

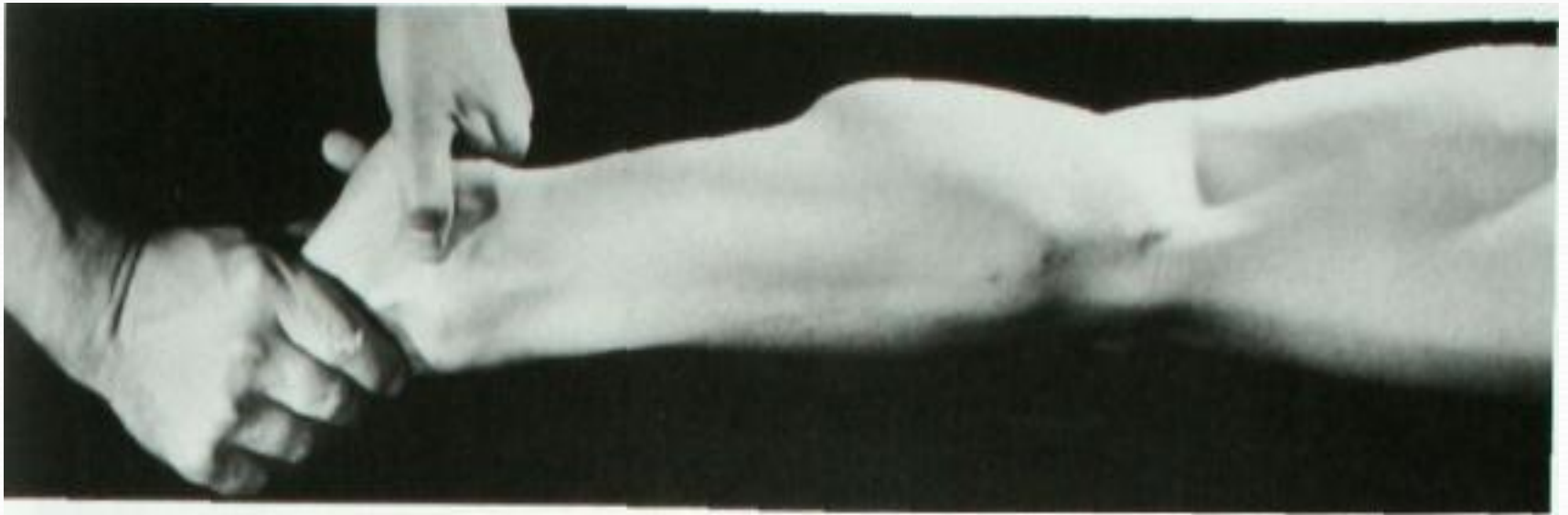
# **Ankle manual Muscle Testing**

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**Tests & Measurements**

# Muscle Testing of Ankle Planter Flexors



*Ankle Planter Flexors*

# Ankle Planter Flexors

## o The Primary muscles

- Gastrocnemius
- Soleus
- Plantaris

## o The Accessory muscles

- Tibialis Posterior
- Peroneus Longus
- Peroneus Brevis
- Flexor Hallucis Longus
- Flexor Digitorum Longus

# Gastrocnemius Muscle

## *Origin*

- ***Medial head***

- Proximal and Posterior part of medial condyle & adjacent part of femur.
- Capsule of knee joint.

- ***Lateral head***

- Lateral condyle and posterior surface of femur.
- Capsule of knee joint.

## *Insertion*

- Medial part of posterior surface of calcaneus.



## *Nerve supply*

- Tibial nerve S<sub>1</sub>, S<sub>2</sub>.

## *Action*

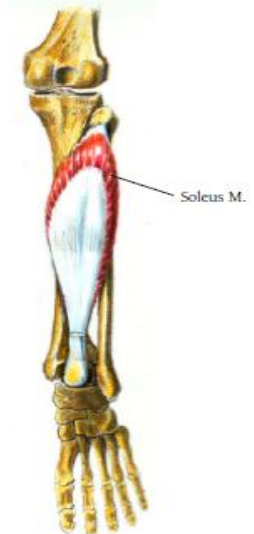
- Planter flexes the ankle joint.
- Assists in the flexion of the knee joint.



# Soleus Muscle

## *Origin*

- Posterior surface of head of fibula and proximal 1/3 of its body.
- Soleal line and middle 1/3 of medial border of tibia.



-Tendinous arch between tibia and fibula.

### ***Insertion***

-With tendon of gastrocnemius into posterior surface of calcaneus.

### ***Nerve supply***

-Tibial nerve L5, S1, S2.

### ***Action***

-Planter flexes the ankle joint.



# Plantaris Muscle

## *Origin*

- Distal part of lateral supracondylar line of the femur
- Oblique popliteal ligament of the knee joint.

## *Insertion*

- Posterior part of calcaneum

## *Nerve supply*

- Tibial nerve L4, L5, S1.

## *Action*

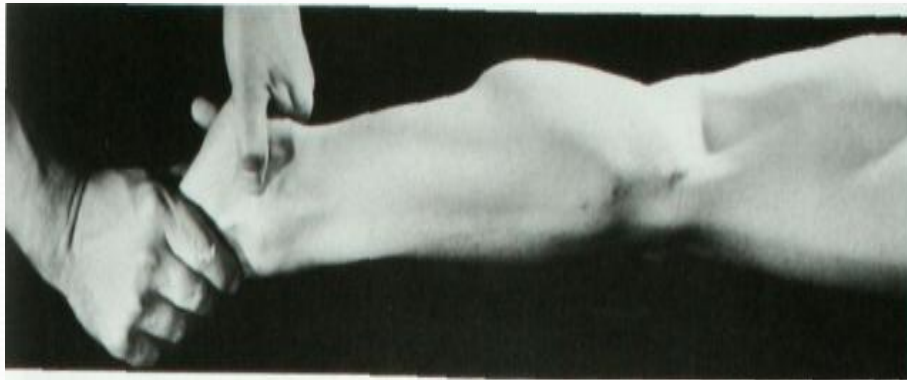
- Planter flexes the ankle joint.
- Assists in the flexion of the knee joint.





# Testing procedure

- ***Non-Weight Bearing Test:*** Refers to the standardized test regarding all grades.



*Combined testing of both calf muscles*



*Isolated Soleus Muscle Testing*

- Patient starting position is Prone lying with foot to be tested over edge of table.
- Therapist stands beside the patient foot. The proximal hand is placed on the lower leg, proximal to the ankle.

### ***Command***

- Pull the heel upward and push backward with your toes -- relax.

### **o Grades 4-5. "Good and Normal strength"**

- Same as for Grade 3 regarding the patient's Position.
- Therapist position and grasps are the same as for Grade 3 but the proximal hand hold the sides of the heel.

-The distal hand is placed on the planter surface of the forefoot.  
Both hands apply resistance.

-**Grade 4:** Moderate leading resistance is given simultaneously at the heel and at the forefoot directly against the lines of motion, the resistance is given through the full range of motion.

-**Grade 5:** Maximum leading resistance is given throughout opposing the range of motion plus a "hold" position is kept at the end of the range

### ***Command***

-Same as for Grade 3. Plus "hold" (at the end of the range) when testing for grade 5

## o **Grade 2. "poor strength"**

-The patient is side lying with the lateral border of the foot

to be tested resting on the table.

-Therapist stands beside the table at the level of the patient's foot. The proximal hand is grasping the lower leg just above the ankle joint to stabilize it.

### ***Command***

-Push your foot down through full range of motion-----Rela

## o **Grades 1 and 0. "Trace and Zero strength"**

-Same procedures as for grade 2 but the therapist palpates the contraction over the muscle fibers and on tendon above calcaneum (Achilles tendon)

- ***Weight Bearing Test:***

- **Grade 3 "fair strength"**

- Patient starting position is standing on leg to be tested, knee straight.
- Therapist stands beside the patient.

***Command***

- Rise on your toes clearing your heel off the floor -----  
relax.



## o Grades 4-5. "Good and Normal strength"

-Same as for Grade 3 regarding the patient and therapist's Positions.

### *Command*

-Rise on your toes through full range of motion-----Relax.

### *Note*

-In grade 4, the patient has to do once, while in grade 5, the patient has to do 3 times.

# Weakness of Ankle Planter Flexors

- Weakness permits a calcaneus position of the foot if the gastrocnemius and soleus are weak.
- In standing, results in hyperextension of the knee and inability to rise on the toes.
- In walking, the inability to transfer weight normally results in a "gastrocnemius limp."

# Effects of Shortness or Contracture

## *Contracture*

- Equinus position of the foot, and flexion of the knee.

## *Shortness*

- Restriction of dorsiflexion of the ankle when the knee is extended, and restriction of knee extension when the ankle is dorsiflexed.
- During the stance phase of walking, shortness limits the normal dorsiflexion of the ankle joint, and the subject toes out during the transfer of weight from heel to forefoot.





# **Muscle Testing of Foot Dorsiflexion and Inversion**

## o The Primary muscle

-Tibialis Anterior

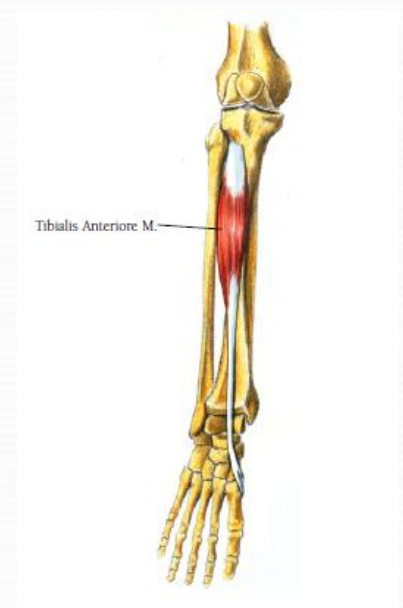
# Tibialis Anterior Muscle

## *Origin*

- Lateral condyle and proximal half of the lateral surface of the tibia
- Interosseus membrane, deep fascia and lateral intramuscular septum.

## *Insertion*

- Base of first metatarsal bone.



-Medial and plantar surface of medial cuneiform bone.

### ***Nerve supply***

-Deep peroneal, L4, 5, S1.

### ***Action***

-Dorsiflexes the ankle joint, and assists in inversion of the foot

### **○Range of Motion:**

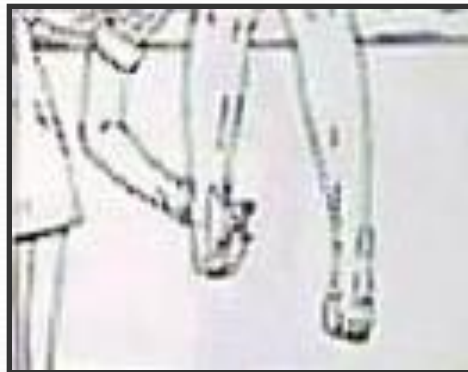
-The range of ankle dorsiflexion is of  $0^{\circ}$  to  $20^{\circ}$ .

# Testing procedure

## ○ Grade 3 and 2 "fair and poor strength"

- Patient starting position is sitting with legs over the edge of the table.

- Therapist is sitting on a stool near the affected leg, the proximal hand grasps around the ankle to stabilize the lower leg.



## ***Command***

-Pull your foot up and in through full range of motion -- re

### ***Note:***

-Grade 3 full range of motion is requested. Grade 2 partial range of motion is requested.

### **o Grades 4-5. "Good and Normal strength"**

-Patient starting position is the Same as for Grade 3 and 2. Heel supported on the thigh of therapist.

-Therapist is sitting on a stool near the affected leg, Proxim hand supports the lower leg above calcaneus. Distal hand grasps the medial border of forefoot to give resistance.

-**Grade 4:** Moderate leading resistance is given directly opposing the line of motion

-**Grade 5:** Maximum leading resistance is given throughout opposing the range of motion plus a "hold" position is kept at the end of the range



-**Note:** Patient should keep big toe flexed to avoid substitution by extensor hallucis longus.

## o Grades 1 and 0. "Trace and Zero strength"

-Patient starting position is back lying, foot over edge of table.

-Therapist stands beside the edge of the table, the distal hand supports the forefoot, the proximal hand palpates contraction of tibialis anterior on its tendon on medial volar aspect of ankle.

### ***Command***

-Try to pull your foot up and in through full range of motion ----- relax.



## Weakness of Tibialis Anterior Muscle

- Weakness of tibialis anterior Decreases the ability to dorsiflex the ankle joint, and allows a tendency toward eversion of the foot. This may be seen as a partial drop foot and tendency toward pronation.
- Substitution:*** The extensor hallucis longus muscle which have the function of assisting the dorsiflexion with inversion motion may substitute a weak tibialis anterior muscle





# **Foot Inversion from Plantar Flexion Tibialis Posterior**

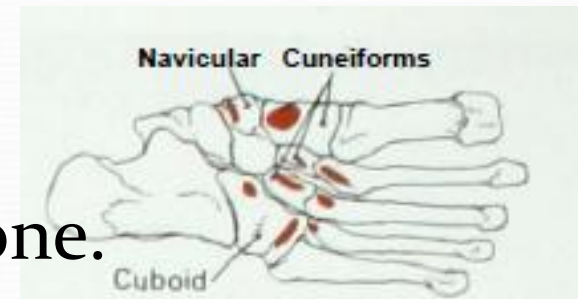
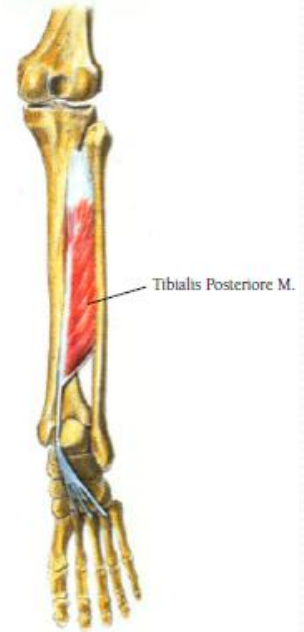
# Tibialis Posterior Muscle

## *Origin*

- Lateral portion of posterior surface of tibia.
- Most of interosseus membrane.
- Proximal 2/3 of medial surface of fibula.
- Adjacent intermuscular septa and deep fascia.

## *Insertion*

- Tuberosity of navicular bone.
- Sustentaculum tali of calcaneus
- Three cuneiforms and cuboid
- Bases of 2nd, 3rd and 4th metatarsal bone.



## *Nerve supply*

- Tibial nerve L4, L5, S1.

## o **The Accessory muscles**

- Flexor digitorum longus
- Flexor Hallucis longus
- Gastrocnemius medial head.

## o **Range of Motion:**

- The range of ankle plantar flexion is of 35.

# Testing procedure

## o Grade 3 "fair strength"

- Patient starting position is side lying affected leg down, foot in planter flexion and resting on lateral border.
- Therapist is Standing at the foot of the table, The proximal hand is placed proximal to the ankle joint to stabilize the lower leg (avoid pressure over tibialis posterior muscle).

**Command** : Raise up medial border of your foot through full range of motion -----  
relax.



## o Grades 4-5. "Good and Normal strength"

-Patient starting position is the Same as for Grade 3 but with the foot over the edge of table.

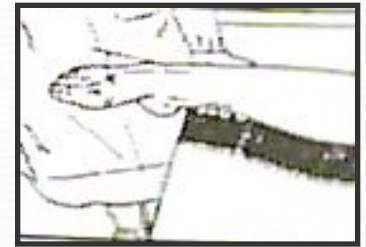
-Therapist is Standing at the foot of the table, Proximal hand supports the lower leg proximal to the ankle joint without pressure over tibialis posterior muscle. Distal hand grasps over the medial border of the foot to give resistance.

**Command** : Raise up medial border of your foot through full range of motion ----- relax.



## o Grade 2. "poor strength"

- Patient starting position is Back lying with foot in planter flexion over the end of the table.
- Therapist is standing at the foot of the table near the affected foot. The proximal hand grasps the leg posteriorly just above the ankle joint.

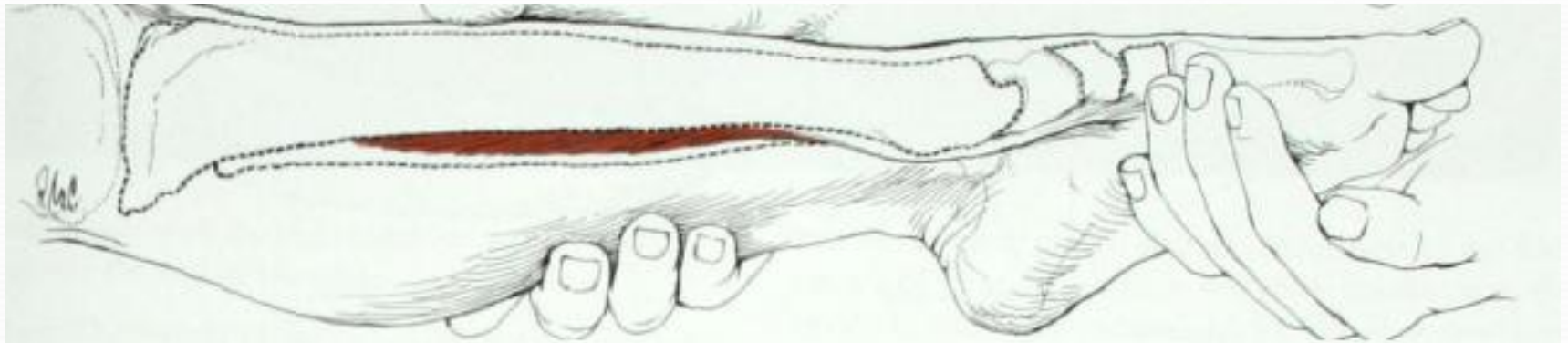


**Command:** Move your foot medially ----- relax.

## o Grades 1 and 0. "Trace and Zero strength"

- Patient starting position is the same as for grade 2.

-Same as for grade 2 but the therapist's distal hand palpates contraction of tibialis posterior on its tendon between medial malleolus and navicular bone, contraction of tibialis posterior may be palpated above medial malleolus.



# Weakness of Tibialis Posterior Muscle

- Weakness of tibialis posterior Decreases the ability to invert the foot and plantar flex the ankle joint. Results in pronation of the foot and decreased support of the longitudinal arch. Interferes with the ability to rise on the toes.
- Contracture:** In non weight bearing, equinovarus position; in weight bearing, a supinated position of the heel with forefoot varus.



# **Foot Eversion from Plantar Flexion Peroneus Longus and Brevis**



# Peroneus Longus Muscle

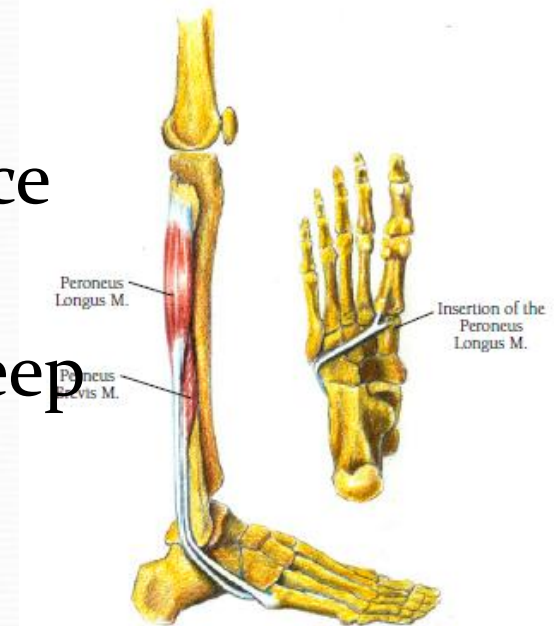
## *Origin*

- Lateral condyle of tibia
- Head and proximal 2/3 of medial surface of fibula
- Intermuscular septa and an adjacent deep fascia

## *Insertion*

- Lateral side of base of 1st metatarsal bone and medial cuneiform

***Nerve supply:*** Peroneal nerve L4, L5, S1.



## ***Action***

- Everts the foot and assists in planter flexion of the ankle joint

# **Peroneus Brevis Muscle**

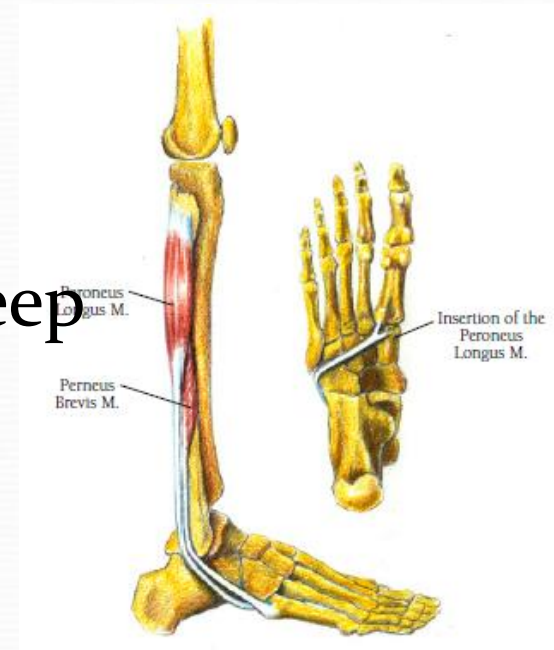
## ***Origin***

- Distal 2/3 of lateral surface of fibula.
- Intermuscular septa and an adjacent deep fascia.

## ***Insertion***

- Tuberosity at base of 5th metatarsal bone, lateral side.

***Nerve supply:*** Peroneal nerve L4, L5, S1.



## ***Action***

-Everts the foot and assists in planter flexion of the ankle joint

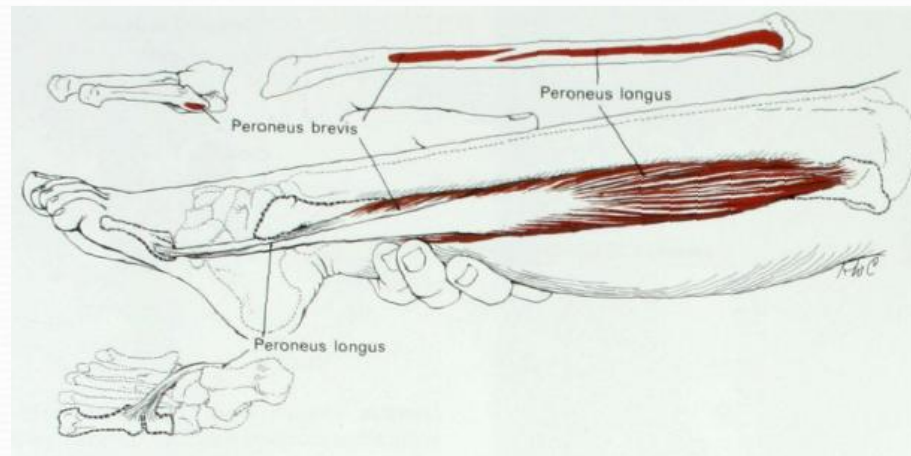
## **o The Accessory muscles**

-Extensor digitorum longus

-Peroneus tertius

## **o Range of Motion**

The range of foot eversion is of 35°.



# Testing procedure

## o Grade 3 "fair strength"

- Patient starting position is side lying, the upper leg is the affected, foot over the edge of the bed and in planter flexion and resting on medial border.

- Therapist is standing at the foot of the table, The proximal hand support the lower leg proximal to the ankle joint.

### *Command*

- Pull your foot up through full range of motion ----- relax.



## o Grades 4-5. "Good and Normal strength"

- The patient is the same as for Grade 3 but with the foot over the edge of table.
- Therapist is the same as for Grade 3. Proximal hand stabilizes leg. Distal hand grasps the forefoot to give resistance.



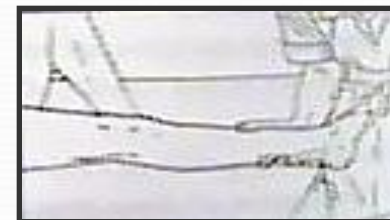
### *Note*

- To test Peroneus brevis, the resistance is given on lateral border of the foot.
- To test Peroneus longus, the resistance is given against planter surface of 1st metatarsal head.

## o Grade 2. "poor strength"

-Patient is supine lying with the affected foot in planter flexion and resting on the table..

-Standing at the foot of the table near the affected foot. The proximal hand grasps the leg to stabilize it.



### *Command*

-Pull your foot out with your small toe up and big toe down  
----- relax.

## o Grades 1 and 0. "Trace and Zero strength"

-Patient starting position is the same as for grade 2.

-The therapist distal hand palpates the tendon of peroneus brevis at a joint proximal to the base of the 5th metatarsal bone on the lateral border of the foot.



-Contraction of peroneus longus may be palpated under head of the 1st metatarsal bone.

## **Effects of Weakness of Peroneus Brevis and Longus**

-Decreases the strength of eversion of the foot and planter flexion of the ankle joint.

-Allows a varus position of the foot.



- Lessens the ability to rise on the toes.
- Decreases lateral stability of the foot.

## **Effects of Contracture of Peroneus Brevis and Longus**

- Results in an everted or valgus position of the foot.



# **Flexion of Interphalangeal Joints of Toes**

# Flexor Digitorum Longus Muscle

## *Origin*

- Middle 3/5 of posterior surface of body of tibia
- From fascia covering the tibialis posterior

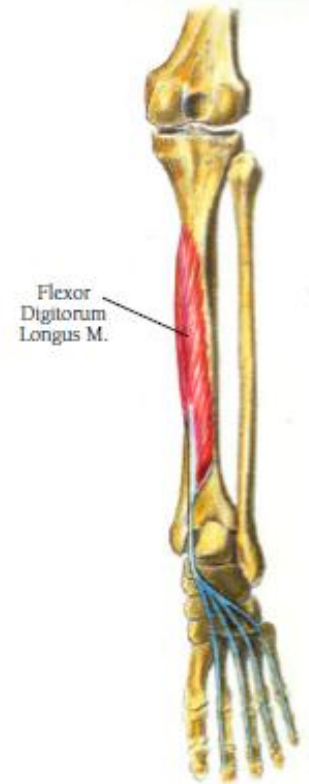
## *Insertion*

- Bases of distal phalanges of 2nd through 5th digits.

*Nerve supply:* Tibial nerve L5, S1.

## *Action*

- Flexes the interphalangeal and metatarsophalangeal joints of the second through fifth digits.



- Assists in planter flexion of the ankle joint and inversion of the foot.

## Flexor Digitorum Brevis Muscle

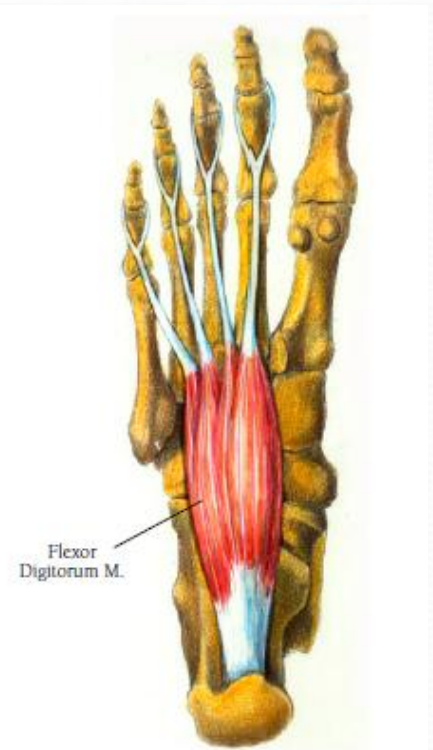
### *Origin*

- Medial process of tuberosity of calcaneus.
- Part of planter aponeurosis and adjacent intermuscular septa.

### *Insertion*

- Middle phalanx of 2nd through 5th digits.

***Nerve supply:*** Tibial nerve, L4, L5, S1.



## ***Action***

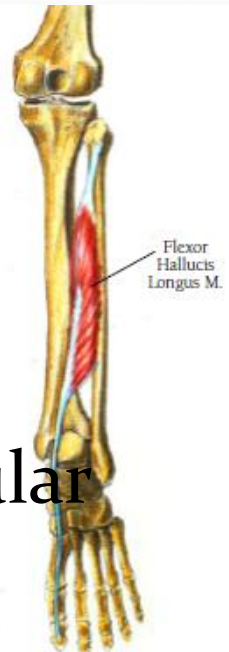
- Flexes the proximal interphalangeal joints of the toes.
- Assists in flexion of the MP joints of the second through fifth digits.



## **Flexor Hallucis Longus Muscle**

### ***Origin***

- Posterior surface of distal 2/3 tibia.
- Interosseus membrane and adjacent intermuscular septa.



## ***Insertion***

- Base of distal phalanx of great toe.

***Nerve supply:*** Tibial nerve L5, S1,S2.

## ***Action***

- Flexes the interphalangeal joints of the big toe.
- Assists in flexion of the metatarsophalangeal joint, plantar flexion of the ankle joint and inversion of the foot.

## **○ Range of Motion**

- The range of motion of the interphalangeal joints flexor muscles of the toes is of 50° to 90°.



# Testing procedure

## ○ Flexor Digitorum Longus Muscle

- Patient starting position is back lying or sitting with the legs extended on the table.

- Standing at the foot of the table, The proximal hand grasps the middle row of phalanges of the lateral four toes.



- For testing of grade 4 and 5 resistance is given by the distal hand beneath the distal or third row of phalanges of the lateral four toes.

## *Command*

-Bend the end of your toes down ----- relax.

## **○ Flexor Digitorum Brevis Muscle**

-Patient starting position is back lying or sitting with the legs extended on the table.

-The therapist's Proximal hand stabilizes the proximal row of phalanges of the lateral four toes and the resistance for Grade 4 and Grade 5 is given by the therapist's distal hand beneath the middle row of phalanges.





## ***Command***

- Bend the middle part of your toes down ----- relax.

## **Flexor Hallucis Longus Muscle**

- Same as previous but the proximal phalanx of hallux is stabilized by the proximal hand and the resistance is given (for Grade 4 and Grade 5) by the distal hand beneath the 2nd and distal phalanx of hallux.



# Extension of Metatarsophalangeal Joints of Toes and Interphalangeal Joints of Hallux



# Extensor Digitorum Longus Muscle

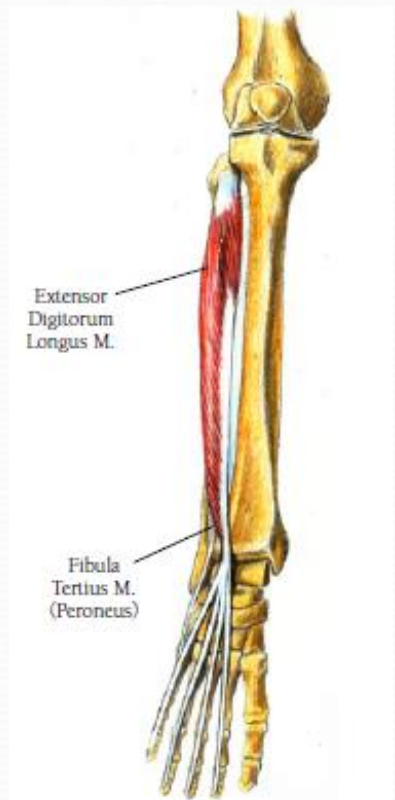
## *Origin*

- Lateral condyle of tibia.
- Proximal three fourths of anterior surface of fibula.

## *Insertion*

- Extensor expansions of 2nd and 3<sup>rd</sup> phalanges through 5th digits.

***Nerve supply:*** Deep peroneal nerve L4,5, S1.



# Extensor Digitorum Brevis Muscle

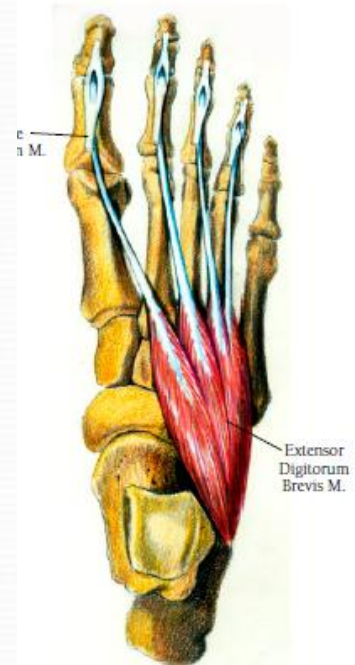
## *Origin*

- upper and lateral surfaces of calcaneus.

## *Insertion*

- Medial division into dorsal surface of proximal phalanx of hallux at base .
- Three lateral divisions into second, third and fourth toes.

***Nerve supply:*** Deep peroneal nerve L4,5, S1.



# Extensor Hallucis Longus Muscle

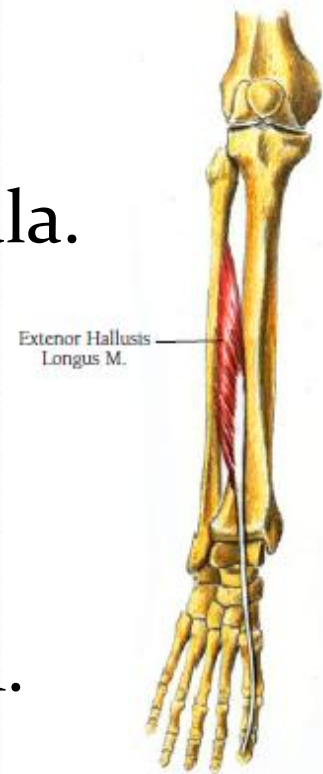
## *Origin*

- Middle 2 fourths of anterior surface of fibula.

## *Insertion*

- Base of distal phalanx of hallux, Plantar surface.

*Nerve supply:* Deep peroneal nerve L4,5, S1.



# Testing procedure

- Patient starting position is back lying, extends lateral four toes.
- The therapist's Proximal hand stabilizes the metatarsal area and the resistance for Grade 4 and Grade 5 is given by the therapist's distal hand over the middle row of phalanges.
- For trace and zero grades, tendons of extensor digitorum longus may be palpated on dorsal surface of metatarsals.
- Fibers of extensor digitorum brevis may be palpated on lateral side of dorsum of foot anterior to malleolus.



***o For Extension of metatarsophalangeal joints of hallux***

- Patient is back lying.
  - The therapist Stabilize metatarsal area.
- Patient extends metatarsophalangeal joint of hallux.
- Resistance is given over proximal phalanx.



***For Extension of interphalangeal joints of hallux:***

- Patient is back lying.
  - The therapist Stabilize proximal phalanx of hallux.
- Patient extends distal joint of hallux. Resistance is given on dorsal surface.

-For trace and zero grades, tendons of extensor hallucis longus may be palpated on dorsal surface of 1st metatarsophalangeal joint and on a diagonal line across dorsum of foot to middle of anterior aspect of ankle.



*Extension of interphalangeal joints of hallux  
extensor hallucis longus*