

# **Footwear and orthoses in neuropathic foot ulceration: Prevention and management**

**Kendra Evans B.Pod (Hons)**

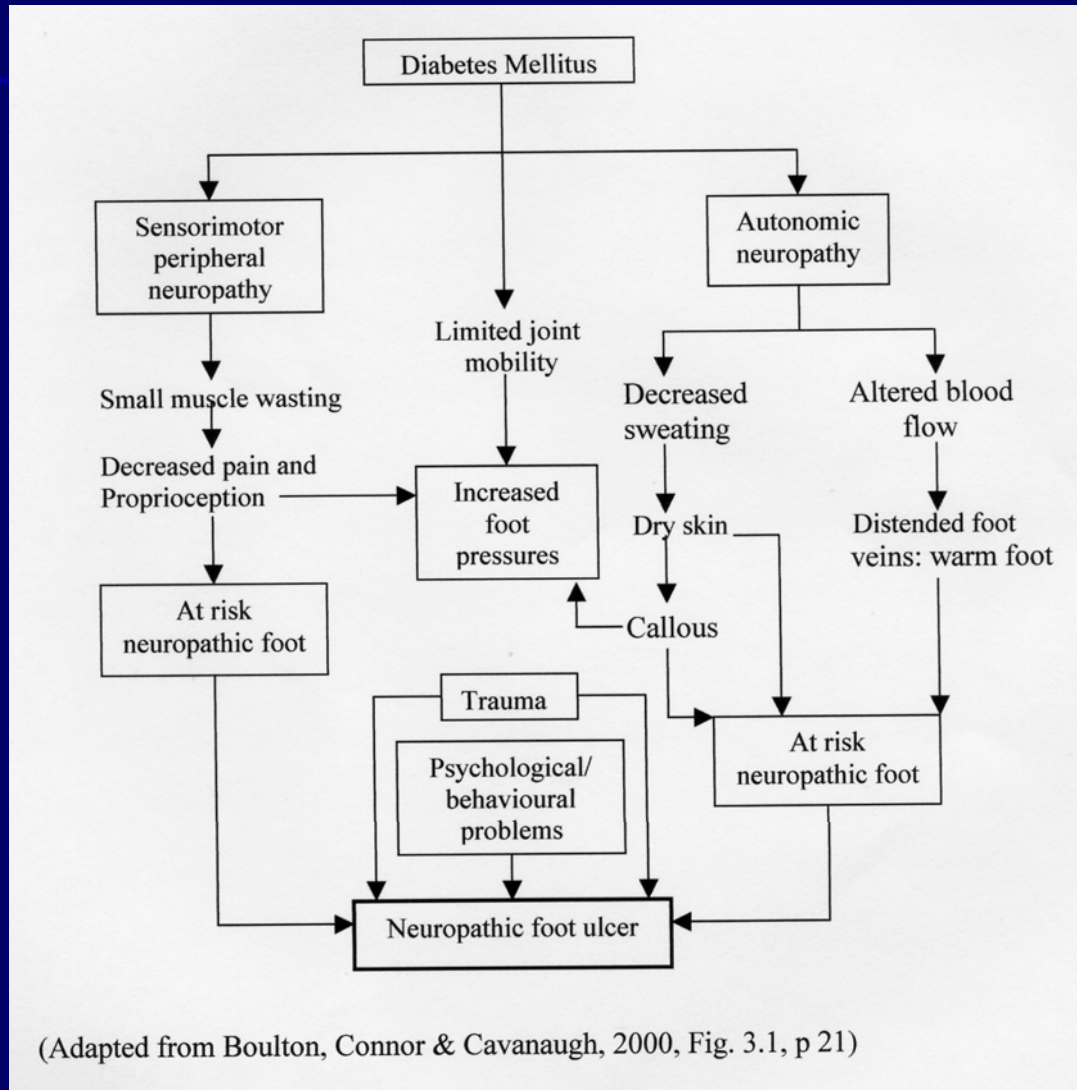
**Podiatrist**

**Royal Hobart Hospital**

# Aetiology

- 15% Patients with diabetes develop foot ulcers<sup>1</sup>
- Neuropathic foot ulcers develop secondary to presence of  $\geq 2$  risk factors<sup>2,3</sup>:
  - Peripheral sensorimotor neuropathy
  - Peripheral autonomic neuropathy
  - Increased plantar pressure
  - Foot deformity
  - Plantar callous
  - Limited joint mobility
  - Peripheral vascular disease
  - Trauma

# Pathway to Ulceration



(Adapted from Boulton, Connor & Cavanaugh, 2000, Fig. 3.1, p 21)

# Management

- Pressure reduction = main treatment<sup>2,3,4,5,6,7</sup>
  - Neuropathy is irreversible
  - Surgery is expensive and invasive
- Pressure reducing modalities
  - Footwear
  - Foot orthoses
  - Felt padding
  - Total contact casting

# Footwear - Objectives<sup>8,9</sup>

- Protection
- Stability
- Facilitate ambulation
- Reduce & redistribute plantar pressure
- Provide shock absorption
- Balance Limb Length Discrepancy
- Accommodate foot deformity & oedema
- Accommodate orthoses or prostheses
- Maintain foot function
- Easy to get on & off
- Essential long-term management

# Footwear – Options

	ADVANTAGES	DISADVANTAGES
OFF-THE-SHELF	<ul style="list-style-type: none"> <li>• Relatively cheap</li> <li>• Readily available</li> <li>• Some can be modified</li> </ul>	<ul style="list-style-type: none"> <li>• Inappropriate if not fitted</li> <li>• Ill-fitting footwear -&gt; ulceration</li> <li>• Difficult to accommodate some orthoses</li> </ul>
EXTRA-DEPTH/WIDTH	<ul style="list-style-type: none"> <li>• Accommodate minor foot deformity</li> <li>• Accommodate orthoses</li> <li>• Choice of materials</li> <li>• Modifiable</li> <li>• Range of sizes, widths, depths &amp; styles</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• Often heavy &amp; bulky</li> <li>• Not suitable for all patients</li> </ul>
CUSTOM-MADE	<ul style="list-style-type: none"> <li>• Guaranteed fit</li> <li>• Accommodate orthoses</li> <li>• Choice of materials</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• Time consuming manufacture</li> <li>• Aesthetically unappealing</li> <li>• Often heavy &amp; bulky</li> </ul>

# Footwear - Options



# Footwear – Modifications<sup>9,10,11,12</sup>

- Rocker sole
  - Restore range of motion
    - Non-enzymatic glycosylation
    - Arthritis
    - Arthrodesis
  - Reduce plantar pressure
  - Increase propulsion
- Medial or lateral flare = stability
- Steel shank = stability
- Heel raise = equalise limb length discrepancy



# Orthoses – Functional<sup>13</sup>

## Advantages

- Correct abnormal foot function
- Treatment of painful lower limb & foot pathologies
- Durable
- Custom-made
  - Flexible
  - Semi-rigid
  - Rigid

## Disadvantages

- Limited shock absorption
- Hard



# Orthoses - Accomodative<sup>13,14,15,16</sup>

## Advantages

- Accommodate
  - Foot deformity
  - Ulceration
- Protect & cushion
- Reduce plantar pressure
- Can restore foot function
- Manufactured from soft materials i.e. EVA

## Disadvantages

- Bulky -> difficult to fit to footwear
- Poor durability



# Felt Padding<sup>4,17</sup>

## Advantages

- Reduce & redistribute plantar pressure
- Accommodate foot deformity
- Useful in infected ulcers
- Cheap

## Disadvantages

- Short-term or adjunctive treatment
- Compresses quickly
- Displacement
- Bulky



# Total Contact Casting<sup>18,19</sup>

## Advantages

- “Gold standard” pressure relief in neuropathic foot ulceration
- Reduce & redistribute plantar pressure
- Reduce oedema
- Protection
- Forced patient compliance

## Disadvantages

- Bulky
- Heavy
- Instability
- Muscular atrophy
- Osteoporosis
- Iatrogenic lesions
- Contraindicated for infected & deep ulcers
- Negative impact quality of life
- Time consuming

# Total Contact Casting



# References

- 1) Vileikyte, L. (2001) Diabetic foot ulcers: a quality of life issue. Diabetes Metabolism Research and Reviews 17, 246-249
- 2) Boulton, A.J.M. (2000) The pathway to ulceration: Aetiopathogenesis. In Boulton, A.J.M., Connor, H. & Cavanagh, P.R. (Eds.), The Foot in Diabetes (3<sup>rd</sup> ed., pp 19-31). John Wiley & Sons: Chichester, United Kingdom
- 3) Reiber, G.E., Vileikyte, L., Boyko, E.J., Del Aguila, M., Smith, D.G., Lavery, L.A. & Boulton, A.J.M. (1999). Causal pathways for incident lower-extremity ulcers in patients with diabetes from two settings. Diabetes Care 22(1), 157-162
- 4) Guzman, B., Fisher, G., Palladino, S. J. & Stavosky, J. W. (1994). Pressure-removing strategies in neuropathic ulcer therapy: An alternative to total contact casting. Clinics in Podiatric Medicine and Surgery 11 (2), 339-353
- 5) Fleischli, J. G., Lavery, L. A., Vela, S. A., Ashry, H. & Lavery, D. C. (1997). Comparison of strategies for reducing pressure at the site of neuropathic ulcers. Journal of the American Podiatric Medical Association 87 (10), 466-472
- 6) Mueller, M. J. (1999). Off-loading techniques for neuropathic plantar wounds. Advances in Wound Care 12 (5), 270-271

# References

- 7) Snyder, R. J. & Lanier, K. K. (2002). Offloading difficult wounds and conditions in the diabetic patient. Ostomy Wound Management 48 (1), 22-35
- 8) Cheskin, M. (2003). The world of orthopaedic footwear. Footwear Technology Nov/Dec pp 21-23
- 9) Dahmen, R., Koomen, B., Haspels, R. & Hoeksma, A.F. (2001). Therapeutic footwear for the neuropathic foot: an algorithm. Diabetes Care 24(4), 705-709
- 10) Praet, S.E. & Louwerens, J.W.K. (2003). The influence of shoe design on plantar pressures in neuropathic feet. Diabetes Care 26(2), 441-445
- 11) Boughton, B. (2001) Rocker sole changes define diabetes footwear. Biomechanics. Retrieved September 13<sup>th</sup>, 2005 from the world wide web: [http://www.biomech.com/db\\_area/archives/2001/0105.footwear.diabet.bio.html](http://www.biomech.com/db_area/archives/2001/0105.footwear.diabet.bio.html)
- 12) Janisse, D.J. (1996). Footwear: Therapeutic Shoe Modifications. Biomechanics Retrieved September 13<sup>th</sup> 2005 from the world wide web: [http://www.biomech.com/db\\_area/archives/1996/9602theratxt.bio.html](http://www.biomech.com/db_area/archives/1996/9602theratxt.bio.html)
- 13) Kirby, K.A. (2002). Functional and accomodative foot orthoses. Retrieved September 5<sup>th</sup> 2005 from the world wide web <http://www.podiatrynetwork.com>

# References

- 14) Ashry, H.R., Lavery, L.A., Murdoch, D.P., Frolich, M. & Lavery, D.C. (1997). Effectiveness of diabetic insoles to reduce foot pressures. Journal of Foot and Ankle Surgery 36(4) pp 268-271
- 15) Kato, H., Takada, T., Kawamura, T., Hotta, N. & Torii, S. (1996). The reduction and redistribution of plantar pressures using foot orthoses in diabetic patients. Diabetes Research and Clinical practice 31(1-3) pp 115-118
- 16) Bus, S.A., Ulbrecht, J.S. & Cavanagh, P.R. (2004). Pressure relief and load redistribution by custom-made insoles in diabetic patients with neuropathy and foot deformity. Clinical Biomechanics 19(6) pp 629-638
- 17) Ritz, G., Kushner, D. & Friedman, S. (1992). A successful technique for the treatment of diabetic neuropathic ulcers. Journal of the American Podiatric Medical Association 82 (9), 479-481
- 18) Baker, R. E. (1995). Total Contact Casting. Journal of the American Podiatric Medical Association 85 (3), 172-176
- 19) Armstrong, D. G., Nguyen, H. C., Lavery, L. A., van Schie, C. H. M., Boulton, A. J. M. & Harkless, L. B. (2001). Off-loading the diabetic foot wound. Diabetes Care 24 (6), 1019-1022