

Fracture of the Ankle

Gulpha Asthi Bhagna/ Bhanga

Hnin Yu Maw Htwe (BMTM , MMTM, Dip. Eng (MUFL))

Tutor

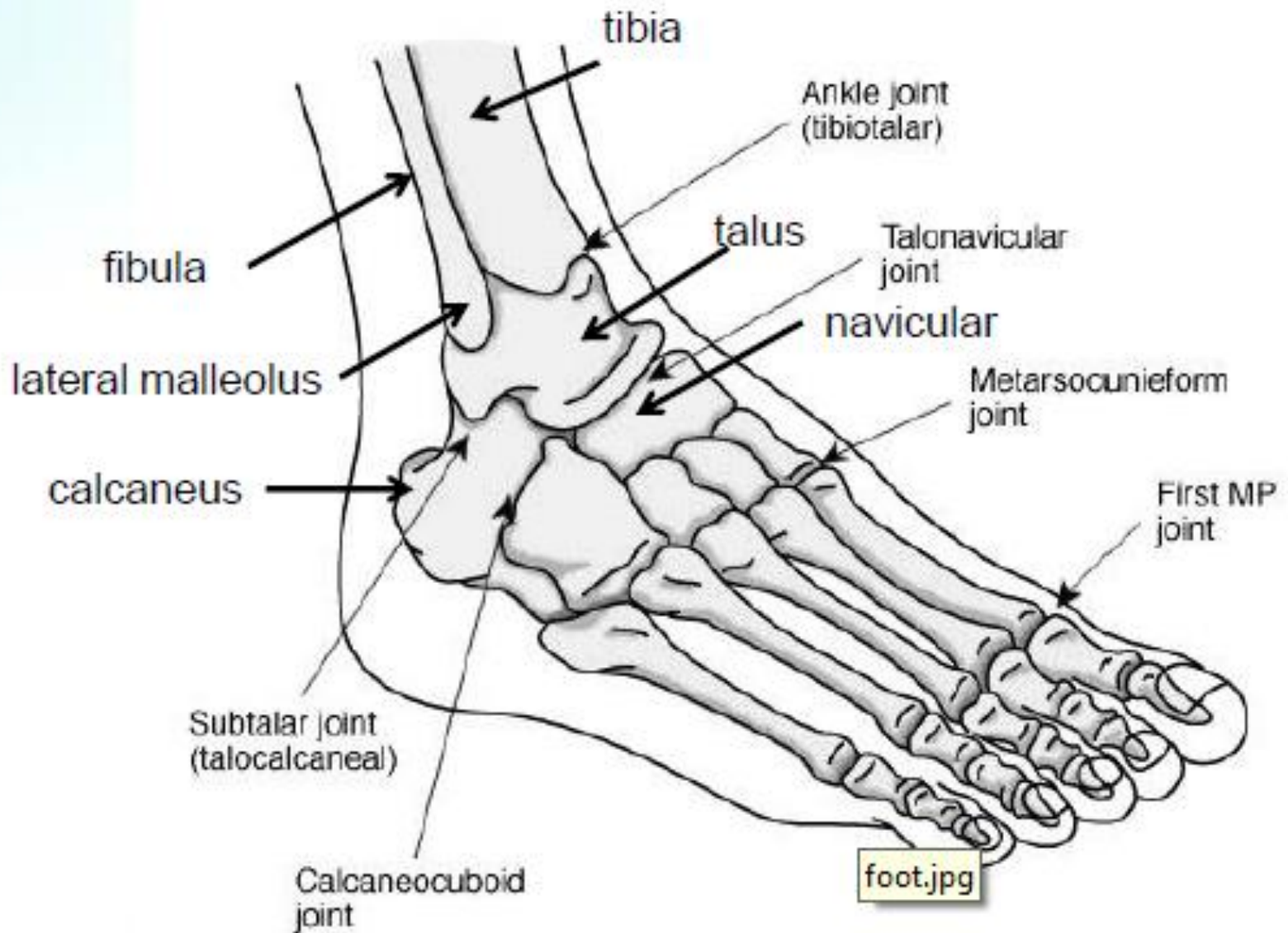
Department of Physical Medicine

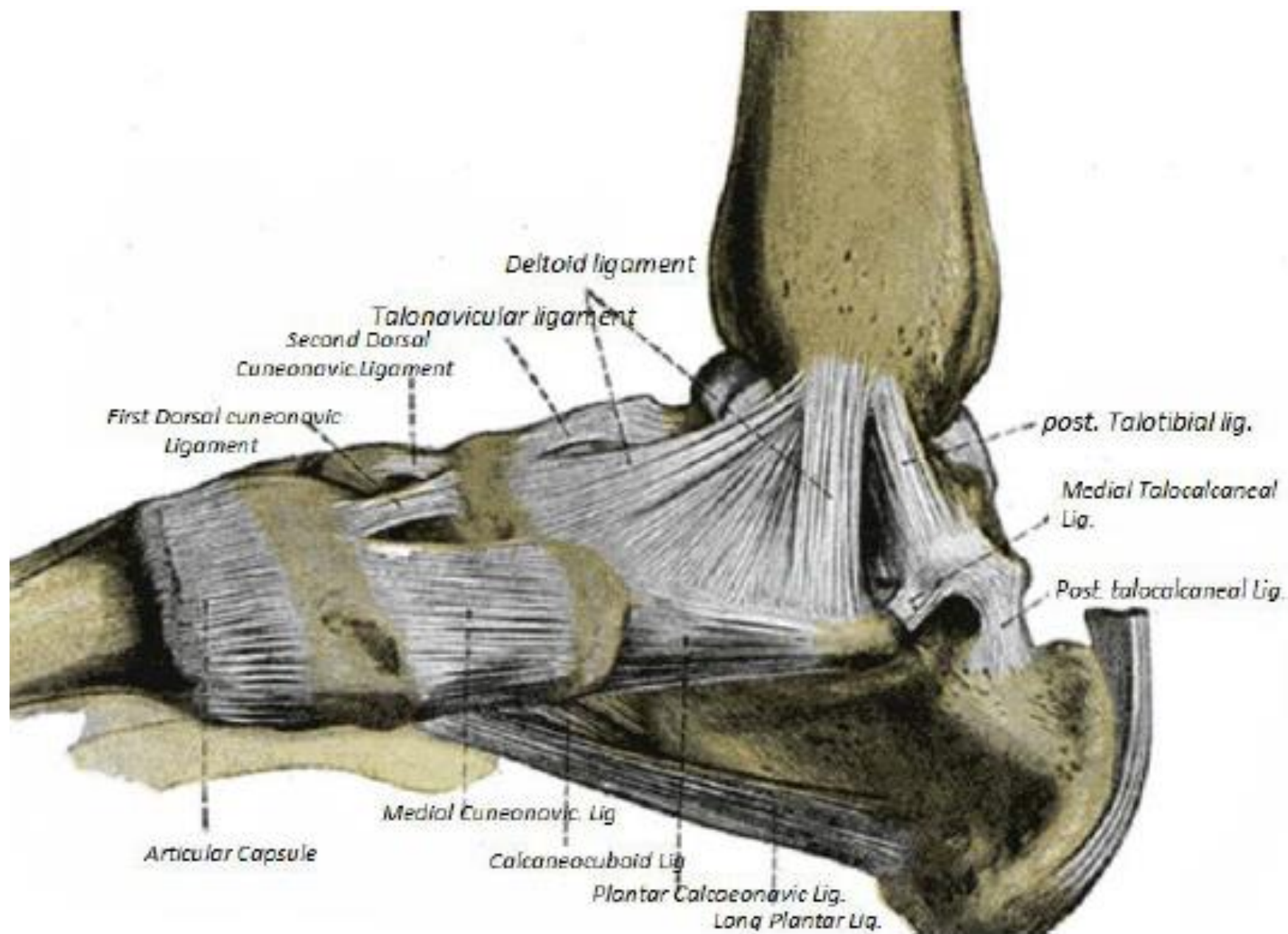
- Ankle anatomy
- Mechanism of injury
- Site of fracture
- Type of fracture
- Line of treatment by method of traditional medicine

Ankle anatomy

- Ankle joint is a hinge joint
- The lower end of the tibia and its medial malleolus
- Together with the lateral malleolus of the fibula
- Inferior transverse tibiofibular ligament form a deep recess (mortise) to articulate with the body of the talus

- ankle joint has a strong medial collateral (deltoid) ligament which is triangular in shape
- made up of the tibionavicular,
- tibiocalcaneal and tibiotalar (anterior and posterior) ligaments





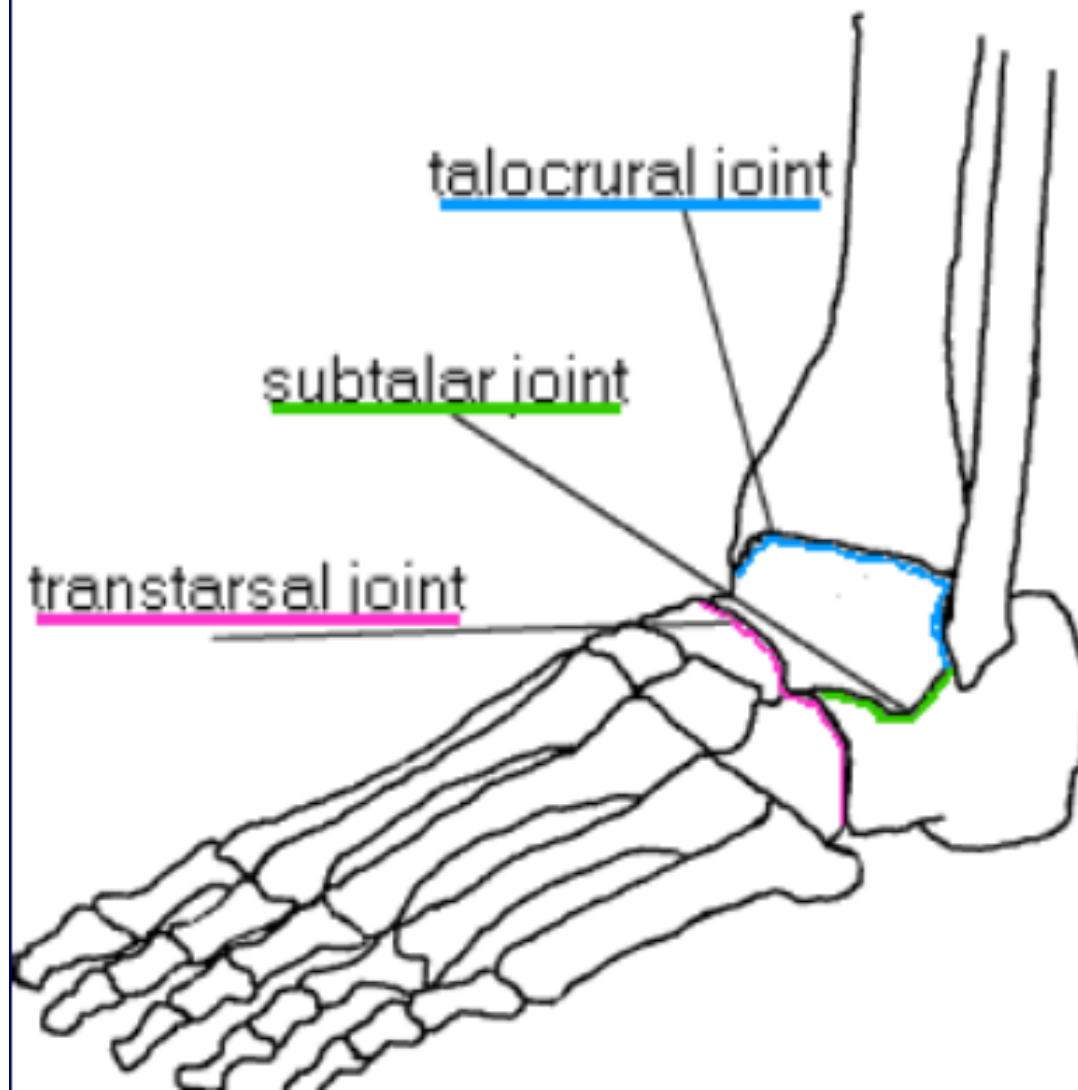
Radiographically Viewed

Ankle Joint (Medial View)

1. Fibula
2. Tibia
3. Ankle joint
4. Promontory of tibia
5. Trochlear surface of talus
6. Talus
7. Posterior tubercle of talus
8. Calcaneus
9. Sustentaculum tali
10. Tarsal tunnel
11. Navicular
12. Cuneiforms
13. Cuboid



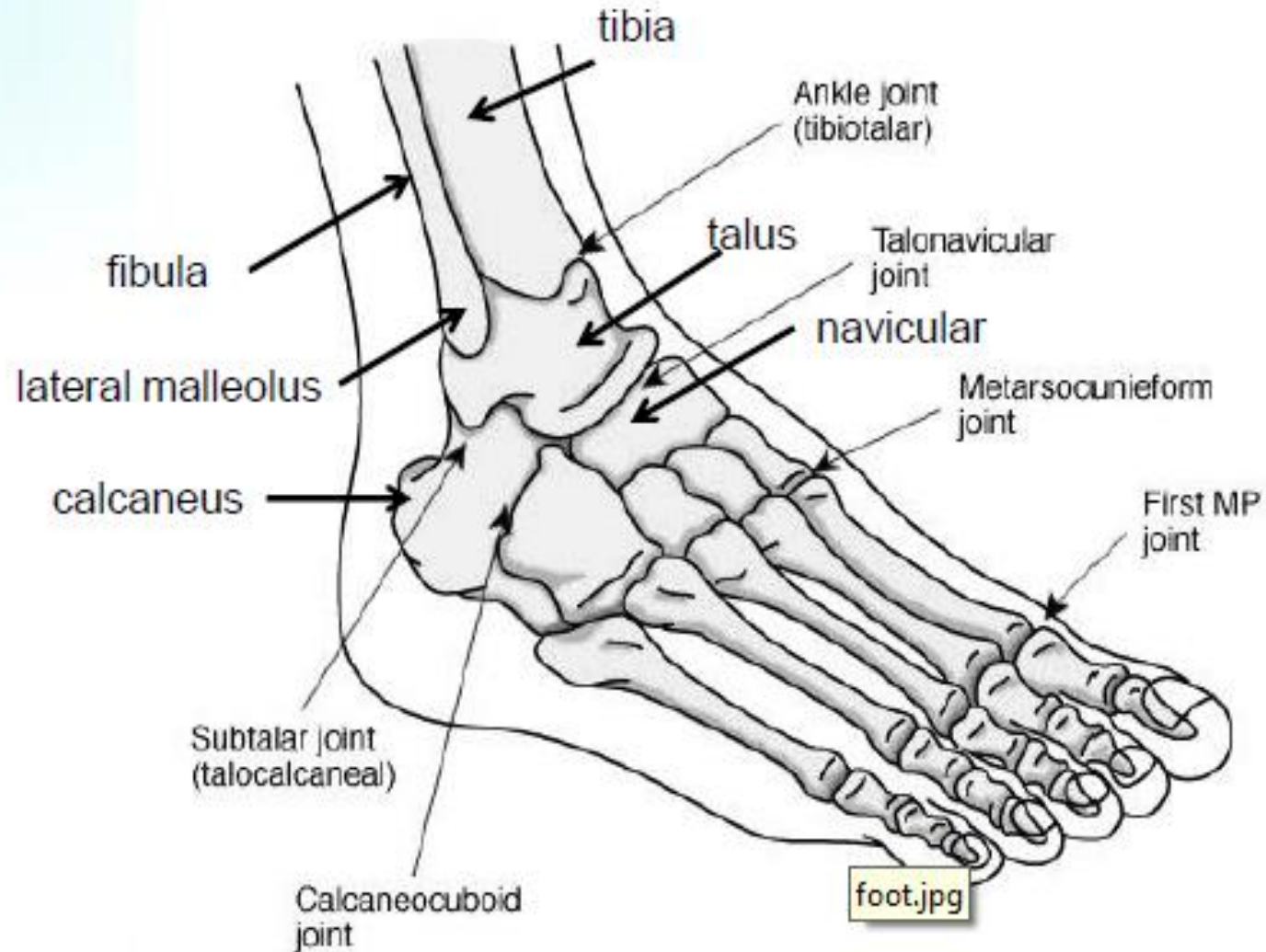
Articulations



ankle joint is a hinge joint, the lower end of the tibia and its medial malleolus, together with the lateral malleolus of the fibula and the inferior transverse tibiofibular ligament form a deep recess (mortise) to articulate with the body of the talus, the ankle joint has a strong medial collateral (deltoid) ligament which is triangular in shape, it is made up of the tibionavicular, tibiocalcaneal and tibiotalar (anterior and posterior) ligaments, injury to the deltoid ligament is commonly associated with

The lateral ligament has 3 parts, the anterior talofibular ligament the posterior talofibular ligament and the calcaneofibular ligament, the lateral ligament is commonly injured with inversion sprains.

The Foot and Ankle:



Distal tibia

Medial malleolus

Weight bearing surface

Anterior and posterior process

Lateral surface

Distal fibula

Lateral malleolus

Anterior tubercle

Posterior tubercle

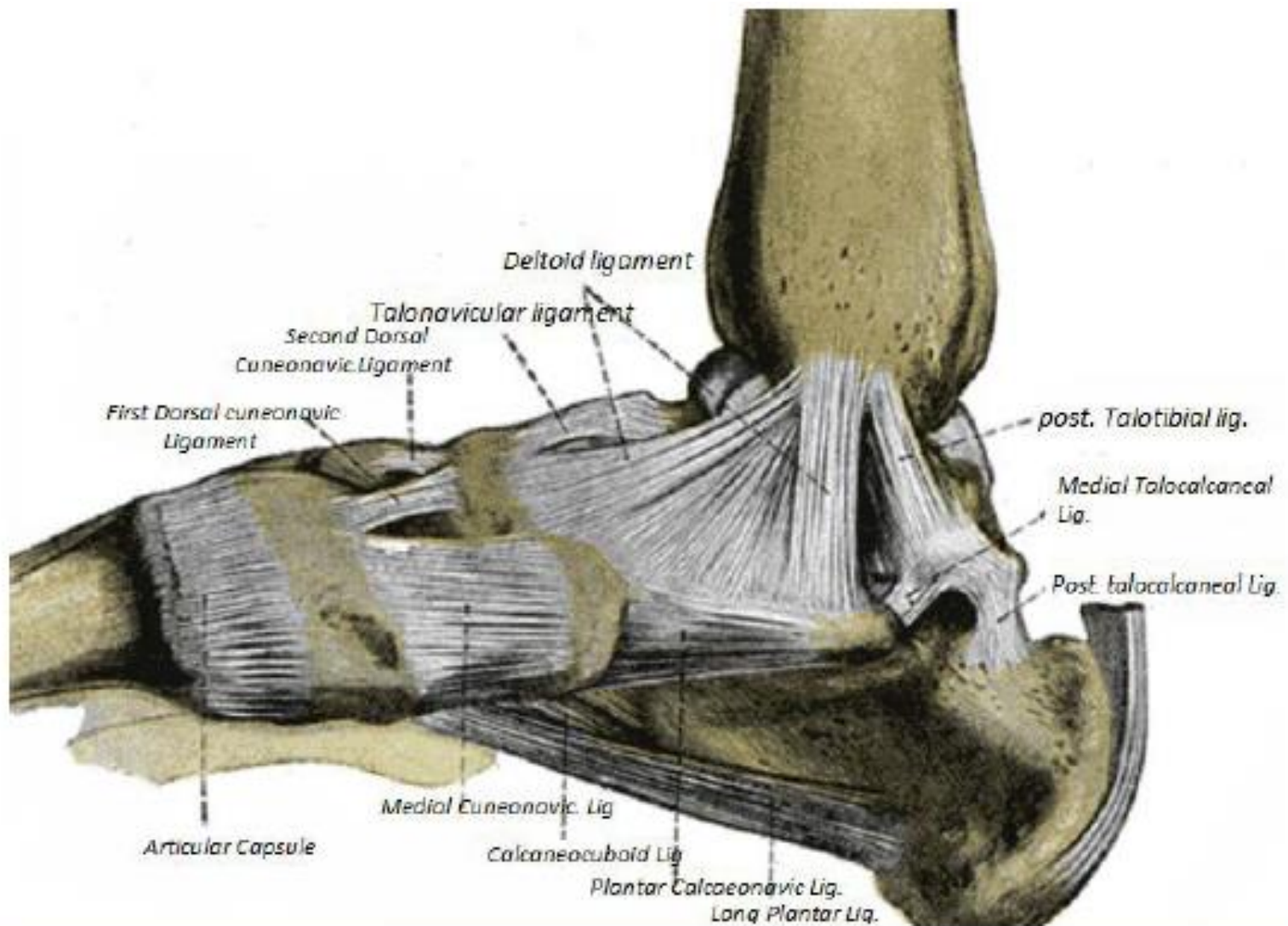


Figure 1. Ligaments of the medial aspect of the foot [8].

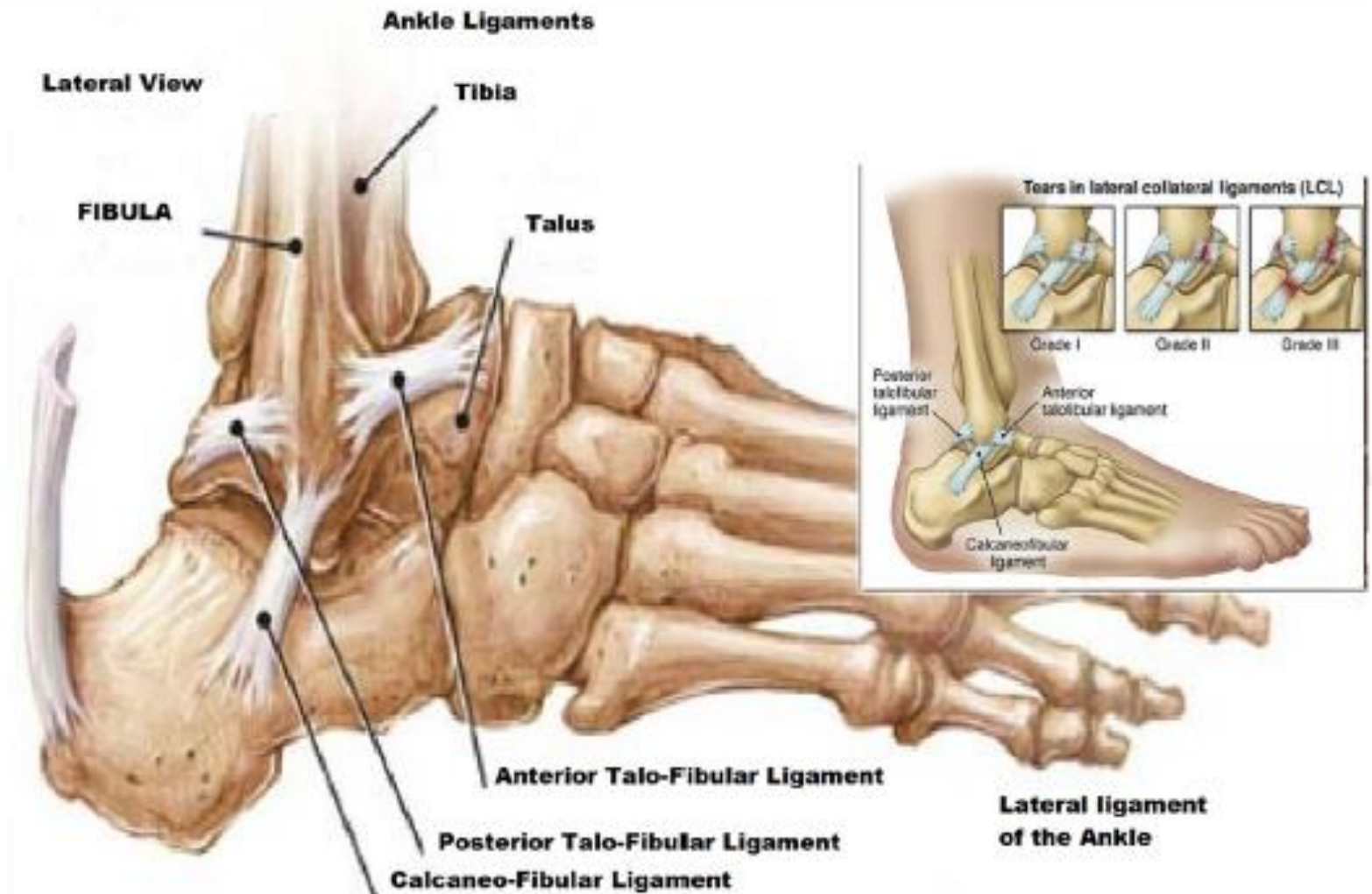


Figure 2. The lateral ligament complex [8].

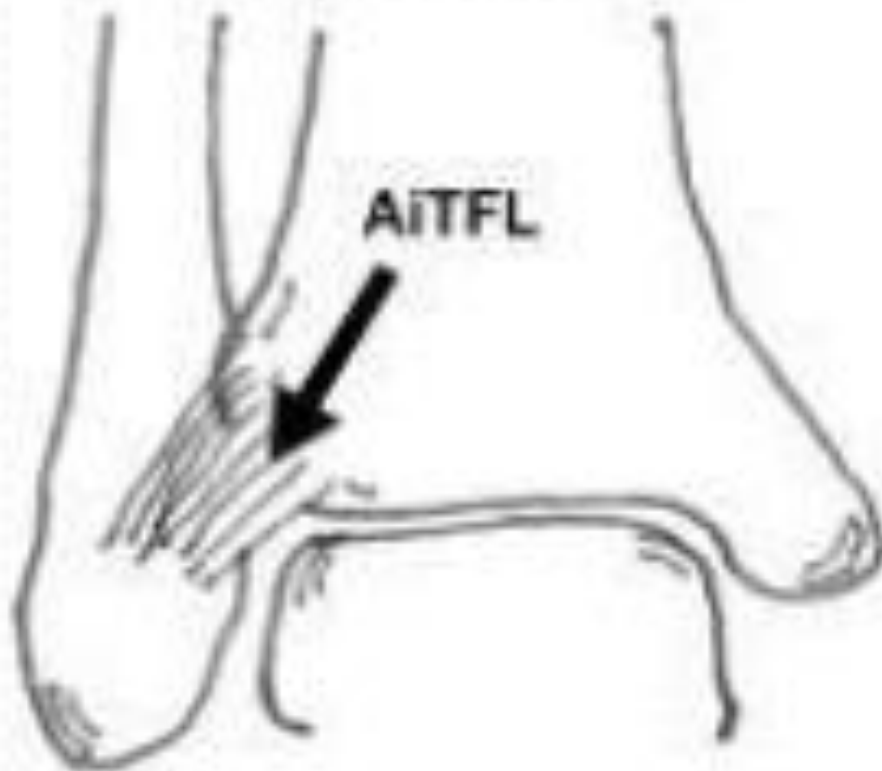
Joint Structure

Inferior Tibiofibular joint

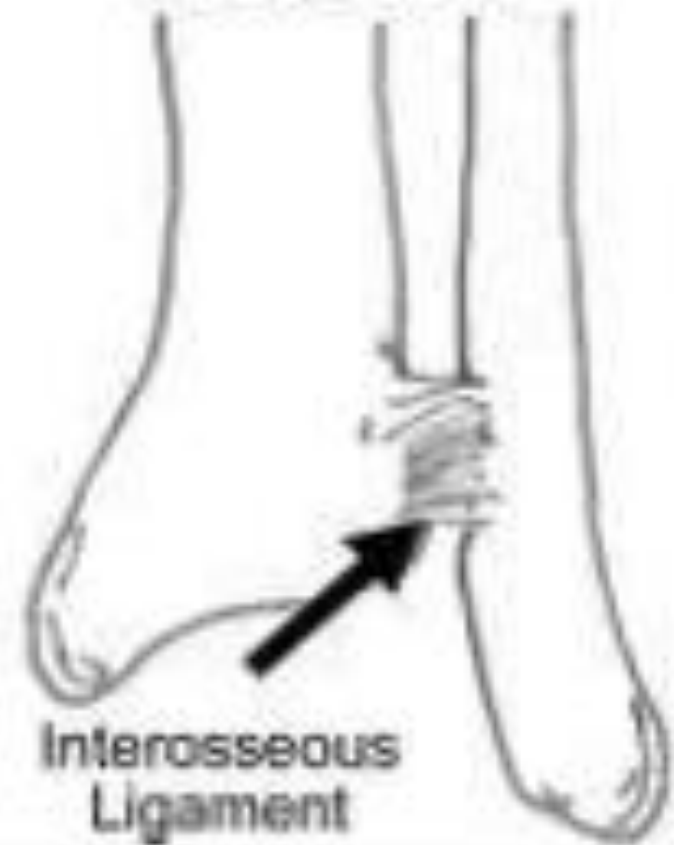
Syndesmosis (fibrous union) between concave distal tibia and convex distal fibula

No joint capsule

Anterior



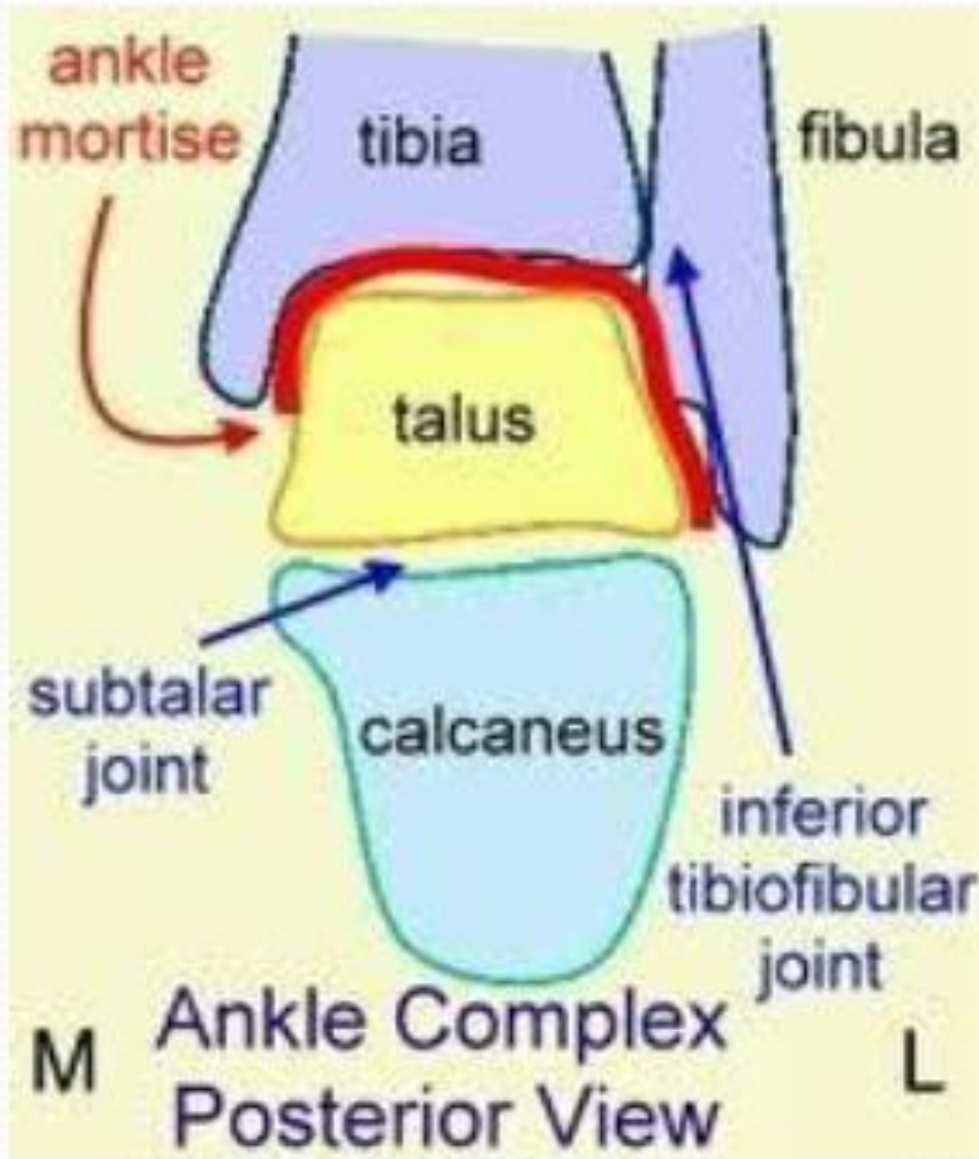
Anterior



Joint Structure

Talocrural:

The distal tibia and fibula sit on top of (and articulate with) the superior aspect of the talus, with the medial and lateral malleoli wrapping around the talus



Ankle Function

Plantar flexion

Dorsiflexion

Inversion

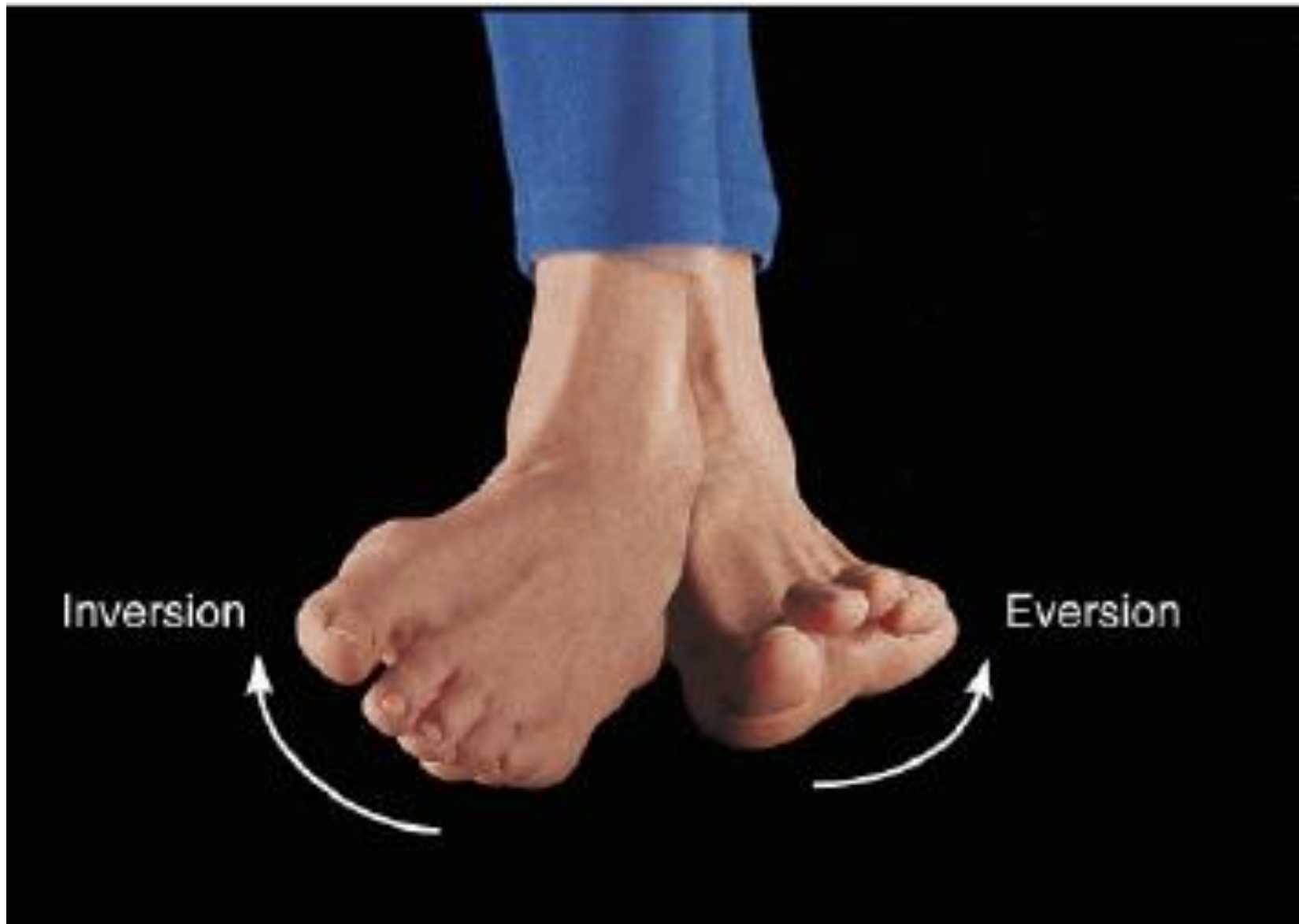
Eversion

Range of movement (ROM)

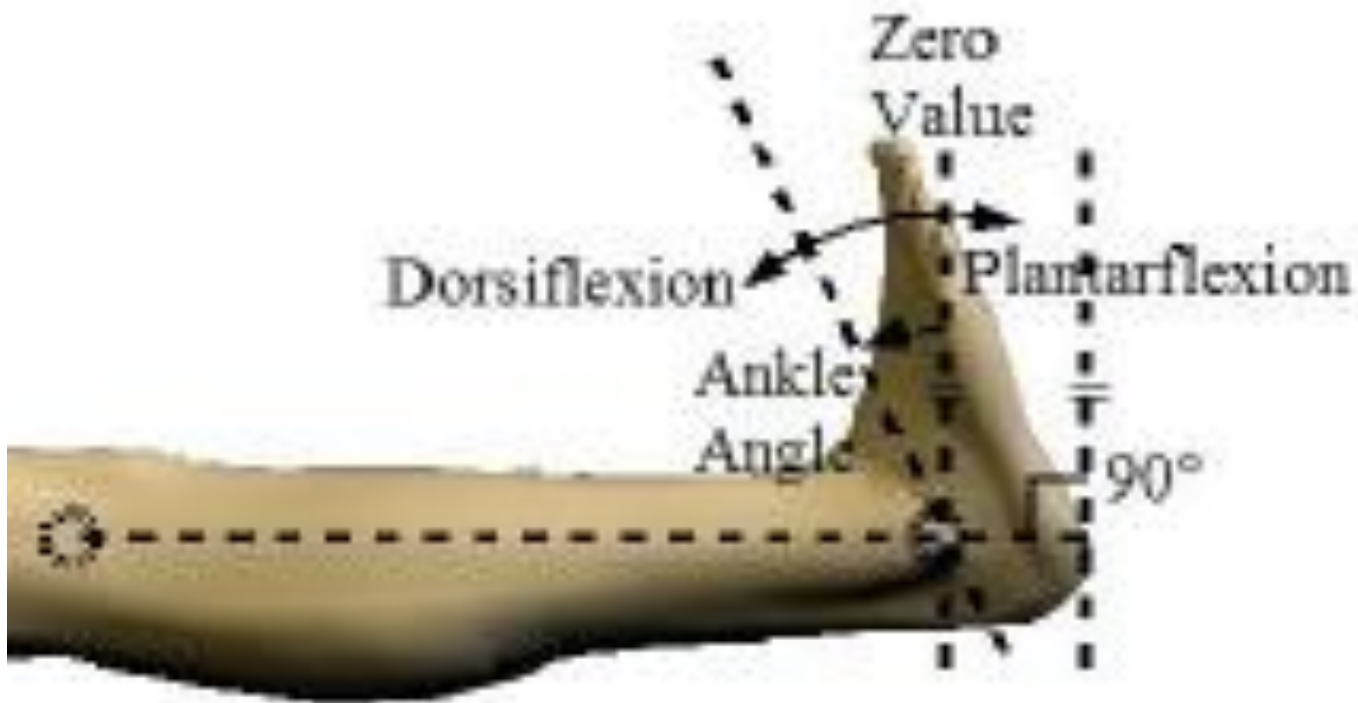
Dorsiflexion of ankle joint – 32 to 35 degree

Plantarflexion of ankle joint – 25 degree









end range DF.jpg

What is an ankle sprain?

Sprain= a stretched or torn ligament

High ankle sprain

What is a common ankle sprain?

A tearing of the ligaments that connect the Fibula to the Talus or Calcaneus.

high_a







High ankle sprain



© Healthwise, Incorporated

Ankle fracture is one of the **most common** lower limb fractures for they account for 9% of all fractures representing a significant portion of the **trauma** workload. Ankle fractures usually affect **young men** and **older women**, however, below the **age of 50**; ankle fractures are the commonest in men.

Ankle fractures are one of the most common lower limb fractures they account for 9% of all fractures , representing a significant portion of the trauma workload . The annual incidence of ankle fracture is between 107 and 184 per 100,000 persons , and around 2% of ankle fractures are open fractures

Ankle fractures usually affect young men and older women , however, below the age of 50; ankle fractures are the commonest in men. After this age, females become predominant.

The most common causes of ankle fractures are twisting injuries and falls, followed by sports injuries . Diabetes mellitus and obesity are associated with fractures in middle aged and older adults . Most fractures are associated with ligament injuries, and the magnitude and direction of the deforming force applied to the ankle joints directly correlate to the fracture pattern.

Fracture and fracture dislocations of the ankle are common. Most are low energy fractures of one or both malleoli, usually caused by a **twisting mechanism**. Less common are the **more severe fractures**.

Most common causes of ankle fractures

- twisting injury
- falls,
- followed by sports injuries
- Diabetes mellitus and
- obesity are associated with fractures in middle aged and older adults
- Most fractures are associated with ligament injuries, and the magnitude and direction
- of the deforming force applied to the ankle joints directly correlate to the fracture pattern

Mechanism of injury

- Direct injury
- Indirect injury
- stumbles and falls
- Usually the foot is anchored to the ground while the body lunges forward
- The ankle is twisted and the talus tilts and / or rotates forcibly
- Causing a low energy fracture of one or both malleoli
- With or without associated injuries of the ligaments

- twisting injuries and falls
- followed by sports injuries

Extended Lauge-Hansen Classification of Indirect Ankle Fracture

1. Supination- external rotation
 - a. Stage 1- anterior tibiofibular complex disruption
 - b. Stage 2- Fracture of fibula at or above the syndesmosis
 - c. Stage 3- Posterior tibiofibular complex disruption
 - d. Stage 4 – Deltoid ligament complex disruption

2. Pronation- abduction at syndesmosis

- a. Stage 1- Deltoid ligament complex disruption
- b. Stage 2- Fracture of fibula at syndesmosis

- 3. Pronation – abduction above syndesmosis
 - a. Stage 1- Deltoid ligament complex disruption
 - b. Stage 2- Anterior and posterior ligament complex disruption
 - c. Stage 3 – Fracture of the fibula above the syndesmosis

4. Pronation – external rotation

- a. Stage 1- Deltoid ligament complex disruption
- b. Stage 2- Anterior tibiofibular ligament complex disruption
- c. Stage 3- Fracture of the fibula above the syndesmosis
- d. Stage 4 – Posterior tibiofibular ligament disruption

5. Supination- adduction

- a. Stage 1- Lateral- collateral ligament complex disruption
- b. Stage 2- Vertical fracture of the medial malleolus

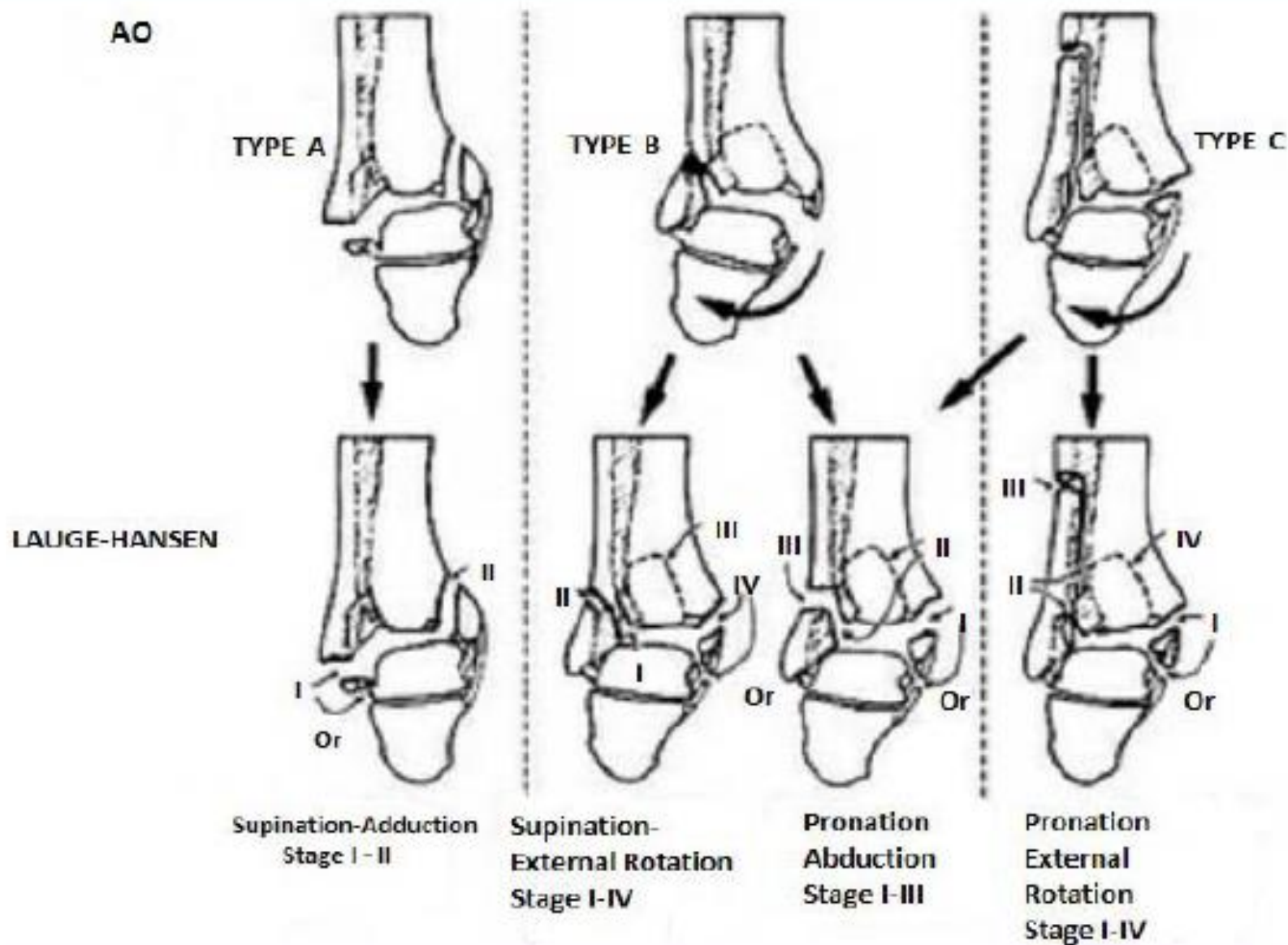


Figure 3. Classification of Ankle fractures [8].

Types of fracture

- Spiral fracture
- Avulsion fracture
- Transvers fracture

your ankle where a small sliver of bone has been pulled off the end. This is known as an ‘avulsion’ fracture. This usually happens because one of the ligaments in your ankle has pulled the piece of bone away

Common symptoms of a ankle fracture are:

- Deformity around the ankle
- Swelling
- Heamatoma
- Bony tenderness
- Instability and pain on attempting to walk

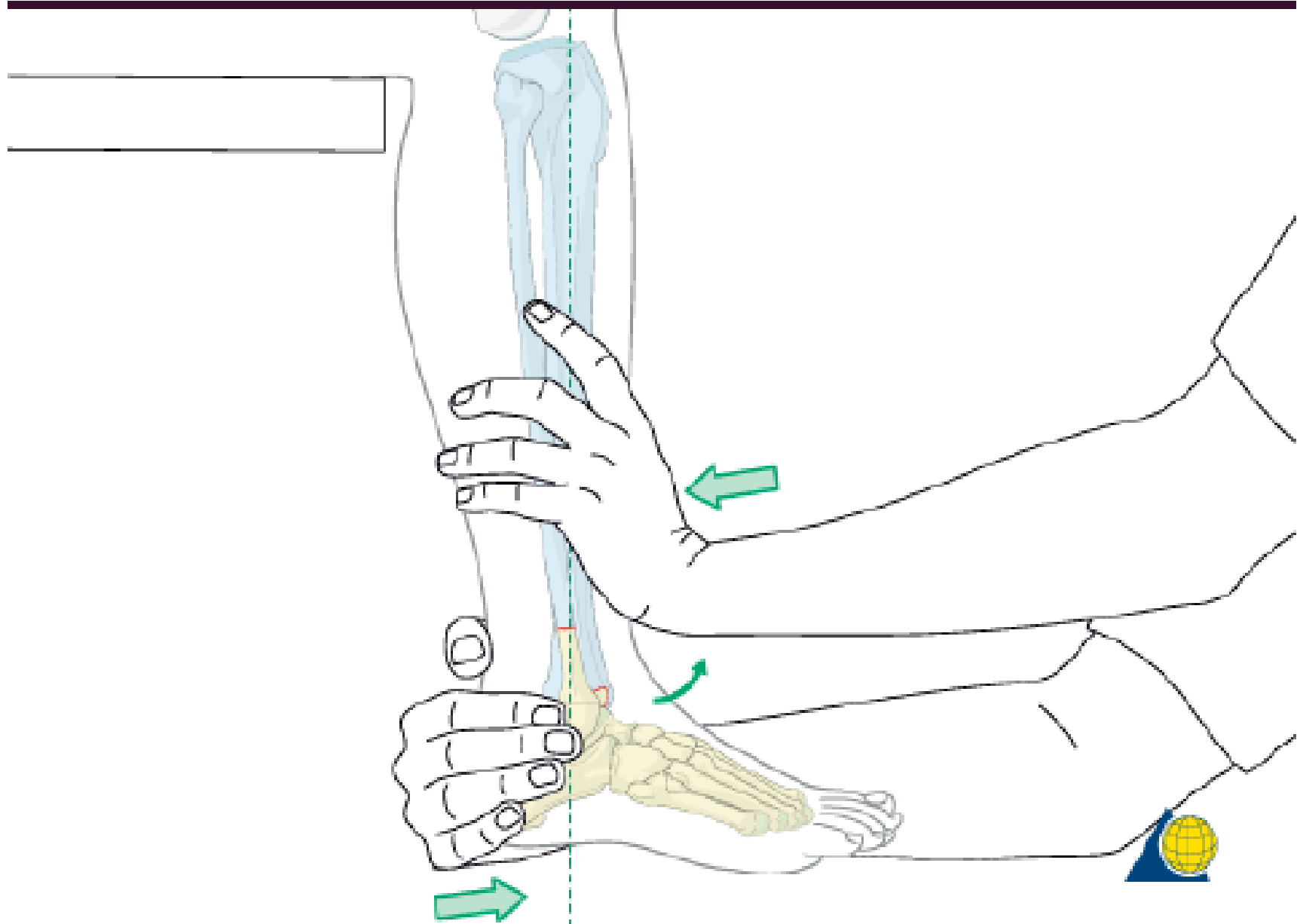
Diagnosis

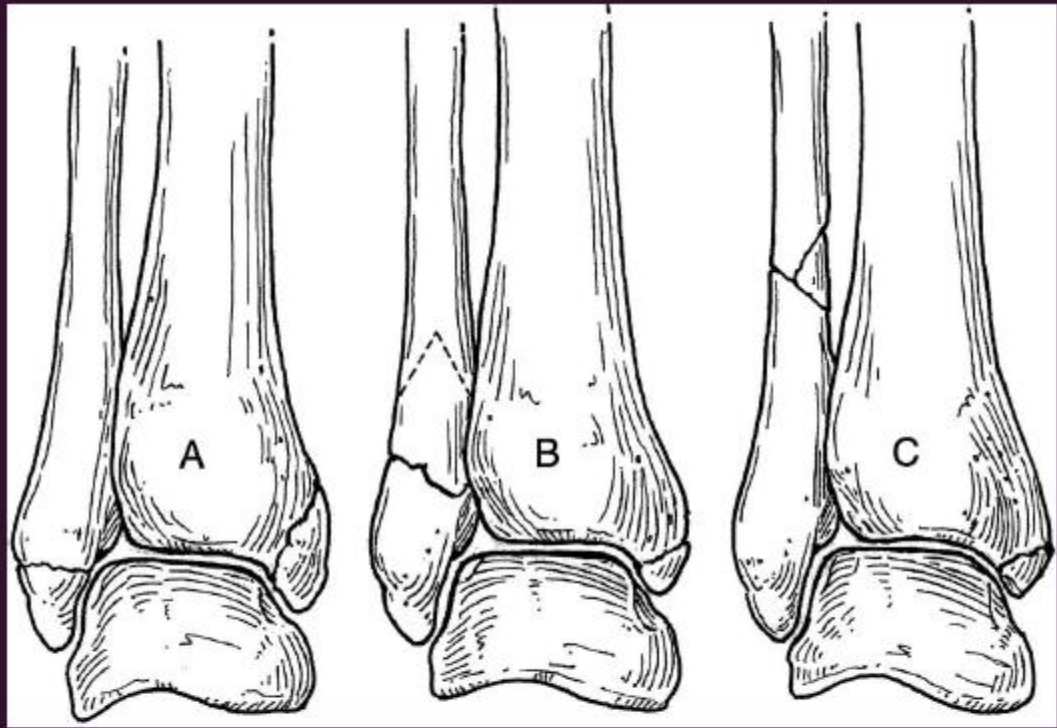
Ankle fractures usually result from torsional forces and present typically with tenderness, swelling, deformity and inability to weight-bear. However, beware the non-displaced ankle fracture presenting post-injury with minimal swelling and no deformity.

The history of the injury normally gives a good indication of the mechanism of fracture and can assist in decision making regarding management. The physical examination of the ankle must also involve a thorough assessment of the foot.

Line of treatment for ankle joint fracture

- Reduction
- Medical bandaging
- Using of POP slab
- Massotherapy
- Panchakarma therapy
- Exercise



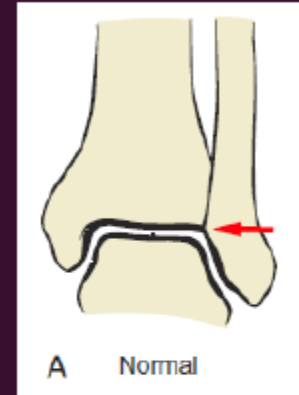


ANKLE FRACTURE

Non-operative Treatment

- **Indications:**

- Nondisplaced stable fracture with intact syndesmosis
- Patient whose overall condition is unstable and would not tolerate an operative procedure



- **Management:**

- Below the knee cast for 4-6 weeks
- Follow with serial x-rays and transition to walking boot or short-leg walking cast

Nonoperative Treatment

- Clinical example
 - SER injury
 - Treated in short leg dynacast
 - Films 4 months post injury show healed stable mortise
 - Less than 3 mm displacement of the isolated fibula fracture with a reduced ankle mortise do not require surgery



Short Leg Dynacast

Stockinet and velban application

Add padding to heel



1



2

Support metatarsal heads
Ensure freedom of toes

Avoid impingement over 5th toe



3



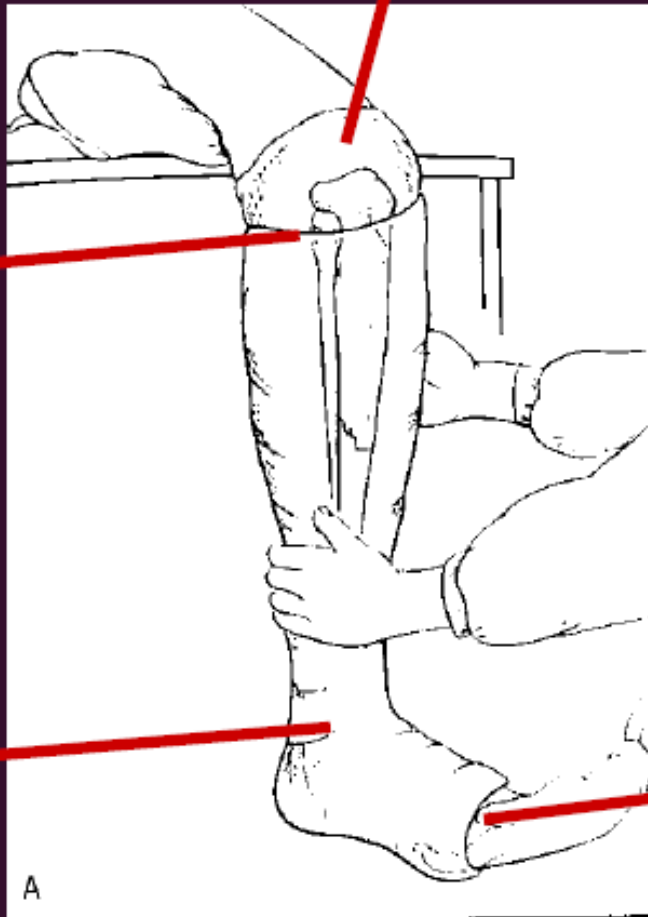
4

Flexed knee

Padded fibular
head

Neutral ankle
position

Toes free



Assistant or foot stand required to maintain ankle position

Not 90 degree over ankle joint



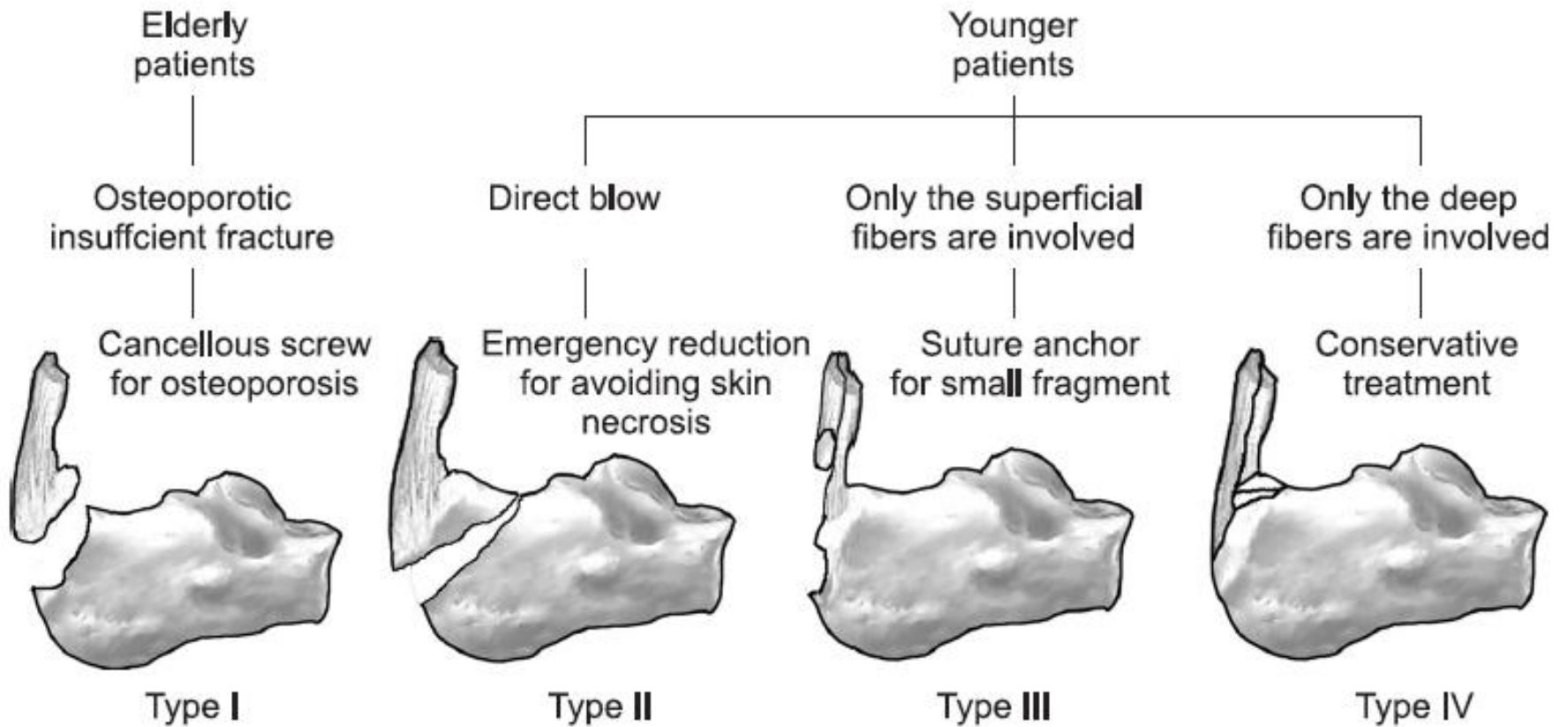
Walking sandal



Weight bearing is not allowed until cast is dry ^{1_017}

Ankle Fracture





A recovery plan has been provided below

Time since injury Recovery plan

24-72 hours Try to rest and elevate your foot. A cold pack (ice pack or frozen peas wrapped in a damp towel) can provide short term pain relief. Apply this to the sore area for up to 15 minutes, every three to four hours and ensure the ice is never in direct contact with your skin.

.

0-2 weeks If you were given a boot, wear it for comfort when walking. You can walk on your injured foot as long as it is not too painful. If you were given crutches, you can stop using these when you feel able to.

You should take the boot off when you are resting. You do not need to wear it at night. Start the exercises described below as you are able to

2-6 weeks Reduce the amount of time you wear the boot and gradually start to resume your normal activities. Continue with the exercises shown below

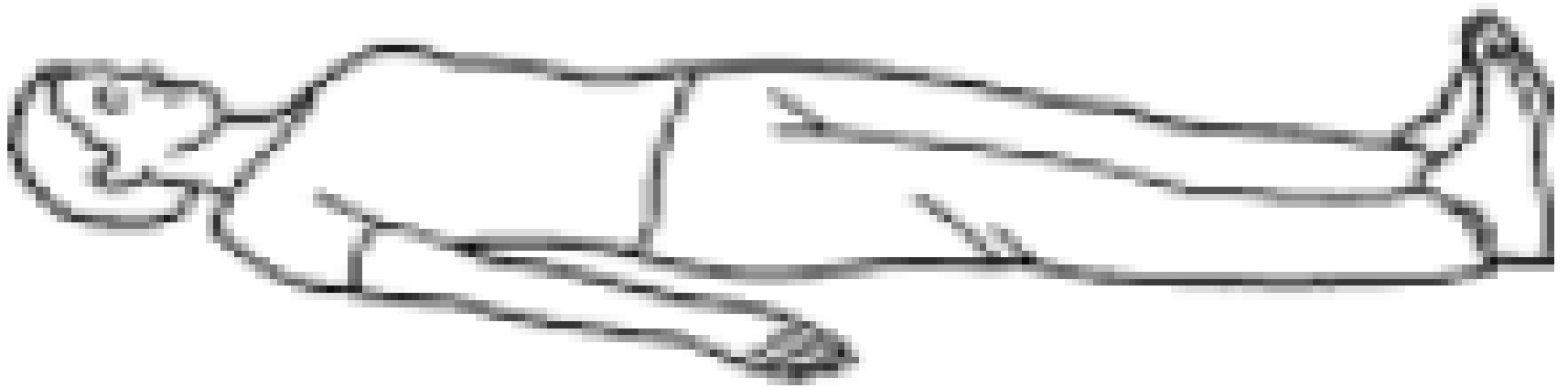
- 6-12 weeks By now you should be returning to your normal level of activity. You might still feel some discomfort with higher level activities such as running.
- If you experience a significant increase in pain and/or swelling you will need to reduce your activity levels and gradually increase these over a longer period of time.

Exercises should be carried out 3-4 times daily

1. Static Quadriceps:

Tighten muscles in front & back of the thigh.

Hold for 5 seconds, relax. Repeat x 10



2. Straight Leg Raise:

Start with the leg straight.

Raise the leg off bed by approximately 12 inches.

Hold for 5 seconds, relax. Repeat x 5.



3. Knee Flexion:

Lying on your back, bend your knee as much as possible by sliding the leg up and down.

Support your foot on the bed and use a plastic bag or sliding board under the foot for comfort. Repeat x 10.



4. Knee Extension:

Place a pillow or folded towel under your knee.

Push the knee straight into the towel, hold for 5 seconds.

Repeat x 10.



5. Side lying Abduction

Lying on your side with operated leg on top.

Straighten knee and lift leg towards the ceiling.

Repeat x10



Ankle Fractures

- Ankle fractures are usually defined as single malleolar, bimalleolar, or **trimalleolar**

Trimalleolar involves med/lat and posterior tibial malleolus

- Isolated fibular fractures are the most common type of fracture and, without displacement, usually requires 4-6 weeks to heal

Tibial Plafond - the articular surface of the distal end of the tibia.

Figure: Courtesy of David B. Thordarson, MD



Figure 1. A 28-year-old man jumped from the top of a trailer, landed on both feet, noted immediate pain, and could not walk. An anteroposterior radiograph of his right ankle shows the extension of tibial plafond fracture lines (arrows) into the weight-bearing surface of the joint. Such injuries generally require surgery and often lead to poor outcomes.

Weight bearing exercises

Repeat each exercise three to four times a day.

1. Hold onto a chair or table for support and practise standing on your injured leg for up to 30 seconds. When able, stand on the injured leg without holding onto the support.



Rise up and down on your toes. Repeat this 8 to 12 times, or as much as pain allows



causes of ankle pain

- Achilles tendon injury or Achilles tendinopathy.
- Joint problems - eg, gout
- Tendon injuries, usually often due to poor running technique over a long period putting an imbalanced
- strain on the muscles and joints around the ankle.

The following conditions cause pain in the heel rather than the ankle, although this pain may extend into the ankle as things get worse:

Bruised heel: this normally causes heel rather than ankle pain. It is usually caused by overuse such as repetitive bounding, long-distance running or landing heavily on the heel. The heel bone is protected by a pad of fatty tissue. Repeated pounding can cause the fat to flatten and move sideways so that cushioning is lost and bruising of the bone develops. It is treated by rest and prevented by protective footwear.

Plantar fasciitis. This means inflammation of a strong band of tissue called the plantar fascia that stretches from your heel to your middle foot bones.

complications of ankle fracture

Most ankle breaks (fractures) heal uneventfully.

Possible early complications include:

- Infection (especially after open fracture).
- Damage to nerves and blood vessels (especially after displaced fracture)

- Compartment syndrome (severe swelling in the leg soon after the injury, putting pressure on nerves and blood vessels)
- Poor healing

- Damage to skin and soft tissues by a tight or poorly finished cast.
- Burns to the skin as the plaster hardens.
- Failure of bones to knit together and heal well. This can lead to delayed union, union with poor

- alignment, or complete non-union even after six months.
- Temporary complications of wearing a cast include thinning of the bones and wasting of the muscles,
- both of which occur significantly even in a 4-6 week period of casting

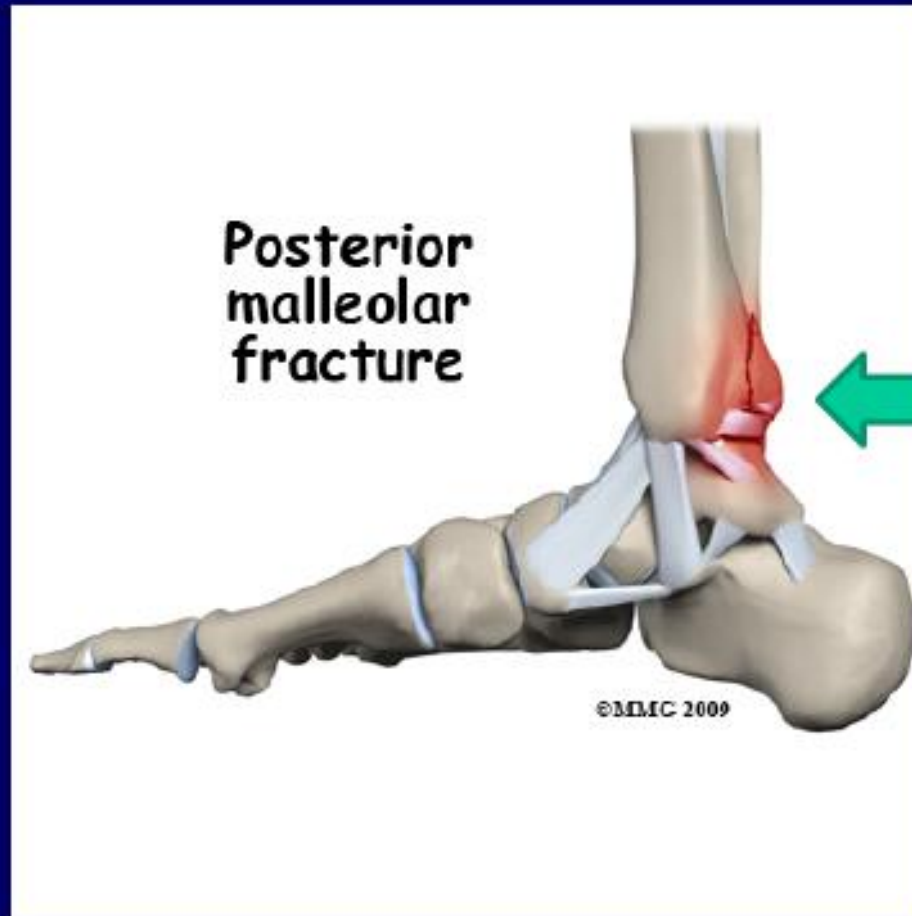
- Inflammation of the veins of the lower leg (thrombophlebitis).
- Clotting (thrombosis) of the deep veins of the leg (deep vein thrombosis) which can relate both to reduced mobility and to pressure on the leg veins from swelling and casting.

- Complications of surgical treatment of ankle fracture can include pain from, and infection around,
- surgical pins (which can in themselves be distressing and frightening).

Possible later complications include:

- Osteoarthritis of the ankle.
- Stiffness and loss of flexibility in the ankle.
- Long-term instability of the ankle joint, needing later correction.

Posterior Malleolar Fracture



Calcaneal Fracture



Lateral radiograph of the ankle. There is a hatchet injury to the calcaneus.

Technical management

- a. *Bhagna Sthapana* (Reduction)
- b. *Bandhana* (Immobilisation or Retention)
- c. *Sukhchestaprasara* (Physiotherapy)

Medication

- a. Oral Medication
- b. Local Medication
- c. Parenteral Medication

Do's and Don'ts

- a. Dietetic instructions
- b. Life style modifications

Factors influencing fracture healing: In Sushruta Samhita and other ancient Ayurvedic texts a cascade of factors influencing prognosis of fracture healing viz. age, physical status, nutritional status, type of bone involved, techniques of management, seasonal variables, *Prakriti* (Psycho-somatic constitution), anatomical factors etc. have been described.

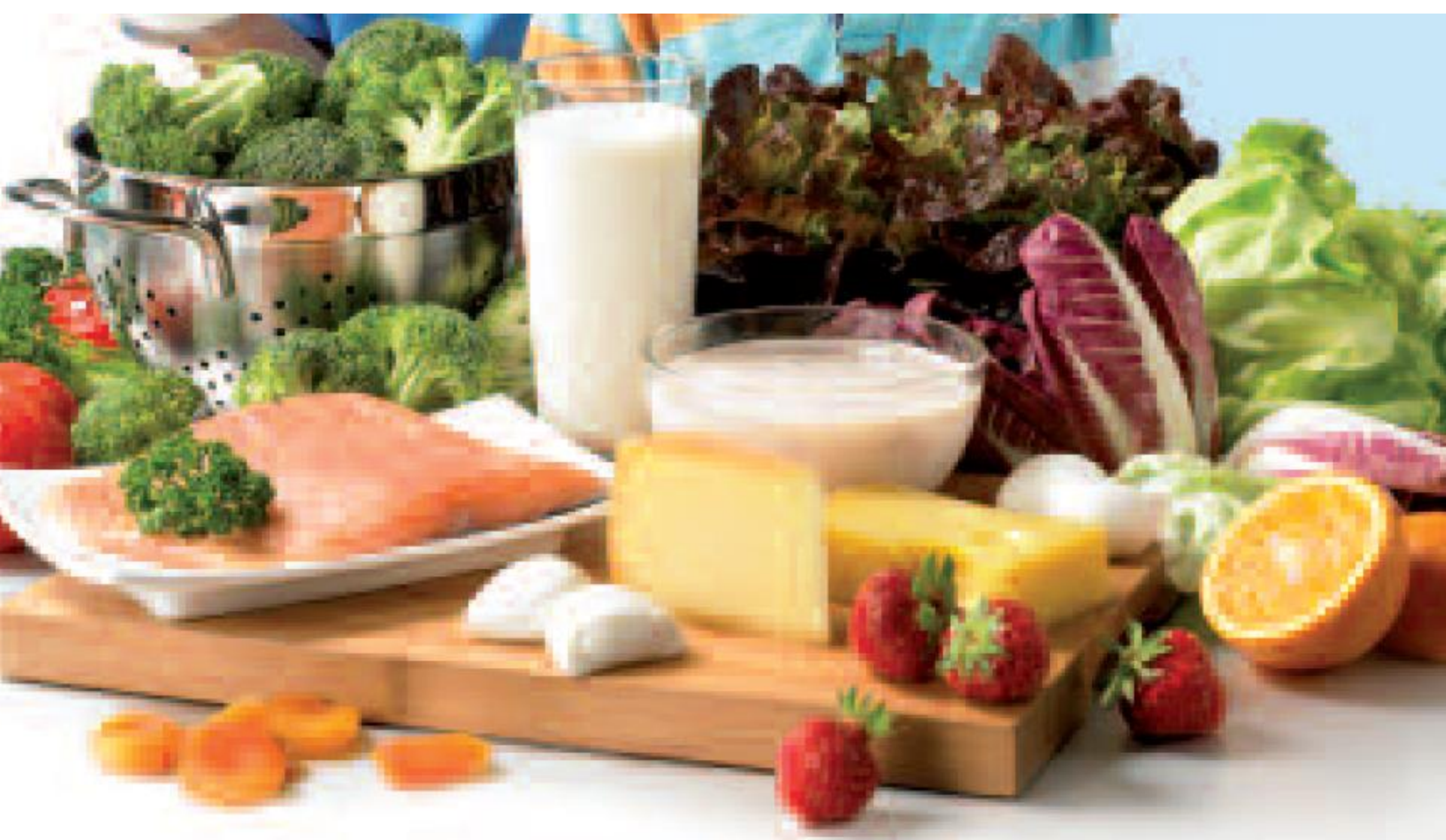
Initial management / First aid

applicable in *Avrana* (closed injuries) type of *Bhagna* (skeletal injuries). Application of the cold water or ice packs is a very important measure and even today it is abundantly used in general trauma and sports injury management

When a tissue injures certain **pathological processes** and metabolic response of the body towards **trauma immediately starts**. Very important are the bleeding from the **torn vessels** resulting into immediate **local swelling, pain** receptors stimulation resulting into pain at the **injured site**, increased local metabolic rate and setting up of the **sterile inflammatory response**

- Cold water or ice pack application on the injured sites immediately after the injury constricts the blood vessels of that area resulting into less haemorrhage subsequently less swelling and less blood loss.
- By the application of cold water the inflammatory response is suppressed and metabolic needs of injured tissue are also reduced which further help to keep the swelling and pain minimal

➤ Cooling of the local tissues also reduces the irritation of local pain receptors resulting in to further reduction of pain









canned fish with soft, edible bones (the calcium's in the bones!) such as sardines, pilchards and salmon; nuts – especially brazil nuts and almonds; some fruits such as oranges, apricots and dried figs; and calcium-set tofu.

Milk



Cheese



Juice



Almonds and Brazil nuts





Salmon

Goat's milk



Egg yolks









Lateral View of SER



Lateral View of SER



References:

Department of Physical Medicine.(2019). Fourth year fracture and Traumatology Text Book. University of Traditional Medicine, Mandalay.

Perry, Clayton, R. and Elstrom, John, A. (2012). Handbook of fractures. Published by: Lotus Press, P.O Box 325, Twin Lakes, Wisconsin 53181, web:www.lotuspress.com.

Solomon, L., Warwick, D and Nayagam, S. Apley's: System of Orthopaedics and Fracture, Ninth Edition.