

# Nonoperative management of foot and ankle injury related to sports

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## Ankle sprain

- Ankle is a most common injury site of musculoskeletal (1per 10,000persons, per day)
- Sprain: 75% of ankle injuries
- Acute ankle trauma: 10~30% sports related
  - Basketball (45%), Volleyball (25%), Soccer (31%)
- Unfortunately ankle sprains not simple: 33~40% patients complain residual symptom
- Operative vs Conservative: controversial in high-grade injury
  - Operation: residual pain & giving way decrease (JBJS Br 2003, Pijnenburg)-8yr
  - Conservative: functional rehabilitation excellent result (JBJS Am 1998, P. Povacz)-2yr

### 1. Classification

Complicated: usually conservative treatment

Uncomplicated: usually require surgical treatment

### 2. Pathoanatomy and mechanisms of injury

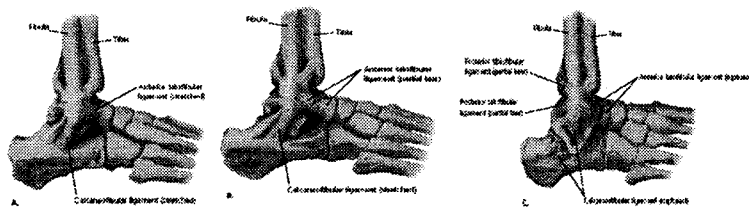


Fig. 1.

Lateral ankle stability: Ant. Talofibular ligament  
Calcaneofibular ligament  
Post. Talofibular ligament

Medial ankle stability: Deltoid ligament (deep and superficial)

Bony mortise

Ant. Tibiofibular ligament

Bony mortise & thick deltoid ligament: medial injury rare (3%)

Plantar flexion and inversion: m/c cause of ankle sprain

**TABLE 1**  
**Classification of Ankle Sprains**

Grade	Signs and symptoms
I: partial tear of a ligament	Mild tenderness and swelling Slight or no functional loss (i.e., patient is able to bear weight and ambulate with minimal pain) No mechanical instability (negative clinical stress examination)
II: incomplete tear of a ligament, with moderate functional impairment	Moderate pain and swelling Mild to moderate ecchymosis Tenderness over involved structures Some loss of motion and function (i.e., patient has pain with weight-bearing and ambulation) Mild to moderate instability (mild unilateral positivity of clinical stress examination)
III: complete tear and loss of integrity of a ligament	Severe swelling (more than 4 cm about the fibula) Severe ecchymosis Loss of function and motion (i.e., patient is unable to bear weight or ambulate) Mechanical instability (moderate to severe positivity of clinical stress examination)

### 3. Diagnosis

Careful history: situation and mechanism of injury

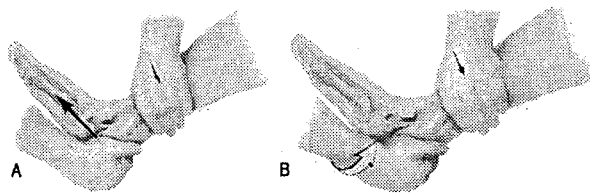
Previous injury to the joint etc

Careful P/Ex.: Inspection

Palpation

Weight-bearing status

Special tests



**Fig. 2. (A) ADT (B) Talar tilt test**

Complicated lesion 에 대한 관찰이 반드시 필요하다.

5<sup>th</sup> metatarsal base fracture

Syndesmosis injury (10% complicated)

Osteochondral talar dome lesion etc.

#### 4. Radiology

Series film: AP, Mortis, Lateral (Ottawa ankle rules, 1994 JAMA)

6주 이상 symptomatic- CT or MRI고려

#### 5. Initial management

PRICE

Initial goals prevent swelling and maintain range of motion

#### 6. Functional Rehabilitation

TABLE 2  
Components of Early Functional Rehabilitation of Ankle Sprains

Component	Procedure	Duration and frequency	Comments
Range of motion Achilles tendon stretch, nonweight-bearing	Use a towel to pull foot toward face.	Pain-free stretch for 15 to 20 seconds; perform five repetitions; repeat three to five times a day.	Maintain activity in a nongravity position with compression.
Achilles tendon stretch, weight-bearing	Stand with heel on floor and bend at knees.	Pain-free stretch for 15 to 20 seconds; perform five repetitions; repeat three to five times a day.	
Alphabet exercises	Move ankle in multiple planes of motion by drawing letters of alphabet (lower case and upper case).	Repeat four to five times a day.	Exercises can be performed in conjunction with cold therapy.
Muscle strengthening isometric exercises	Resistance can be provided by immovable object (wall or floor) or contralateral foot.	For each exercise, hold 5 seconds; do 10 repetitions; repeat three times a day.	Strengthening exercises should only be done in positions that do not cause pain.
Plantar flexion Dorsiflexion Inversion	Push foot downward (away from head). Pull foot upward (toward head). Push foot inward (toward midline of body).		
Eversion	Push foot outward (away from midline of body).		
Isotonic exercises	Resistance can be provided by contralateral foot, rubber tubing or weights.	For each exercise, hold 1 second for concentric component and perform eccentric component over 4 seconds; do three sets of 10 repetitions; repeat two times a day.	Emphasis is placed on the eccentric component; exercises should be performed slowly and under control.
Plantar flexion Dorsiflexion Inversion	Push foot downward (away from head). Pull foot upward (toward head). Push foot inward (toward midline of body).		
Eversion	Push foot outward (away from midline of body).		
Toe curls and marble pickups	Place foot on a towel; then curl toes, moving the towel toward body. Use toes to pick up marbles or other small object.	Two sets of 10 repetitions; repeat two times a day.	Toe curls can be done throughout the day, at work or at home.
Toe raises, heel walks and toe walks	Lift body by rising up on toes. Walk forward and backward on toes and heels.	Three sets of 10 repetitions; repeat two times a day; progress walking as tolerated.	Strengthening can occur from using the body as resistance in weight-bearing position.

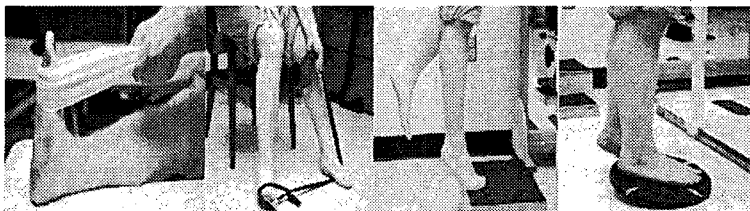


Fig. 3.

Components of Advanced Functional Rehabilitation of Ankle Sprains

Component	Procedure	Duration and Frequency	Comments
<b>Proprioceptive training</b> Circular wobble board	In sitting position, rotate board clockwise and counterclockwise using one foot and then both feet; in standing position, rotate board using one leg and then both legs.	Do five to 10 repetitions; repeat set two times a day.	Wobble board exercises can be performed with eyes open or closed and with or without resistance.
Walking on different surfaces	Walk in normal or heel-to-toe fashion over various surfaces; progress from hard, flat floor to uneven surface.	Walk 50 feet two times a day.	Walking exercises can be performed with eyes open or closed and with or without resistance.
<b>Training for return to activity</b> Walk-jog	Do 50 percent walking and 50 percent jogging in forward direction and backward direction; progress to jogging; jog in a pattern (e.g., circle, figure-eight)	Increase distance in increments of one-eighth mile.	Increase intensity and incorporate activity-specific training. <sup>6</sup>
Run-walk	Do 50 percent jogging and 50 percent running in forward and backward directions; run in a pattern (e.g., circle, figure-eight)	Increase distance in increments of one-eighth mile.	Increase intensity and incorporate activity-specific training. <sup>6</sup>

## Plantar Fasciitis

- Chronic tear and inflammation of plantar fascia due to repetitive tensile overload on the plantar fascia
- Inflammatory change, fibrosis, degenerative change
- 특히 족관절의 배굴(dorsiflexion) 운동이 제한된 경우 조기에 heel off가 일어나면서 제 1 중족 족지 관절의 배굴이 증가함으로 windlass mechanism이 과도하게 작용

### 1. Clinical manifestation

- Morning pain, first step pain
- Worse after rest or sitting, improve after moving around
- Aggravation after excessive activity
- Middle aged
- Pronated or cavus foot are more vulnerable

### 2. Physical Examination

- localized tenderness on inferomedial area of calcaneal tubercle
- windlass test; plantar fascia를 passive stretching시 증상 유발
- tight heel cord, LOM of MTP joint, pes planus, pes cavus 확인

### 3. Radiology

#### 1) X-ray 상 plantar heel spur; 약 50%에서 발견됨

- not consistent with pain
- location; plantar fascia의 기시부가 아니라 FDB의 기시부

- 2) Ultrasound; Plantar fascia의 thickness, fluid collection...
- 3) Bone scan
- 4) MRI

#### 4. Treatment

Treatment	Benefit	Comments
Relative rest	Decrease pain, slow degenerative process	Cross-training to maintain fitness
Stretching	Increase mobility of plantar fascia Decrease tension of gastrocnemius-Achilles complex	Plantar fascia: 15-30 sec rolled under arch, cross-friction massage, great toe extension, towel stretch Gastrocnemius: slant board, wall stretch, curb or stair stretch
Night splints (90°)	Prolonged passive stretch	Commercially available, compliance difficult
Strengthening	Improve structural integrity of longitudinal arch Improve plantar flexor strength	Toe curls Toe taps Heel raises
Anti-inflammatory agents		
NSAIDS	Pain control	Short course Risk of GI problems
Ice	Local pain control	15 minutes 2-3 times/day
Iontophoresis	Decrease inflammation, focal pain control	Time-consuming, reserve for elite athletes or laborers
Corticosteroid injections	Decrease inflammation, focal pain control	Use in later stages, risk of plantar fascia rupture, atrophy
Arch supports		
Arch taping	Stabilize midfoot structures	Inexpensive, trial modality
OTC arch supports	Stabilize midfoot structures	Mild pes planus Adolescents experiencing rapid growth Symptoms less than 8 weeks
Customs orthotics	Stabilize midfoot structures Correct anatomical problems	Ideal for anatomical problems Expensive
Shoes	Correct anatomical and biomechanical factors	Change shoes every 300-500 miles Check for correctable problems
ESWT	Induce inflammatory response Increase neovascularization	High-energy: single treatment, local anesthesia needed Low-energy: multiple treatment sessions, no anesthesia needed, standardization still needed
Surgery	Pain control	Failed conservative therapy at least 6 months, often much longer

#### 1) Conservative Treatment

; 6-9개월까지 충분한 치료가 필요하며, 90% 이상 좋은 결과를 얻을 수 있다.

##### Step 1

- ① Activity modification; 직접적인 충격이나 운동량 증가 등은 피함.
- ② Icing, Massage
- ③ Stretching; heel cord, plantar fascia, intrinsic m.
- ④ Orthosis; heel cup, heel pad, arch support

##### Step 2

- ① Immobilization; Night Splint
- ② Medication; NSAID for acute phase
- ③ Steroid injection (not recommend)
- ④ Prolotherapy

##### Step 3

- ① Cast or Brace
- ② PT
- ③ Shock wave therapy



Fig. 4.

# Recalcitrant (or resistant) plantar fasciitis

- Obesity, bilateral, prolonged duration
- Excessive pronation or cavus, heel cord tightness, fat pad atrophy
- Misdiagnosis, repeated steroid injection
- Mostly need operation

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