Evidence Based Management of Acute Achilles Tendon Ruptures

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Disclosures

- None

Clinical Question

- *What is the optimal treatment for a recreational athlete with an acute Achilles tendon rupture?*

- Achilles---Legendary Greek hero of Trojan war
  - Defeated Hector
  - Central character in Homer's *The Iliad*
  - Said to be invulnerable due to coat of armor
  - As an infant his mother, Thetis, tried to make Achilles immortal by dipping him in the river Styx, holding him by the heel
  - Achilles eventually mortally wounded by an arrow to the heel

Achilles

"Achilles' Heel"

- ….a weakness in spite of overall strength, which can actually or potentially lead to downfall…..

  - Wikipedia, 2021

What's in a name?

- Achilles Tendon
- "Tendo Achilles"
- "Heel cord"
- "Tendocalcaneus"

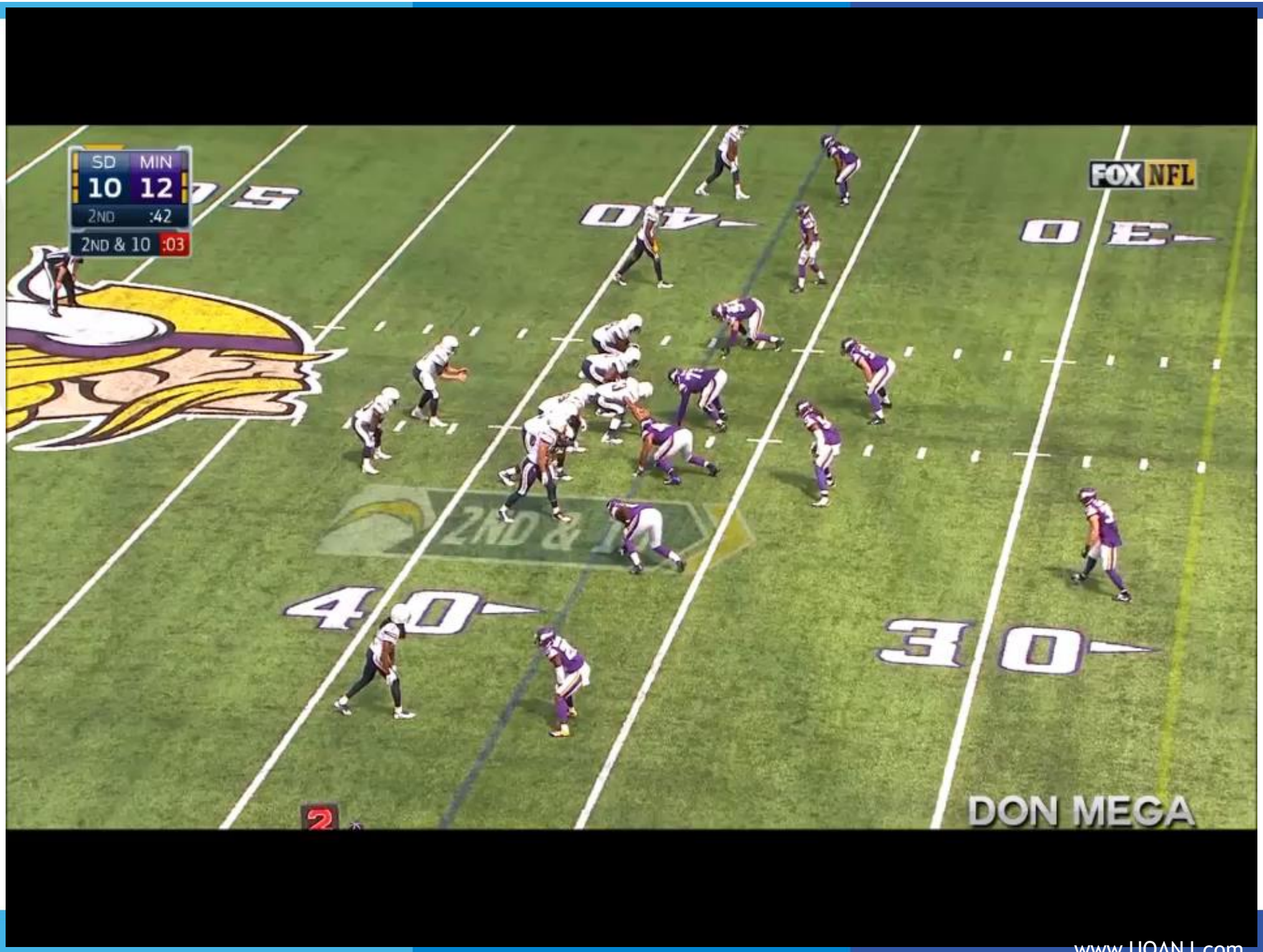
- Os calcis

- Triceps surae

Achilles Tendon Rupture

- Relatively common injury in adult male athletes
- Recreational athletes, “weekend warriors”
- 4th and 5th decade
- Males ~10:1

- Typically a non-contact injury
- “Pop” and pain and cannot RTP
- Often can walk off the court/field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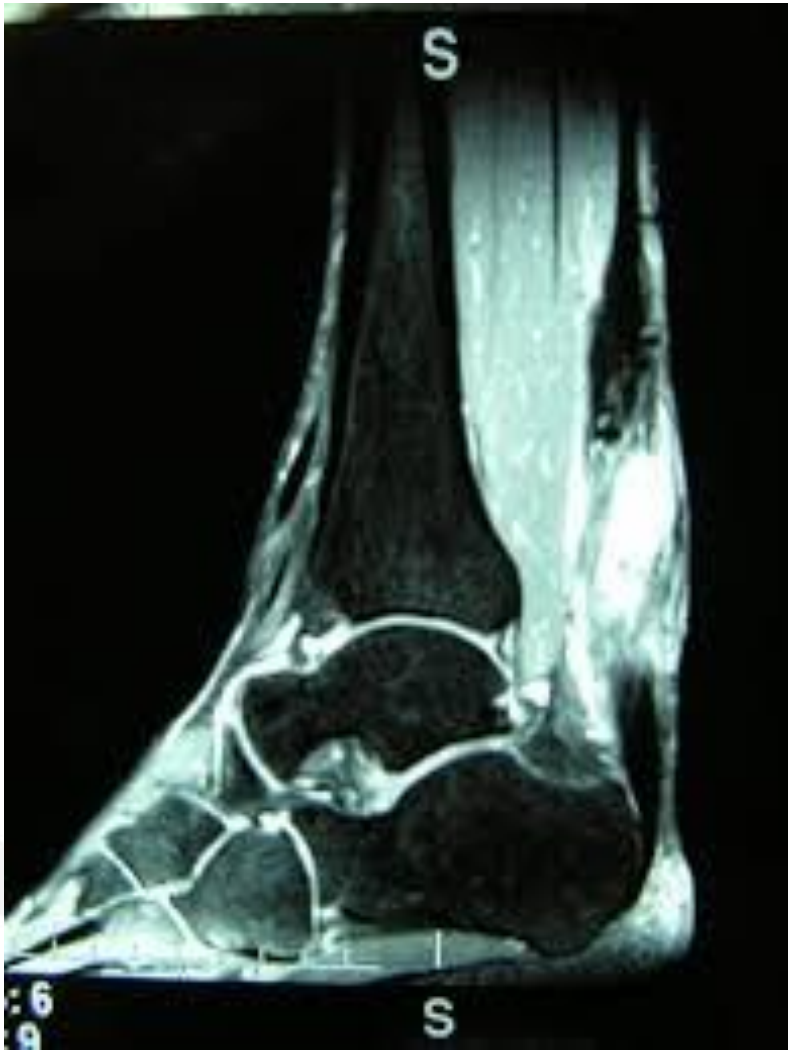
Achilles Rupture

- Usually 2-6cm from heel cord insertion
- Blood flow watershed area?
- Pre-existing tendon degeneration?
- Injury can also occur proximally (MT jxn or muscle belly) or distally (at calcaneus).....

Achilles Rupture: Diagnosis

- History
  - Age, mechanism, RTP?
  - **Timeframe**
- Exam
  - Swelling, Ecchymosis, Tendon gap
  - Motor fxn may be +/- normal!
  - Abnormal Thompson test
- Imaging
  - Xray to r/o boney avulsion, calcific tendonitis
  - MRI: not necessary, but good tool if diagnosis or location of tear in doubt

Thompson Test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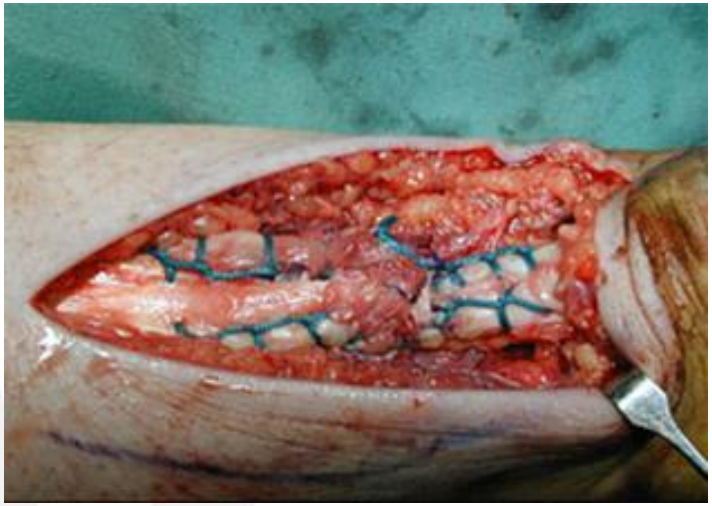
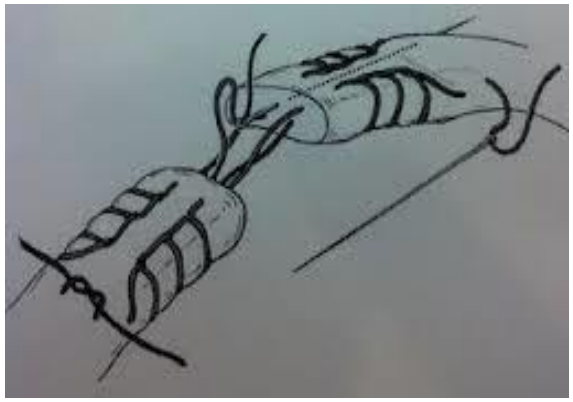
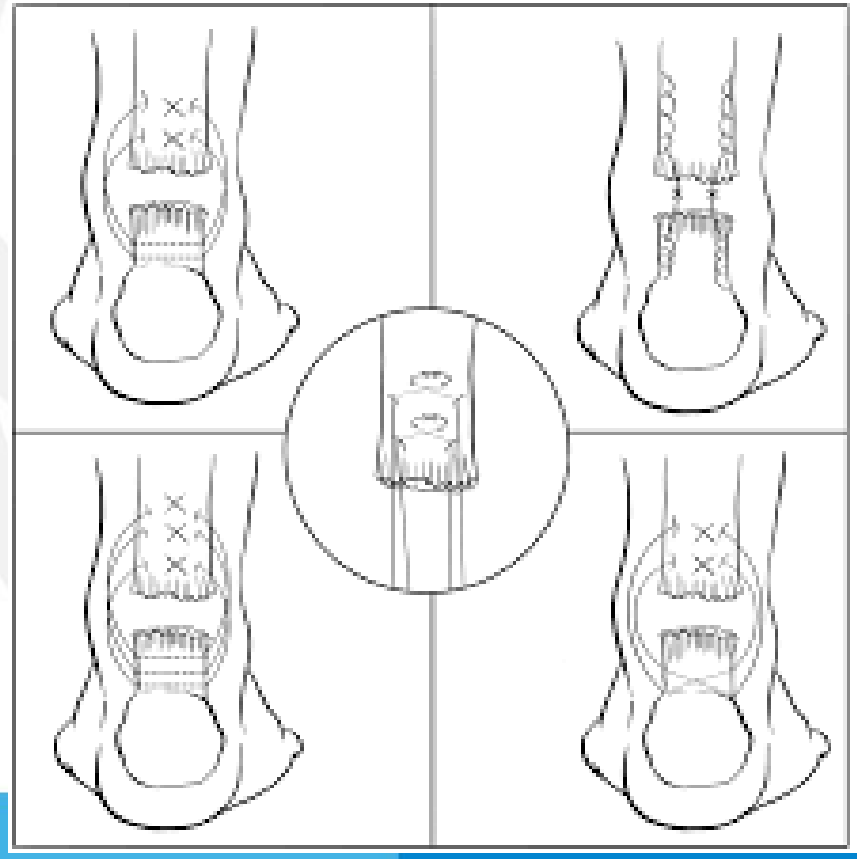
Achilles Rupture: Treatment Options

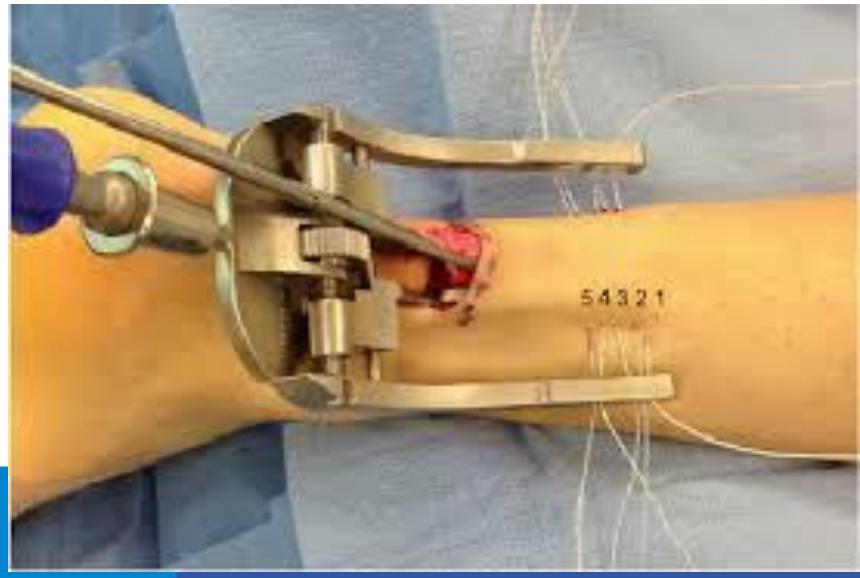
- Non-operative
  - Cast vs. Boot
  - NWB vs Early weight bearing
  - Immobilization vs Early functional rehab
- Operative
  - Open repair
    - Post operative casting vs. boot
    - Post operative NWB vs. Early weight bearing
    - Post operative immobilization vs Early functional rehab
  - Percutaneous repair (“M.I.S”)






Percutaneous Repair
Achilles Tendon
Ultrasound Guided Surgery
Achilles Tendon
Ultrasound
'Stab' Incisions
Surgical
Suture Needle
MendMeShop

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Achilles Rupture Treatment

- Considerations:
  - Healing rate
  - Re-rupture
  - Return to function
    - ADLs, Work
    - Sport
  - Timeframe
  - Complications

Achilles Rupture Treatment

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Figure 3. Photograph of the patient's heel, two weeks postop showing superficial sepsis

Achilles Rupture Treatment

- Considerations:
  - Healing rate
  - Re-rupture
  - Return to function
    - ADLs, Work
    - Sport
  - Timeframe
  - Complications

Figure 3. Photograph of the patient's heel, two weeks postop showing superficial sepsis

Operative vs Non-operative

- ***Historically***:
  - Non-operative treatment = short-leg cast, NWB for 4-12 weeks
    - **Risk: Re-rupture (8%-21%)**
  - Operative treatment = open repair, then short leg cast, NWB for 4-8 weeks
    - Re-rupture rate 2%-5%
    - **Risk: Infection/wound complications (0%--5%)**

Cetti *AJSM* 1993, Moller *JBJS* 2001

Operative vs Non-operative: EBM

- What does the evidence tell us regarding operative vs non-operative treatment of Achilles tendon ruptures?

- *PUBMED SEARCH OF RELEVANT LEVEL 1-3 STUDIES*

Levels of Evidence

Medscape® www.medscape.com

Level of Evidence	Grading Criteria	Grade of Recommendation
1a	Systematic review of RCTs including meta-analysis	A
1b	Individual RCT with narrow confidence interval	A
1c	All and none studies	B
2a	Systematic review of cohort studies	B
2b	Individual cohort study and low quality RCT	B
2c	Outcome research study	C
3a	Systematic review of case-control studies	C
3b	Individual case-control study	C
4	Case-series, poor quality cohort and case-control studies	C
5	Expert opinion	D

Operative vs Non-operative

- Bhandari, *Clin Orthop Relat Res*, 2001

- Meta-analysis, 6 studies, ~450 patients, [Level I/II]
- Level I/II
- **Operative**
  - ~6-8wks cast
  - **Re-rupture 3.1%**
  - **Infection 4.7%**
- **Non Operative**
  - **~8wks cast**
  - **Re-rupture 13%**

- --For every 10 patients tx'd with surgery, 1 re-rupture prevented
- --1 Infection for every 21 patients who received surgery

- **"Surgery generally recommended"**

- ***WB status not well defined

Op vs Non-Op

- Moller, *JBJS (Br)*, 2001
- Level 2 Prospective study
- Non-op
  - **8 wks cast, 4wks NWB**
  - 21% re-rupture (11pts, 10 just while walking!)
  - ~50% abnormal function at 2 years
- Op
  - 2 wks plaster, then **WBAT in boot, functional rehab**
  - 1.7% re-rupture
  - Better functional outcome, earlier return to work

- Recommendations: Surgery for Achilles Rupture to prevent re-rupture

Early Motion after Achilles Injury

- Twaddle, *AJSM*, 2007
- RCT, Level 1
- Operative and Non-operative patients treated with early ROM after 2 wks in equinus plaster
  - » Active DF to neutral, Passive (gravity) PF
- NWB for 6 wks, both groups
- **42 pts total**, 1 year f/u
- Results: No difference in re-rupture rate (3 total), no difference in functional scores, no infx


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Twaddle, 2007

- Conclusions:
  - “…..Controlled early motion is the most important part of treatment of ruptured Achilles tendon”
  - Controlled early motion found to be safe!!!

Hand: Early Motion after Tendon Repair

- Gelberman, et al. Effects of early intermittent passive mobilization on healing canine flexor tendons. *J Hand Surg*, 1982
  - Conclusions: Early protected passive mobilization augments the physiologic processes that determine the strength and excursion of repaired flexor tendons

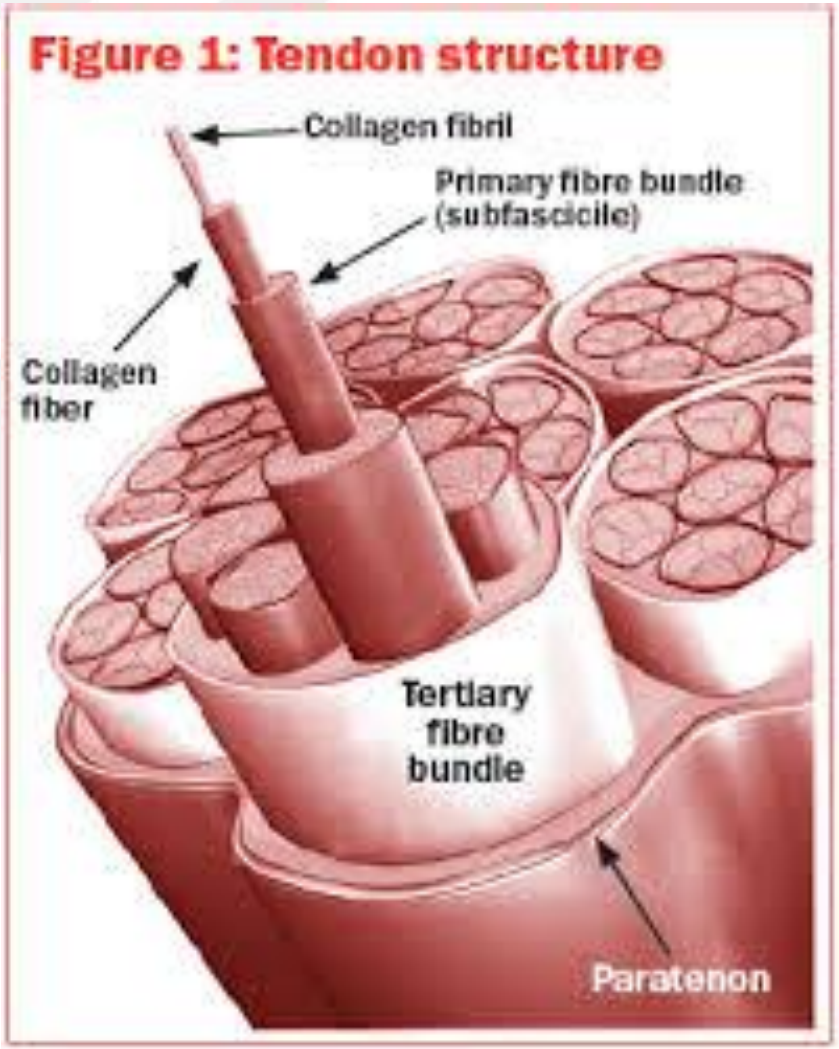
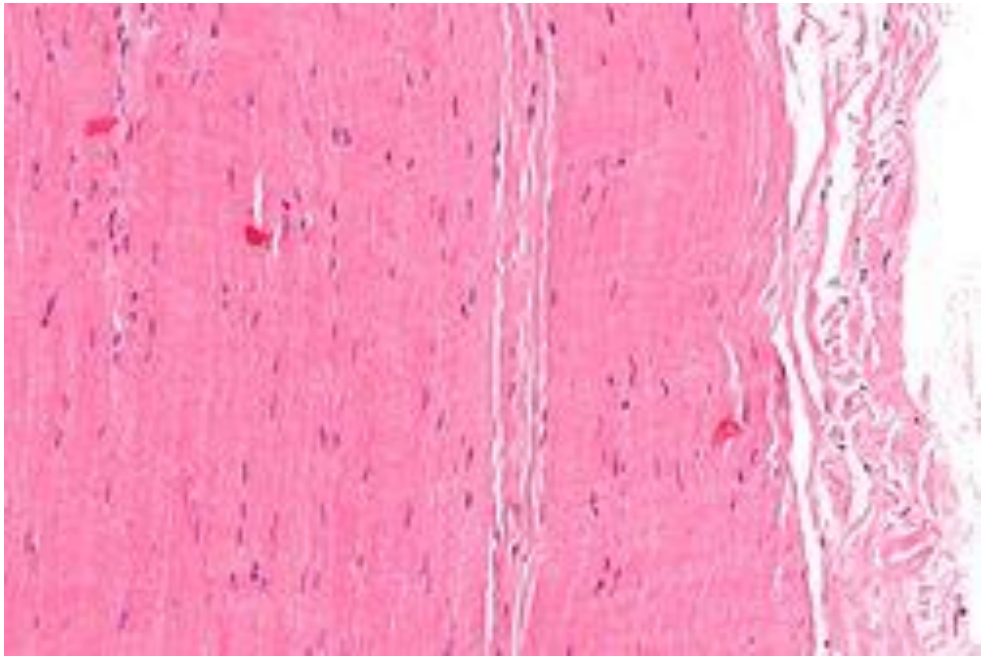
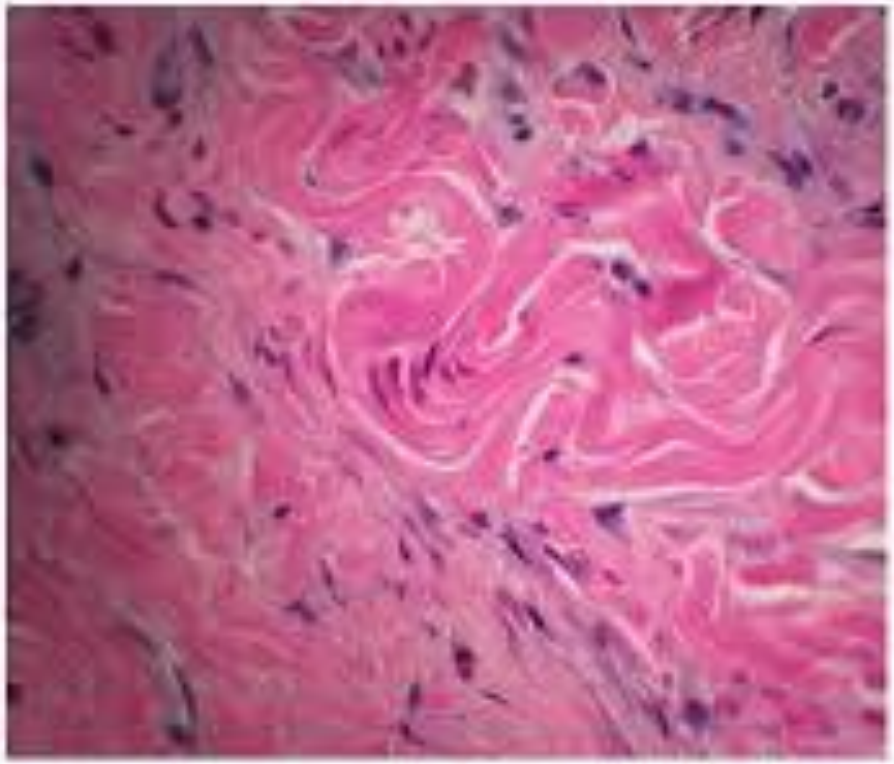


Figure 1: Tendon structure
Collagen fibril
Primary fibre bundle (subfascicile)
Collagen fiber
Tertiary fibre bundle
Paratenon



Collagen arrangement



Early Range of Motion Makes Sense!

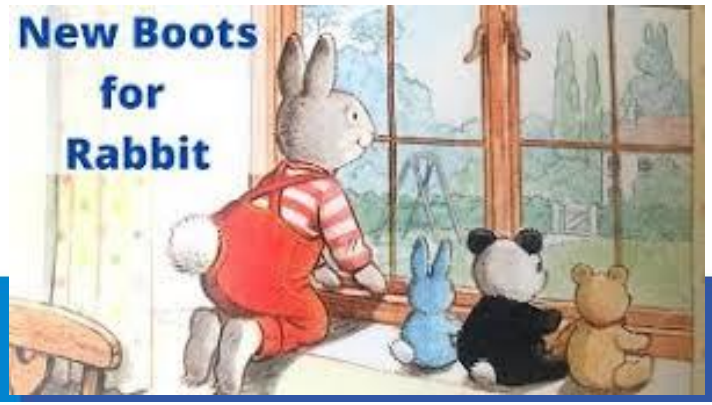
…..and, it appears to be safe

Early Weight Bearing after Repair of Achilles Rupture

- Suchak *JBJS (Am)*, 2008
- Level 1 study; N=110
- Early WB (2 weeks) vs Delayed WB (6 weeks) after surgical repair; Early ROM
  - No difference in re-ruptures (None!)
  - ~16% surgical complication rate, not well defined
  - Better early recovery in early WB group (socially, ADLs)
  - Only 6 month f/u
  - **Early WB after surgical repair is safe**

Early Weight Bearing Science

- Stehno-Bittel, Biochemistry and biomechanics of healing tendon. *Med Sci Sports Exercise* 1998
  - Rabbits, surgically repaired, NWB vs functional casting
  - Functional (WBAT)casting ~60% increase in total collagen, 20% stronger tendon vs rigid (NWB) casting



Early Weight Bearing also Makes Sense!

.....and, it also appears to be safe

Op vs Non-Op, Early WB/PT

- Willits, *JBJS* (Am), 2010
- Multicenter RCT, Level 1, **2 yr f/u**
- 144 patients
- Operative vs Non operative
  - Both groups early WB (2 weeks) and early ROM
- Re-rupture ~4.6%; no difference b/t groups
  - Operative (2), Non Op (3)
- No clinically important difference b/t groups
- **Non-op, early WB, early ROM a good option**

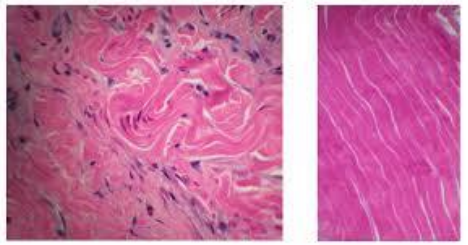
Non-Operative treatment of Achilles Ruptures with Early ROM and Early WB appears to be as safe and effective as Operative treatment

Non-operative Treatment…???

- Barfod, *JBJS (Am)*, 2014 [Denmark]
- RCT, Level 1, 1 yr f/u
- Non Op, WBAT (day #1) vs NWB (6 weeks)
- Early ROM* both groups at 2 weeks
  - *PF to neutral, 5x/day
- No difference in outcomes
- **9% re-rupture** (3/26 WB, 2/25 NWB)!
- **40-50% strength deficit c/l limb at 1 year**
- Only 16% had returned to pre-injury level of play at 1 year
- Better early Quality of Life in the early WB group

WHAT ABOUT FUNCTION ?

- Lantto, *AJSM* 2016
  - RCT, level 1, **Op vs non Op**, N=60, 18mos f/u, recreational athletes
  - Early WB (1 week) both groups
  - ROM/PT started after 6 weeks*



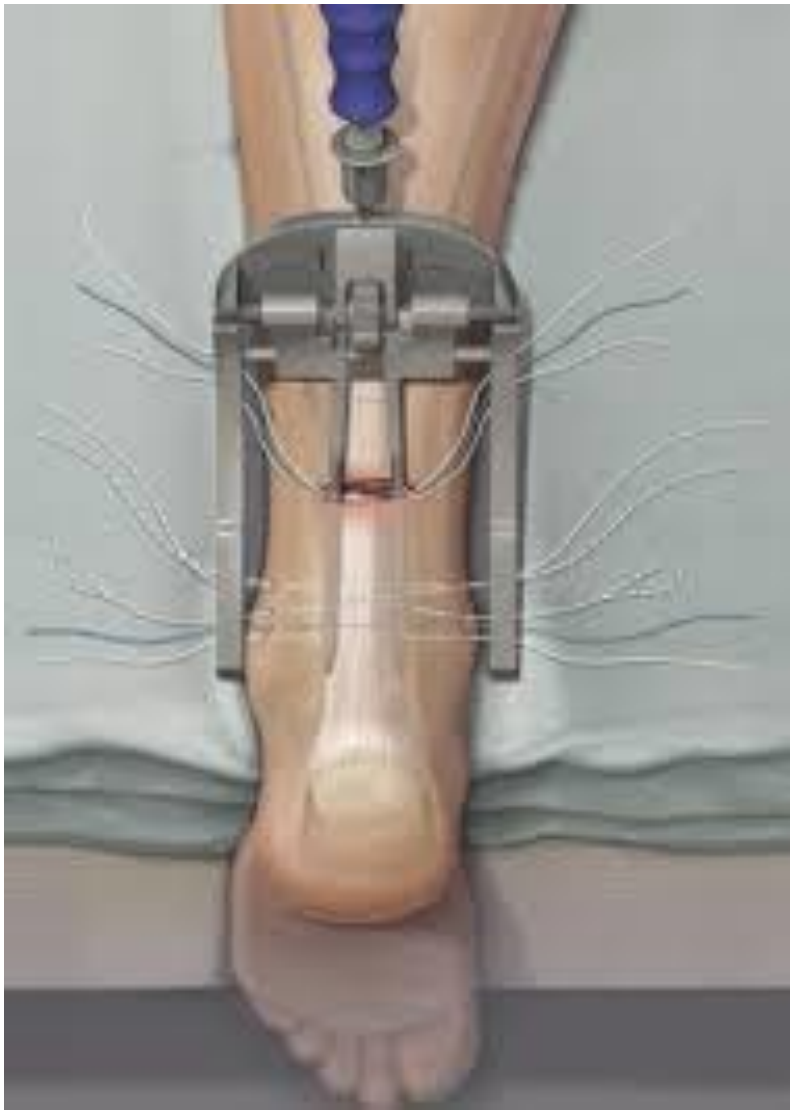
- Results:
  - No difference in ankle scores (Leppilahti)
  - No difference in pain, stiffness, subjective strength, ROM
  - Isokinetic calf strength: Op 24% better at 6 mos, 15% better at 18mos
    - Neither group recovered to level of c/l side
  - RAND-36 Op > Non-op
  - Re-rupture 4 **(14%)** non-op, 1 (3%) Op $p > .05$
  - Infection 1 (3%) Op group
- Conclusions:
  - Non-op treatment a reasonable option
  - **Op vs Non-op similar subjective results**, better and faster recovery of isokinetic calf strength with surgery, trend towards higher re-rupture rate if Non-Op
- Questions:
  - Did delayed ROM play a negative role in the non-op group?

So what's the deal?

- Evidence is not clear if it is the early WB or the early ROM that gives modern day non-operative treatment good results
- Regardless, Non-operative treatment (with early ROM and/or early WB) appears to be a very good option
- Unclear if operative treatment produces better functional results….

Minimally Invasive Achilles Repair

- Percutaneous Achilles Repair System (PARS)
- Studies show decreased infection and re-rupture rates equivalent to open repair
- Concerns over sural nerve injuries



MIS Achilles vs Open Repair

Grassi, *JBJS* 2018

- Meta-analysis
- Level I
- ~350 pts

- MIS had a decreased risk of complications vs Open repair
- No increase in re-rupture with MIS
- No diff in sural nerve injury

Manent, *J Foot Ankle Surg* 2019

- Level II, RCT
  - Small N (#34)
- Open vs MIS vs Non-Op
- Early WB, Early ROM

- 1 year f/u, Non Op > Open = MIS (pain, fxn, activity)
  - No re-ruptures
  - No Infxs
  - Operative: + Scar/hyperalgesia for ~ 1yr

Operative Complications

- Stravenuiter, *Foot Ankle Int*, 2019
- Level III, retrospective comparative series
- Open vs MIS

- Results
  - 12% complication rate for open, 13% for MIS
  - Wound complications (5%, 7.6%), VTE, Sural nerve injuries

Elite Athletes

- Trofa, *AJSM*, 2017
- Level III Cohort study
- 62 professional athletes (25 NBA, 32 NFL, 5 MLB)
  - Operative Repair, Avg age 29.5

  - 31% never RTP!
  - Those who did RTP, 75% and 82% of total games played at yr 1 and 2, compared to pre-injury year
  - vs non-injured controls, Fewer games played, Decreased play time, and Worse performance statistics at 1 years, BUT NOT AT 2 YEARS

Post-op Protocols

- Brumann, Injury, 2014
- Systematic review of RCT, post-op protocols

- *"Immediate FWB leads to higher pt satisfaction, early RTW and RTP"*
- *"All functional parameters favor FWB, but not to statistical significance"*
- *"No increased re-rupture in early WB group"*

- *"Early ROM (at 2 weeks) superior to [cast] immobilization with earlier RTP and RTW and does not lead to higher re-rupture rate"*

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Achilles Rupture Non-Operative Protocol

Post Op Time:	Exercise Progression
Day 0-14	▪ Equinus short leg cast, Non-weight bearing ▪ Initiate straight-leg raises, quads sets, knee ROM exercise
Day 14	▪ Short leg cast removed ▪ 20* elevated CAM walker placed ▪ Boot to be worn while sleeping ▪ Protected WB with crutches ▪ Pt. to remove CAM for 5 minutes q hour, to perform Active dorsiflexion (to neutral only for1st 6 weeks), passive plantar flexion from seated position. ▪ Continue SLRs, quads sets
Week 4-6	▪ Weight-bearing as tolerated (WBAT) ▪ Maintain heel lift ▪ Continue AROM DF (to neutral), PROM PF exercises ▪ Continue SLRs, quads sets
Week 6	▪ D/C heel lift ▪ No CAM walker at night ▪ Continue exercises with therapist ▪ Add gentle dorsiflexion stretches, no range restriction now ▪ Gentle resistance exercises ▪ Proprioception and gait training
Week 8-12	▪ Wean from CAM walker (cane prn) ▪ Over course of 4 weeks add bicycling, walking, elliptical ▪ Add sports specific re-training at 12 weeks
Week 16	▪ Return to sporting activities at 4-6 months

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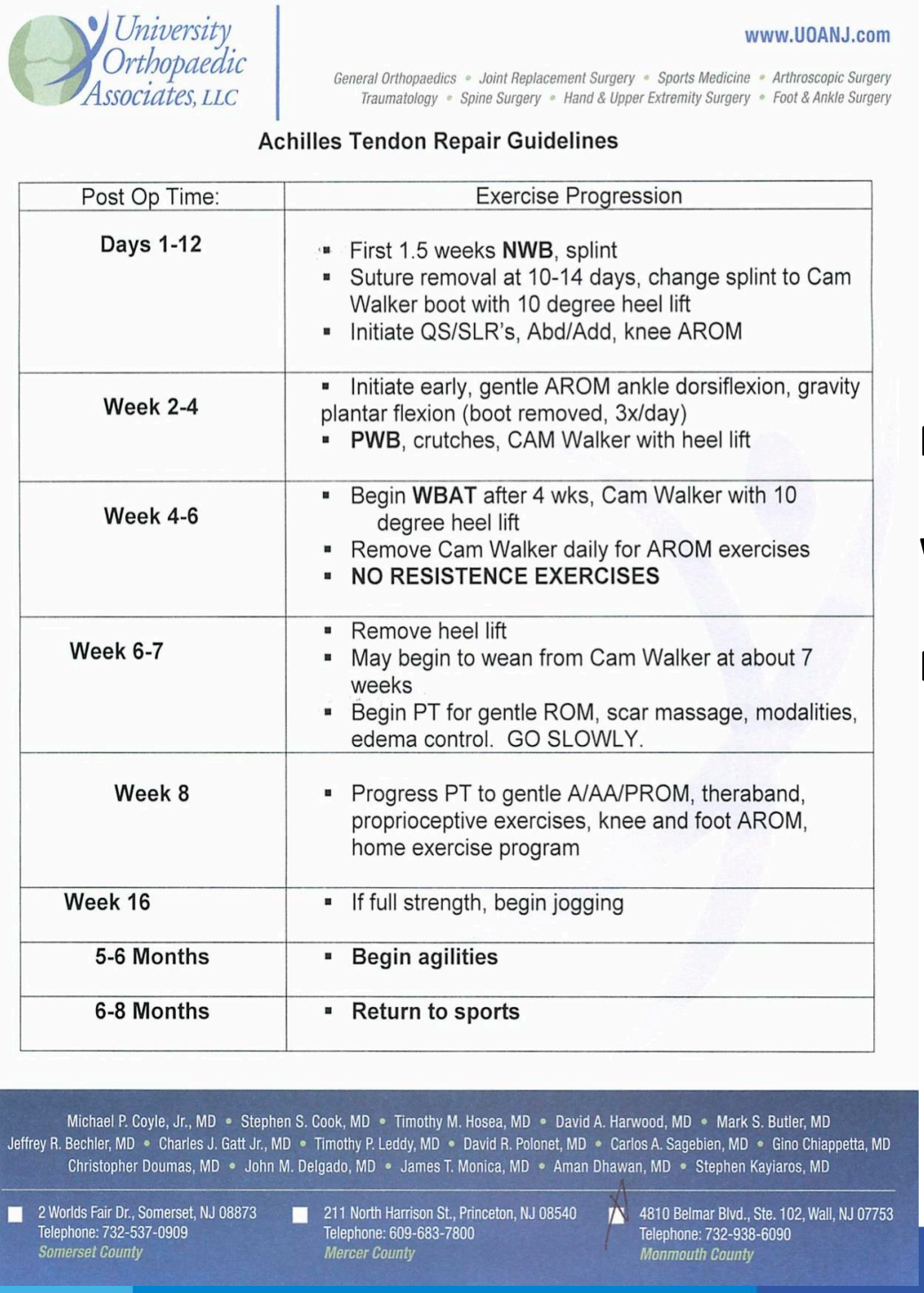
PWB at 2 weeks

WBAT at 4 weeks

ROM at 2 weeks



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Achilles Tendon Repair Guidelines

Post Op Time:	Exercise Progression
Days 1-12	▪ First 1.5 weeks **NWB**, splint ▪ Suture removal at 10-14 days, change splint to Cam Walker boot with 10 degree heel lift ▪ Initiate QS/SLR's, Abd/Add, knee AROM
Week 2-4	▪ Initiate early, gentle AROM ankle dorsiflexion, gravity plantar flexion (boot removed, 3x/day) ▪ **PWB**, crutches, CAM Walker with heel lift
Week 4-6	▪ Begin **WBAT** after 4 wks, Cam Walker with 10 degree heel lift ▪ Remove Cam Walker daily for AROM exercises ▪ **NO RESISTENCE EXERCISES**
Week 6-7	▪ Remove heel lift ▪ May begin to wean from Cam Walker at about 7 weeks ▪ Begin PT for gentle ROM, scar massage, modalities, edema control. GO SLOWLY.
Week 8	▪ Progress PT to gentle A/AA/PROM, theraband, proprioceptive exercises, knee and foot AROM, home exercise program
Week 16	▪ If full strength, begin jogging
5-6 Months	▪ **Begin agilities**
6-8 Months	▪ **Return to sports**

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PWB at 2 weeks

WBAT at 4 weeks

ROM at 2 weeks

Anecdotal Evidence (Level ∞)

- Med School Roommate #1 (Ortho MD, USC)
  - "Athletes need restoration of the tension, so I fix them all!"
  - "In L.A. it's harder to talk people out of surgery…."
- Med School Roommate#2 (Ortho MD, Flagstaff)
  - Recreational outdoor athlete, tore his Achilles 1.5 yrs ago
  - Treated it non-op, early WB, early ROM
  - 8 mos: "no pain, no problems, I have jogged, but not yet sprinted or jumped….."
  - 1.5yrs and 3.5yrs: "no limitations. I jog, I snowboard, I hike, I kick the soccer ball with my kids. I don't play hoops anymore, but…"
  - "recommend Non op for recreational athletes. Pros??"

MEDSCHOOL ROOMMATE #2, 1.5YRS POST-INJURY

Summary Based on EBM Review

- Achilles ruptures may be treated non-operatively
- Operative treatment an option, but wound infection risk
- Re-rupture risk is diminished with early ROM and early WB in non-operative patients
- Operative and Non-operative treatment should include early WB and early ROM
- Early ROM and early WB are safe
- Regardless of treatment, a large # of athletes never return to prior level of play….
- Some MDs favor Operative treatment for high-level athletes
- Minimally Invasive Operative Treatment holds promise as a good option. But does not eliminate complications.

Clinical Question

- *What is the optimal treatment for a recreational athlete with an acute Achilles rupture?*

Non-operative treatment* with early protected weightbearing and early ROM

*If operative treatment chosen, early WB and early ROM should be utilized

THANK YOU!!!

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