

Orthotic Treatment of Neuropathic Diabetic Foot Ulcers

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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 glycemc 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***

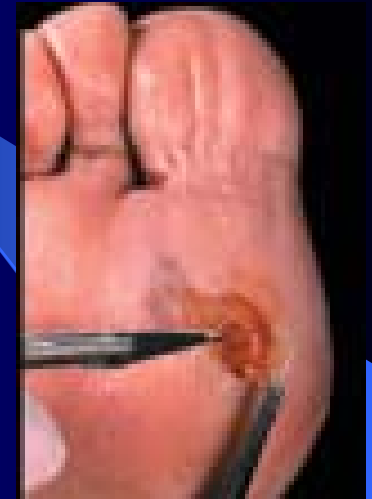
(Armstrong, D. Clinical Podiatric Medicine and Surgery 1998;
Katz, I. Diabetes Care, 2005; Kominsky, SJ. The High Risk Foot
in Diabetes 1991)

- ***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 (Armstrong, 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
 - Therapeutic 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

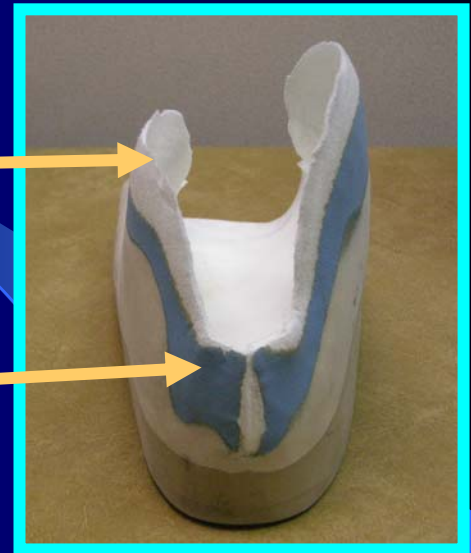
- Post with AFO cast



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

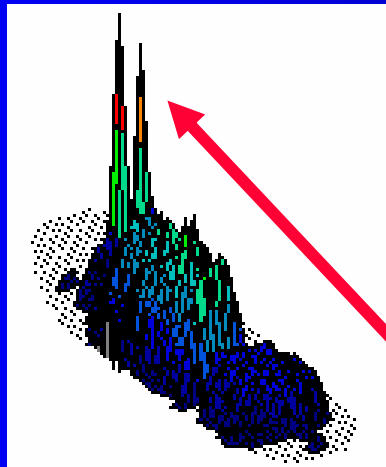


Total Contact Foot-bed Technique

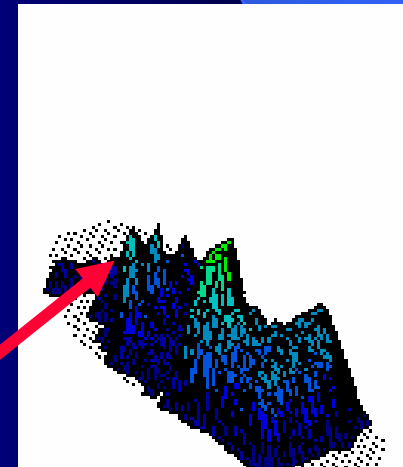
- “Stock” Cast Walker
vs
- Cast Walker plus custom Foot-bed

F-Scan Case studies :

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



“Stock” Air Cast Walker



Air Cast Walker + Custom Foot-bed

Pressure on ulcer

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

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Thank You

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