Lower Extremity Musculoskeletal Exam Techniques: Evidence-Based Treatment of Common Lower-Extremity Injuries

Anthony Beutler, MD, FAAFP

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Dr. Beutler practices family medicine and comprehensive primary care sports medicine for the U.S. Air Force, caring for active-duty service members, retirees, and their families in the Washington, DC, area. He is an award-winning educator and teacher, and he and his team recently developed and implemented a new musculoskeletal curriculum for USU’s medical school. The author of numerous articles and a textbook, Dr. Beutler has lectured throughout the world. One of his favorite activities is helping family physicians make their musculoskeletal practices more rewarding and profitable.

Learning Objectives

1. Distinguish musculoskeletal conditions that result from overuse/repetitive motion injuries in the lower extremities, with particular attention to those that occur in pediatric patients.
2. Assess an injured patient’s range of motion, stability, bone alignment, soft tissue swelling, palpable warmth or mass(es), pain or tenderness and crepitation in the lower extremities.
3. Identify red flags from the physical examination of lower extremity injuries that warrant referral to a sub-specialist (e.g. surgery, physical therapy) or for diagnostic imaging.
4. Apply appropriate treatment strategies for patients with musculoskeletal injuries in the lower extremities.

Associated Sessions

- Upper & Lower Extremity Musculoskeletal Exam Techniques: PBL
Audience Engagement System

Overview

- Facts and Philosophy
- 3 Common Conditions
  - Victims and Culprits
  - Myths, Legends & Mystical Truths
  - Evidence-Based Treatment
- Coding Minute
- Annoying Editorial Comments

Better Diagnose, Treat, and Code for Musculoskeletal Medicine

AES Question
Tell me about you...
Who are you?
1. Family Medicine Resident
2. Family Medicine Staff or Family Med Trained
3. Peds
4. Other

AES Question
Have You Previously Attended an MSK Session That I Have Taught?
1. Yes, at this AAFP conference.
2. Yes, at a previous AAFP or other conference.
3. No. And why is your nose so big?

AES Question
How Comfortable Are You Diagnosing & Treating Common MSK Problems?
1. Not at all comfortable
2. Comfortable with the basics
3. Fairly comfortable with MSK
4. Confidently diagnose & treat MSK

Facts and Philosophy

Editorial Comment

How much Musculoskeletal Medicine (MSK) do you See?
- 22-34% of outpt visits (civilian) for MSK complaints
- MSK = 2% of Med School Curriculum (US & Canada)
Two Areas of Difficulty
• Proper **History** and **Physical** leading to correct Diagnosis
• Proven-Effective **Treatments** for the Correct Diagnosis

3 Common Culprits & Victims

**Case #1**
- 32 yo male with R heel pain
- Recently "started running to get fit"
- Hurts to run, but he can run through pain
- No PMHx
  - no previous h/o pain
  - no previous h/o running
- Hurts worst with 1st step in AM

**Diagnosis?**

- Normal appearance
- No previous running
- Hurts worst with 1st step in AM

**AES Question**

**What is most likely the correct diagnosis?**
A. Plantar fasciitis
B. Calcaneal stress fracture
C. Achilles tendinopathy
D. Tarsal tunnel syndrome

**Plantar Fasciitis**

**Pathoanatomy**
• NOT an inflammatory condition (not an "-itis")
• Microtears of the plantar fascia
• Subsequent collagen degeneration

**Plantar Fasciitis**

**Diagnosis**
Like Real Estate: Location, Location, Location....
Take Your Right Shoe Off

• Identifying The VICTIM
  – That’s easy

• Identifying The CULPRIT
  – Most common error:
    Not Identifying/Treating the Culprit

AES Question
What is the Best Initial Treatment for Plantar Fasciitis?
1. Steroid Injection
2. NSAIDs & Heel Cups
4. New Running Shoes/Orthotics

Victims & Culprits

Victim
– Plantar Fascia

Culprits
– Tight Heel Chord (70%)

Biomechanics of Walking 101

Victim
– Plantar Fascia

Culprits
– Tight Heel Chord (70%)
– Training Error
– Muscular Weakness
– Overpronation
– Shoes
Plantar Fasciitis

Treatments for Victims & Culprits

Victim
– Plantar Fascia

Culprits
– Tight Heel Chord (70%)
– Training Error
– Muscular Weakness
– Overpronation
– Shoes

Treatments
- NSAIDs
- Heel Pads/Cups
- Steroid Injection
- Ionto/phonophoresis

Plantar Fasciitis

Treatments for Victims & Culprits

Victim
– Plantar Fascia

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Treatments
- NSAIDs
- Heel Pads/Cups
- Steroid Injection
- Ionto/phonophoresis

- Heel Cord Stretching
- Increase 10% per wk
- Towel Drag Exercises
- Orthotics
- www.aapsm.org

Plantar Fasciitis

Treatment

First Line
- Stretching of Achilles/PF
  - a MUST for prolonged relief
- Strengthening
  - calf & foot intrinsics
  - strong muscles absorb shock that would otherwise injure fascia
- Ice
- Activity Modification
  - Decrease running to 50% pre-injury level
  - IF pain changes gait, d/c running

Plantar Fasciitis

Treatment

Second Line
- Orthotics
  - first line for those with significant pes planus/cavus
  - "off-the-shelf" for 1st time PF
- Night Splints
  - most helpful for chronic PF pain (w/stretching)
  - excellent for 1st step AM pain
- Steroid Injection
  - effective for short-term pain control
  - use proper injection technique
- Referral Therapies – 3rd Line Treatments
  - Platelet Rich Plasma (PRP) Injection
  - Extracorporeal Shock Wave Therapy
- Surgery
  - Recommend 12 months of conservative tx first

Plantar Fasciitis

Patient Speak

But Doctor, what about my heel spurs?

Stretch & Strengthen!

Plantar Fasciitis

Patient Speak

But Doctor, what about my ibuprofen?

"Ice, Ice, Baby!!!"
Welcome to the GRAMP-C’s

Great Research; And Maybe Practice-Changing

2014-2015 – Masochistic 3rd Line Therapies
Lots of Studies about Steroid Injections vs Platelet Rich Plasma Injections vs Organic Bear Snot Injections vs Etc.

What does it all mean?
Summary:
#1 – What can you do in your office?
#2 – Steroid injections ARE effective for pain relief, probably 3-6 weeks.
#3 – PRP might be more effective... but not much!
#4 – Ultrasound-guided injection might be more effective than palpation guided... but not much!

Conclusions:
#1 – Stretching and orthotics still work well for Plantar Fasciitis.
#2 – Stretching works even better if a Big Hunk Trainer helps you do it!


What’s the Deal with Shock Wave Therapy?
“Clinically relevant effectiveness of focused extracorporeal shock wave therapy in the treatment of chronic plantar fasciitis: a randomized, controlled multicenter study”

Good study (246 patients!), definitively proves:
• Shock Wave Therapy is PAINFUL!!!!
• Shock Wave better than placebo for people with 6 months or more of pain
  – 69% shock wave vs 35% placebo group at 12 weeks
  – Less difference (but still significant) at 1 year

My Conclusion:
• Before having surgery, patients should consider shock wave
• “Shock wave therapy works better if patients continue their plantar fascia stretching program!!”

– Rompe JD. Radial shock wave treatment alone is less efficient than radial shock wave treatment combined with tissue-specific plantar fascia-stretching in patients with chronic plantar heel pain. J Pain. 2015

Victim
Plantar Fascia

Culprits
– Tight Heel Cord (70%)
  – Training Error
  – Muscular Weakness
  – Overpronation
  – Shoes

Treatments for Victims & Culprits
#1 – Stretch, Strengthen, #2 – Orthotics, #3 – Steroid Injection

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Victim
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Culprits
– Tight Heel Cord (70%)
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  – Overpronation
  – Shoes

Treatments
• NSAIDs
• Heel Pads/Cups
• Steroid Injection
• Iontophoresis
• Heel Cord/PF Stretching
• Increase 10% per wk
• Towel Drag Exercises
• Orthotics
• www.aapsm.org
Case #2

- 38 yo male with L ankle pain
- Was playing tennis yesterday afternoon and...
- He is limping, but can bear weight
- PMHx "weak ankles," no surgeries

Exam:
- Swollen, esp lateral, echy
- No TTP over shaded areas
- Very TTP antero-distal to lateral malleolus
- Xrays – tech on vacation to Ottawa...

Lateral Ankle Sprain

Diagnosis & Pathology

- Why the Anterior Talo-Fibular Ligament (ATFL)?
  - Biomechanics 101
  - The “buckle point”
- Why do I care?
  Medial Sprains are scary!

Differential Diagnosis:

- Ankle Fracture
- Foot Injury
- Other Sprains:
  - Medial Ankle Sprain
  - Tibialis posterior or peroneal tendons
  - Syndesmotic (High Ankle) Sprain

Victims & Culprits

Culprits

- The Tennis Court?
- Loss of Motion
- Loss of Strength
- Loss of Balance (Proprioception)
AES Question
After a Grade I-II Ankle Sprain, How Long Should You Wear an Ankle Brace?
A. Not at all
B. 6-8 days
C. 6-8 weeks
D. 6-8 months
E. Indefinitely

Treatments for Victims & Culprits

Victim
– ATFL

Culprits
For Re-Injury
– Loss of Motion
– Loss of Strength
– Loss of Proprioception

Medial Ankle Sprain
– Be skeptical & cautious
It’s a sprain, but patient can’t walk...
– Need a brace?
– Need crutches?

Thinking Points
Medial Ankle Sprain
It’s a sprain, but patient can’t walk...
What brace do I use and for how long?
– Who is your patient?
– Decrease re-injury rates for 6-8 months
When should pt come back if not better?
– 6 weeks

Welcome to the GRAMP-C’s
Great Research. And Maybe Practice-Changing"
Best Ankle Sprain Reviews of 2012 & 2017 (and Probably All Time!)

“How can we minimize recurrent ankle sprains”

• **#1 - Wear Ankle Braces (SOR: A)**
  - Lace-up, semi-rigid braces prevent primary and secondary injury
  - Bigger effect in secondary prevention, but still significant in primary
  - NNT – 22 (combined 1º and 2º)

• **#2 - Do Balance Training (SOR: A)**
  - Effective for primary prevention: NNT = 22
  - VERY effective for secondary prevention: NNT = 9

- Hemphill B, J Fam Pract, 2011 Dec 60(12): 759-60

So Which is Better?
Bracing, Balance Training, or Combination

“Bracing superior to neuromuscular training for the prevention of self-reported recurrent ankle sprains: a three-arm randomized controlled trial”

• 3 Arm RCT (n=384!) looking at re-sprain rate after 1 year
  1. Balance training for 8 weeks
  2. Semi-rigid brace with sport activity for 12 months
  3. Combination (balance x 8 wks; brace w/ sport x 8 wks)


= 27% recurrence
= 15% recurrence
= 19% recurrence

So Which is Better?
Bracing, Balance Training, or Combination

“Bracing superior to neuromuscular training for the prevention of self-reported recurrent ankle sprains: a three-arm randomized controlled trial”

- Speaking of Cost – Home PT = Referral PT efficacy for ankle sprain
  - And Home PT much LESS Cost

- Brison RJ, The BMJ, 2016 Nov 16; 355: i5650

“Effects of prophylactic ankle bracing on dynamic reach distance and obstacle course performance in military cadets”

• 37 Healthy military cadets
• Did obstacle course and functional measures with & without braces

Findings:
- #1 – Small difference in range of motion when braced
- #2 – NO DIFFERENCES in agility, run-times, or other performance measures

Your Answer: "Suck It Up and Wear Your Brace!"


Patient Speak:
But Doctor, I Can't Jump in Braces!

Lateral Ankle Sprain

**Treatments for Victims & Culprits**

<table>
<thead>
<tr>
<th>Victim</th>
<th>RICE</th>
<th>NSAIDs</th>
<th>Bracing</th>
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<tbody>
<tr>
<td>ATFL</td>
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Treatments for Re-Injury

1. Triple Therapy Rehab, 2 – Brace x 8-12 mo, 3 – Re-eval after 6 wks

Overview

• Overview of Musculoskeletal Exam
• 3 Common Conditions
  – Victims and Culprits
  – Evidence-Based Treatment
  - Case 1 – Plantar Fasciitis
  - Case 2 – Lateral Ankle Sprain
  - Case 3 –

• Coding Minute
• Annoying Editorial Comments
Case #3

- 28 yo female with bilateral knee pain for 6 weeks
- No trauma, PSHx
- No swelling, locking, or giving way
- Started an exercise program (on your advice) 8 weeks ago
- Hurts worst going up and especially down stairs

AES Question

What is your most likely diagnosis?
A. Meniscus Injury
B. ACL Tear
C. Patellofemoral Pain
D. Iliotibial Band Pain Syndrome

Patellofemoral Pain

- Pain syndrome – accounts for ~ 90% of knee pain to military primary care clinics
- Unclear link with osteoarthritis
- Natural Selection vs Military Recruitment

Symptoms
- Patellofemoral Synd
- PFPS
- PFCS
- Anterior Knee Pain

Epidemiology

- Biomechanical imbalance → pain in peri-patellar structures
- Many possible pain generators

Diagnostic Clues
- Bilateral
- Vague, no discrete injury
- Pain with stairs, esp. down
- Theatre sign
- “Effusion” very uncommon

Best Treatment

A. 21-day course of NSAID at anti-inflammatory dosage range
B. Rest, Ice, Compression and slow return to activity
C. Kinesio tape or patellar bracing
D. Quadriceps & core strengthening exercises
CSI Musculoskeletal
3 Prevalent Myths
Wool, Cashmere, and NSAIDs

Patellofemoral Pain
Victims & Culprits

Victim
- Patellofemoral Joint

Culprits
- Muscle Tightness
  - Quads, Hams, Gastroc
  - Muscle Weakness
  - Quad, Glut Medius
  - Mal-alignment
  - Pes planus, patellar tilt

Treatments
- RICE – Acute 4 Chronic
- NSAIDs – Acute 4 Chronic
- Brace – Works well 4 few

Patellofemoral Pain
The Dirty Truth About NSAIDs

- "There is only limited evidence for the effectiveness of NSAIDs for short term pain reduction in PFPS."

  – Cochrane Review 2007


Patellofemoral Pain
Assess for Muscular Tightness

- Hamstrings
- Popliteal Angle
- Normal: Women ~0°
  Men < 30°

- Gastrocnemius
  - You already know
  - 15° dorsiflexion

- Quadriceps & Hip Flexor
  - Modified Thomas Test

- Tight Hamstrings
  - Tight Hip Flexor
  - Tight Quads
Patellofemoral Pain

**Assess for Muscular Strength**
- Quadriceps
  - Listen
  - LOOK
  - Single Leg Squat
- Gluteus Medius
  - Single-leg stance
  - Single-leg squat
  - Step-down

**Assess for Muscular Strength**
- Quadriceps
  - Listen
  - LOOK
  - Single Leg Squat
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- Quadriceps
  - Listen
  - LOOK
  - Single Leg Squat
- Gluteus Medius
  - Single-leg stance
  - Single-leg squat
  - Step-down

**Assess Anatomic Alignment**
- Pes Planus

**Patellofemoral Pain**

**Victims & Culprits**

**Victim**
- Patellofemoral Joint

**Culprits**
- Muscle Tightness
  - Quads, Hams, Gastroc
- Muscle Weakness
  - Quads, Glut Medius
- Mal-alignment
  - Patellar tilt, tibial tuck

**Treatments**
- RICE: Acute & Chronic
- NSAIDs: Acute & Chronic
- Braces: Works well & few
- Popliteal Angle, Thomas Test, 15° dorsi
- Single Leg Squats & Single Leg Step-Downs
- Orthotics (OTC vs Custom)
Feel Like You’re Drowning?

Annoying Editorial Comment

- How to Find a Good Physical Therapist
  - Fingers do the walking
  - Phone a friend

- Refer patellofemoral pain
  - If patient returns with stretching, strengthening = Good Therapist!
  - If patient gets lots of ice, heat, and fancy gels = Don’t waste your time.

Welcome to the GRAMP-C’s

Great Research; And Maybe Practice-Changing

Best Patellofemoral Articles

What Do They All Say?

1. Muscle strengthening exercise therapy is best treatment for PFP
2. Exercise therapy works better if a big hunk trainer helps you do it!

- van der Heijden RA. Cochrane Database Syst Rev. 2015
- Covey CJ. J Fam Pract. 2014
- Crossley KM, BJSM, 2016

Best Patellofemoral Articles

A Closer Look

Cochrane Review:
- … consistent evidence that exercise therapy for PFPS may result in clinically important reduction in pain and improvement in functional ability, as well as enhancing long-term recovery

Rixe et al:
- … the most effective… treatment modality for patients with PFPS is… strength training of the quadriceps and hip abductors and stretching of the quadriceps muscle group
- Adjunctive therapies, including taping, biofeedback devices, and prefabricated orthotic inserts, may provide limited additive benefits in select populations

Back to Cochrane:
- Hip plus knee exercises may be more effective in reducing pain than knee exercises alone

Maybe You DO Need to Look For Risk Factors!

Additional Effects of an Individualized Risk Factor-Based Approach on Pain and the Function of Patients With Patellofemoral Pain Syndrome: A Randomized Controlled Trial

53 patients with PFPS randomized to standard or tailored rehab
- Findings:
  - Both groups improved
  - Tailored rehab group showed greater pain relief

### Patellofemoral Pain

**Victims & Culprits**

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**Treatments**

- RICE – ABLER + Exercise
- NSAIDs – Ace & Naprosyn
- Braces – Works well 4 few
- Popliteal Angle, Thomas Test, 15° dorsi
- Single Leg Squats & Single Leg Step-Downs
- Orthotics

1. Strengthen Quads/hip/core.
3. Orthotics/Brace

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  - Case 1 – Patellar Fossa
  - Case 2 – Lateral Ankle Sprain
  - Case 3 – Patellofemoral Pain
- Coding Minute
- Annoying Editorial Comments

### Coding Minute

**Take Credit for What you Do**

- **Military Disclaimer**

### 5 Dos and Don’ts of Coding

1. Do capture time required for:
   - Exercise Teaching (E&M or CPT 97110)
   - Crutch Training (E&M or CPT 97116)
   - Brace Fitting and Care Coordination (E&M)

2. Don’t forget to code injections:
   - Most injections - CPT 20610

3. Do use a 25 or 29 modifier:
   - Diagnosis and treatment in same visit requires the modifier in many states
Coding Minute
Taking Credit for What you Do

5 Dos and Don'ts of Coding
1. Do capture time required
2. Don’t forget to code injections
3. Do use a 29 modifier
4. Don’t forget to bill Durable Medical Equipment
   – Ankle braces, crutches, etc...

Overview
• Overview of Musculoskeletal Exam
• 3 Common Conditions
  – Victims and Culprits
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    ✓ Case 1 – Plantar Fasciitis
    ✓ Case 2 – Lateral Ankle Sprain
    ✓ Case 3 – Patellofemoral Pain
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Practice Recommendations
• Plantar Fasciitis:
  1st Line: Stretching and Strengthening Exercises (See handout)
  2nd Line: Orthotics (Start with over the counter)
  3rd Line: Steroid Injection (For pain causing limp or recalcitrant symptoms)
• Ankle Sprain:
  1st Line: ROM, Strength, and Balance (See handout)
  2nd Line: Brace for 8-12 months
  3rd Line: Re-evaluate if still painful after 6 weeks
• Patellofemoral Pain:
  1st Line: Strengthen Hip/Quad/Core
  2nd Line: Supravital Strengthening (Find a good PT or Athletic Trainer)
  3rd Line: Orthotics/Bracing

Evidence-Based Treatments for Lower Extremity Injuries
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Uniformed Services University
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Think I’ve Stretched the Truth?

Very Special Thanks to our models:
Kathy Fields, Melanie McGrath, Quinton Sawyer, and Michelle Boling

Questions
**Hip Case**

- 56 yo female with L hip pain for a week
- No trauma, may have banged it into a door a few weeks ago
- Pain runs down outside of thigh down to knee
- Hurts to get out of a chair and to lay on L side
- Getting so bad she can hardly walk

**Diagnosis**

**Clues to Diagnosis**
- Any lateral hip pain
- Pain running down toward knee
- Wide spectrum of pain
- No matter the history, always press on the troch bursa

**Differential Diagnosis**
- Anything....

**Trochanteric Bursitis**

**Pathoanatomy**
- Gluteus Medius is Key
  - Keeps hips level

**Victim:**
- Troch Bursa

**Culprits:**
- RICE
- NSAIDs
- Phonophoresis
- Steroid Injection

**Treatments**
Trochanteric Bursitis
Treating the Culprits

- **Gluteus Medius Strengthening**
  - Single-leg step downs
  - Lateral leg lifts
  - Hula Girl exercises

- **Iliotibial Band Stretching**
  - A good idea in theory
  - Mixed practical results

Inject First, Ask Questions Later…..

- **Steroid Injections vs NSAIDs**
  - No head-to-head studies
  - Retrospective study:
    - Patients receiving injection 3X more likely to be pain free after 3 months
  - If pain recurs or patient is young/athletic: Find & Treat the Culprit

Most Ostentatious Troch Bursa Article – 2012

- “Management of the greater trochanteric pain syndrome: a systematic review”
  - Reviewed all clinical trials EVER
  - 14 papers using conservative vs surgical treatments
  - Findings:
    - Repeated Shock Wave Therapy or Home PT Exercises
      - Both = 80% relief at 15 months
    - All other treatments “Need More Study”

They’ve Changed the Name, but Treatment the Same?

- “Corticosteroid injections for greater trochanteric pain syndrome: a randomized controlled trial in primary care”
  - Open label, multicenter randomized clinical trial
  - 120 patients visiting Dutch GP’s received:
    - Steroid injection (60)
    - Usual care (home PT, NSAIDs, n=60)
  - Findings:
    - At 3 months:
      - 34% usual care, 55% steroid inject “recovered”
    - At 12 months: No Difference between groups
  - Brinks A, Ann Fam Med. 2011 May-Jun;9(3):226-34

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**Deep Calf Stretch**

- Stand on your injured leg, bend your knee, and place your hands on your hips.
- Hold your uninjured leg with your uninjured hand in a comfortable position.
- Hold for 30 seconds or until you feel a stretch in your calf muscle.

**Plantar Fascia Stretch**

- Stand with your injured leg on a counter or wall, keeping your heel flat on the ground.
- Bend your other knee and reach down to touch your toes with your uninjured hand.
- Hold for 30 seconds or until you feel a stretch in your plantar fascia.

**Towel Fig-Eight Stretch**

- Use a towel to stretch your calf muscle.
- Hold one end of the towel in each hand and pull it over your head.
- Hold for 30 seconds or until you feel a stretch in your calf muscle.

**Rehabilitation for Ankle Sprain**

- **Step 1:** Ice the ankle for 20 minutes, 4 times a day.
- **Step 2:** Use crutches for 2-3 weeks, especially after getting out of bed in the AM.
- **Step 3:** Perform ankle range of motion exercises daily.
- **Step 4:** Progress to more challenging exercises as tolerated.

**Step 2: Re-training Balance – Single Leg Balance**

- Stand on your uninjured leg, bend your other knee, and hold onto a counter or wall.
- Hold for 30 seconds or until you feel a stretch in your calf muscle.

**Other Notes**

- Avoid tight-fitting shoes, socks, and pants that restrict movement.
- Avoid activities that cause pain or discomfort.
- Use ice packs to reduce swelling and inflammation.
- Use over-the-counter pain medication as needed.