

# **Common Foot Pathomechanics**

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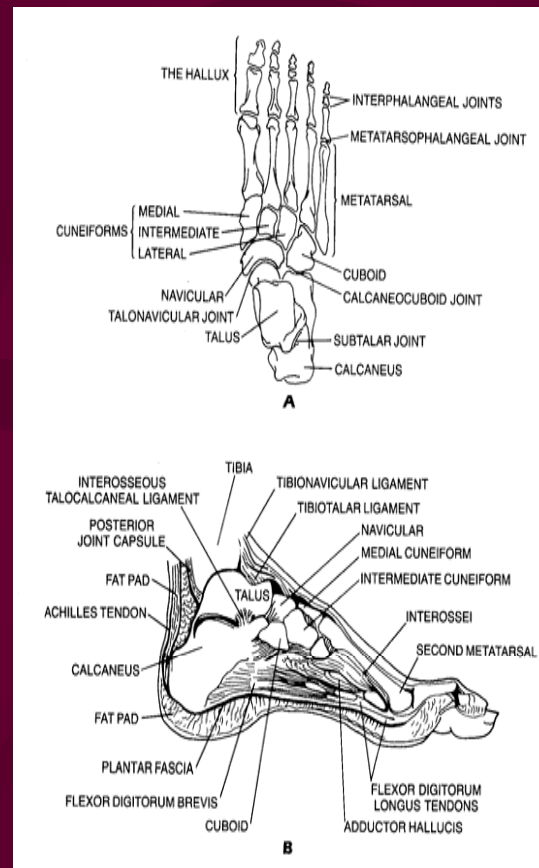
# Foot Biomechanics

**The foot is an amazing structure. The 26 bones have to bear the weight of the body and all the forces involved in standing and walking - not to mention the stresses involved in sport and other strenuous activities. It has to last you a lifetime.**

# **Foot Biomechanics**<sub>(cont)</sub>

**The 26 bones fit together in a complex arrangement, with natural arches from front to back and from side to side. They are linked to one another by joints which are held together by ligaments and tendons. This allows for the natural springiness and suppleness of the foot.**

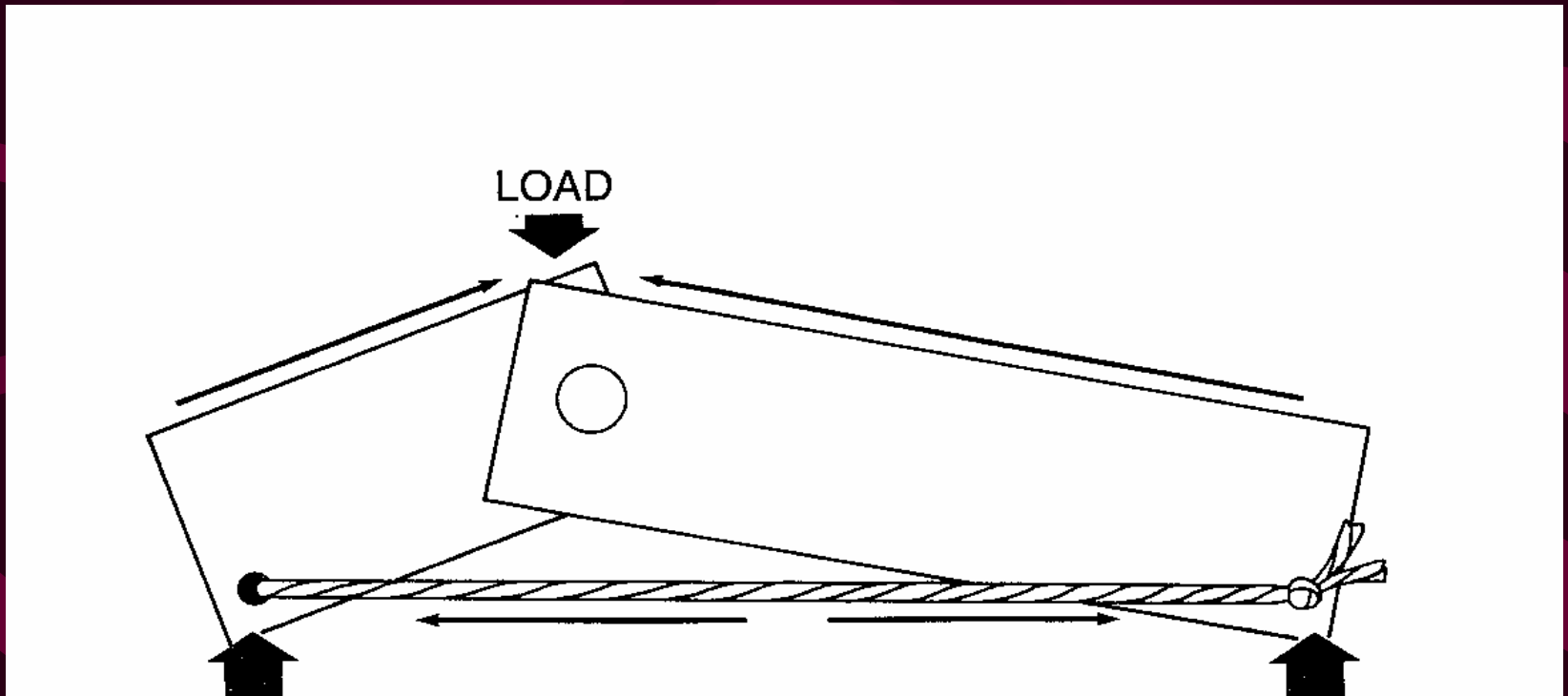
# Foot Biomechanics (cont)



# Foot Biomechanics<sub>(cont)</sub>

**The Foot can be represented by a truss, the wooden members represent the bony structure of the foot and the plantar fascia extends from the the calcaneous to the plantar aspect of the proximal phalanges representd by the tether**

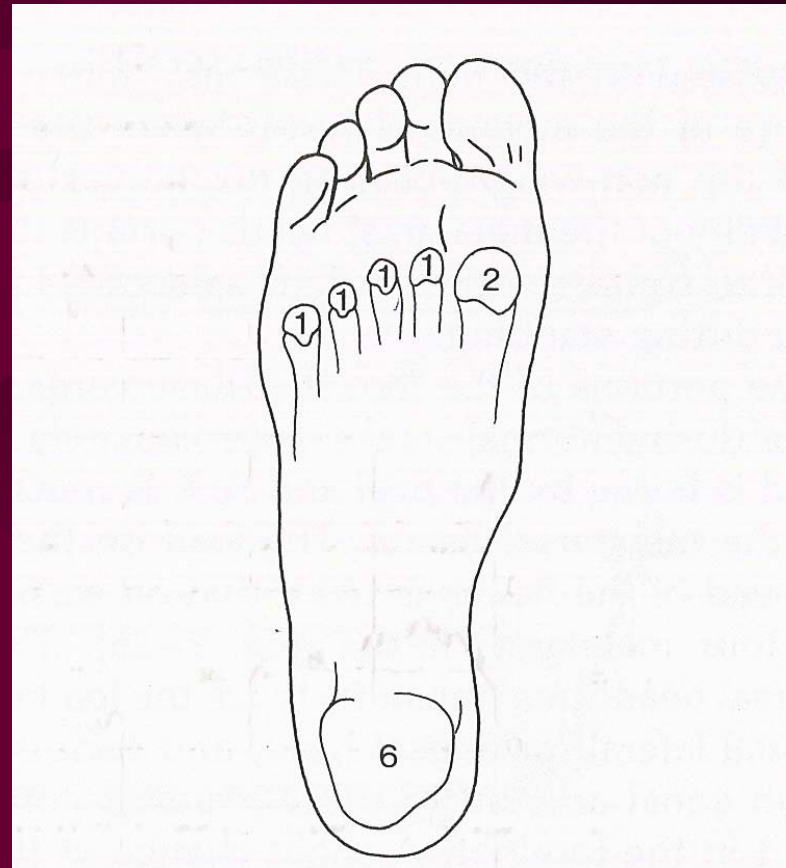
# Foot Biomechanics<sub>(cont)</sub>



# Load Distribution

## During Stance:

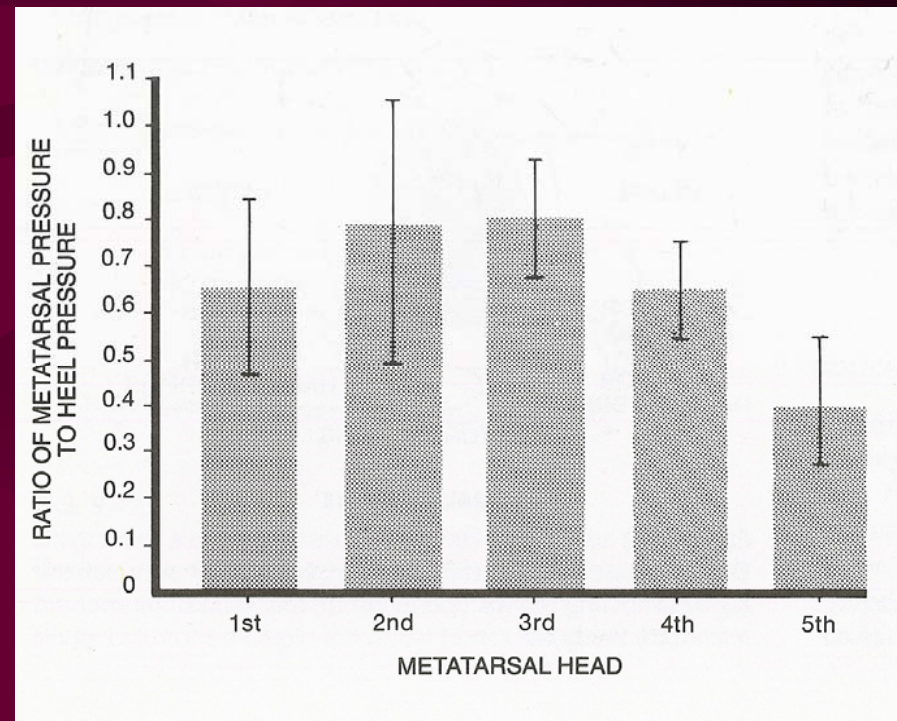
- The metatarsal head of the hallux is subjected to twice the load on each of the lateral four metatarsal heads.



# Load Distribution<sub>(cont)</sub>

## During Stance:

- The second tarsometatarsal joint is stiffer than the other mid foot joints.
- It concentrates the ground reaction force as the load progresses forward.
- The second metatarsal experiences an increased load during the later part of the stance (30% of the cycle)





# Diabetic Foot

- **Diabetic foot problems develop from a combination of causes such as poor circulation and neuropathy.**

# Motor Neuropathy

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graph TD; A[Motor Neuropathy] --> B[Atrophy & weakness of foot Intrinsic muscles]; A --> C[Reduced or absent sweat secretion]; B --> D[Flexion deformity of the toes]; B --> E[Abnormal walking pattern]; C --> F[Dry skin with cracks and fissures]; D --> G[Areas of increased pressure. MT heads and toes];
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Atrophy & weakness of foot Intrinsic muscles

Reduced or absent sweat secretion

Flexion deformity of the toes

Abnormal walking pattern

Dry skin with cracks and fissures

Areas of increased pressure.  
MT heads and toes

# Diabetic Foot<sub>(cont)</sub>

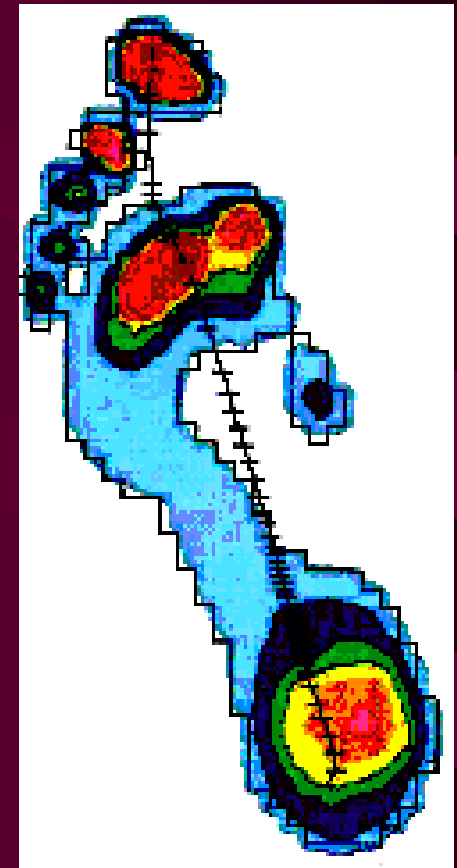
## Diabetic Neuropathy

- **Diabetic neuropathy can cause insensitivity or loss of ability to feel pain heat and cold.**
- **Diabetic neuropathy can cause foot deformities such as bunions, hammer toes and charcot foot.**

# Diabetic Foot<sub>(cont)</sub>

## Diabetic Neuropathy

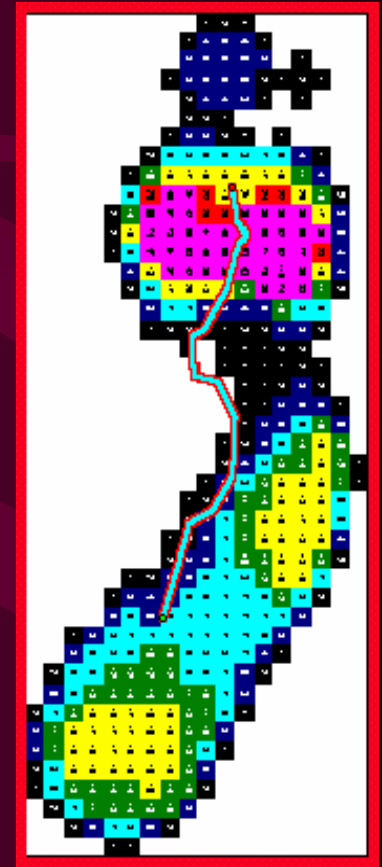
- **Diabetic neuropathy usually leads to a biomechanical abnormalities leading to abnormal plantar foot pressure, increasing the risk of ulceration.**



# Diabetic Foot<sub>(cont)</sub>

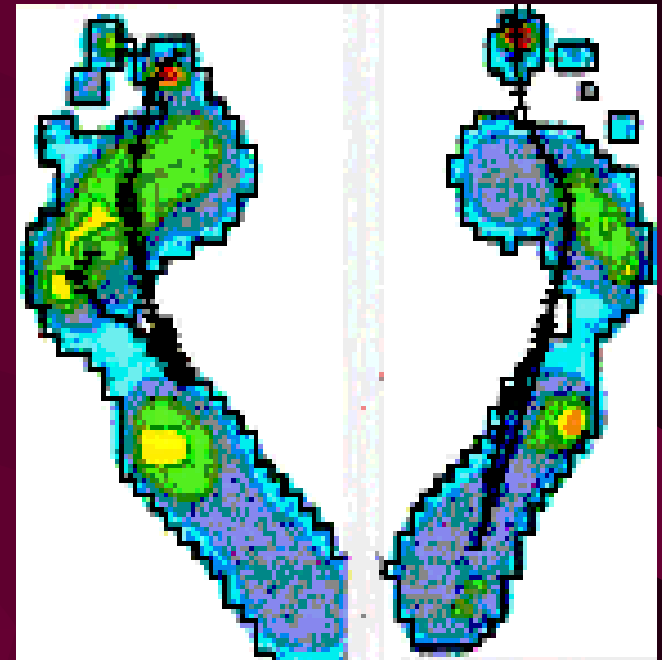
## Diabetic Neuropathy

- Foot deformity and neuropathy can increase the risk of ulcer in diabetic patients, simply because most of ulcers occur through a foot deformity (i.e prominent metatarsal heads, clawed toes,..etc).

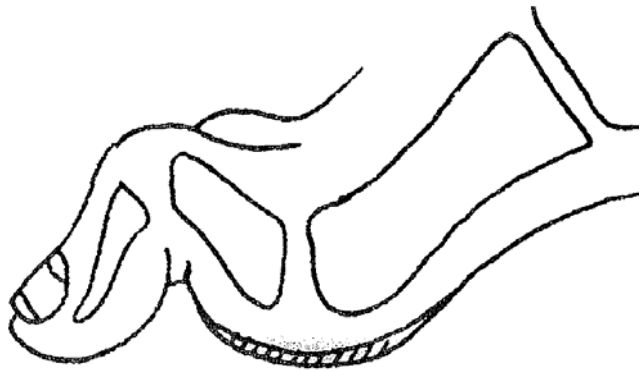


# Diabetic Foot<sub>(cont)</sub>

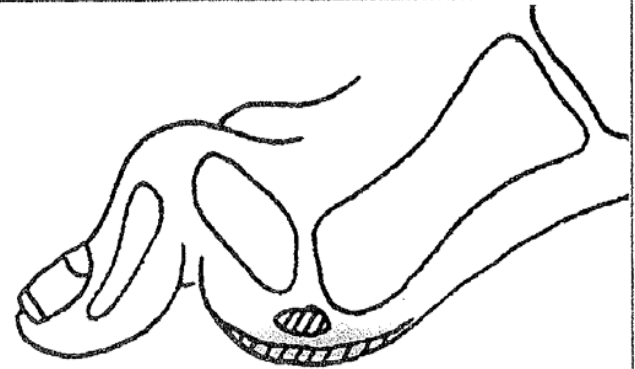
**There is great association between foot and ankle limited joint mobility and increased plantar pressure which in turn increases the risk of ulceration**



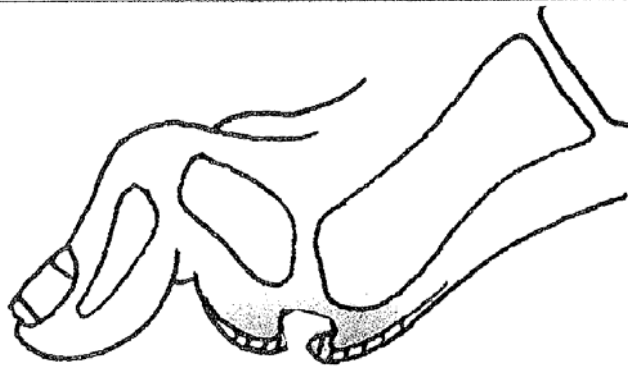
# Diabetic Foot<sub>(cont)</sub>



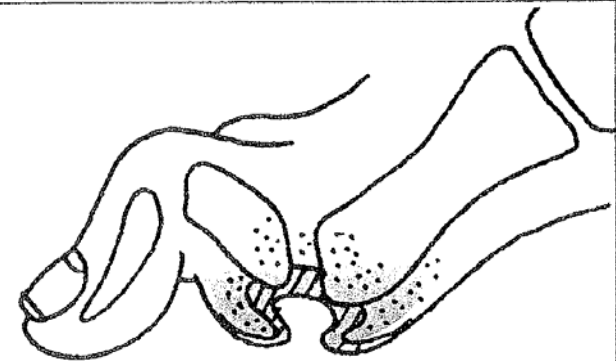
1. Callus formation



2. Subcutaneous hemorrhage



3. Breakdown of skin



4. Deep foot infection with osteomyelitis

# Foot Biomechanical Loading

**Foot biomechanical loading can be altered as a result of :**

- **deformities.**
- **Abnormal walking pattern.**
- **Limited joint mobility**
- **Repeated plantar pressure and shear stress**



# **Foot Biomechanical Loading<sub>(cont)</sub>**

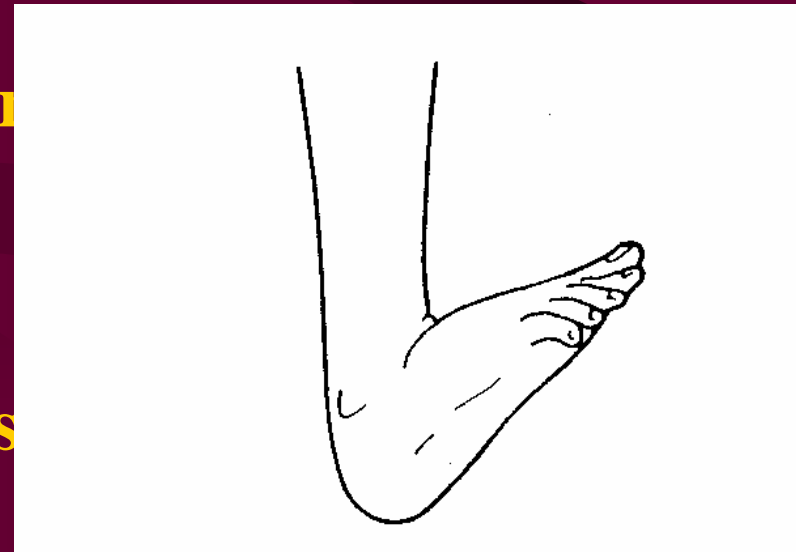
**Abnormal loading of the foot such that the weight is primarily borne on one of its quadrants only such as :**

- Heel.**
- Forefoot.**
- Medial side.**
- Lateral side.**

# Foot Abnormalities

## Talipes Calcaneus (Pes calcaneus)

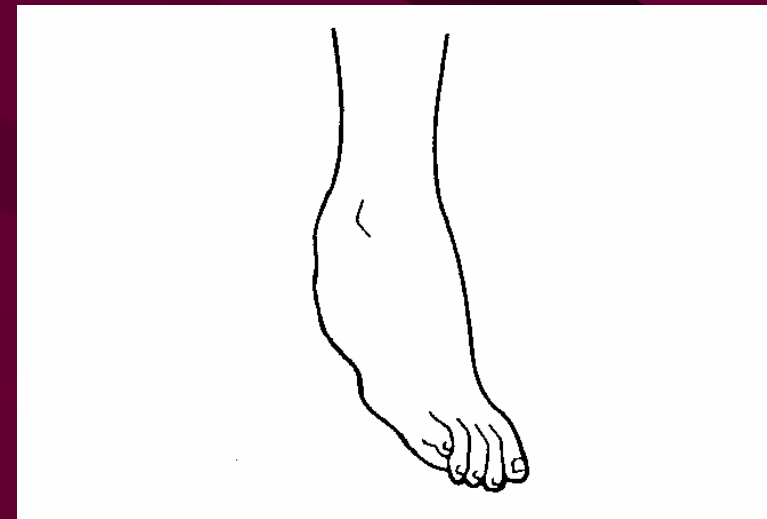
The foot is pulled into dorsiflexion as a result of muscle imbalance resulting from spasticity of the interior tibial muscle or weakness of the triceps Surae.



# Foot Abnormalities<sub>(cont)</sub>

## Talipes Equineus (Pes Equinus)

The forefoot is in plantar flexion where the heel never contacts the ground and the metatarsal heads are the first to establish contact. This can be due to spasticity of the plantar flexor.



# Foot Abnormalities<sub>(cont)</sub>

## Talipes Equinovarus (Club foot).

- **Excessive lateral foot contact leading to elevation of the medial border of the foot and depression of the lateral border.**
- **Weight is borne by the outer border of the foot. Results from spasticity or weakness.**



# Foot Abnormalities<sub>(cont)</sub>

## Charcot Foot

- Charcot foot occurs most often in people with diabetes mellitus. The bones affected in charcot are the tarsals and the metatarsals.



# Foot Abnormalities<sub>(cont)</sub>

## Charcot Foot

- **Chronic hyperglycemia is believed to trigger the development of neuropathy, which over time may proceed to charcot.**



# Foot Abnormalities<sub>(cont)</sub>

## Charcot Foot

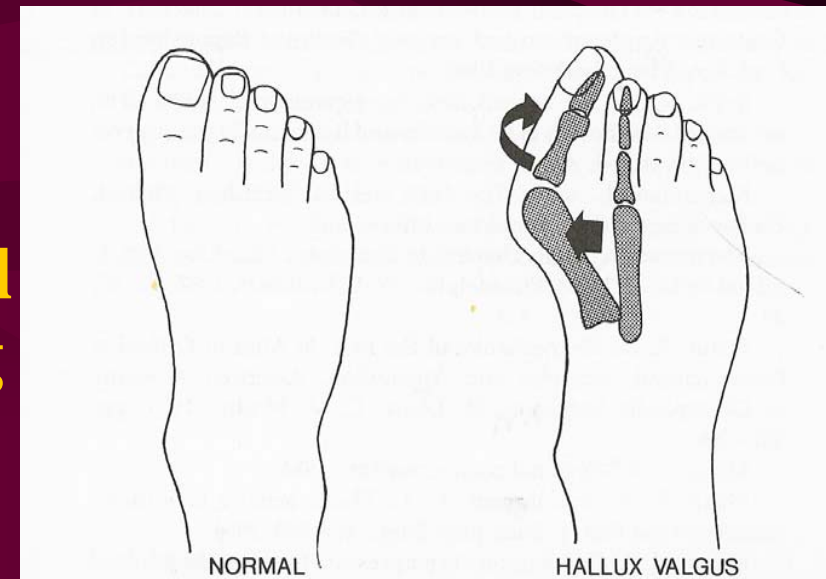
- **The loss of pain perception and of the sense of the position of the foot results in repeated injuries such as torn ligaments and bone fracture.**



# Foot Abnormalities<sub>(cont)</sub>

## Hallux Abducto Valgus (Bunion)

- **A common forefoot problem characterized by lateral drifting of the first metatarsal toward the other toes. leading to:**
  - **A bump on the the side of the foot .**
  - **Possible toes overlapping.**

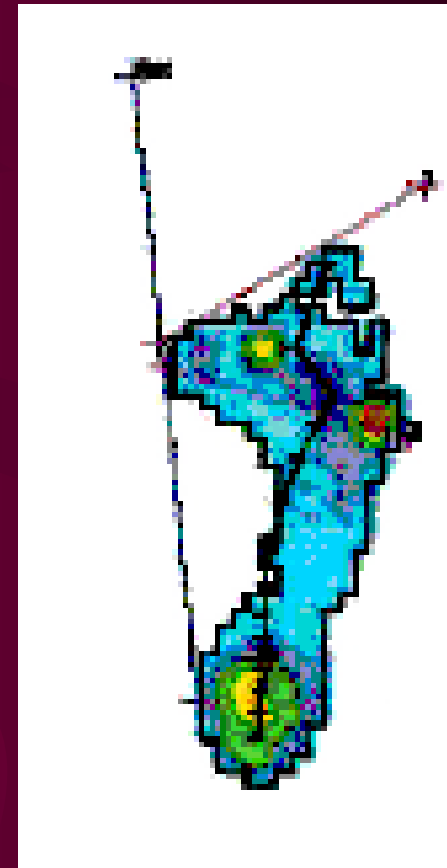




# Foot Abnormalities<sub>(cont)</sub>

## Hallux Abducto Valgus (Bunion)

- Possible causes are abnormal foot function, arthritis, and /or improper fitting footwear



# Foot Abnormalities<sub>(cont)</sub>

## Hallux Rigidus Foot.

- The foot is adducted and inverted with most of the weight bearing along the lateral side of the foot.
- The fifth metatarsophalngeal joint is over loaded, and the first metatarsophalngeal joint bears no load.



# Foot Abnormalities<sub>(cont)</sub>

## Achilles tendonitis

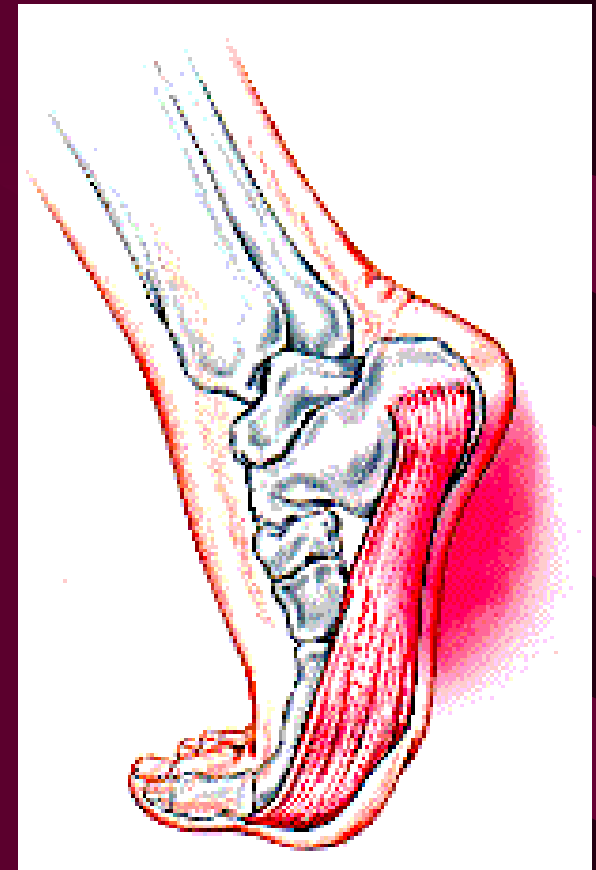
- **Inflammation and degeneration of the achilles tendon.**
- **Caused by over pronation where the arch collapses upon load bearing adding stress on the achilles tendon during walking.**



# Foot Abnormalities<sub>(cont)</sub>

## Plantar Fasciitis

- Inflammation caused by excessive stretching of the plantar fascia, leads to heel pain, heel spur, and/or arch pain.



# Foot Abnormalities<sub>(cont)</sub>

**Plantar Fasciitis can be caused by:**

- **Over pronation (flat feet).**
- **Excessive weight on the foot (obesity or pregnancy).**
- **Improper fitting footwear.**



# Foot Abnormalities<sub>(cont)</sub>

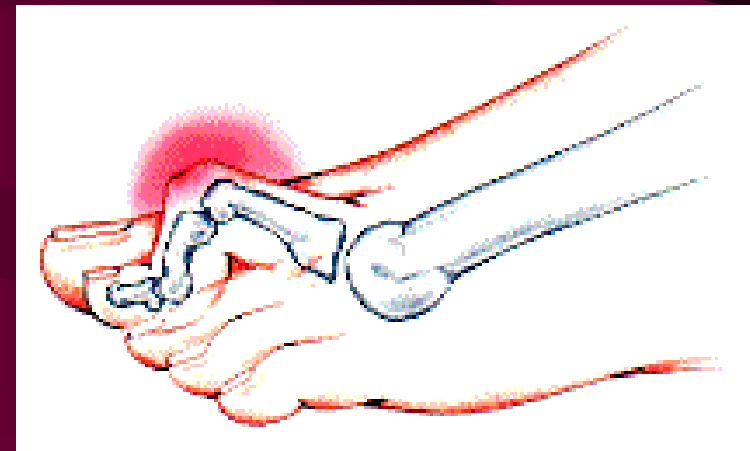
## Hammer Toes

- **A toe that is contracted at its middle joint. Its either flexible or rigid depending on joint mobility. It occurs in any toe except the great toe.**

# Foot Abnormalities<sub>(cont)</sub>

## Hammer Toes.

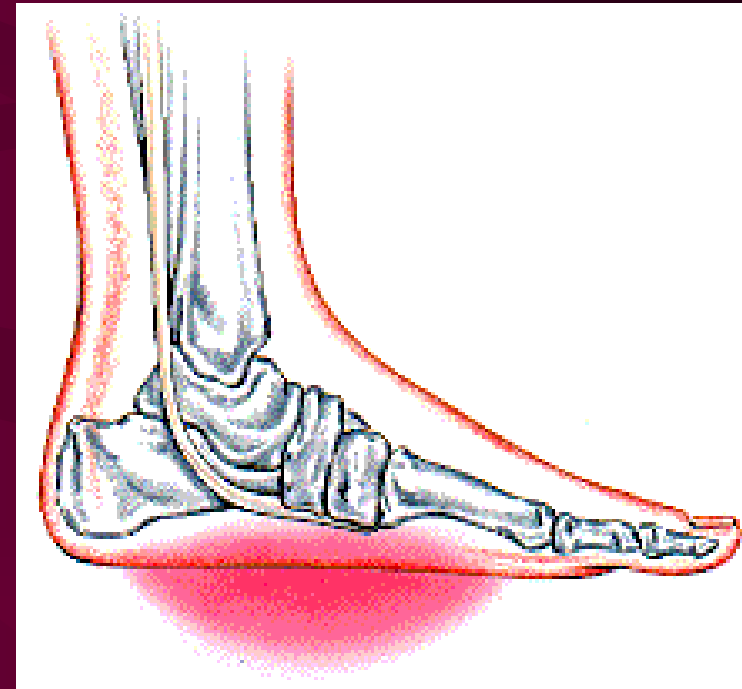
- Results from muscle imbalance that causes tendons and ligaments tightening leading to curling of the toe's joints downwards.



# Foot Abnormalities<sub>(cont)</sub>

## Over Pronation (Flat Feet).

- A common biomechanical problem that occurs in the walking process, where the arch collapses upon weight bearing.

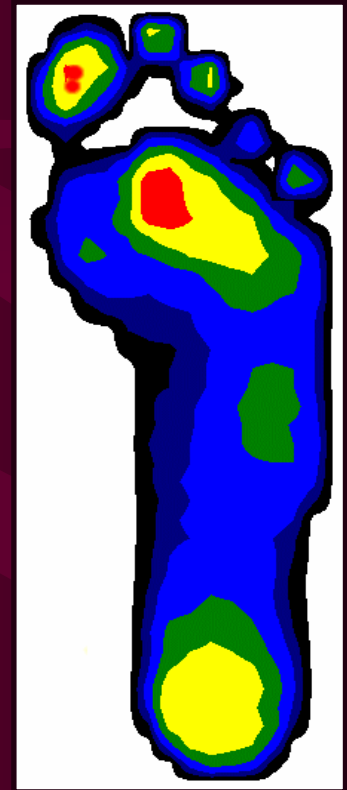




# Foot Abnormalities<sub>(cont)</sub>

## Over Pronation (Flat Feet).

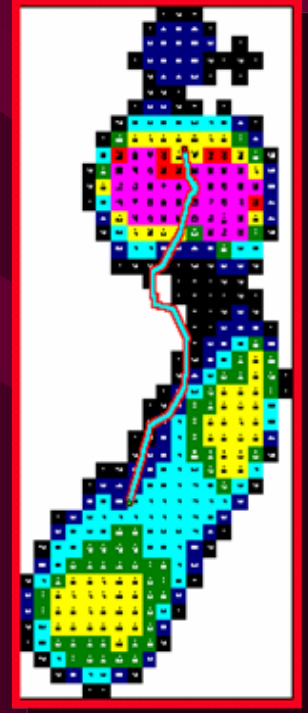
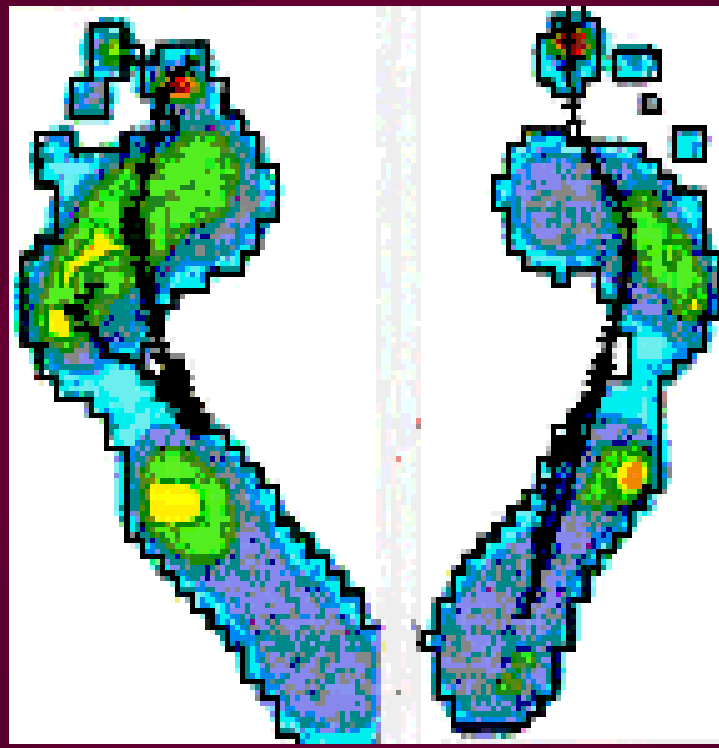
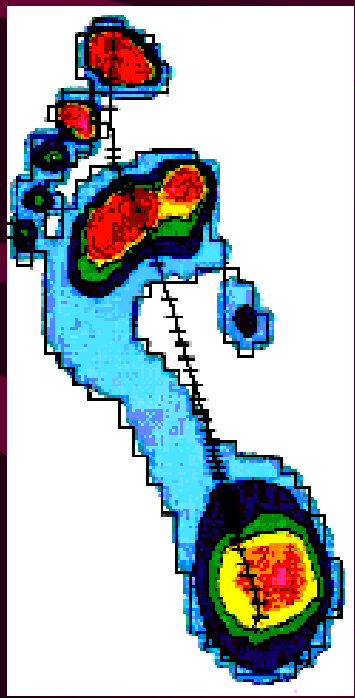
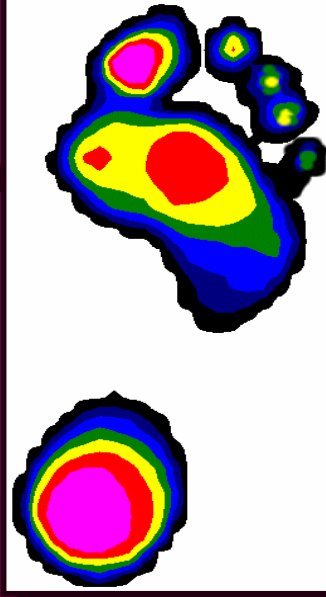
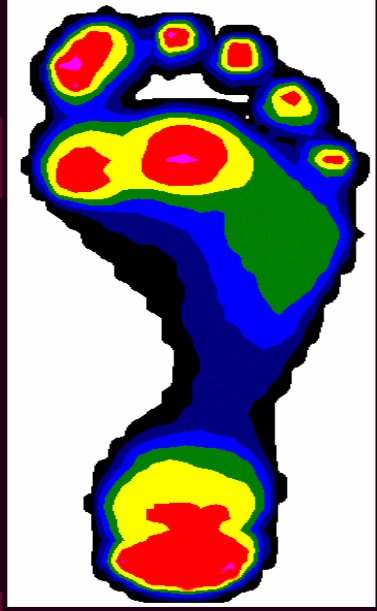
- It results in additional stresses, leading to plantar fasciitis, heel spurs, hallux abducto valgus .....etc.



# **Foot Abnormalities**<sub>(cont)</sub>

## **Insufficient Push Off**

- **A gait pattern where the weight is borne by the heel and the whole foot is lifted off the ground at once.**
- **It can be due to foot deformity such as calcaneus deformity, triceps surae or achilles tendon problems (rupture of the achilles tendon or weakness of the soleus gastrocnemius**





**Thank You**