

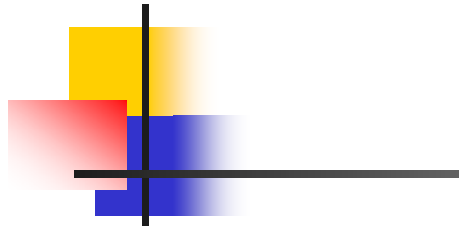


Νέες Τεχνολογίες στην Ανάλυση της Κίνησης

Διάλεξη 4

Δυναμομετρία. Μέτρηση των πιέσεων των κάτω άκρων

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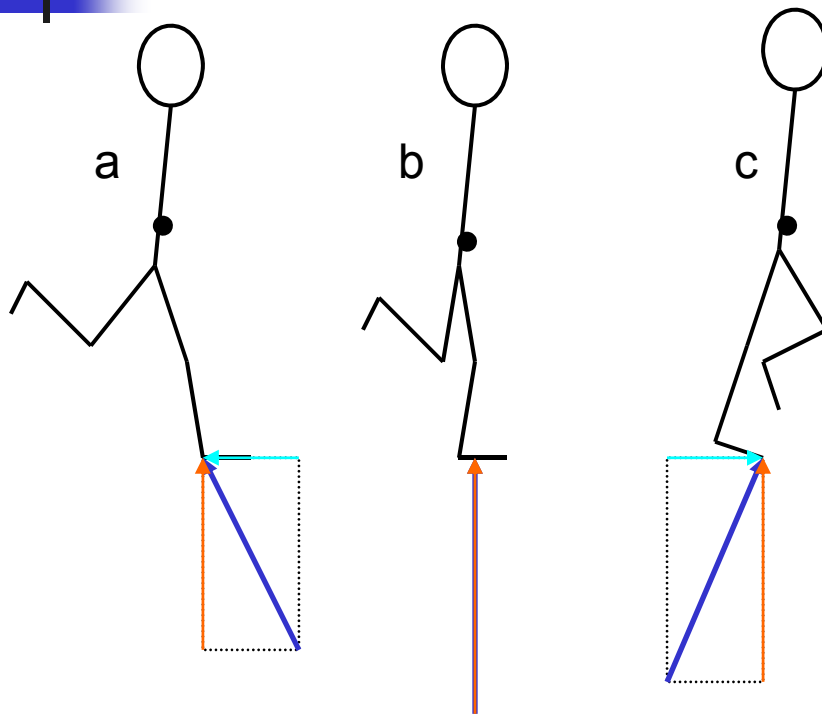
“Walk it off, Billy! It's just a turned ankle!”



Εισαγωγή

- ❖ Επιβάρυνση μυοσκελετικού συστήματος
 - ❖ καταγραφή των δυνάμεων αντίδρασης του εδάφους
 - ❖ Η καταγραφή των πιέσεων κάτω από το πέλμα

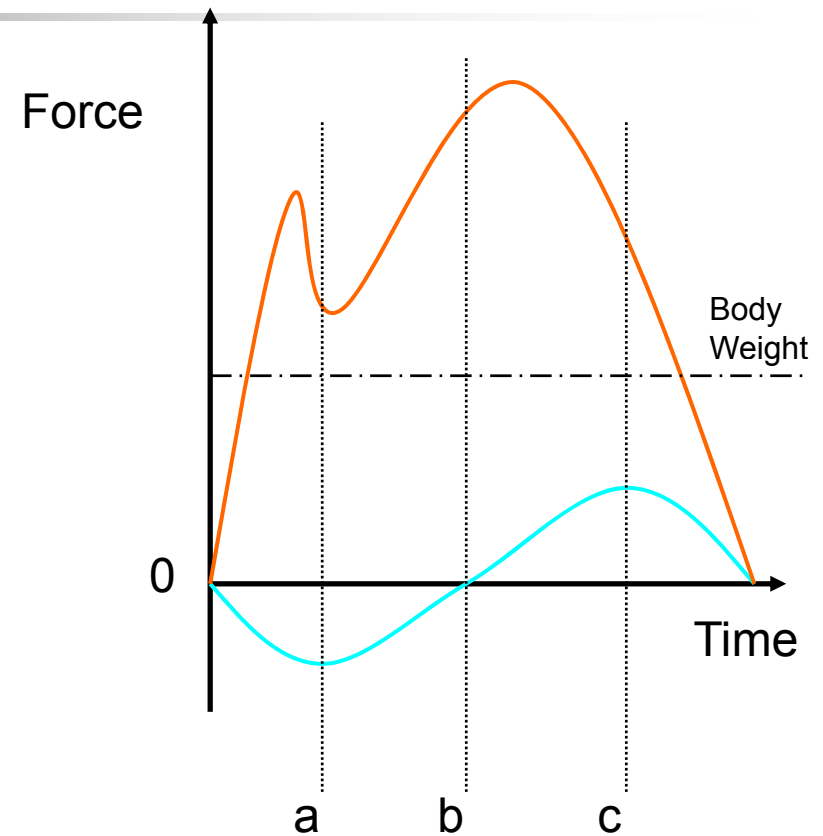
Revision: Ground Reaction Force (GRF) during Running



Resultant GRF

F_z – vertical component of GRF

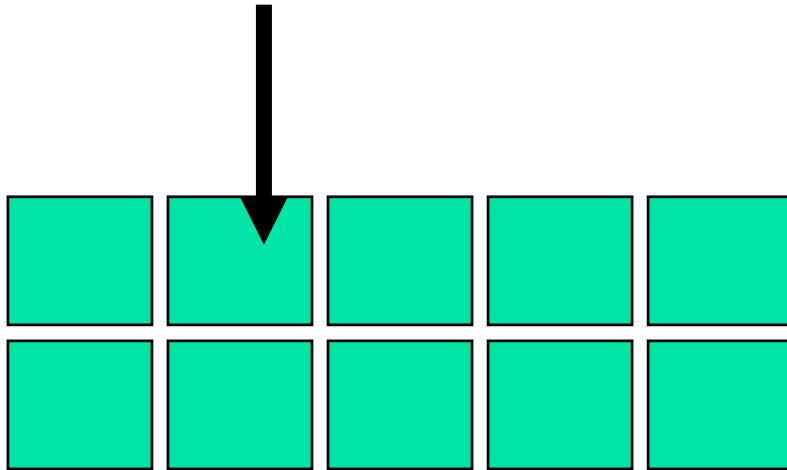
F_y – anterior-posterior component of GRF





Πίεση

$$\text{Pa} = \text{N/m}^2$$



Πίεση σε 1 sensor

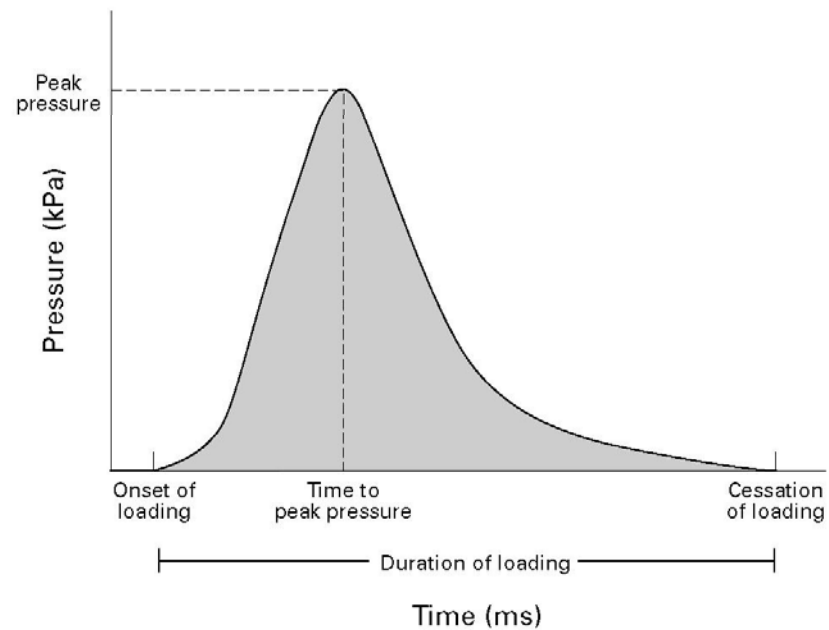
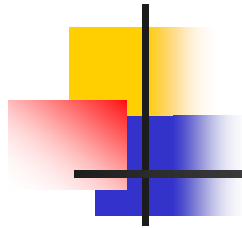
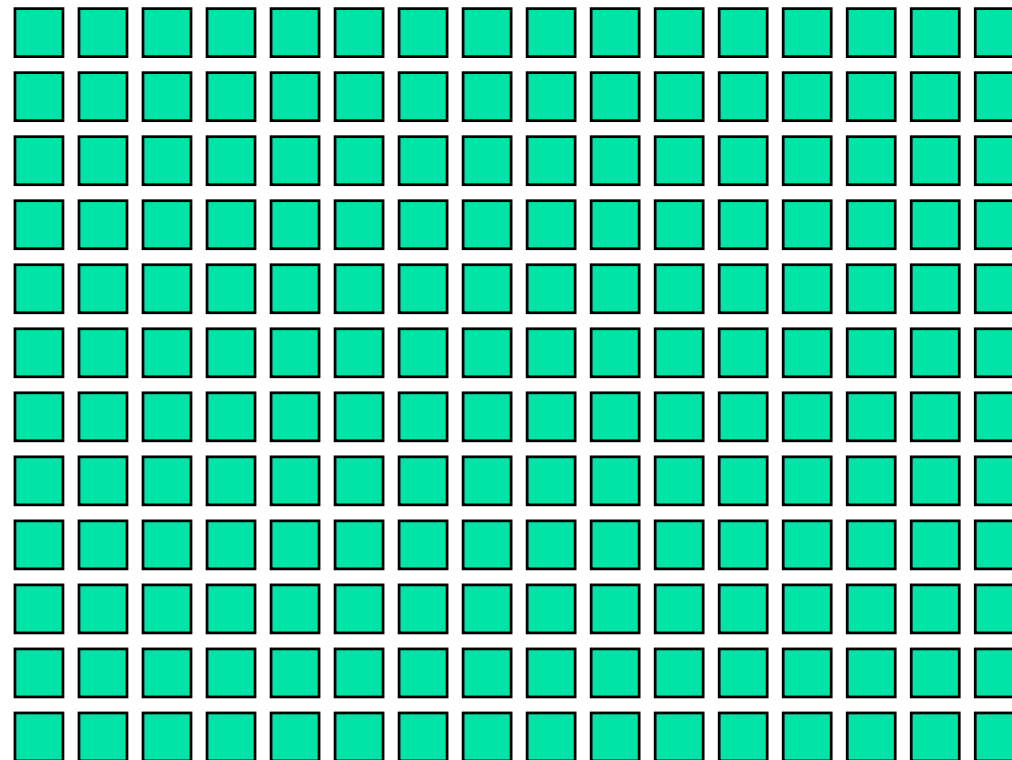


Figure 1

Pressure-time curve (for a single sensor) and parameters of interest with respect to the amplitude and timing of loading. The time parameters can also be expressed as a percentage of the whole contact phase (divide loading duration of a single sensor or area by the total contact time). The impulse can be obtained by the summation of the single pressure values multiplied by the time interval. (Integral of shaded area).



Πλατφόρμα πίεσης



Peak Pressure

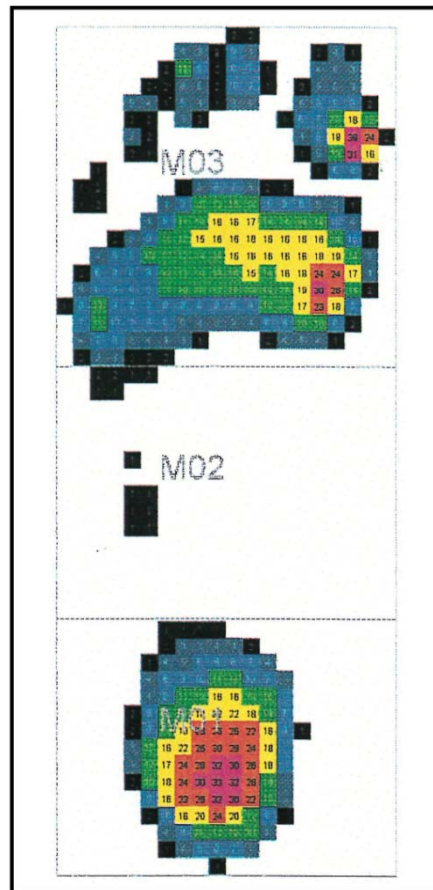
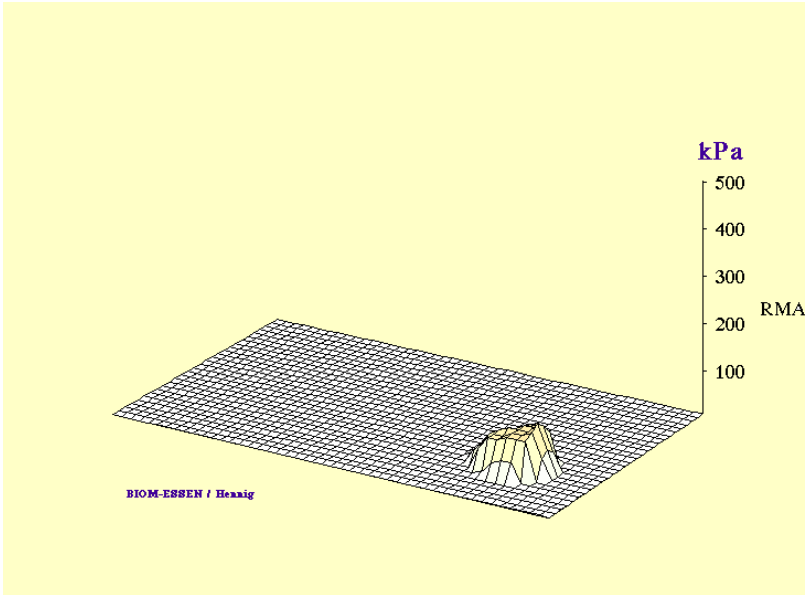
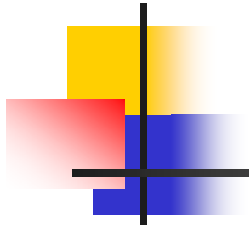


Figure 1.
A peak pressure plot divided into 3 regions of interest: hindfoot, midfoot, and forefoot.



Sequence of pressure plots

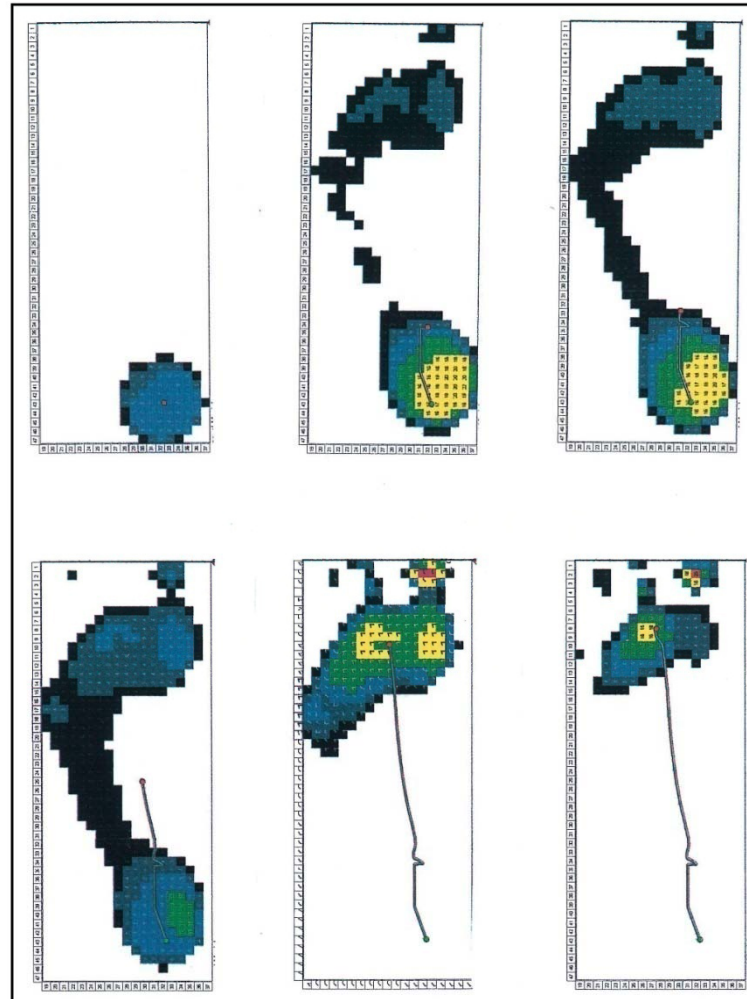
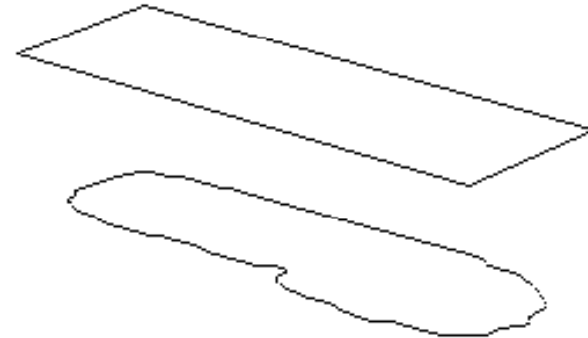


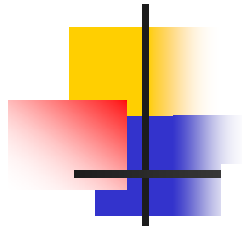
Figure 4.
Sequence of pressure plots over the entire stance phase of walking.



Pressure Measurement

- Pressure Platforms or Pressure Insoles
 - Consist of a series of force transducers, each with a small area
 - Mean Pressure = Force/Area (N/m^2 or Pascal [Pa])





Διάγραμμα Πίεσης-Χρόνου

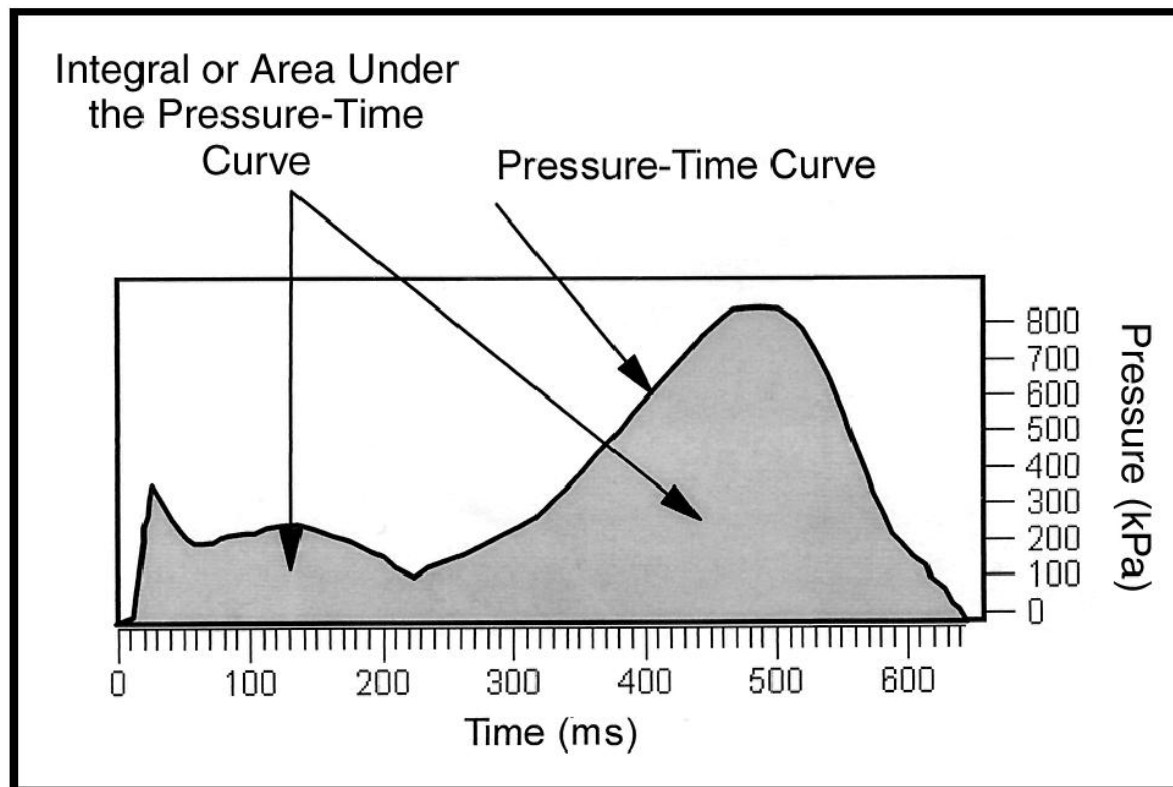


Figure 3.

An illustration of the integral or the area under the pressure-time curve.

4 display modes

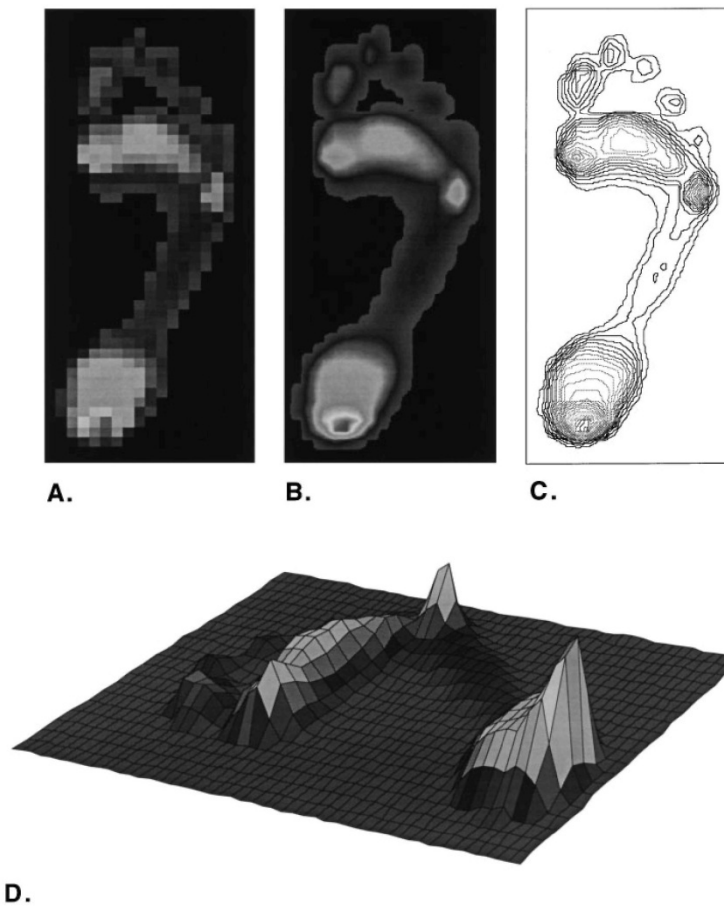


Figure 3
Four different ways to display the plantar pressure pattern: A. 2-D foot print (here shown in grey scale but usually color coded), B. interpolated image, C. isobaric image, D. wire-frame pressure mountain.

Χωρισμός σε επιμέρους μέρη

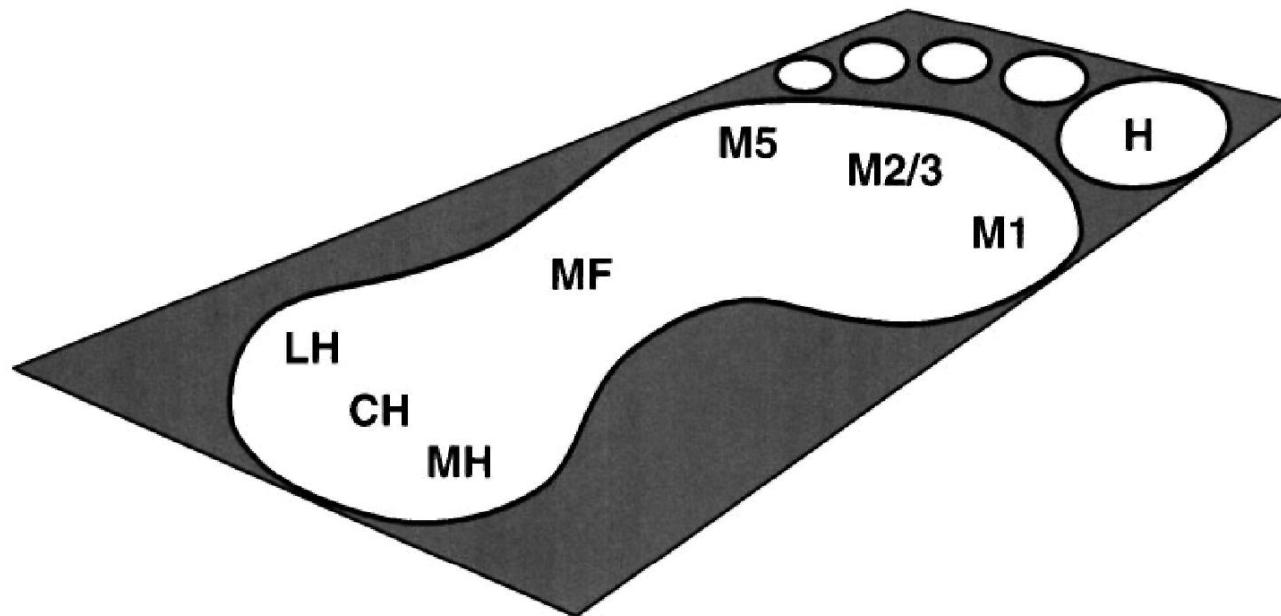
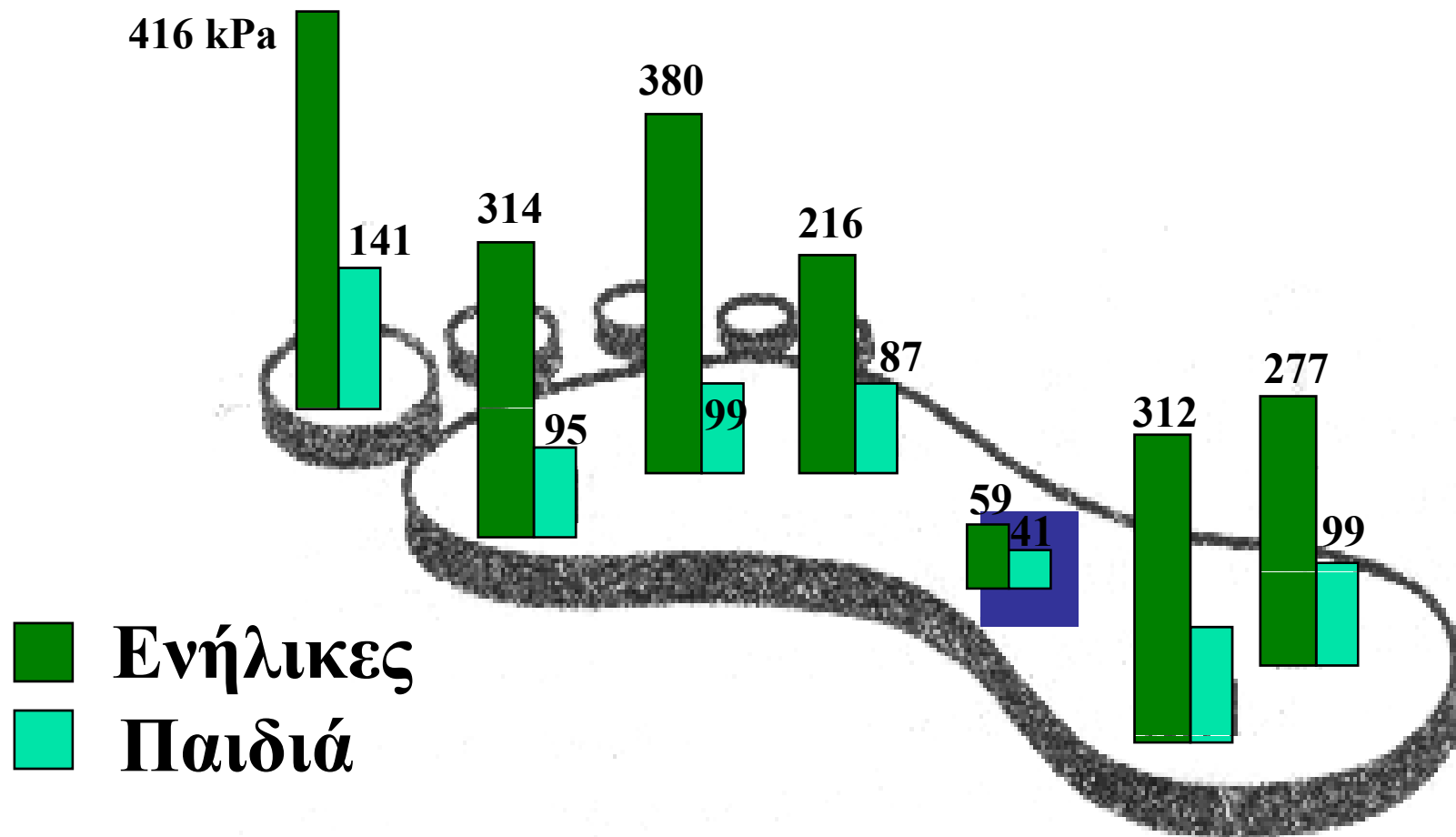


Figure 2

Foot outline with eight regions of interest that are used in our own projects to evaluate foot loading characteristics. MH=Medial heel, CH=Central heel, LH=Lateral heel, MF=Midfoot, M1=Medial forefoot (1st Metatarsal), M2/3=Central forefoot (2nd/3rd Metatarsal), M5=Lateral forefoot (5th Metatarsal), H=Hallux.

Ενήλικες και παιδιά





Καταγραφή των πελματικών πιέσεων συνεισφέρει:

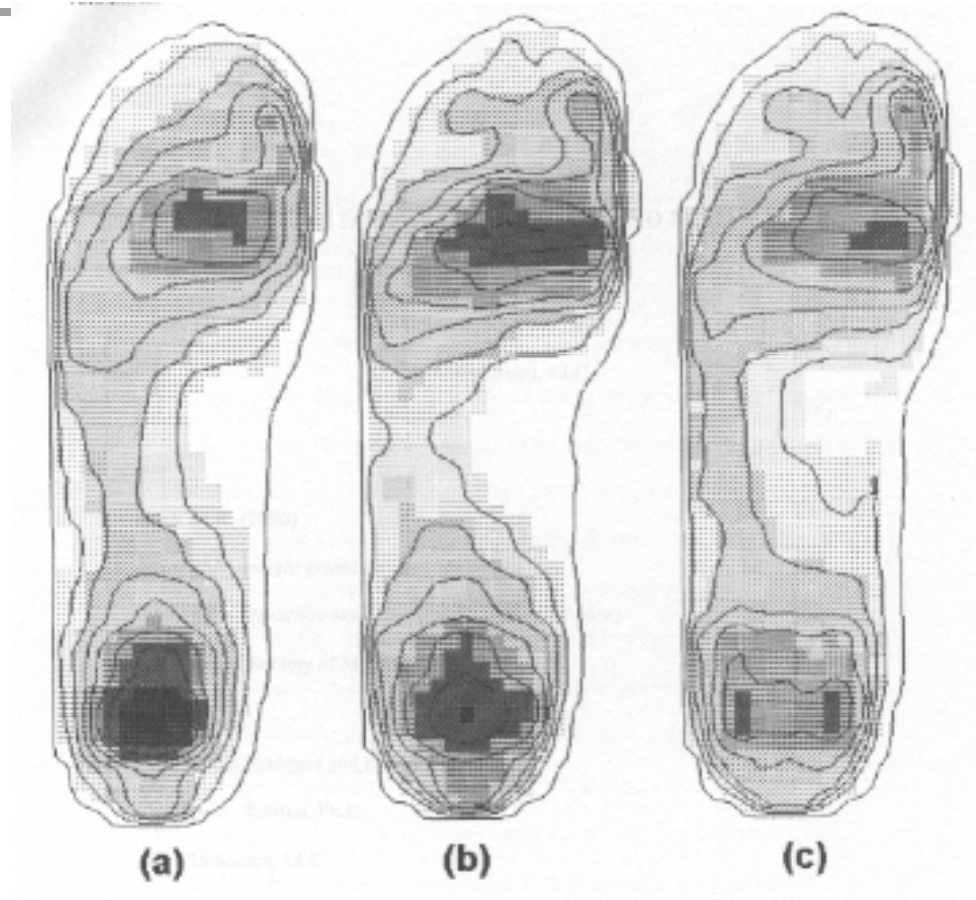
- στην μελέτη των ανατομικών χαρακτηριστικών του ποδιού
- στην μελέτη των επιβαρύνσεων των διαφόρων περιοχών του πέλματος κατά την εκτέλεση διαφόρων κινήσεων
- στην διάγνωση και αντιμετώπιση προβλημάτων που επηρεάζουν την πελματική επιβάρυνση
- στον σχεδιασμό κατάλληλων υποδημάτων

Pressure during Running at $5 \text{ m}\cdot\text{s}^{-1}$

(a) Poor Cushioning

(b) Moderate Cushioning

(c) Good Cushioning



Ρευματοειδή αρθρίτιδα

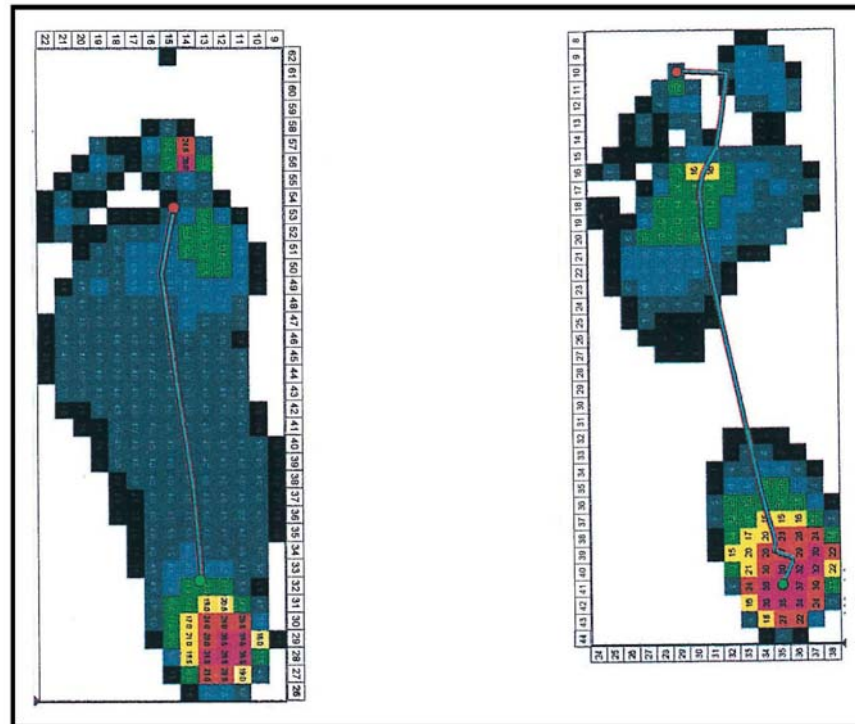


Figure 2.

Peak pressure plots for 2 children of similar ages. Left plot is from a child with juvenile rheumatoid arthritis, and right plot is from a child without known pathology.

Ρευματοειδή αρθρίτιδα

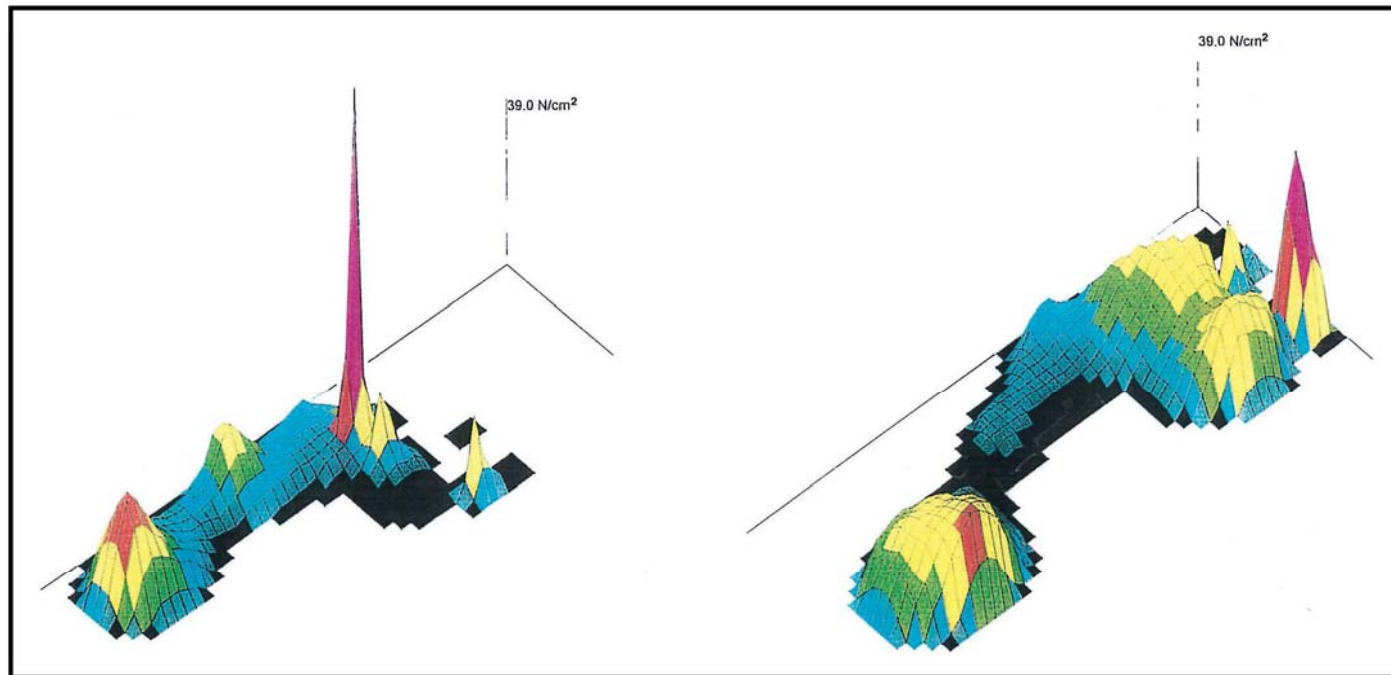
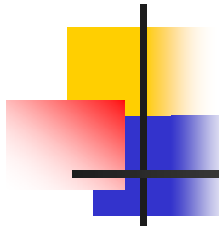
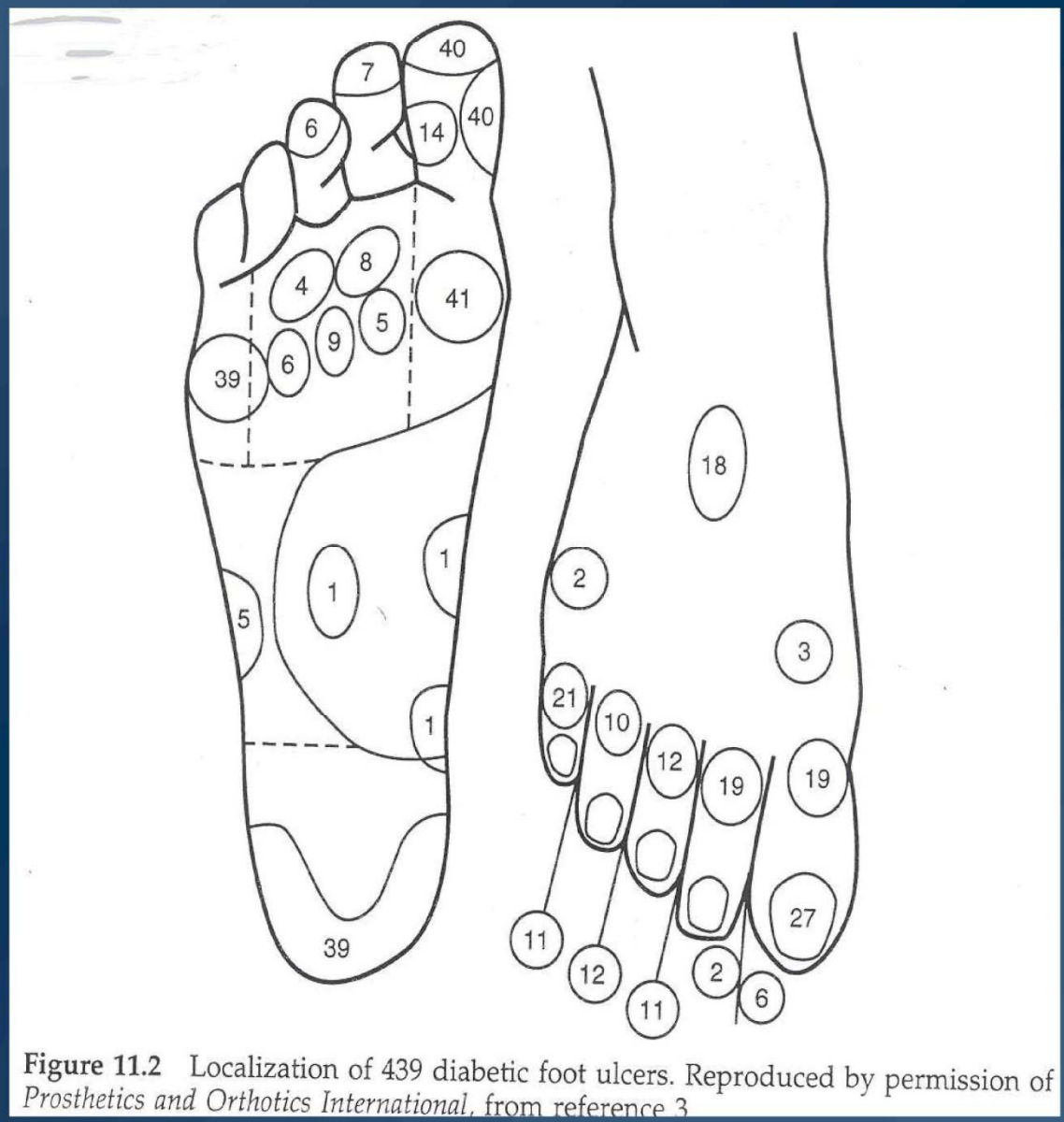


Figure 5. Three-dimensional peak pressure plots for 2 children of similar ages. Left plot is from a child with juvenile rheumatoid arthritis, and right plot is from a child without known lower-extremity pathology.



Ulcer location:

- Plantar sole = 25%
- Tops of toes = 25%
- Plantar hallux = 20%
- Heels = 10%
- Between toes = 10%
- Tips of toes = < 5%
- Sides of foot = < 5%



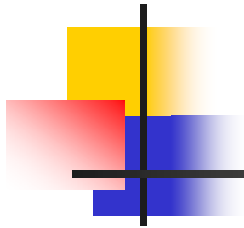


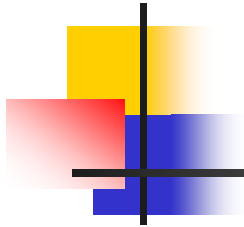
Ελκος στο διαβητικό πόδι

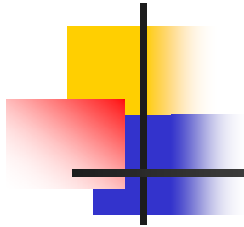
- Heal 85%
 - > 6months in 15%
- Amputation 15%

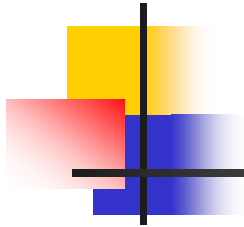
Υπερκεράτωση (κάλτοι)





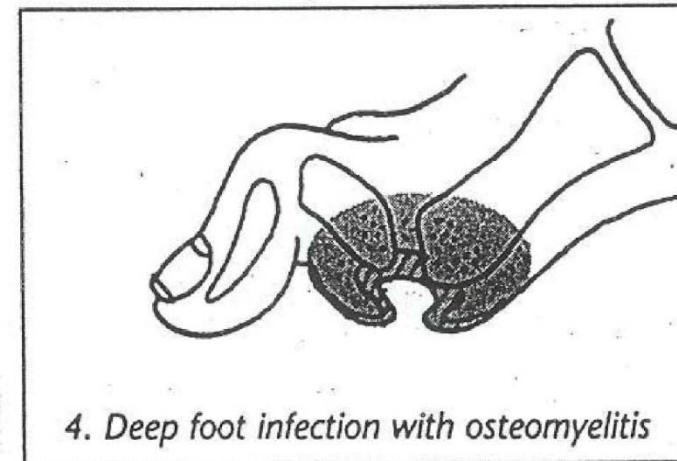
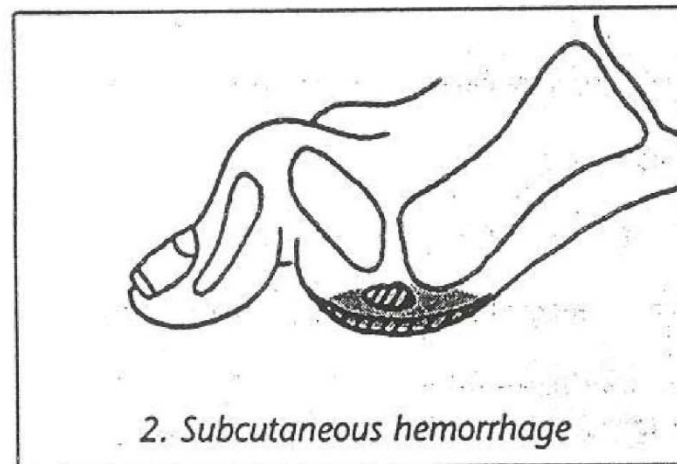
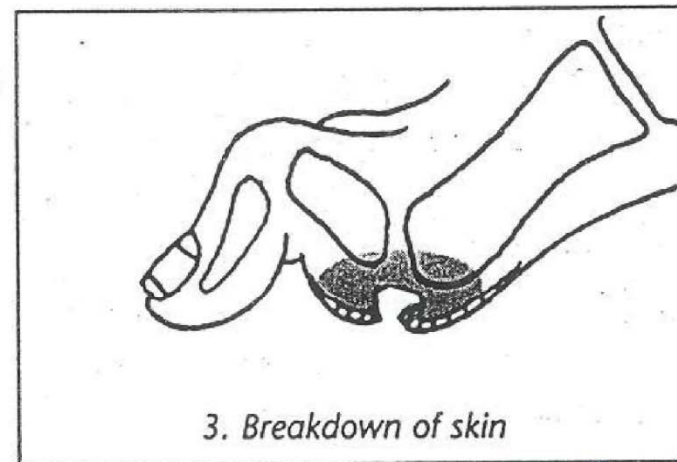
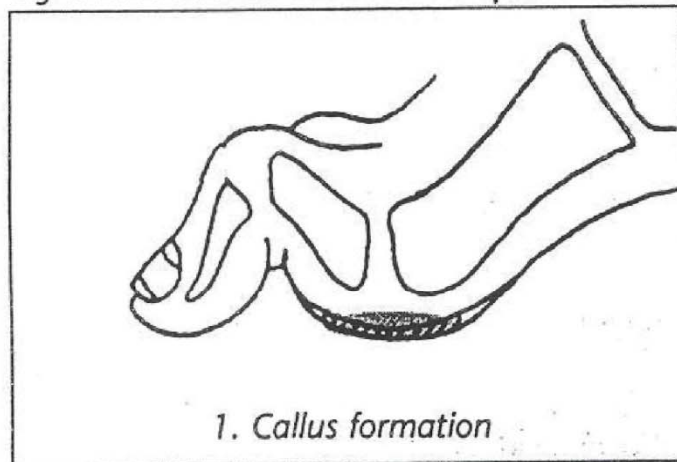






Γαμψο – σφυρο δακτυλία

Fig 1. Illustration of ulcer due to repetitive stress



Πραμορφωτική Ρ.Α. + βλαισό δάκτυλο



Γαμψοδακτυλία





Therapeutic shoe

- Inappropriate footwear 21-76% of ulcer
- Therapeutic footwear designed to
 - Protect feet from external injury
 - Reduce plantar pressure, shock and shear forces
 - Accommodate, stabilize support deformities
 - Suited to occupation, home, leisure
- Does therapeutic shoe work ?
 - For all ?
 - For some ?



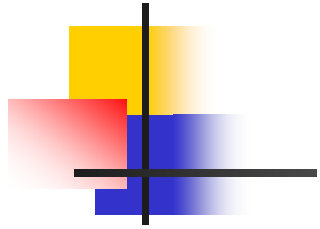
Therapeutic footwear: components

- Padded socks (CoolMax, Duraspun)
- Shoe inserts/insoles
- Therapeutic shoes



Footwear recommendation

- | | |
|---------------------|---|
| 1. Low risk | 1. Proper style/fit cushioned stock shoes |
| 2. Sensation | 2. Cushioned insoles |
| 3. Ulcer | 3. Custom molded insole |
| 4. Severe deformity | 4. Custom shoe / insole |

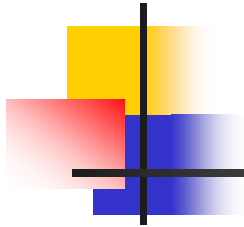


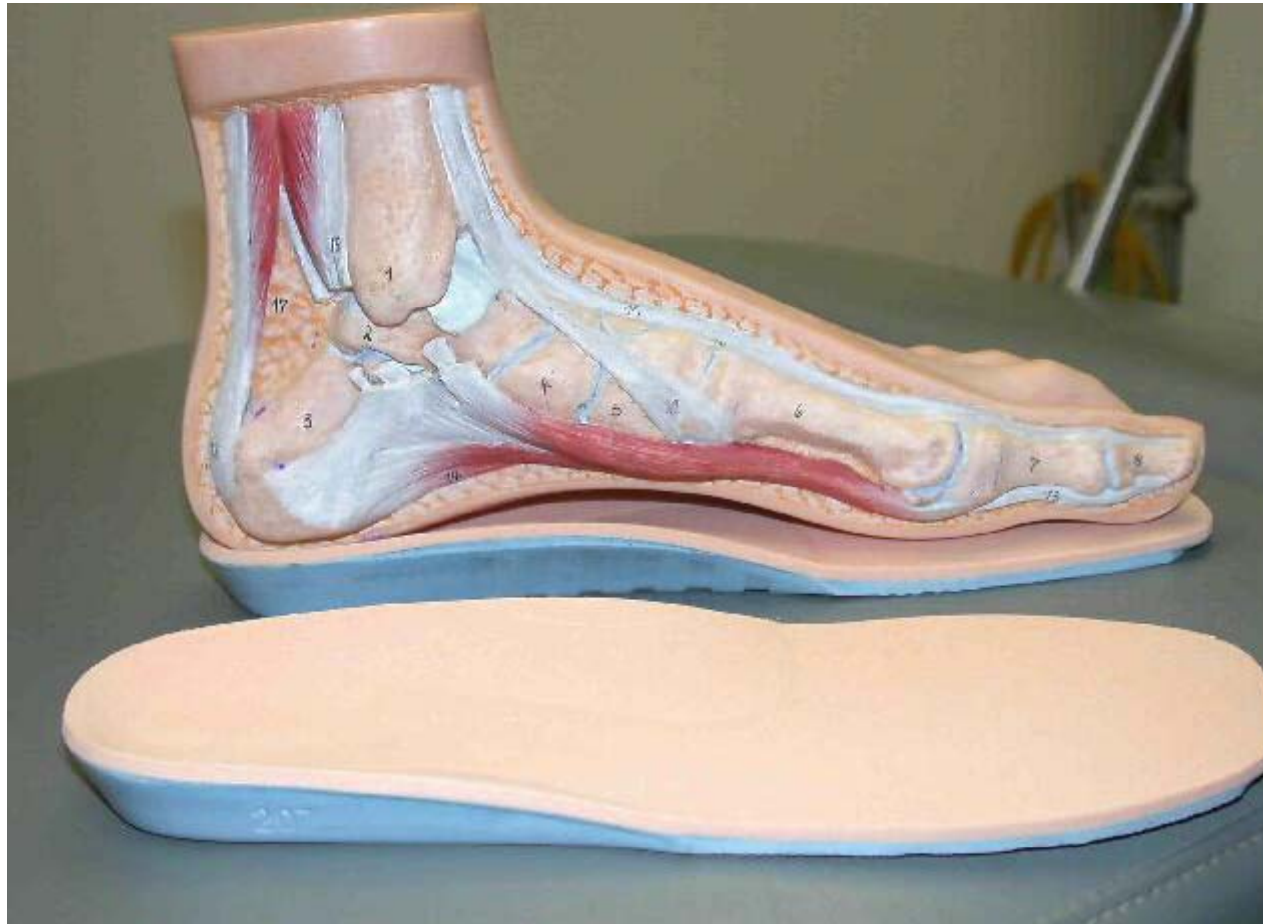
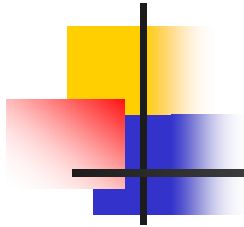
SHOES *and* SOCKS

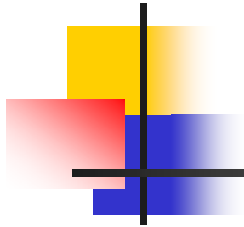
take 'em off!



IF YOU HAVE DIABETES
Have your doctor check your feet.







Statement of Certifying Physician for Therapeutic Footwear

Patient Name: _____ HIC #: _____
Address: _____

I certify that all of the following statements are true:

1. This patient has diabetes mellitus. —ICD-9 Code: _____
(ICD-9 diagnosis codes 250.00-250.93)
2. This patient has one or more of the following conditions (*check all that apply*):
 - History of partial or complete amputation of the foot
 - History of previous foot ulceration
 - Peripheral neuropathy with evidence of callus formation
 - Foot deformity
 - History of pre-ulcerative callus
 - Poor circulation
3. I am treating this patient under a comprehensive plan of care for his/her diabetes.
4. This patient needs special shoes (depth or custom-molded shoes) and/or inserts because of his/her diabetes.

Certifying Physician Information

Signature: _____ Date: _____
Name: _____ DEA # _____
Medicare UPIN # _____ Medicaid Provider # _____

Prescription Form for Therapeutic Footwear

(Prescribing physician may be different from certifying physician.)

Patient Name: _____ HIC#: _____
Address: _____
Diagnosis: _____
Change to be effected: _____
Additional relevant information, such as systemic conditions or allergies to specific materials: _____

Prescribing Physician Information

Signature: _____ Date: _____
Name: _____ DEA # _____
Medicare UPIN # _____ Medicaid Provider # _____



Συστήματα κατασκευής ορθωτικών

- Scanning του ποδιού
 - Scanner
 - Μετρήσεις
- Κατασκευή ορθωτικού



2-D foot scanning

IDEAS S.A.

Avenue de Villefranche, 80

B - 1330 Rixensart

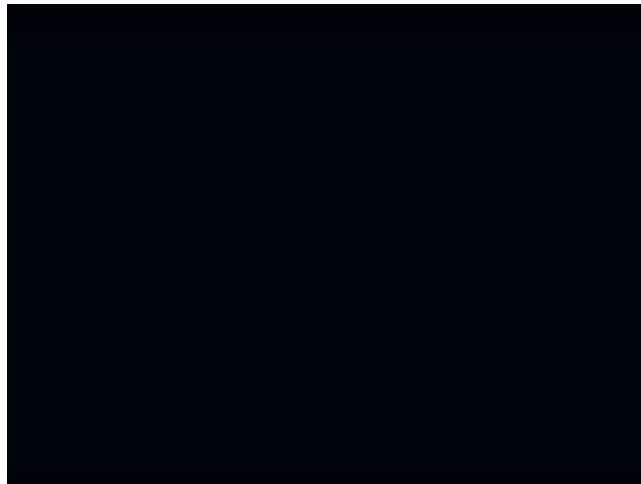
Belgium

www.ideas.be
info@ideas.be

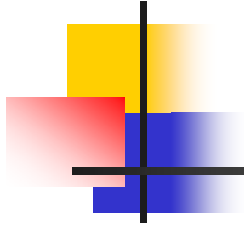




3-D foot scanning



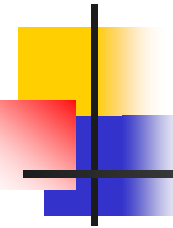
Κατασκευή παπουτσιού (λογισμικό)



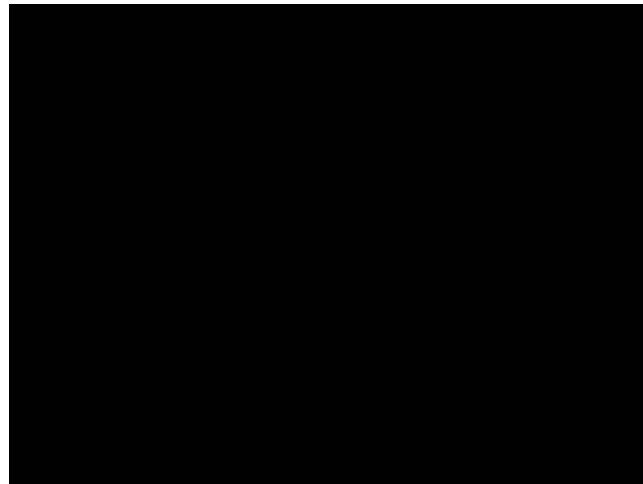


Κατασκευή σόλας - λογισμικό





Κατασκευή πρωτότυπου





Βιβλιογραφία

- Stults B, Clark S and Miller T. Skills for the internist: the diabetic foot. University of Utah Medical Center
- Orlin M, McPoil T (2000). Plantar pressure assessment. Physical therapy 80, 399-409
- Rosenbaum D and H P Becker (1997). Plantar pressure distribution measurement. Technical background and clinical applications. Foot and Ankle Surgery 3, 1-14

Τεστ υποδοχέων πόνου

