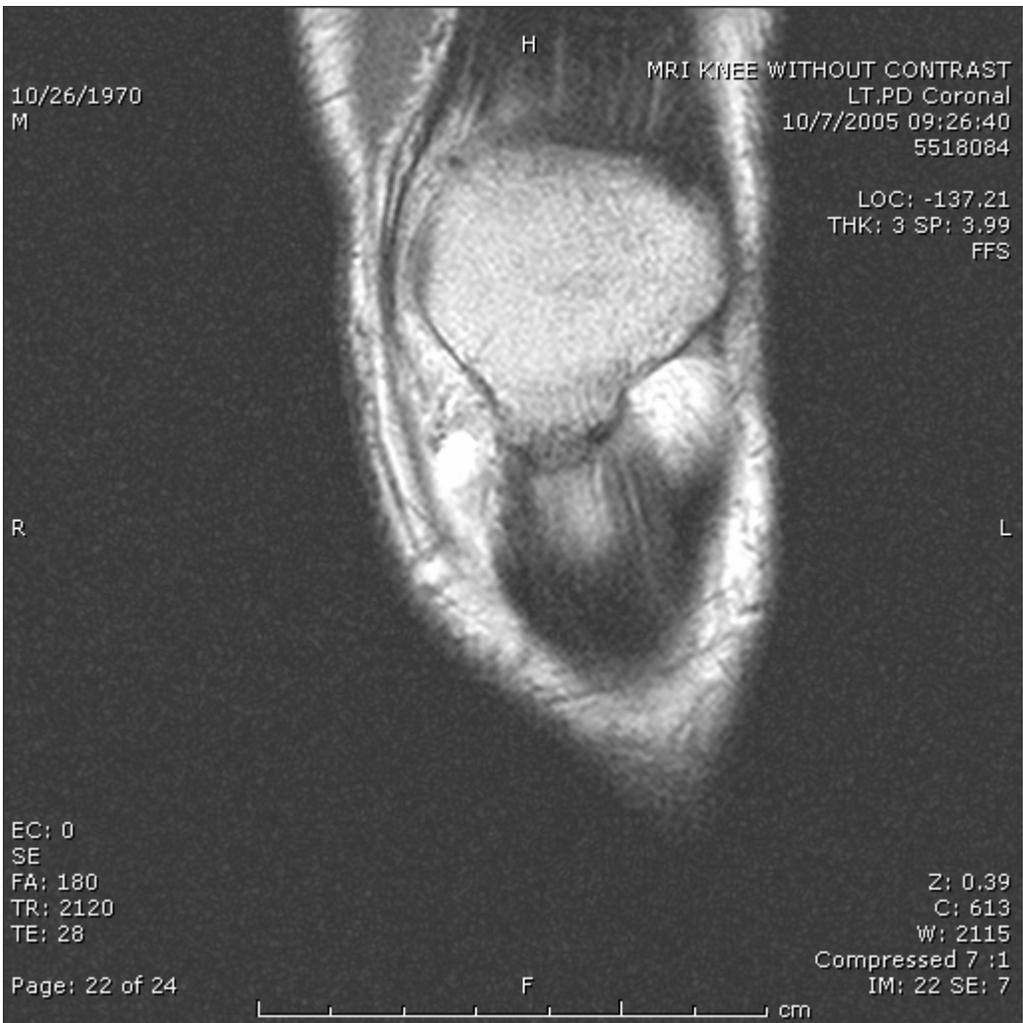
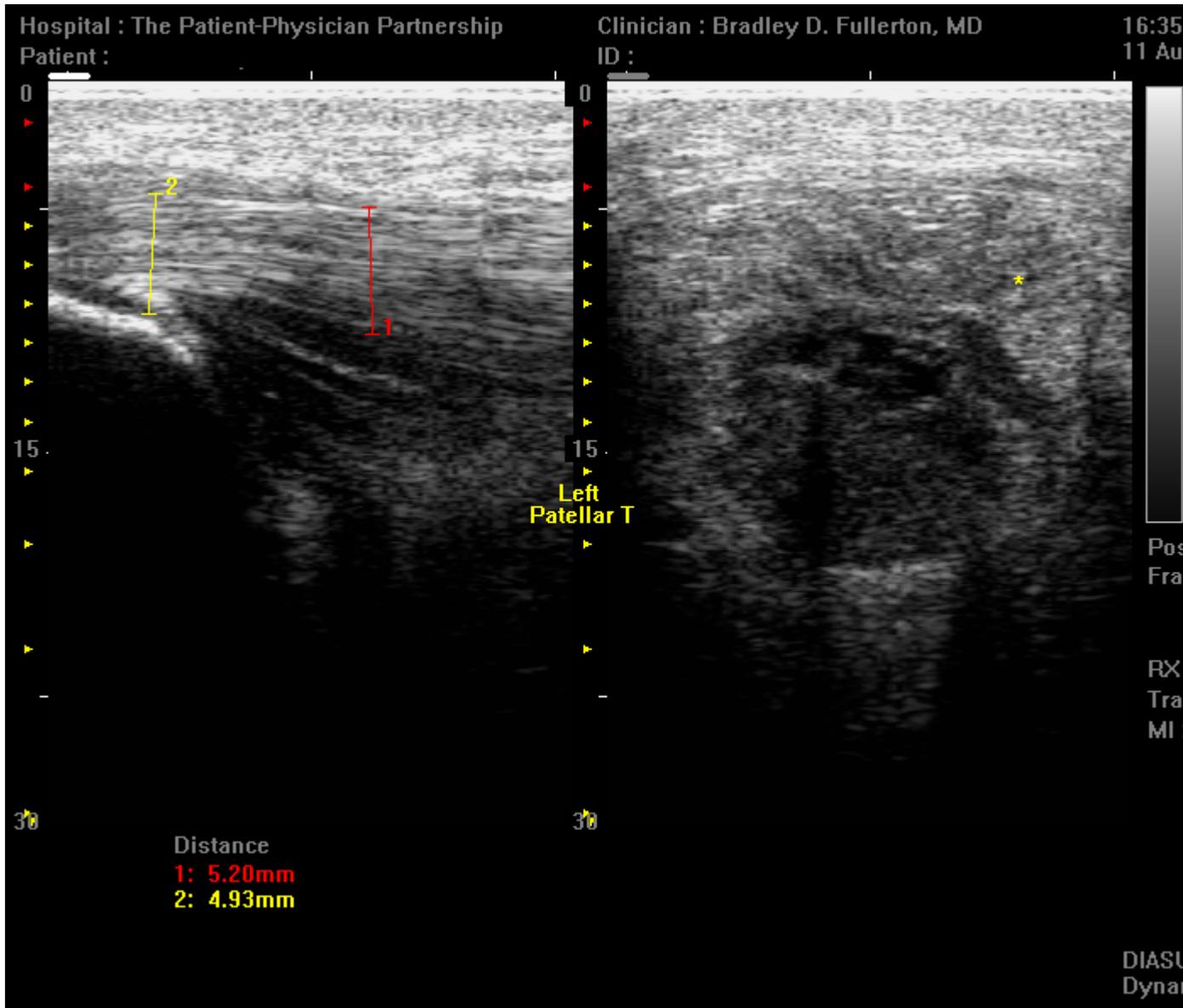


Figure 4



### Case 2:

#### **Anterior talofibular ligament sprain**

A 18 year old female softball pitcher with no significant medical history presented with chronic pain, swelling, crepitus and sensation of instability in the left ankle ? months after an ankle sprain from a motor-vehicle accident (MVA). Since the MVA on ?, she has required an ankle orthotic in order to pitch and run. Exam is remarkable for anterolateral ankle edema, tenderness and palpable crepitus associated with positive anterior drawer sign. An MRI on October 5, 2004 revealed “chronic appearing tear of the anterior talofibular ligament with associated fibrosis, probable tear of the calcaneal

fibular ligament, partial tear involving the deep fibers of the deltoid ligament, bone contusion of the medial talar dome and body and small tibiotalar joint effusion” (**Figure 2**). Ultrasound examination on October 5, 2004 (**Figure 3**) revealed



10/30/1986  
F

A  
MRI ANKLE WITHOUT CONTRAST  
RIGHT pd\_tse\_axial  
8/18/2005 15:19:10  
5359258

LOC: -3.10  
THK: 4 SP: 4.8  
FFS

R

L

EC: 0  
SE  
FA: 180  
TR: 2150  
TE: 14

Z: 0.39  
C: 987  
W: 1994

Page: 15 of 26

Compressed 7 :1  
IM: 15 SE: 6

P  
| | | | |  
cm



10/30/1986  
F

A  
MRI ANKLE WITHOUT CONTRAST  
LEFT T2 TSE FS AXIAL  
10/5/2004 12:35:39  
4330380

LOC: -22.95  
THK: 3.5 SP: 4.48  
FFS

R

L

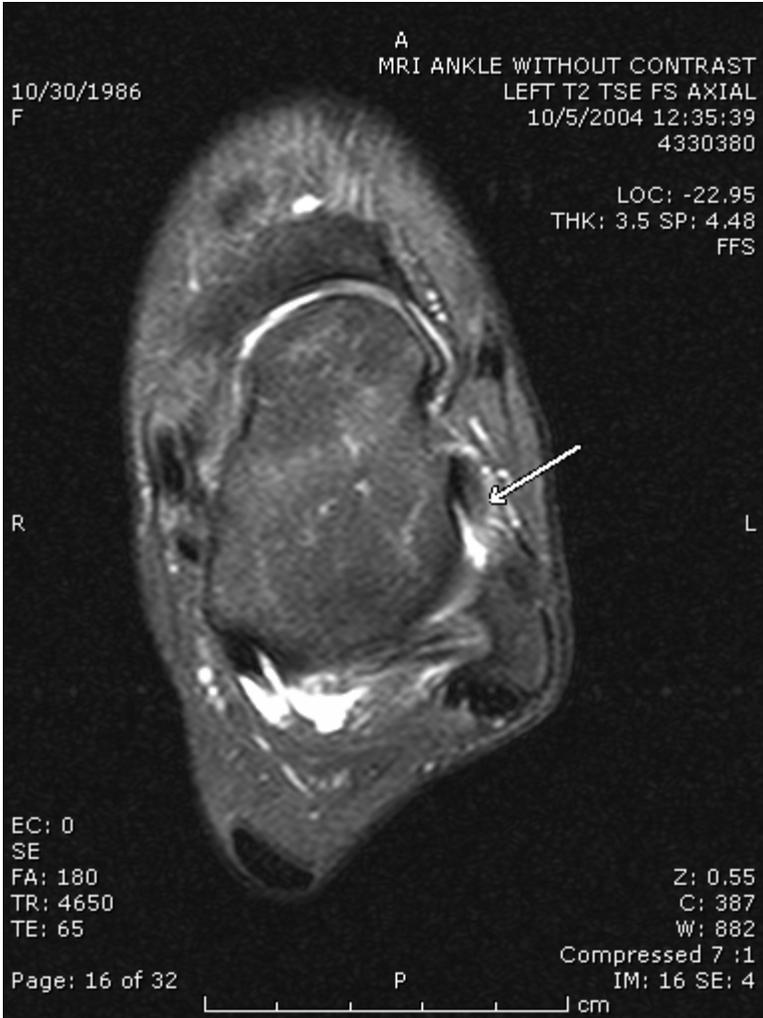
EC: 0  
SE  
FA: 180  
TR: 4650  
TE: 65

Z: 0.55  
C: 387  
W: 882

Page: 16 of 32

Compressed 7 :1  
IM: 16 SE: 4

P  
cm



Hospital : The Patient-Physician Partnership

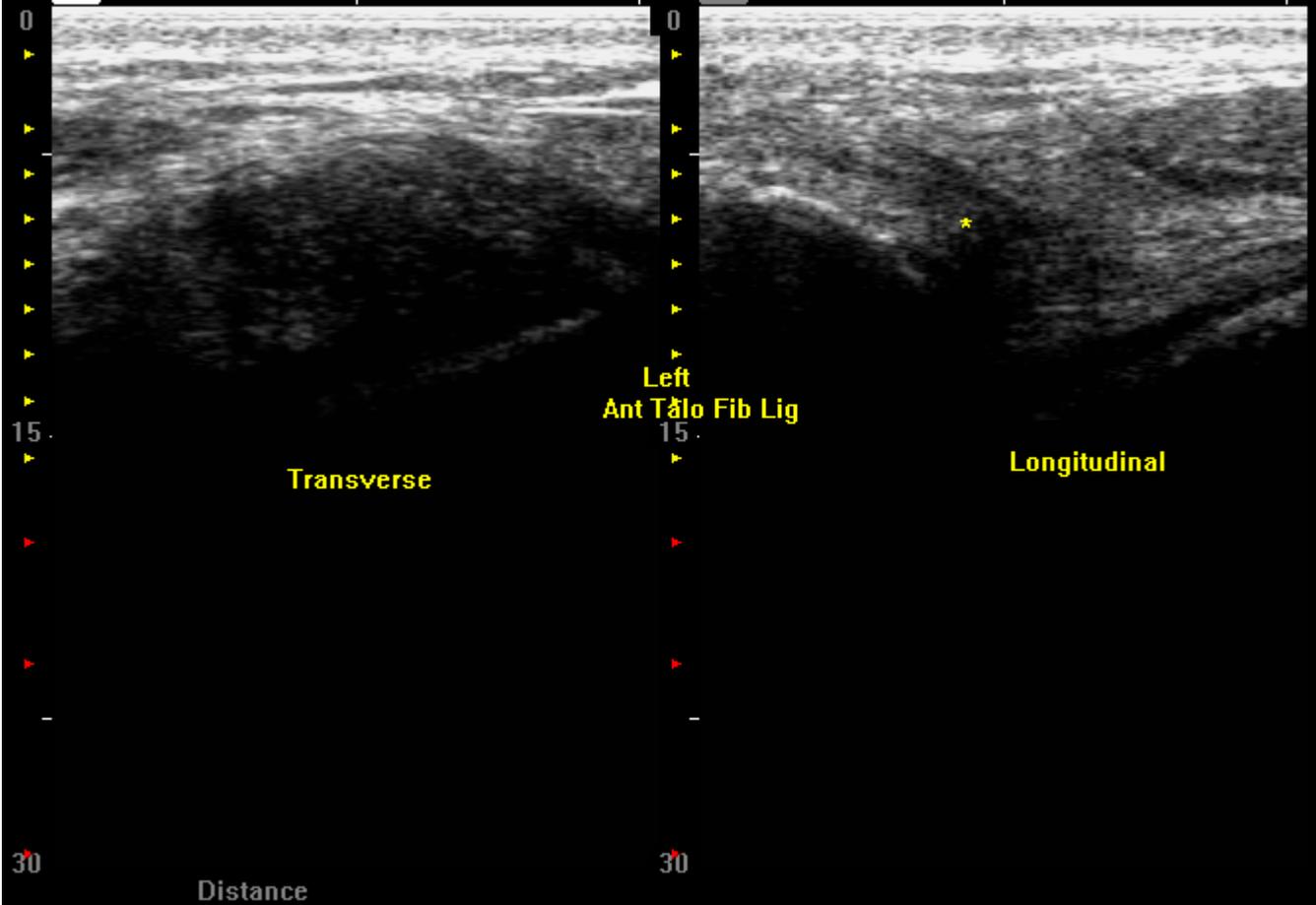
Clinician : Bradley D. Fullerton, MD

14:32

Patient :

ID :

05 Oc



Pos  
Fra

RX  
Tra  
MI

DIASU  
Dyna

Hospital : The Patient-Physician Partnership

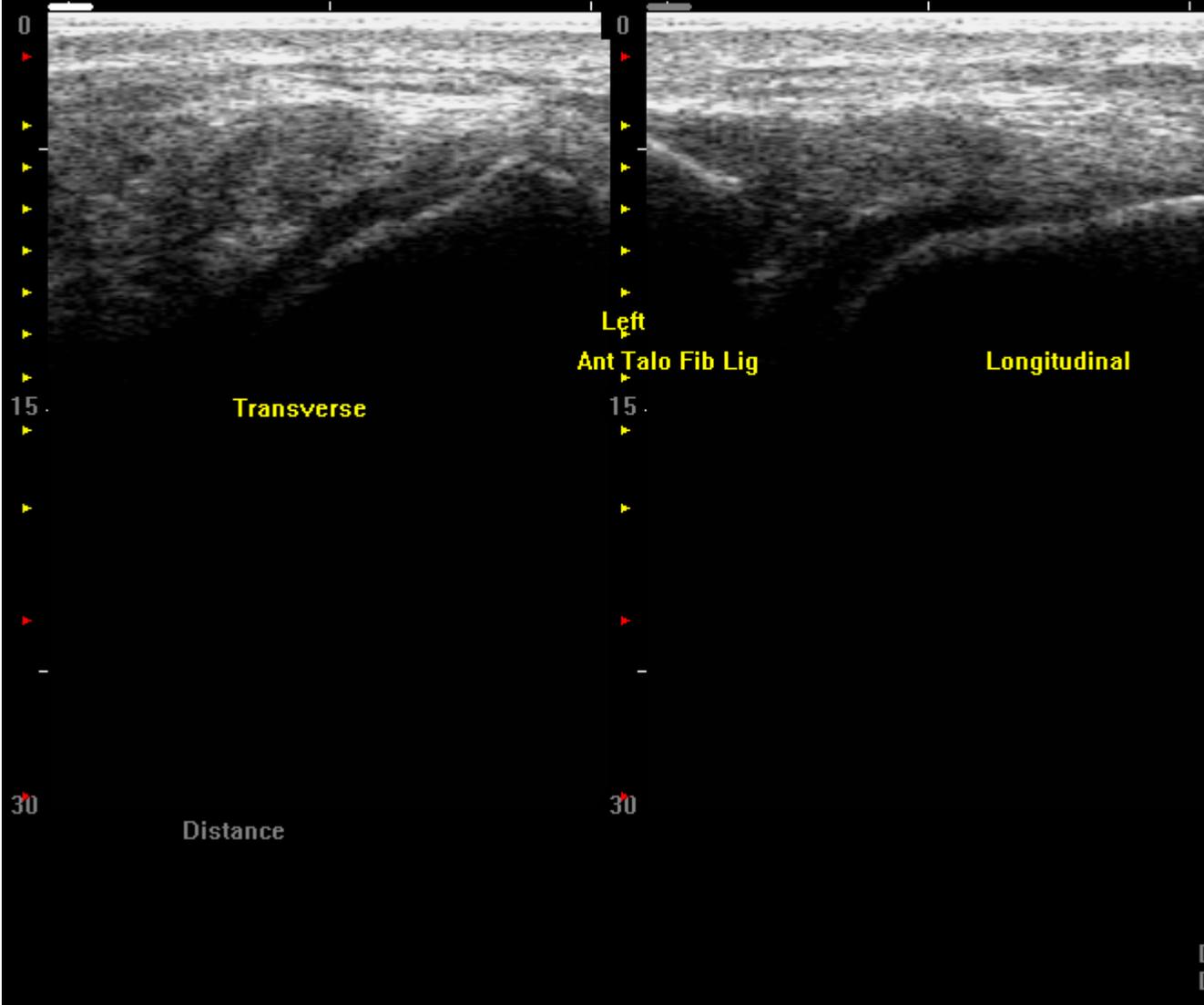
Clinician : Bradley D. Fullerton, MD

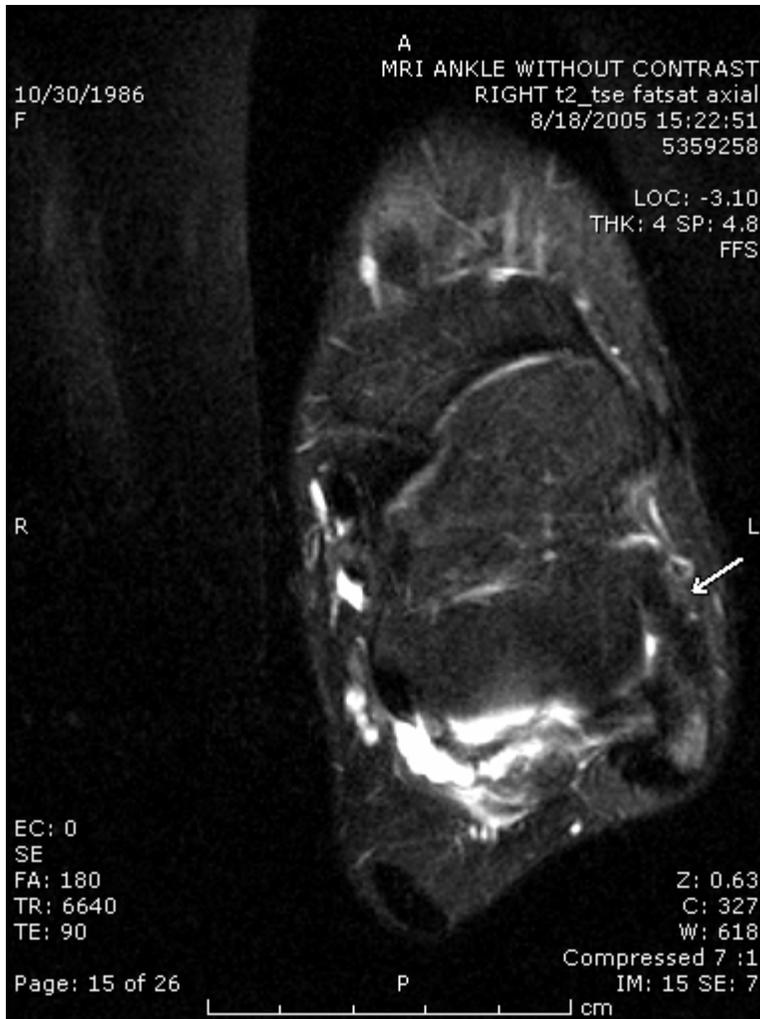
11:26

Patient :

ID :

14 Ju





### Case 3:

#### Degenerative, complex tear of the medial meniscus

- A 59 year old WF with history of coronary artery disease s/p stent, remote Uterine cancer treated by hysterectomy, chronic low back pain due to lumbar degenerative disc disease with sacroiliac joint dysfunction and osteoarthritis of the right knee s/p arthroscopic debridement for degenerative meniscal tear presented in November 2003 with complaints of left knee pain, swelling and sensation of instability. She felt that the left knee was “going to give out like the right one did last year.” Exam was remarkable for antalgic gait, tenderness to palpation (over the medial joint line, MCL, tibial tuberosity and pes anserine insertions) and positive McMurray’s sign. An MRI on December 10, 2003 revealed “complex tear of the medial meniscus includes horizontal cleavage tear of the posterior horn and body, as well as radial tear which transveres the posterior horn-body junction; medial joint space degenerative chondromalacia with

minimal reactive marrow edema adjacent to the meniscal pathology; prominent inflammation surrounding the medial collateral ligament, may be degenerative in the absence of recent trauma; mucoid degeneration signal is suspected within ACL” {IMG\_1127 & IMG\_1134}. Based on the exam and MRI, her Orthopedic surgeon scheduled arthroscopic debridement in early 2004. Ultrasound imaging on December 11, 2003 confirmed the degenerative changes in the MCL and medial meniscus while revealing mild tendinosis in patellar and pes anserine tendons. After discussion, patient agreed to one Prolotherapy treatment prior to undergoing arthroscopy in March; this first treatment was performed on January 23, 2004. The next day she slipped on a wet floor resulting in non-displaced fracture of the right patella. The right knee was immobilized during weight bearing for 6 weeks; during this time she decided to delay the arthroscopy indefinitely. Subsequent treatments occurred on April 2<sup>nd</sup>, May 7 and June 4. Follow-up ultrasounds were performed on March 4, May 6 and July 8. At the last follow-up she reported complete resolution of her left knee symptoms and her knee exam was normal. At phone follow-up in December 2004, she denied any recurrence of her previous left knee symptoms and agreed to a follow-up MRI {View 3, Slice 19 & View 4, Slice 16} which was read as “mild intrasubstance signal within the posterior horn of the medial meniscus but without criteria for tear. Otherwise unremarkable MRI of the left knee.”

Se:2/2  
Im:17/19  
OSag L35.1

59 F 3091  
12/10/03  
15:05

ET:6

A  
R

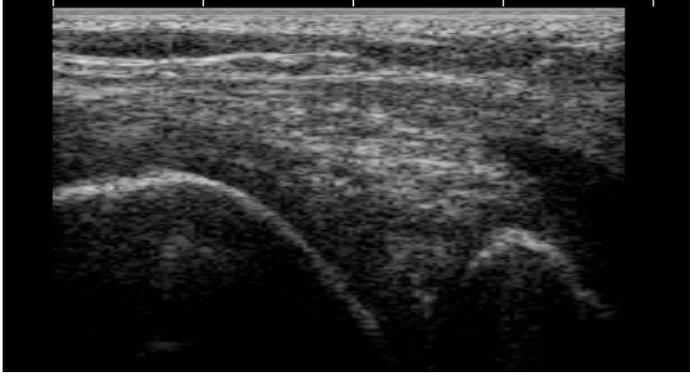
P  
L

fse-x1c/90  
TR:2050  
TE:11.5/Ef  
EC:1/1 20.8kHz

EXTREM  
FOV:14x14  
3.0thk/1.0sp  
19/02:16  
256x192/2 NEX  
FCf/StF/NP/VB/ED/SPF  
L544 L = 742

Patient-Physician Partnership

Clinician : Bradley D. Fullerton, MD  
ID :



Se:6/6  
Im:3/18  
OCor: P84.4

59 F 3091  
12/10/03  
15:19

ET:6

R  
P

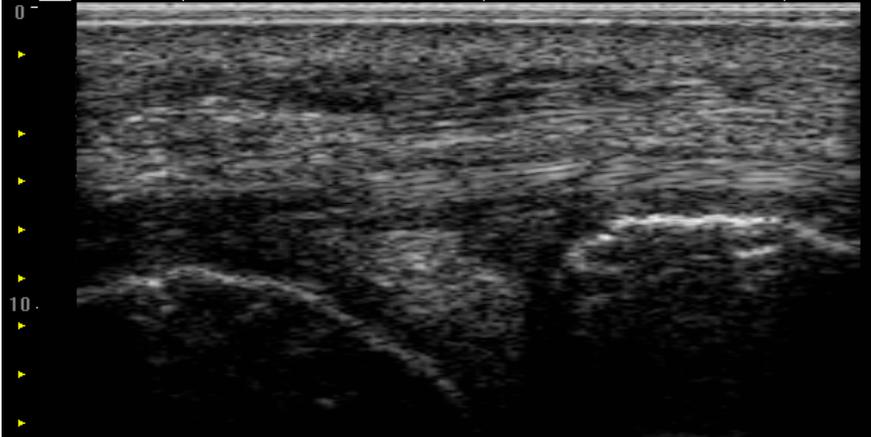
L  
A

FSE  
TR:1750  
TE:14/Ef  
EC:1/1 20.8kHz

EXTREM  
FOV:14x14  
3.0thk/1.0sp  
18/01:59  
256x192/2 NEX  
FCf/NP/VB/ED/TRF  
330 L = 1339

Hospital : The Patient-Physician Partnership  
Patient :

Clinician : Bradley D. Fullerton, MD  
ID :



11/24/1944  
F

MRI KNEE W/O CONTRAST  
LEFT pd\_tse\_fs\_sag  
12/27/2004 13:22:33  
4590119

LOC: 69.55  
THK: 3 SP: 3.6  
FFS

A

P

EC: 0  
SE  
FA: 180  
TR: 2000  
TE: 14

Z: 0.51  
C: 702  
W: 1382  
Compressed 7 :1  
IM: 19 SE: 4

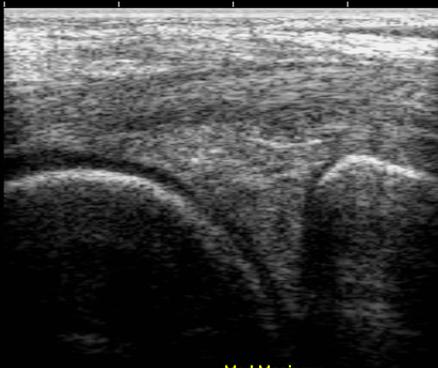
Page: 19 of 26

F



The Patient-Physician Partnership

Clinician : Bradley D. Fullerton, MD  
ID :



Med Meniscus



**Discussion:**  
Patellar tendinosis

<sup>1</sup> Reeves KD, Hassanein K. Randomized prospective double-blind placebo-controlled study of dextrose Prolotherapy for knee osteoarthritis with or without ACL laxity. *Alternative Therapies*, March 2000, Vol 6, No. 2

<sup>2</sup> Reeves KD, Hassanein K. Dextrose injection Prolotherapy for ACL laxity. *Alternative Therapies*, May/June 2003, Vol 9, No. 3

---

<sup>3</sup> Hacket G.

<sup>4</sup> Kim SR, Stitik TP, Foye PM, Greenwald BD, Campagnolo DI. Critical review of Prolotherapy for osteoarthritis, low back pain, and other musculoskeletal conditions: a physiatric perspective. *Am J Phys Med Rehabil*, 2004 May; 83(5):379-89

<sup>5</sup> Loeser JD. Point of View. *Spine*, 2004; 29(1): 16.

<sup>6</sup> Topol GA, Reeves KD, Hassanein K. Efficacy of dextrose prolotherapy in elite male kicking-sport athletes with chronic groin pain.

<sup>7</sup> Reeves KD, Prolotherapy: Basic science, clinical studies and technique in Pain Procedures. 2<sup>nd</sup> ed. Hanley and Belfus