Orthotic Treatment of Neuropathic Diabetic Foot Ulcers
May 2, 2009

Patrick Reilly B.Sc. CPO(c)
Sharon Grad MD FRCPC
Hamilton Health Sciences
Chedoke Hospital

Orthotic Treatment of Neuropathic Diabetic Foot Ulcers OUTLINE

- Incidence of Diabetic Foot Ulcers
- Review of literature on orthotic management for diabetic foot ulcers
- Provide recommendations for orthotic management as per research
- Discuss Chedoke total contact foot-bed technique

Definition

- Diabetic foot ulceration is a full-thickness penetration of the dermis of the foot in a person with diabetes

Hunt, D. British Medical Journal 2008

Scope Of The Problem

- >2.4 million Canadians have diabetes (Canadian Diabetes Association, 2008)
- ~2.5-10.7% of the diabetic population will present with a foot ulcer annually (British Medical Journal 2008; Canadian Family Physician 2004)

Scope of the Problem cont'd

- 85% of diabetes related amputations are preceded by a foot ulcer (Apelqvist and Ragnarson, **Diabetes Voice** 2005)
- > 3,500 Canadians per year with diabetic foot ulcers will require major lower extremity amputation (Canadian Family Physician 2004)

Scope Of The Problem

- Huge personal and financial burden to individuals and the health care system
- Ulcer treatment in Canada per year

~ $500,000,000

(Melissa Green 2002, Southern Medical Journal)

Long Term Risk Factors for Foot Ulcers

- Duration of diabetes Dx
- Poor glycemic control
- Microvascular complications
- Peripheral vascular disease
- Foot deformities
- Previous foot ulceration or amputation

Hunt, D. BMJ 2008

Strong Predictors of Foot Ulceration

- Altered foot sensation
- Foot deformities
- Previous foot ulcer
- Previous amputation of other foot

Hunt, D. BMJ 2008

Management of Diabetic Foot Ulcers

- Diabetic foot problems are becoming more common
- Prevention is the best option
- The most effective preventative measure for major amputation is screening and referral to a foot care clinic for high risk clients (Hunt, D. BMJ 2008)

Treatment Strategies

- When an ulcer occurs:

- Proceed with an aggressive, multidisciplinary approach

  (Nesbitt, J. Canadian Family Physician 2004)

- Relieve pressure on the ulcer
  - this is ***the primary factor in wound healing***

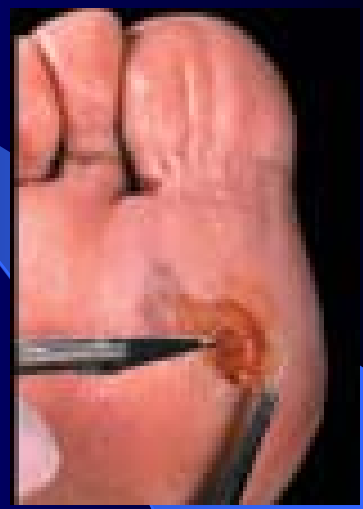
    (Armstrong, D. Clinical Podiatric Medicine and Surgery 1998; Katz, I. Diabetes Care, 2005; Kominsky, SJ. The High Risk Foot in Diabetes 1991)

- *The role of the orthotist is critical*

Treatment Strategies

- The primary goal of ulcer treatment is quick and infection free wound closure

- Three fundamental parts to healing protocol:



1]Regular/skilled debridement and dressing with appropriate wound healing agents (Boulton AJ, New England Journal of Medicine 2004; Wu S, Armstrong D, Diabetes voice, 2005)

2]Treatment of soft tissue infection

3]Offloading the wound is described by many authors as the single most important aspect of healing (Armstong, Lavery, Katz)

Role of the Orthotist

- The orthotist has a primary role to play:
  - Design/fit and follow-up the orthosis
    - Quantify progress
  - Educate patient about wound protection
    - Use orthosis for all weight bearing activities
    - NO “breaks” from the orthosis

Orthotic Management

- In 2005 Katz concluded that:
  - “Neuropathic diabetic foot ulcers are a major public health and economic burden, for which there exists an incredibly wide range of (orthotic) treatments with variable efficacy.”

  - (**A Randomized Trial of Two Irremovable Off-Loading Devices in the Management of Plantar Neuropathic Diabetic Foot Ulcers**, Diabetes Care, Volume 28, Number 3, March 2005)

Orthotic Treatment of Diabetic Ulcers

- What orthotic treatments are currently being used?
  - Total contact casting
  - Cast walkers (Air cast, Royce, etc)
  - Half shoe
  - Therapuetic shoes with Custom foot orthoses
  - Shoes with traditional dressing changes
  - CROW (Charcot Restraint Orthopedic Walker)

THE EVIDENCE

Total Contact Casts

vs.

Removable Cast Walkers

vs.

Half Shoes

vs

Foot Orthoses

Orthotic Treatments

- Total Contact Casts
- High success rate.
  - ***However*** TCCs are not often used due to practical considerations

Orthotic Treatments

Removable Cast Walkers

- Air Cast, Royce, Bledsoe walker etc. are commonly used for wound healing

- Good rate of healing

Orthotic Treatments

- Half Shoes
- Half shoes are easy to obtain and fit.
  - They are used widely with ***modest success***
  - Often the “first step” in offloading strategy

Orthotic Treatments

Custom Foot Orthoses

- Often used as off-loading devices for ulcers
  - Healing rates are poor

The Evidence
Total Contact Casting versus Removable Cast Walker versus Half Shoe

Armstrong, D. et al. Diabetes Care 2001

- RCT
- 63 people with diabetes mellitus and non infected neuropathic plantar foot ulcers
- All participants had weekly visits for wound care/debridement

Total Contact Casting
vs
Removable Cast Walker
vs
Half Shoe

Armstrong et al, Diabetes Care, 2001

After 12 weeks of treatment:

- Total contact casting significantly increased ulcer healing (89% healed)
- Removable cast walkers (65% healed)
- Half shoes (58% healed)

The Evidence

Removable Cast Walker vs. Non-removable Cast Walker

Armstrong et al. Diabetes Care 2005

- RCT, n=50, neuropathic foot ulcer patients
- Group 1= Removable Cast Walker
- Group 2=Same Cast Walker rendered irremovable
- 12 week treatment period
- 4 drop outs

The Evidence
Removable Cast Walker vs. Non-removable Cast Walker

- Armstrong et al, Diabetes Care, 2005
- Non-removable cast walker significantly increased ulcer healing at 12 weeks (83% healed) compared with the removable cast walker (52% healed)

Irremovable Cast Walkers

- Patient compliance matters!
- when cast walkers were rendered irremovable with casting tape the healing rates improved significantly

The Evidence
Non-removable Cast Walker vs. Total Contact Cast

Katz, I. et al. Diabetes Care 2005

- RCT, n=41, neuropathic foot ulcer patients
- Group 1= Irremovable Cast Walker
- Group 2= Total Contact Cast
- 12 week treatment

The Evidence

Total Contact Cast
vs.
Non-removable Cast Walker

Katz et al, Diabetes Care, 2005

- No significant difference in ulcer healing rates between groups at 12 weeks
- 74% healed with TCC vs. 80% healed with non-removable

The Evidence
Total Contact Casts vs. Shoes with Offloading Insoles

- Caravaggi et al, Diabetes Care, Dec 2000
- RCT, n=50, neuropathic foot ulcer patients
- Group 1=TCC,
- Group 2 =shoes + orthoses
- 30 day trial with weekly follow up
- Ulcers were treated with a standardized dressing

The Evidence
Total Contact Casts
vs.
Shoes with Offloading Insoles

Caravaggi, Diabetes Care, 2000

- TCC's significantly improved healing (50% healed) vs specialized cloth shoes (21% healed) after 30 days of treatment

- High patient acceptance

Total Contact Casting (TCC) vs Traditional Dressing Changes

Mueller, M. et al. Diabetes Care 1989

- RCT of total contact casting versus traditional dressing changes n=40
- Total contact casting significantly increased ulcer healing (91% healed with TCC vs. 32% with dressings after 12 weeks)
- TCC reduced infection compared with traditional dressing changes

Evidence: Bottom Line

- *Pressure off-loading with the TCC is the gold standard* for chronic neuropathic non-infected, non-ischemic plantar foot ulcers in individuals with diabetes mellitus

- Some practical challenges with TCC's
  - Staffing
  - Relatively high cost
  - Local preferences/comfort level of prescriber
  - Patient transportation

Treatment Options In Summary

- TCC's are the gold standard
- Irremovable cast walkers can be as effective as TCC's
- Removable cast walkers are somewhat less effective but still useful
- Half Shoe are a mediocre treatment option
- Traditional dressings with shoes are a poor choice
- Shoes with custom orthoses are a poor treatment option

Cast Walker Customization

Customized vs. "Stock" Walkers

- Well Aligned Foot (no contractures)
  - Possible to use an unmodified cast walker
- Frontal or Sagittal Plane contracture
  - Use a custom foot bed. Accommodate all contractures!

Diabetic Ulcer Care at Chedoke

At Chedoke (HHS):

- Medical supervision=Physiatrist, RN
  - Rigid cast walkers with a custom total contact foot-bed fabricated by a certified orthotist
  - Follow-up is done through the physician/homecare
  - Progress is tracked -- measurements and digital photographs

Total Contact Foot-bed Technique

- Simulate the environment inside a Total Contact Cast

- Cast to accommodate all contractures
  - Do not modify!

- Multilayered foot bed
  - Post with AFO cast

Total Contact Foot-bed Technique

- Footbed materials:
  - 5mm Thermofoam or Nora Lunasoft
  - 4mm PPT, additional under ulcer
  - Firm nickelplast
  - Two part foam or additional firm/extrafirm nickelplast

Total Contact Foot-bed Technique

- Align and fit the insert in the cast walker
- Allow the insert to wrap around
- Assess functional leg length

Total Contact Foot-bed Technique

- The technique is simple and, results are generally good
  - Patient: 63 yr old male, 15 yr Hx of Diabetes, TT amputee

Day 1

Day 13

Day 29

Day 55

Case Study


Nov 3 2008
Wound Ruler - Règle pour mesurer
SINGLE USE - À USAGE UNIQUE


Jan 19 2009
mesurer une plaie
Canadian Association of Wound Care
Association canadienne du soin des plaies
www.cawc.net


Wound Ruler - Règle pour mesurer une plaie

Total Contact Foot-bed Technique

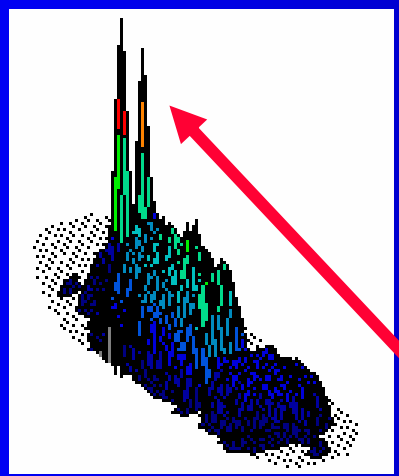
- "Stock" Cast Walker

vs

- Cast Walker plus custom Foot-bed

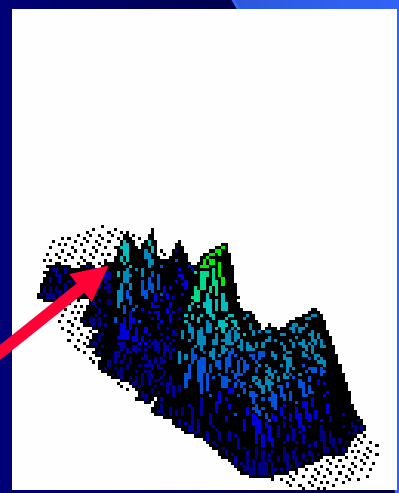
F-Scan Case studies :

Foot-bed + Cast walker = 40%-80% ↓ in pressure on ulcer site



"Stock"Air Cast Walker

Pressure on ulcer



Air Cast Walker + Custom Foot-bed

The Compliance Factor

- Ulcer patients use removable devices as little as 28% of the time (Armstrong et al 2003)
- Use the device **“whenever the foot is on the floor”**
- Some clinics render devices irremovable to “force” compliance

Post Healing Treatment

- Uccioli et al. Diabetes Care 1995
- Non-randomized control trial
- Wearing therapeutic shoes reduced ulcer recurrence compared with ordinary shoes (27% vs. 58%)

In a Nutshell!

- Plantar ulcers pose an urgent and significant threat to individuals with diabetes
- Prolonged healing has high personal and financial costs
- Early, multi-disciplinary treatment of ulcers is effective
- Use proven off-loading techniques

Contact

grads@hhsc.ca

reillyp@hhsc.ca

Thank You

- Valerie Jack, Clinical Intern
- Patrick Reilly B.Sc. CPO (c)
- Ann Toner RN
- Karen Litman CP (c)