Friction Management

For Diabetic Foot Problems

Presented at the 36th Annual Meeting and Scientific Symposium of the American Academy of Orthotists and Prosthetists

Technical Workshop #33: "Diabetic Foot Problems and Novel Ways to Treat Them with ShearBan"

Prepared by Mark Payette, CO

February, 2010

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Diabetic / Neuropathic Foot Problems

23.6 Million Americans

(7.8% of Population)

5.7 Million do not know they have Diabetes

20% of people who present for routine care will have a treatable foot care problem

15% lifetime incidence of foot ulcer

Health Care Costs = $174 Billion

(Direct Medical Costs = $116 Billion)

1958 = 1.5 Million

2007 = 17.9 Million

Ref: National Diabetes Education Program Statistics and NIH Publication
Working Together to Manage Diabetes 2007

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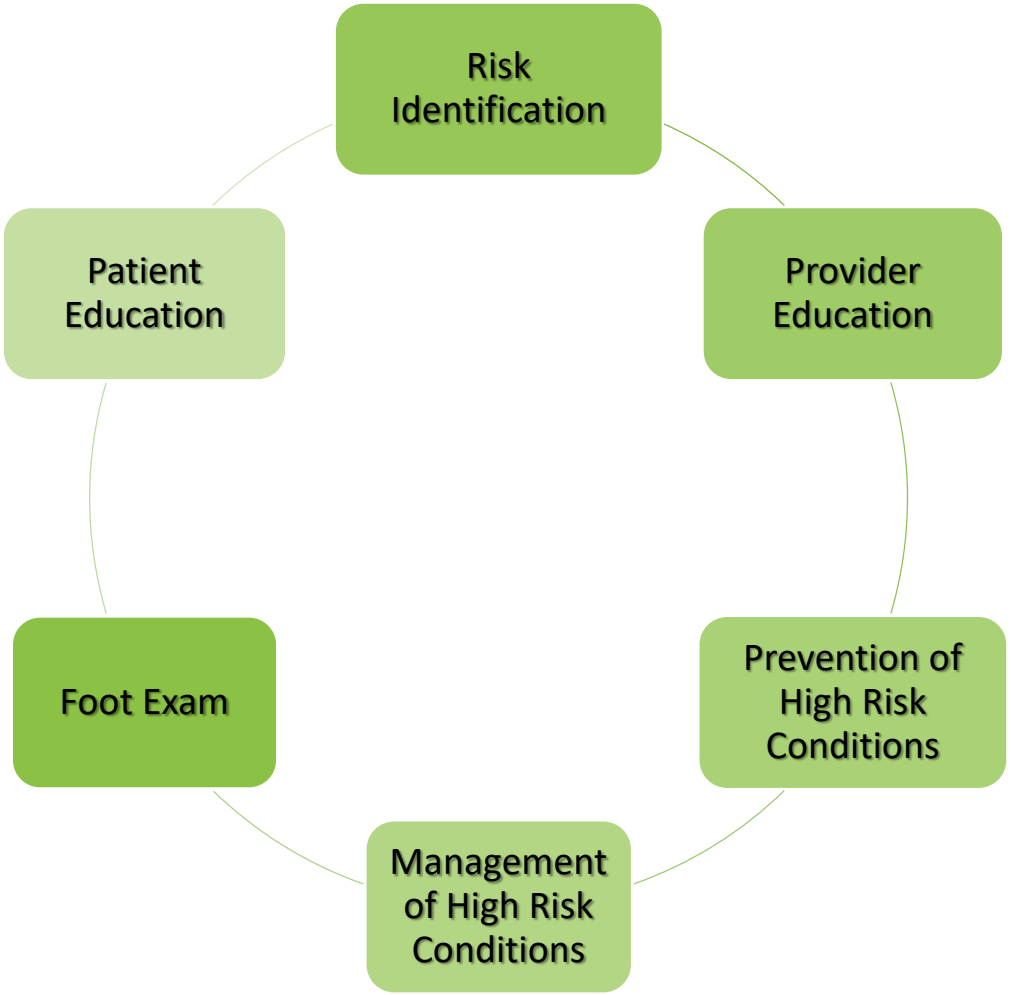
Preventive Foot Care in Diabetes



Ref: American Diabetes Association - Diabetes Care, Volume 27 Supplement I, January 2004

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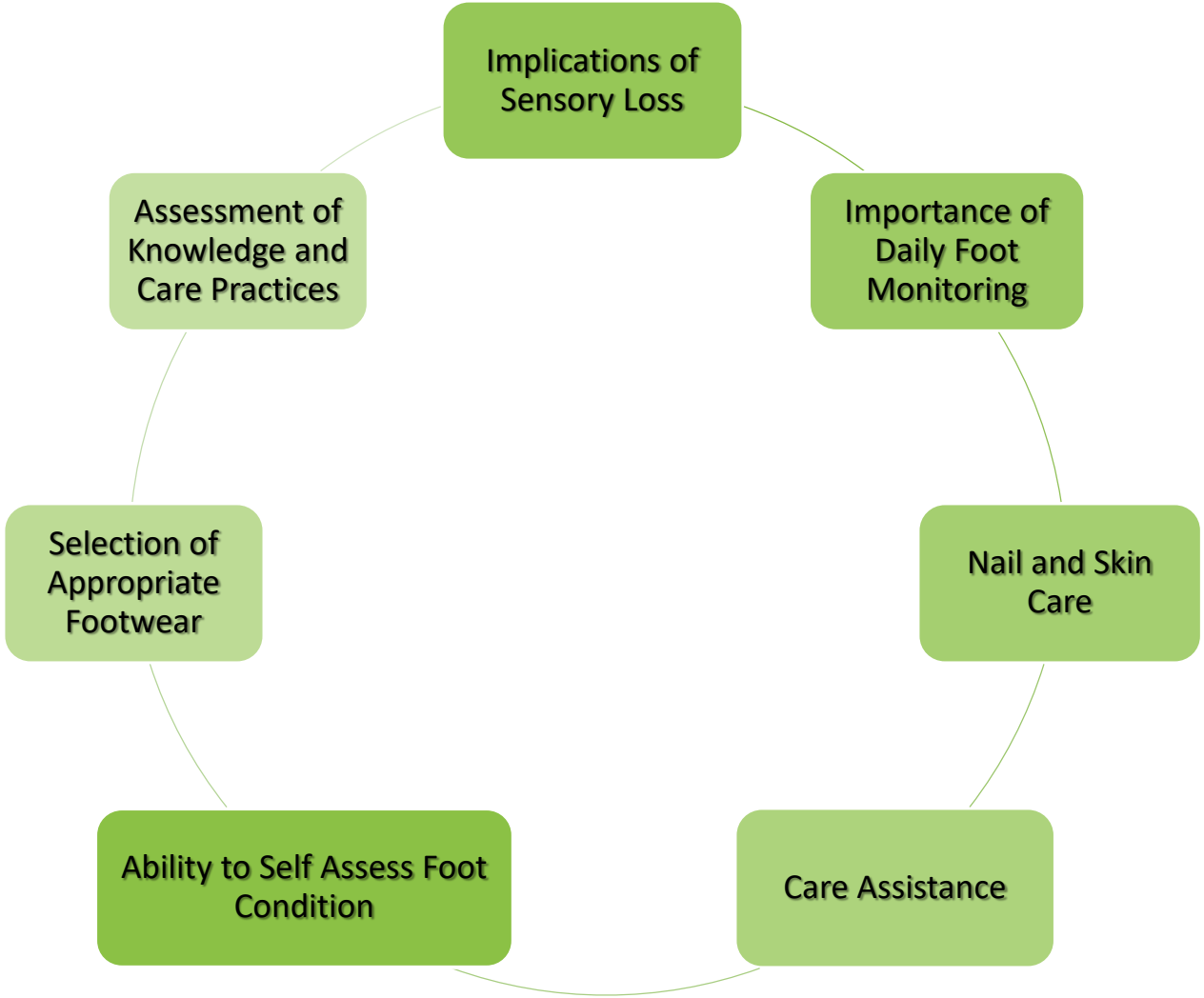
Patient Education



Ref: American Diabetes Association - Diabetes Care, Volume 27 Supplement I, January 2004

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Goal for Low-Risk Foot Patient education

Keep Low Risk Status

Control ABC's: A1C, Blood Pressure, and Cholesterol – Lipid Profile

Tobacco Cessation

Ref: NIH Publication *Working Together to Manage Diabetes 2007*

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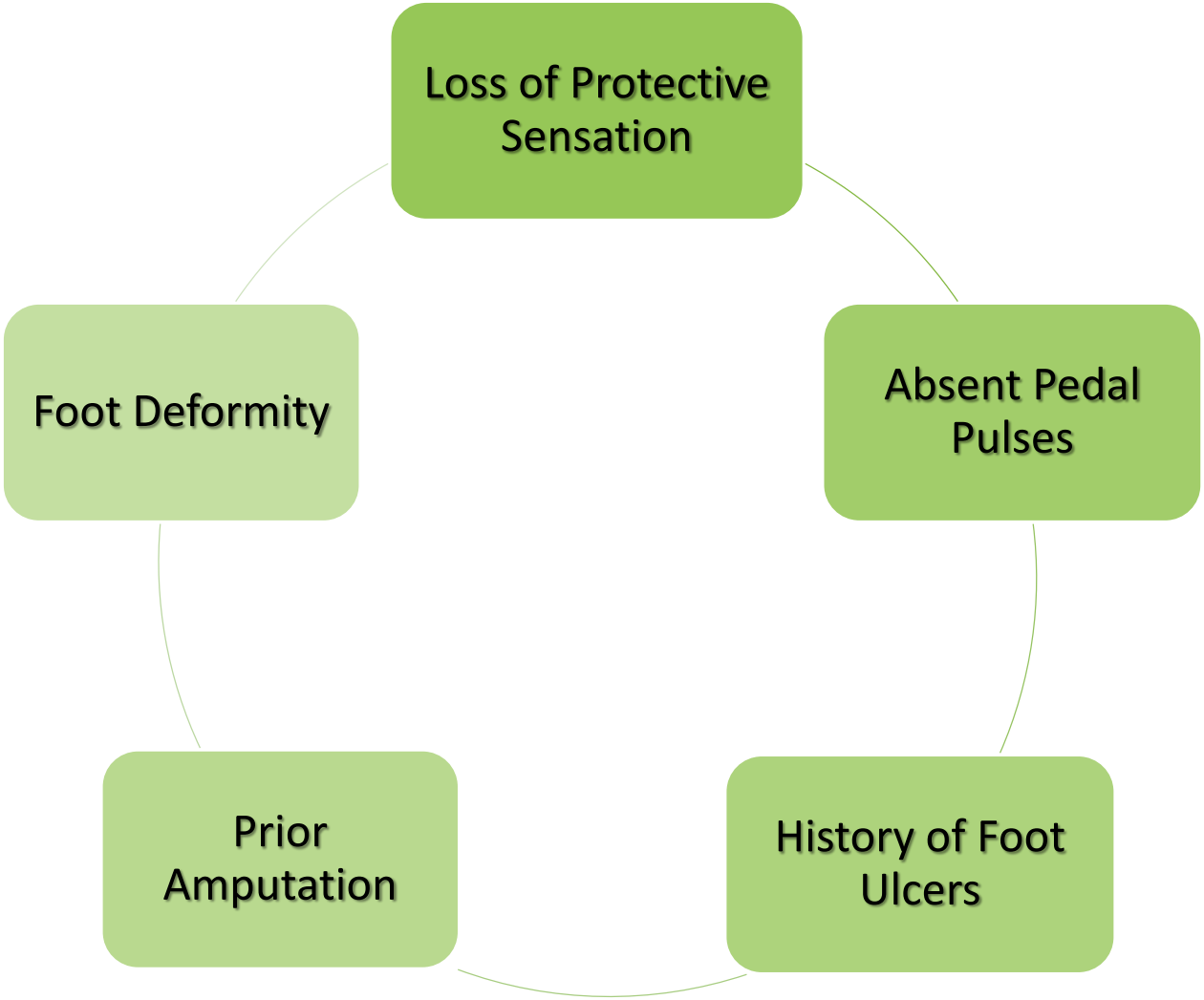
High Risk Foot Status



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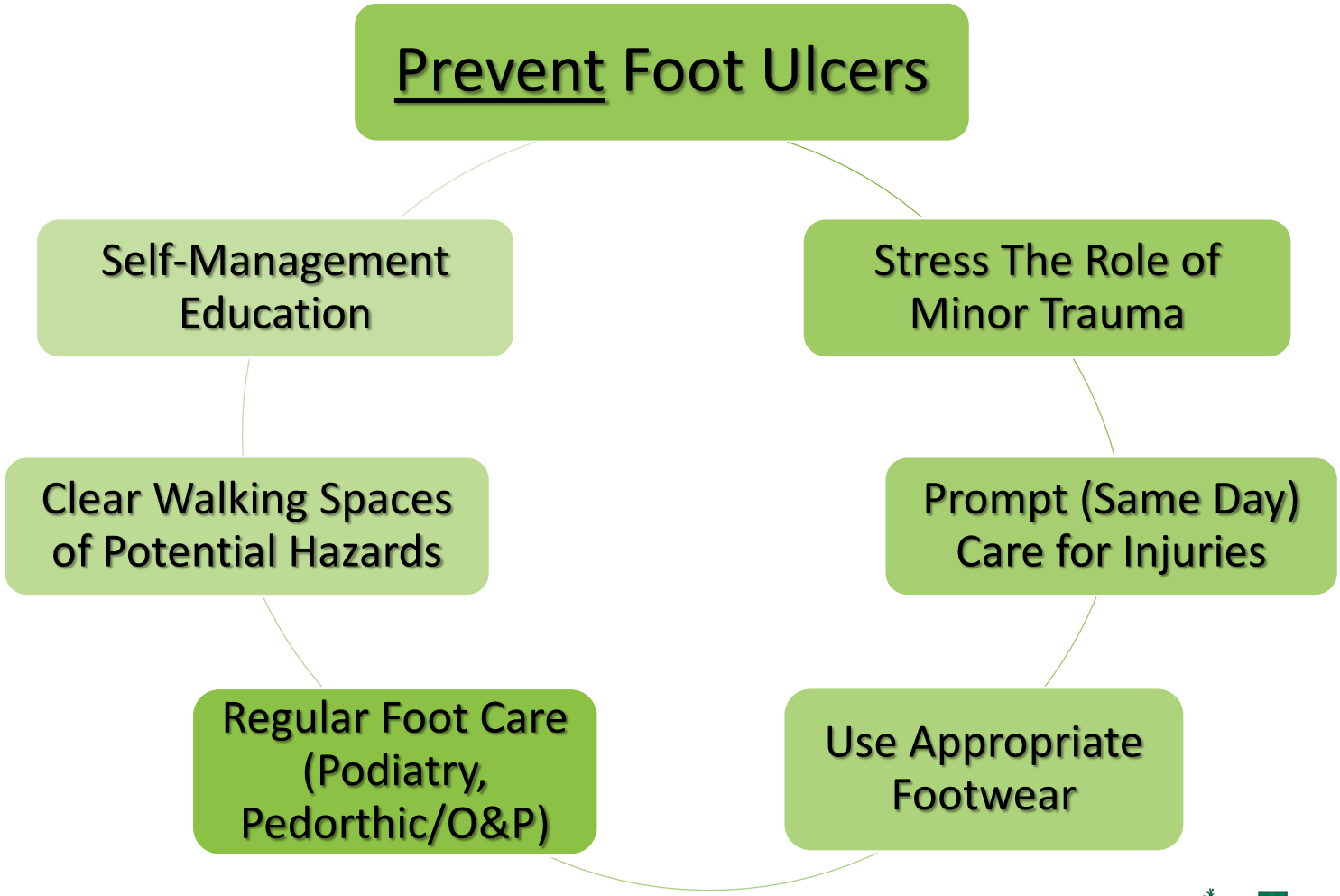
Goal for High Risk Foot Patient Education



Ref: NIH Publication *Working Together to Manage Diabetes 2007*

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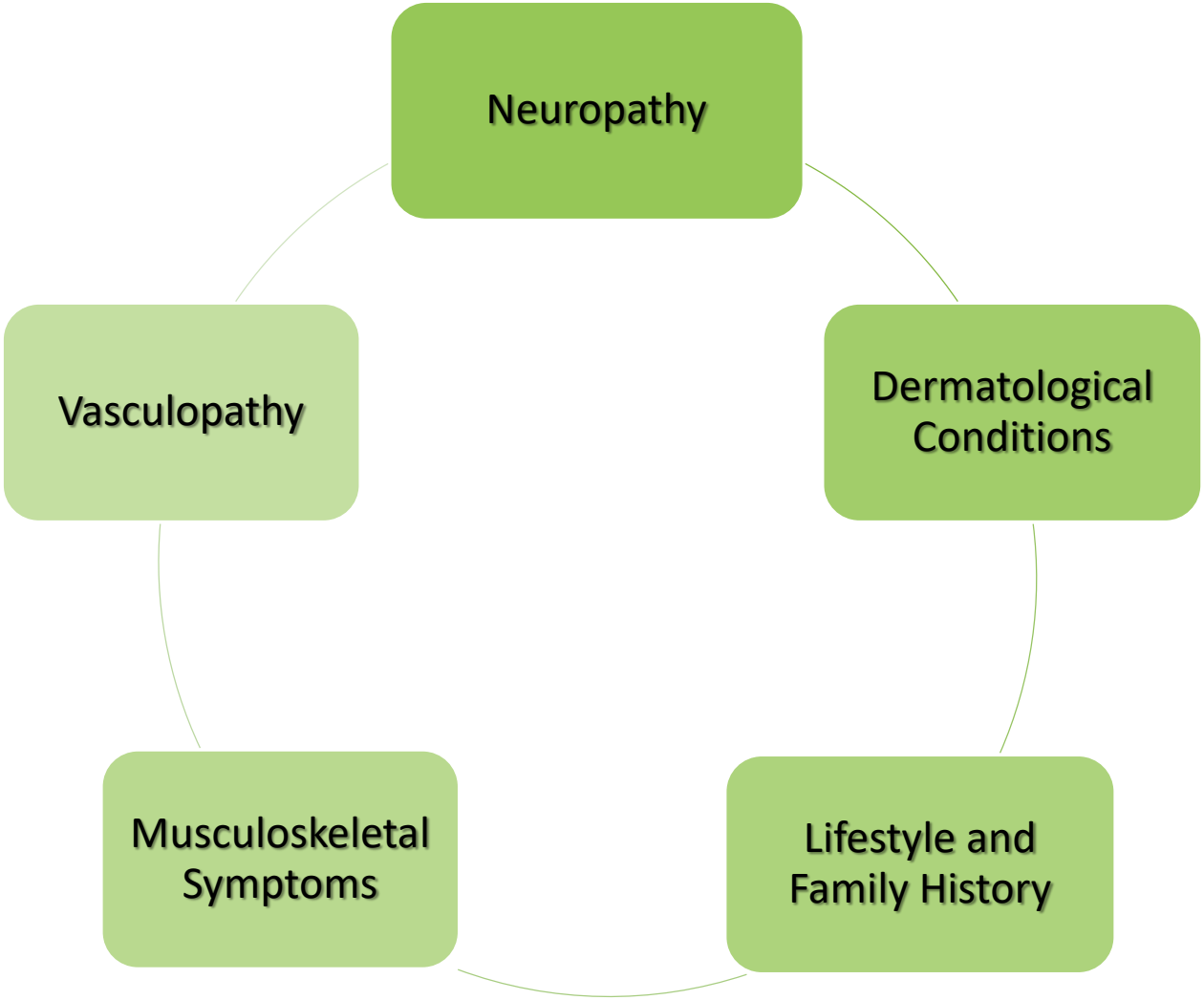
Foot Evaluation



Ref: NIH Publication *Working Together to Manage Diabetes 2007*

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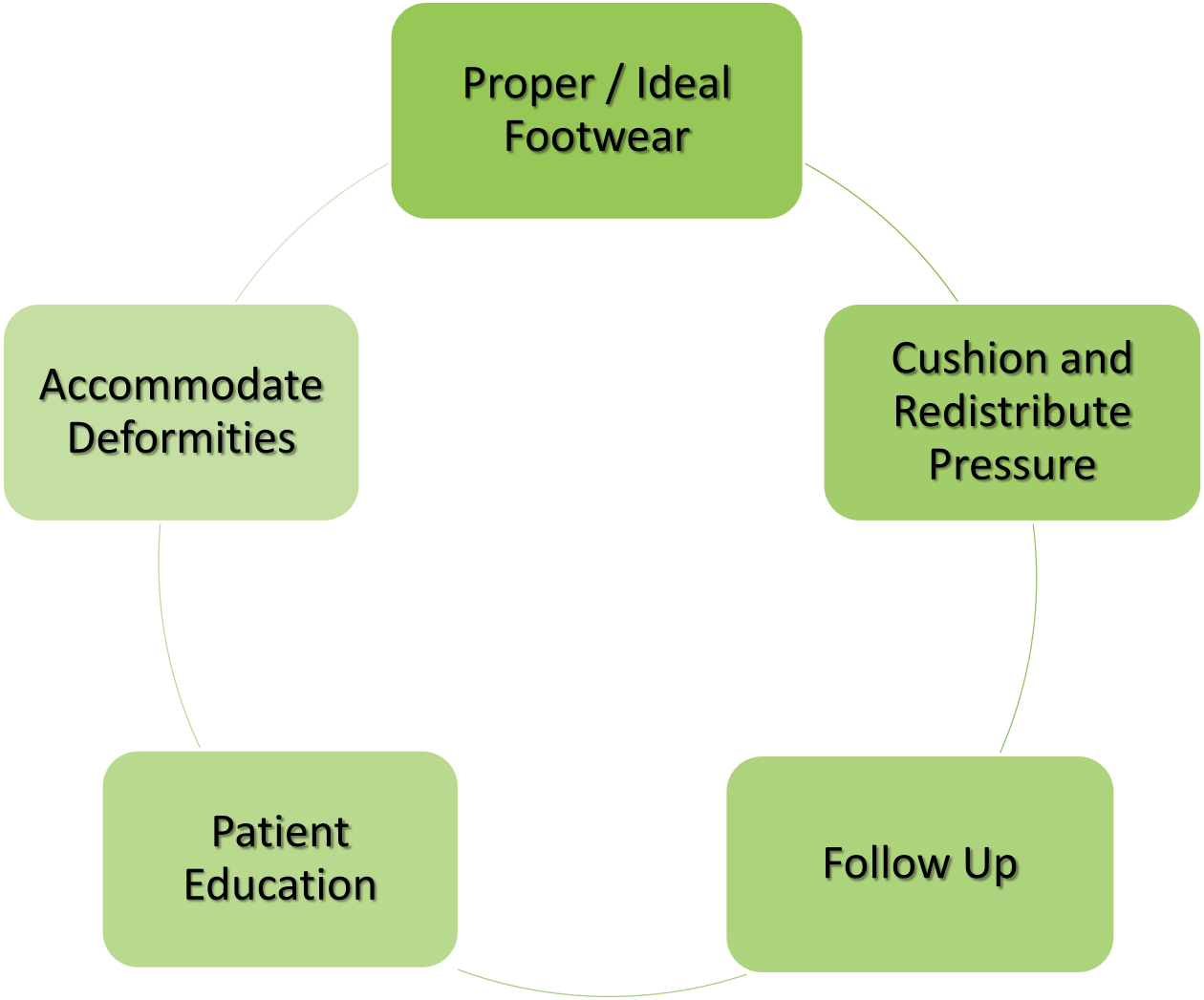
Pedorthic / O&P Interventions



Ref: NIH Publication *Working Together to Manage Diabetes 2007*

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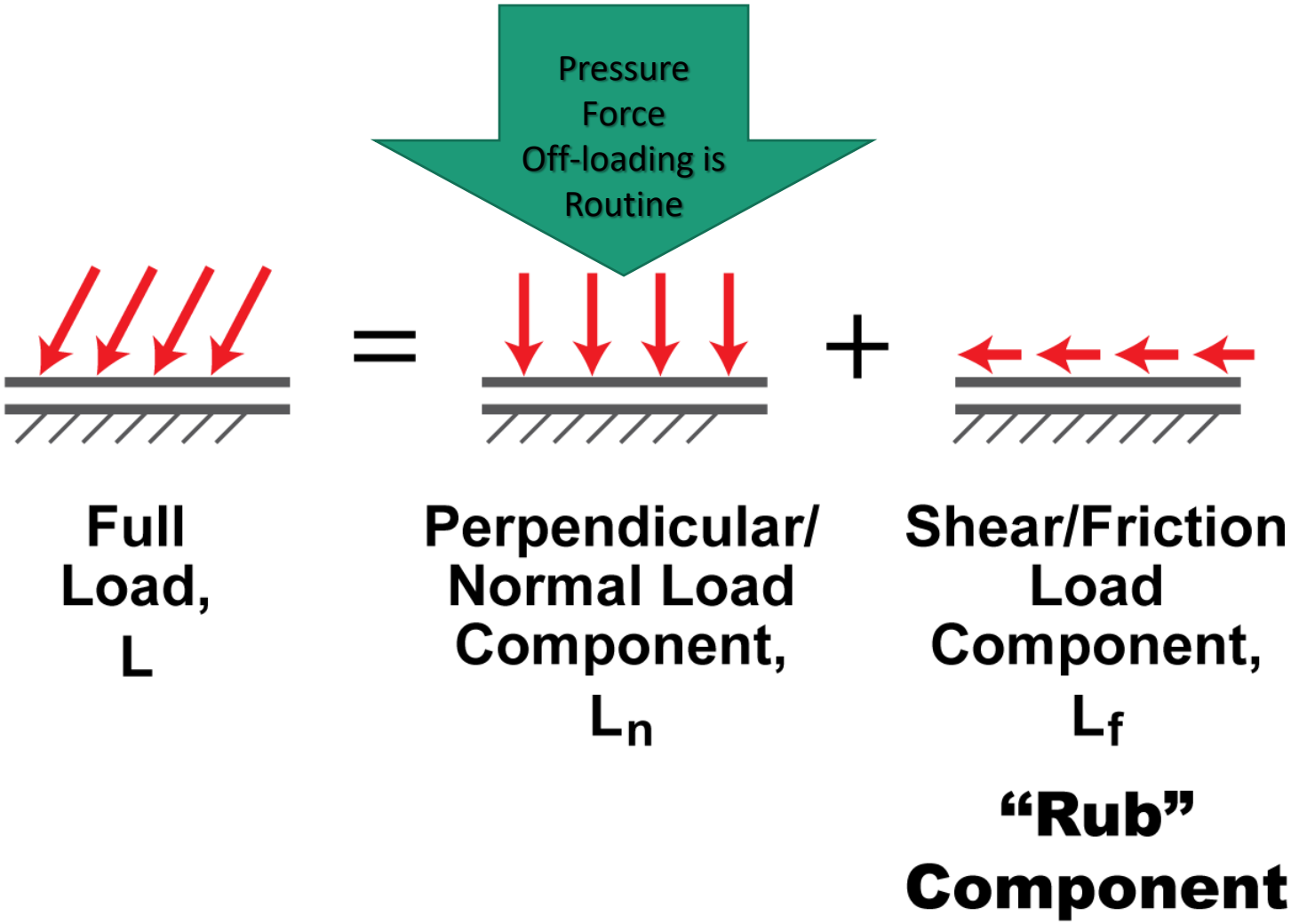
What Else Can We Do?



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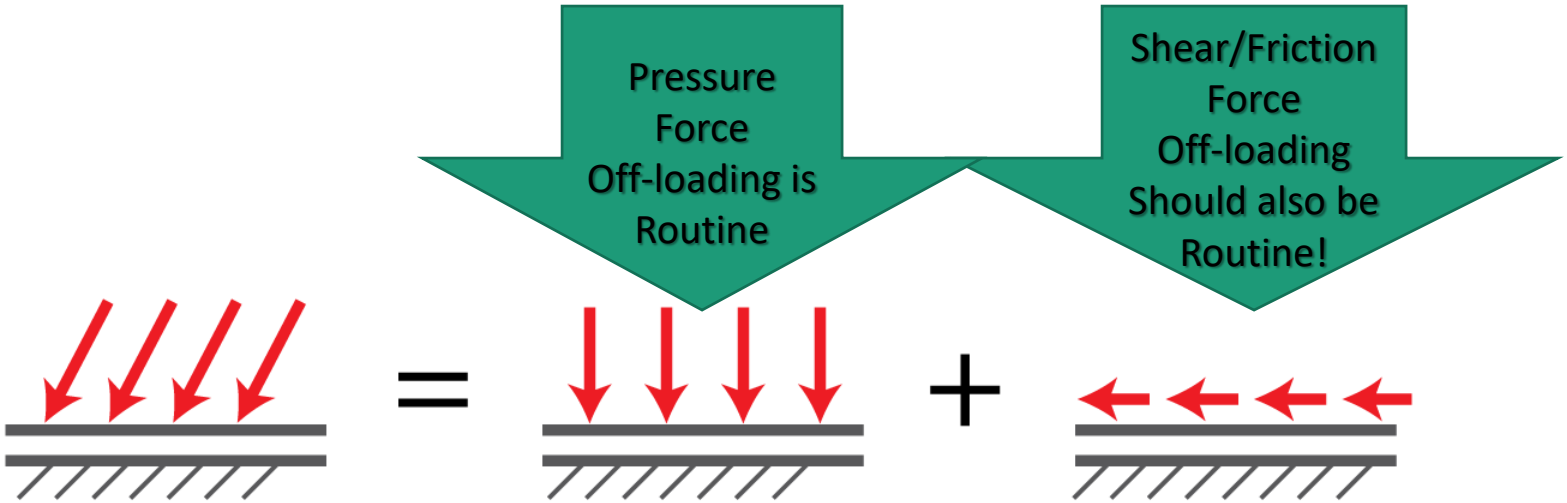

Full Load, L = **Perpendicular/ Normal Load Component, L_n** + **Shear/Friction Load Component, L_f**

"Rub" Component

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Dr. P. F. D. Naylor

British Journal of Dermatology (1955)

“There is an inverse relationship between the friction force and the number of rubs required to form a blister”

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Spence and Shields
Journal of the American Podiatry Association (1968)

“Blisters, Callosities and Ulcers are primarily caused by excessive shear forces, commonly referred to as friction acting on the skin ”

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Repetitive Loading

- Most trauma on the foot is generated by repetitive loading associated with ambulation
- The load is applied, reaches a maximum, then is released / reduced
- This cycle repeats again and again with each step
- The skin takes the first injury and sends the first warning (if sensation is intact)

Joseph Knapik

Journal of Sports Medicine (1995)

Excellent Review of Repetitive Loading Skin Trauma Research Findings with very useful explanations for Military and Sports Application

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What About Pressure?

Tissue Trauma from Pure Pressure
Looks like a Bruise

Friction Loading Against the Skin

- Reddened Skin Areas
  - Angry, Red Skin
  - Skin Rubbed Off
    - Blisters
    - Calluses
    - Ulcers

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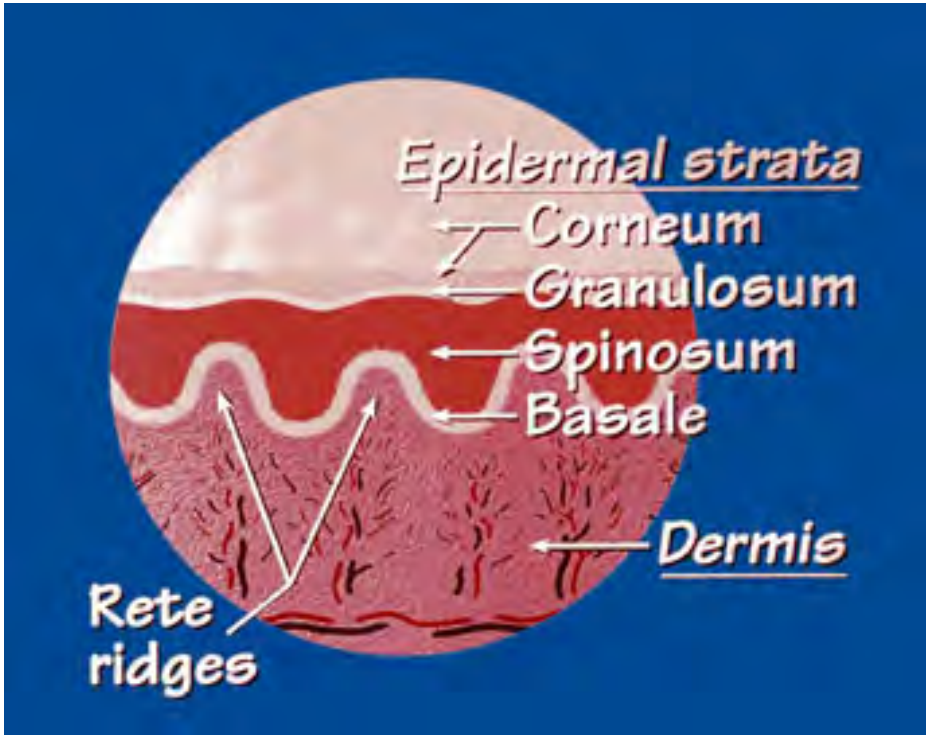

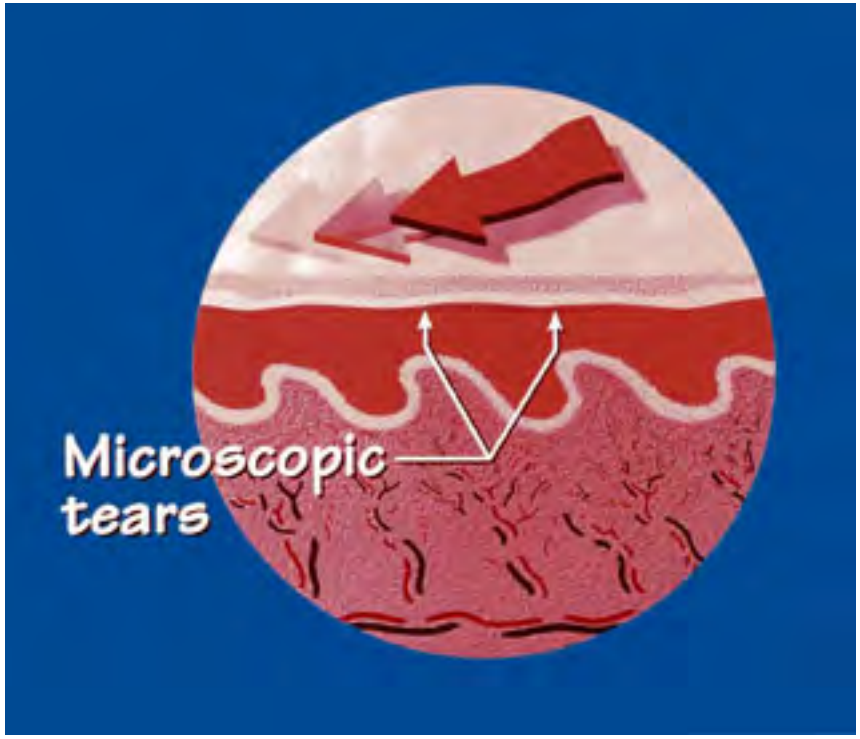

How are Pressure Loads and Friction Loads Related?

Friction Forces Do the Damage

<u>BUT</u>

There Can Be No Friction Without Forceful Contact (Pressure)

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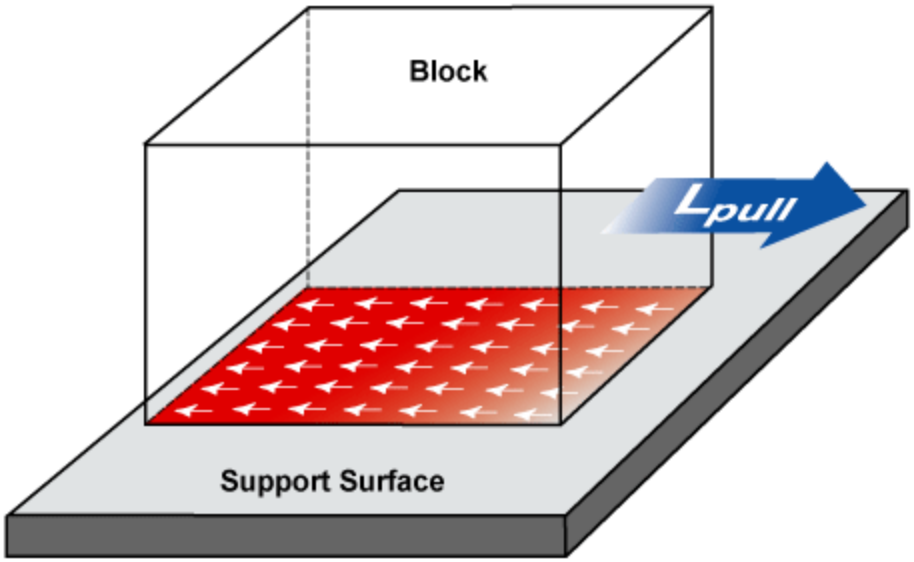
Friction is the force which develops at an interface resisting sliding of one surface relative to the other.



The Friction Force L_f, is the sum of resisting forces at the interface.

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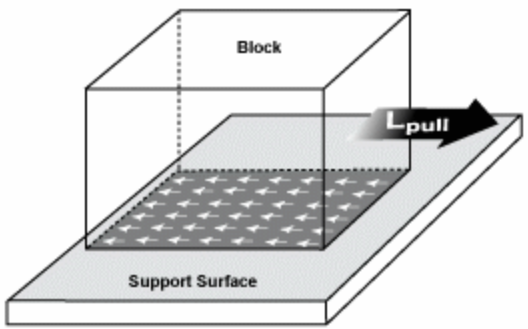

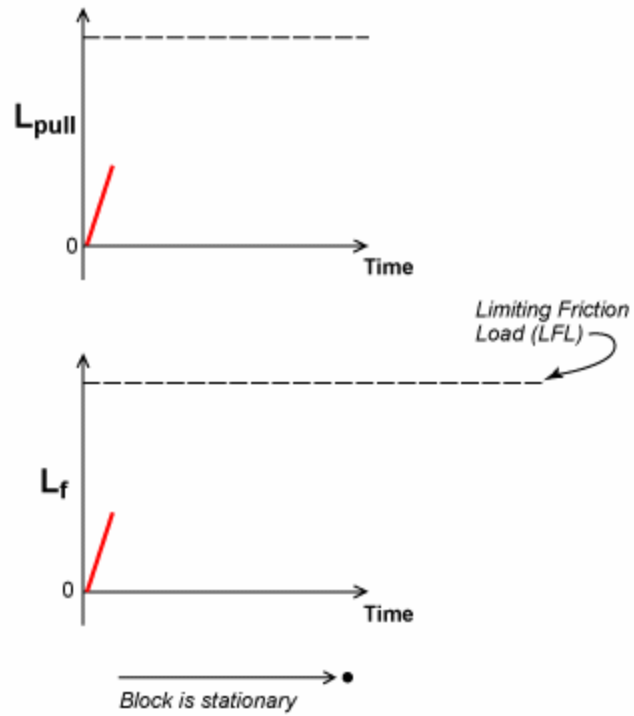

The Friction Force L_f, is the sum of Resisting forces at the interface.

If L_n = Block Weight,

$LFL = L_n \cdot COF$

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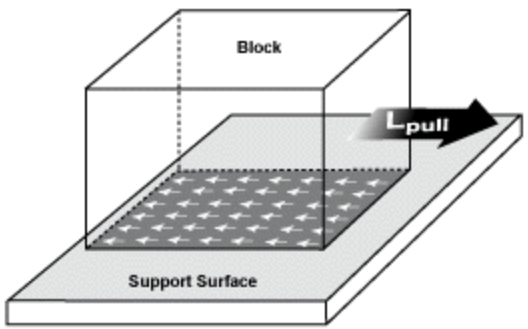

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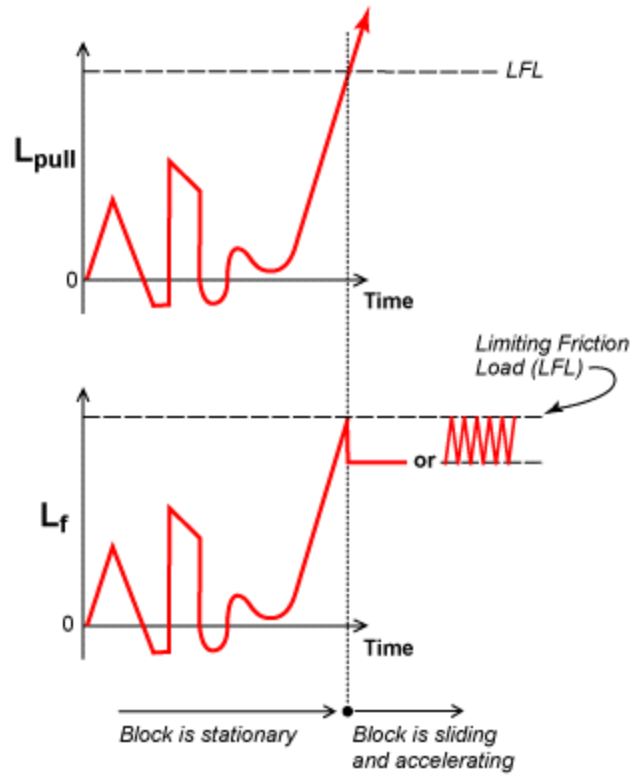

If L_n = Block Weight,

$LFL = L_n \cdot COF$

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Please Notice

Friction Load Peaks
Can Be No Greater Than
Contact Pressure Load (L_n) Times CoF

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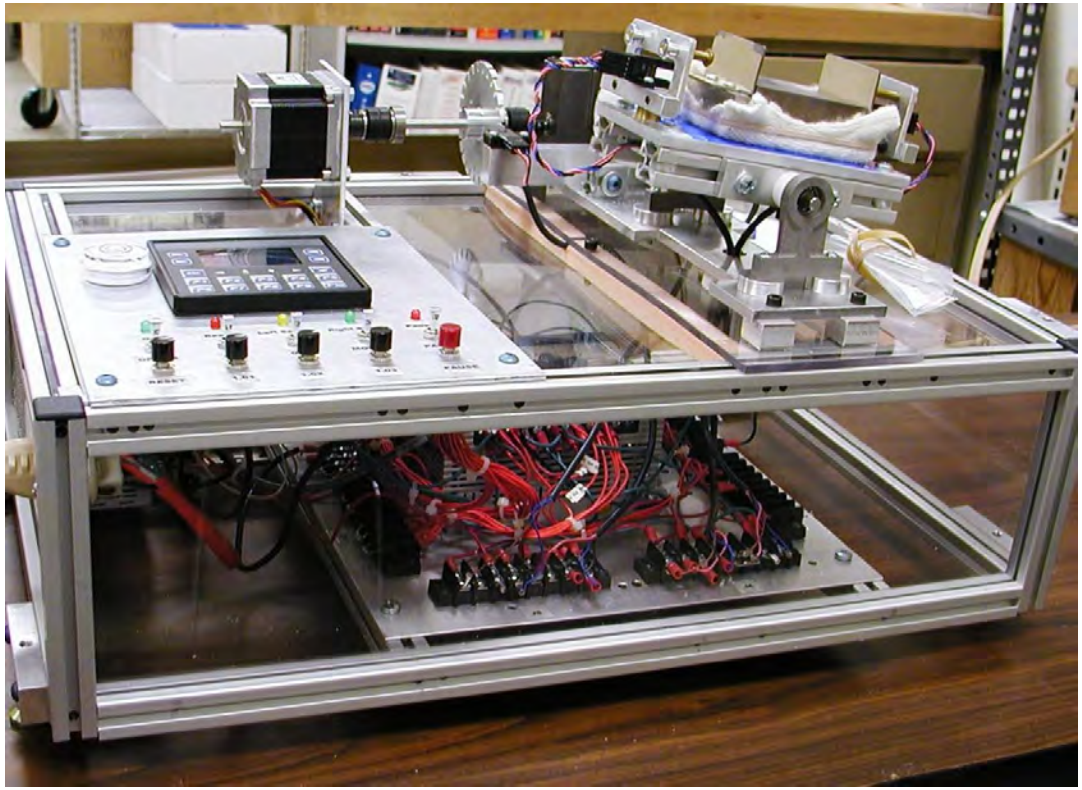
Coefficient of Friction (CoF)

- Ratio of the force required to slide two materials (in contact) to the force perpendicular to the surfaces
- A lower friction coefficient indicates that there is less <u>resistance</u> to the sliding motion
- The CoF is always related to <u>two</u> materials



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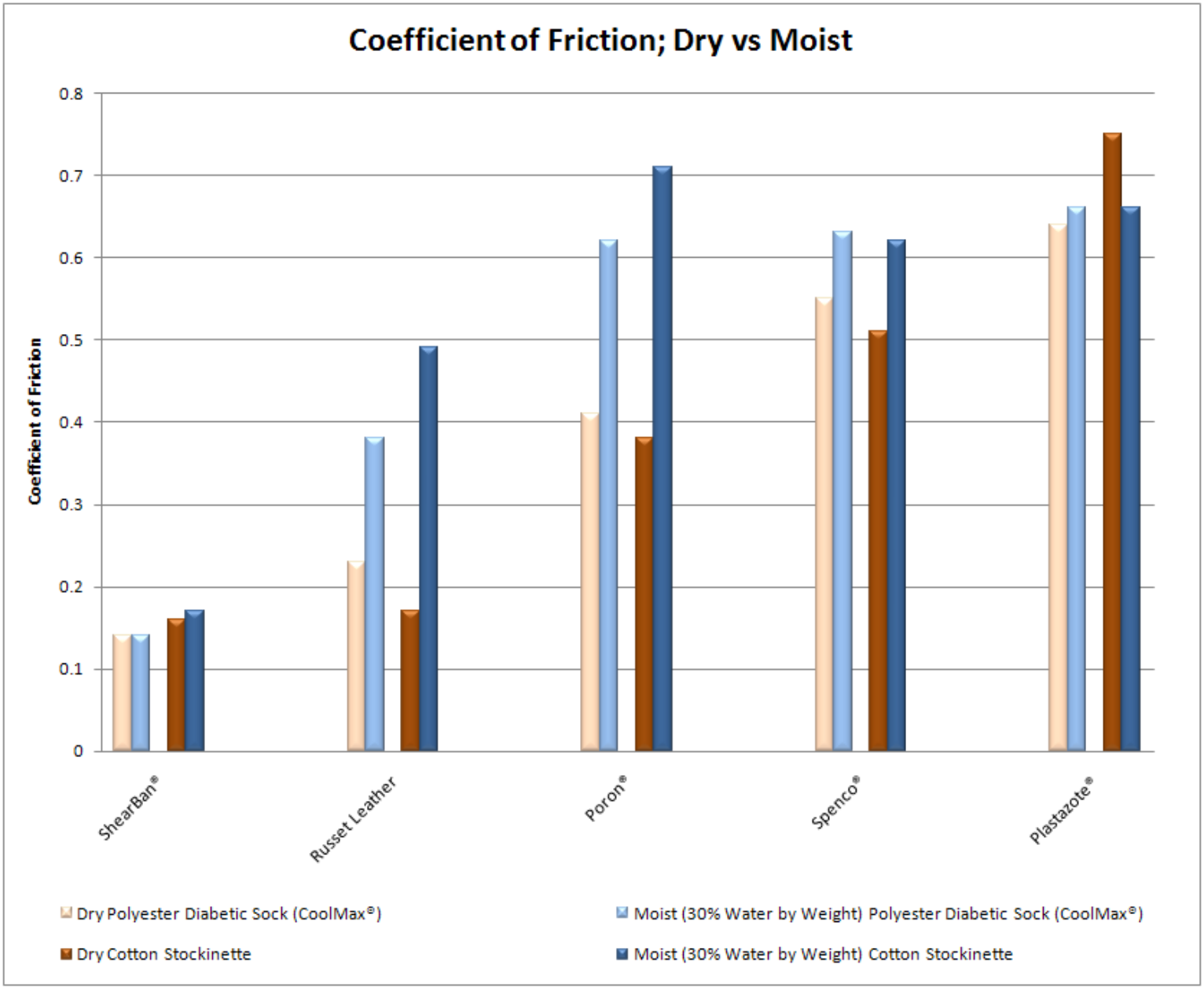

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Friction is <u>Not</u> All Bad…

Stability
Control
Suspension
Propulsion Energy

Friction is <u>Only</u> Bad Where it Peaks High Enough To Cause A Problem

Reducing CoF In Identified Problem or Risk Areas is…

Friction Management

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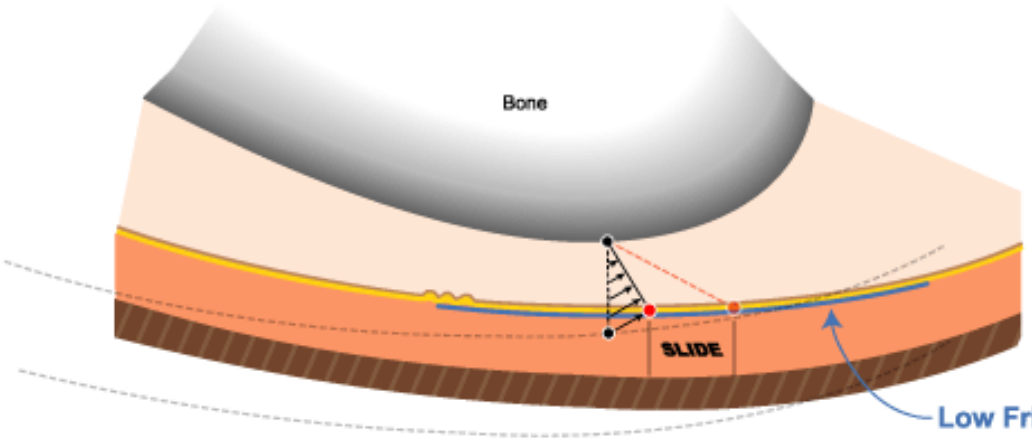
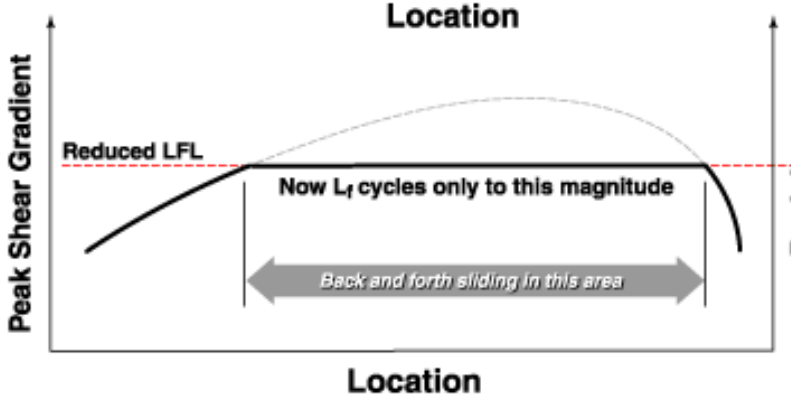
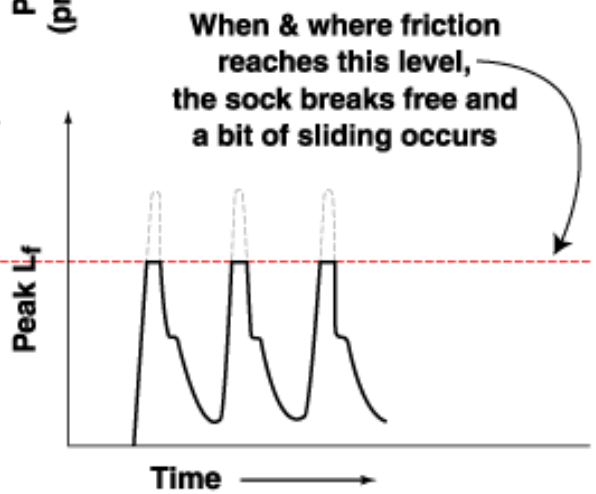


If (Ln • COF) is lowered by 30%





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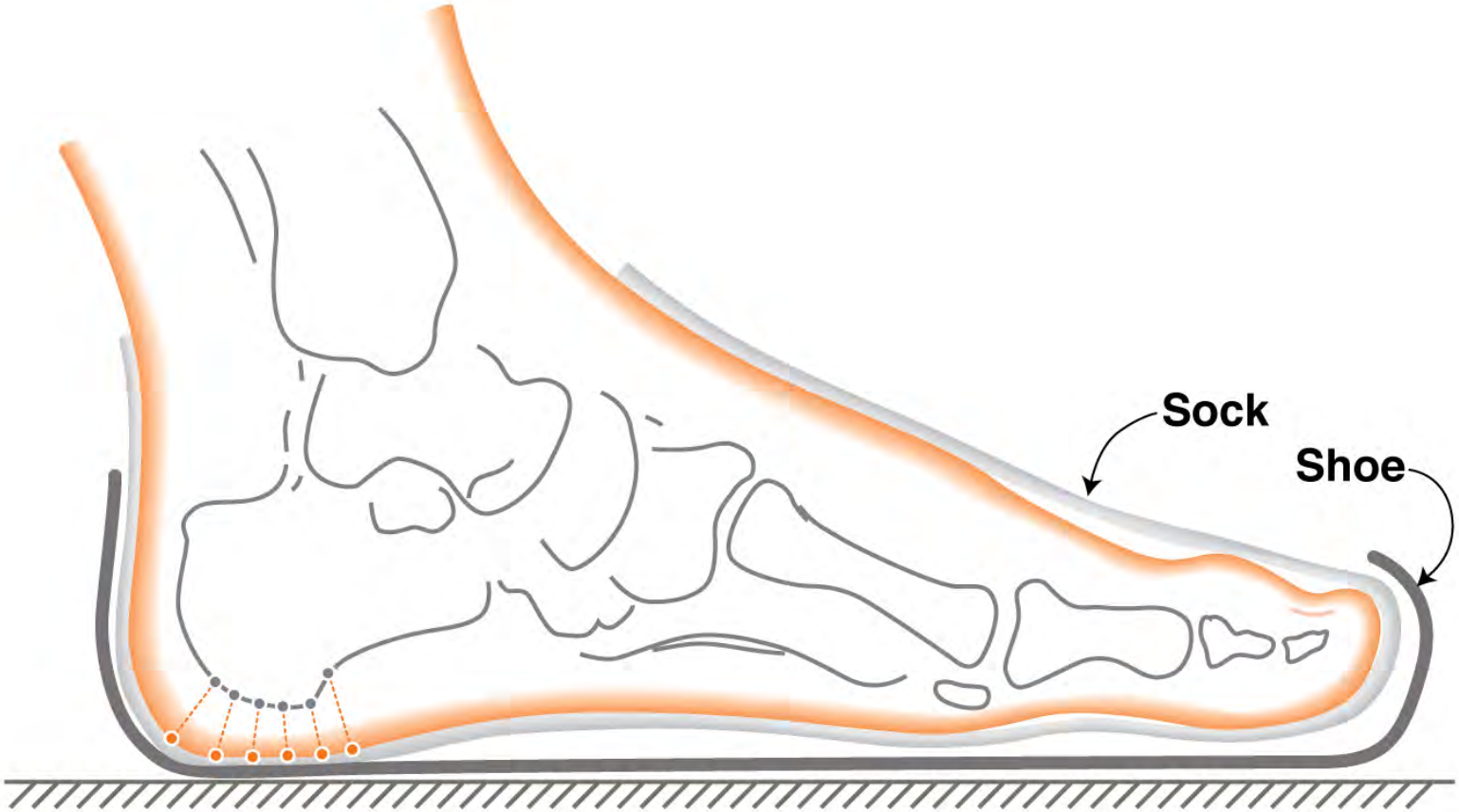
Shear / Friction Forces Generated By Relative Movement of Bones Within the Shod Foot



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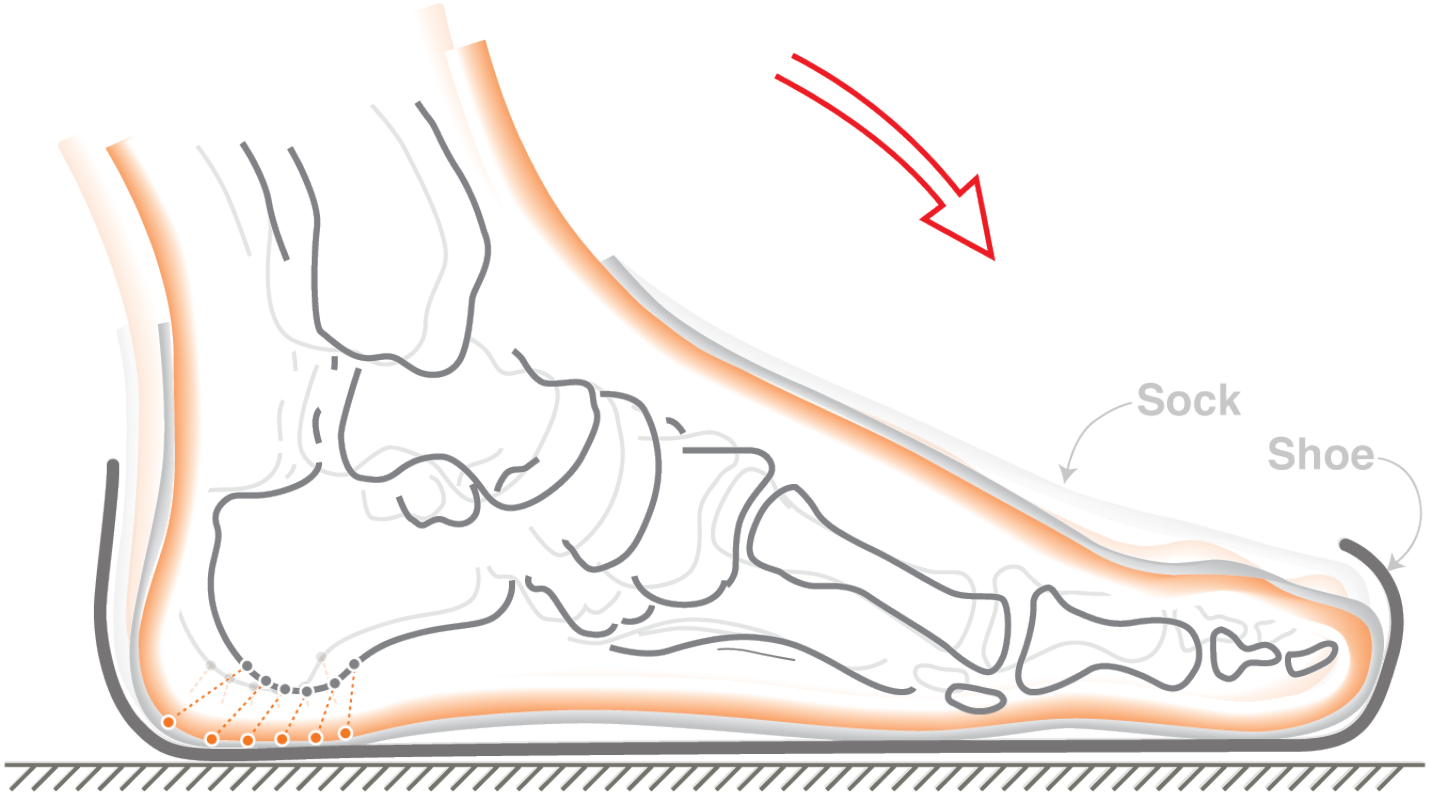

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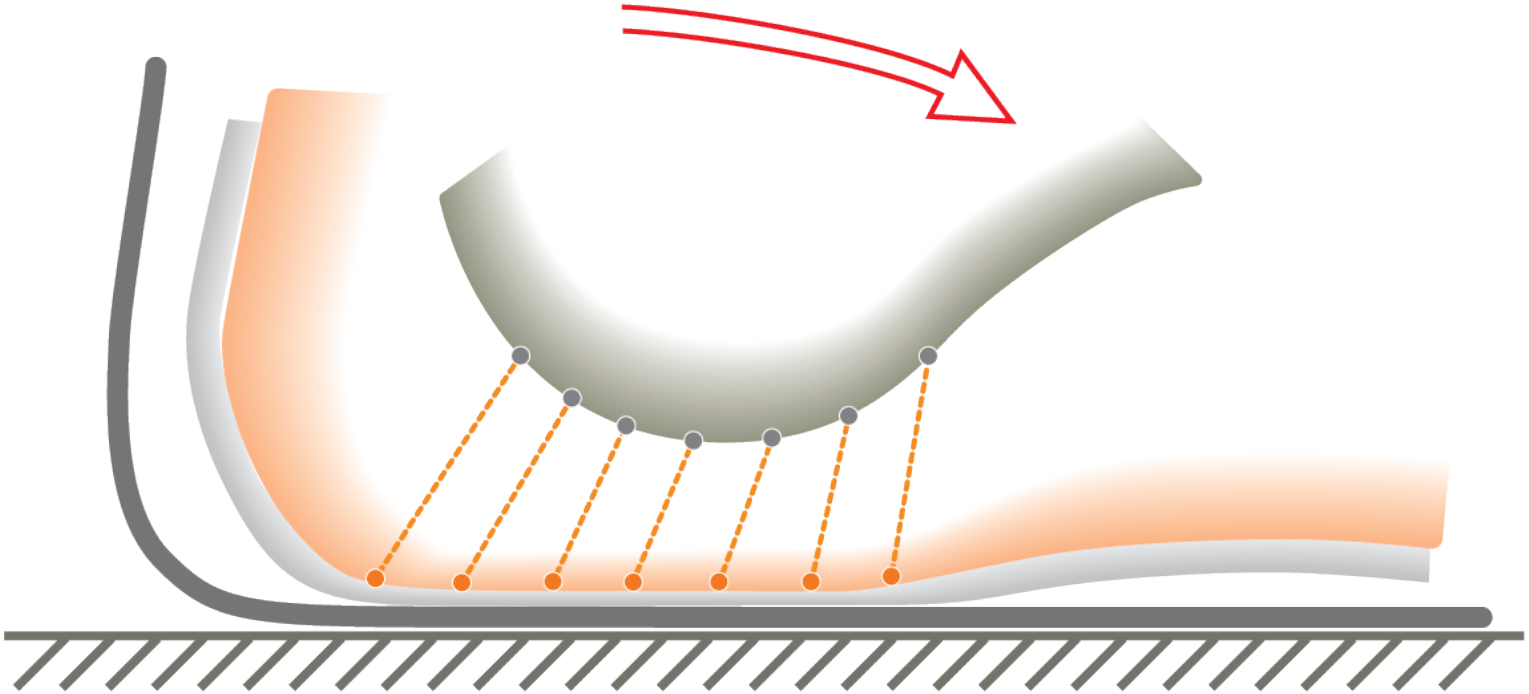

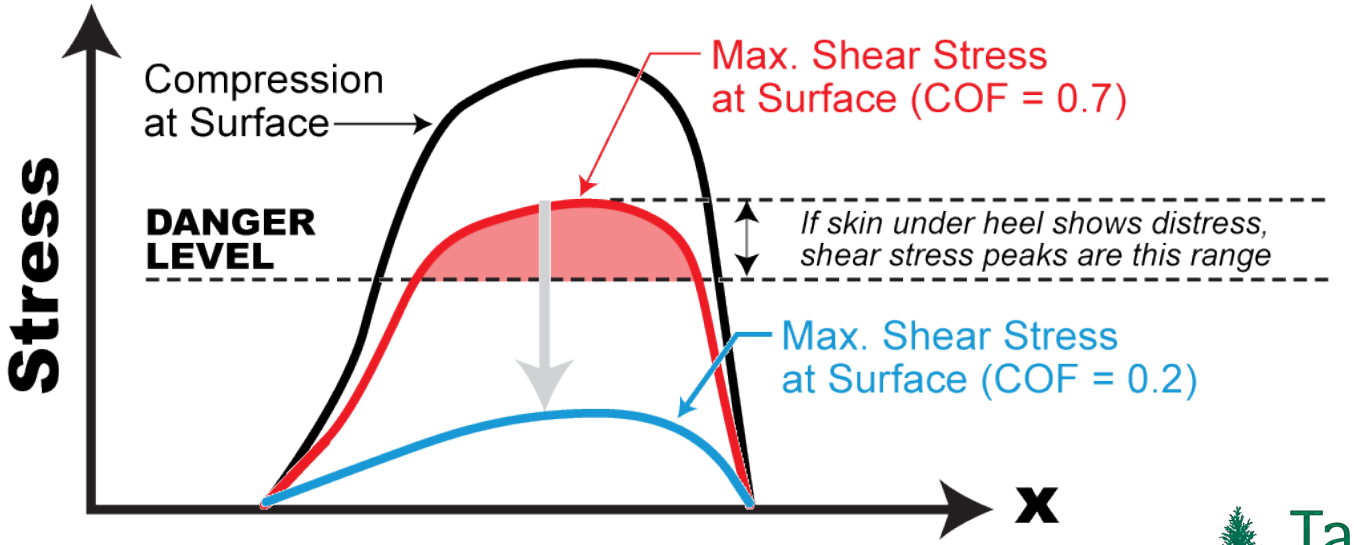

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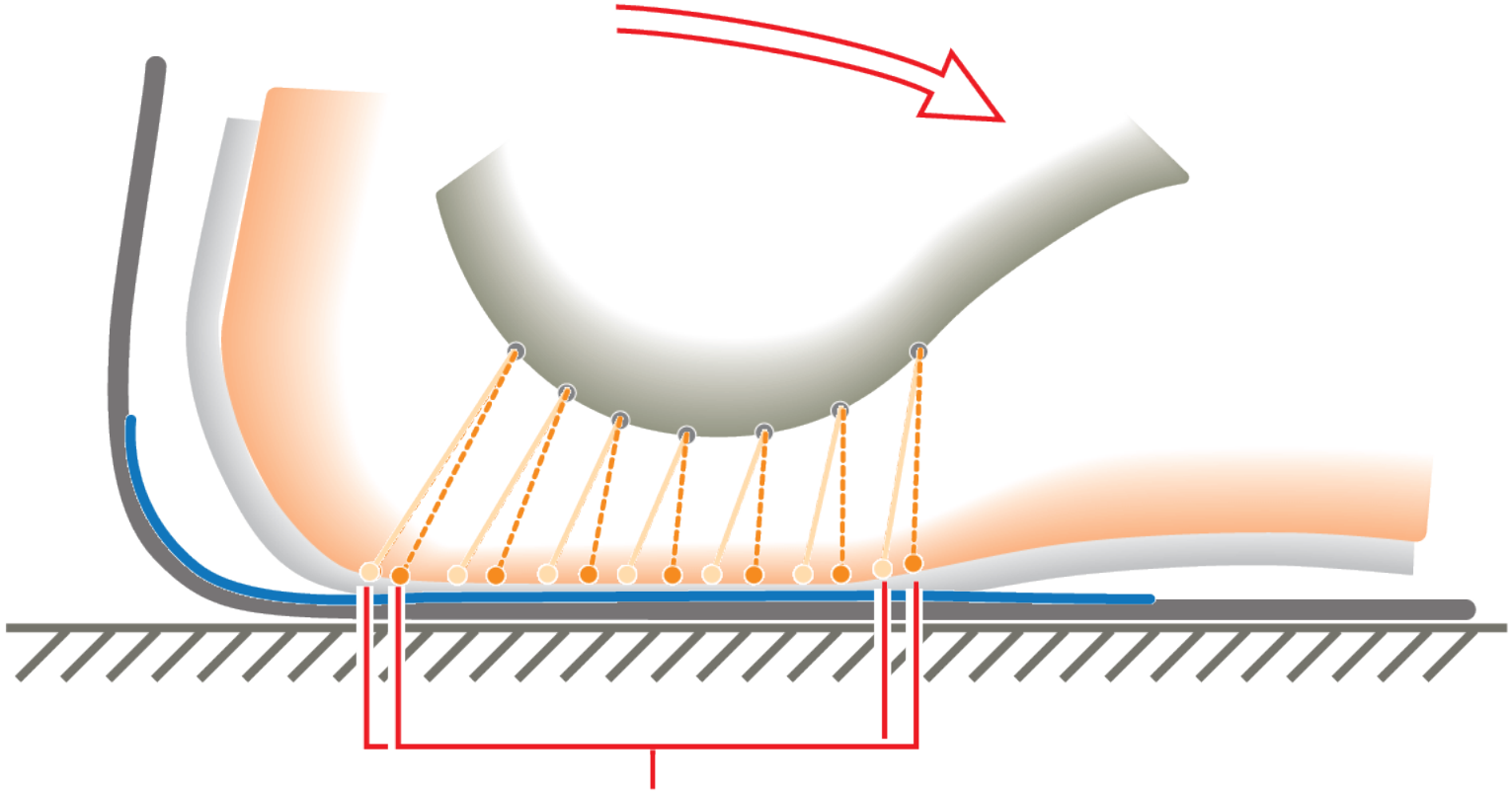

Sock and skin are "released" to move with calcaneous before friction/shear loading builds to trauma-causing levels

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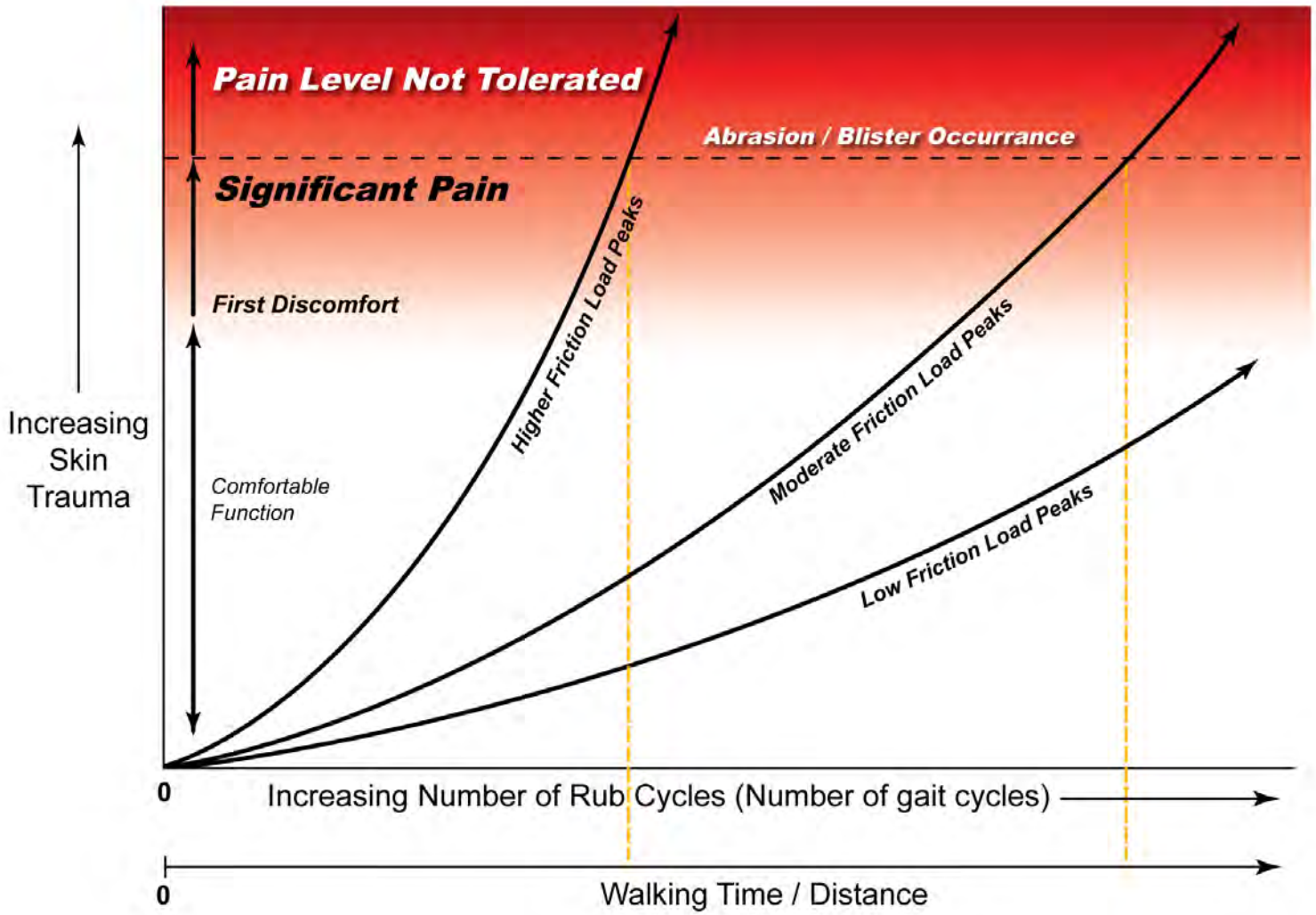
Tamarack Habilitation Technologies Introduces ShearBan Technology



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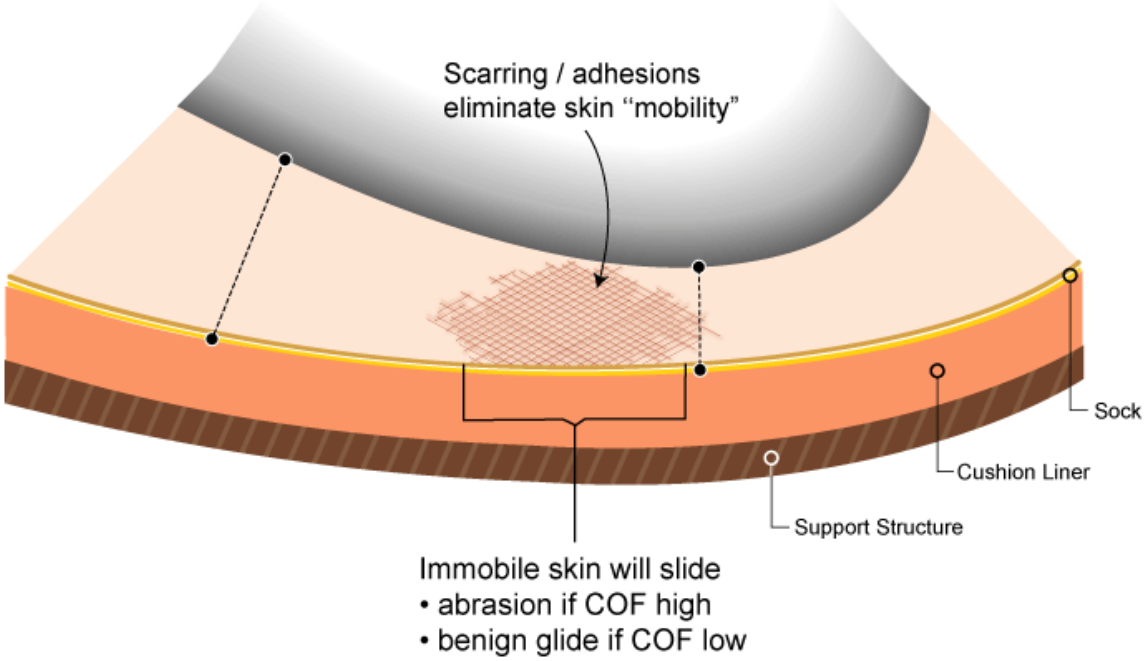
Skin "Mobility"; A Critical Issue

- Scarred / Adhered Areas
- Skin Grafts



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Adhered scars and skin grafts <u>will</u> see the limiting friction load whatever it is

So we must <u>make</u> the friction load low

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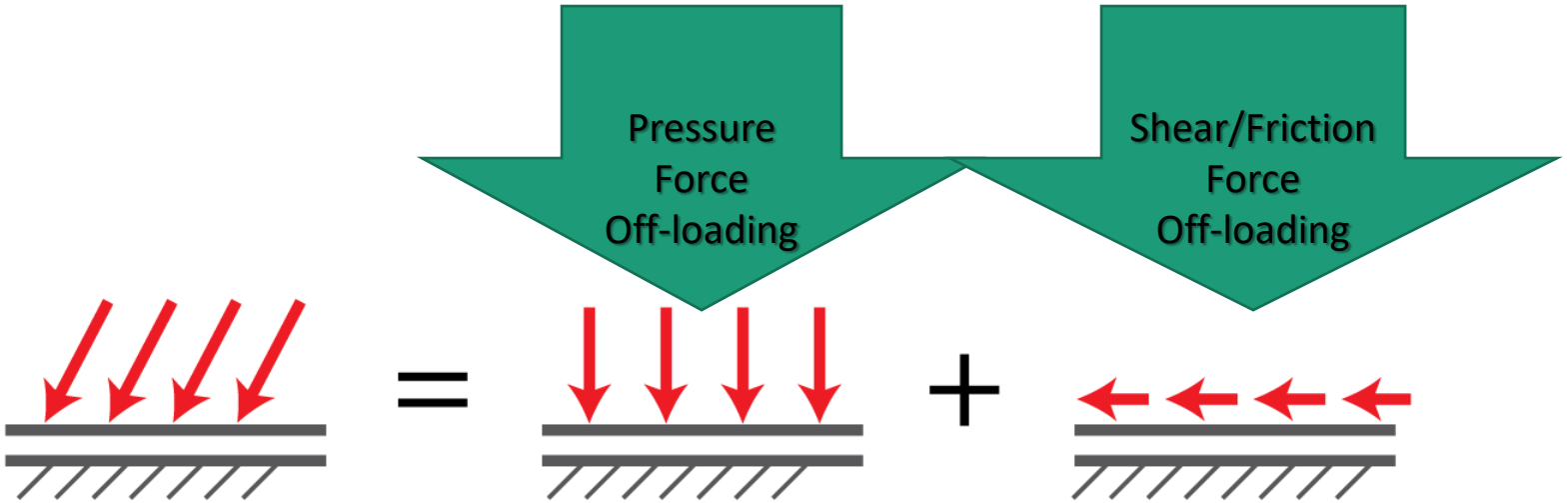

Full Load, L

Perpendicular/ Normal Load Component, L_n

Shear/Friction Load Component, L_f

"Rub" Component

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Questions / Discussion

ShearBan by Tamarack®

- Since 1998
- Ongoing testing and improvements
- Product guide

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glidefree™

Transfer Board Strips with ShearBan® Technology

GlideWear

INNOVATIVE SKIN PROTECTION

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Clinical Case Examples

Courtesy of:

- Dennis Janisse, CPed
- Charlie Kuffel, CPO, FAAOP
- Dane Hupp, PT

Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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50 y/o Male
Diabetes, Type 2 Diabetes
Peripheral Neuropathy, Previous Amputations

Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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3 months later

Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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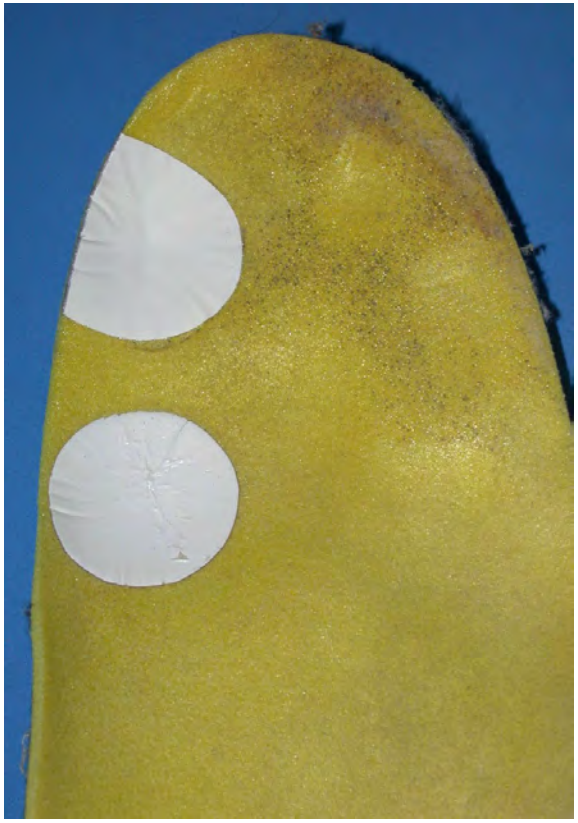

Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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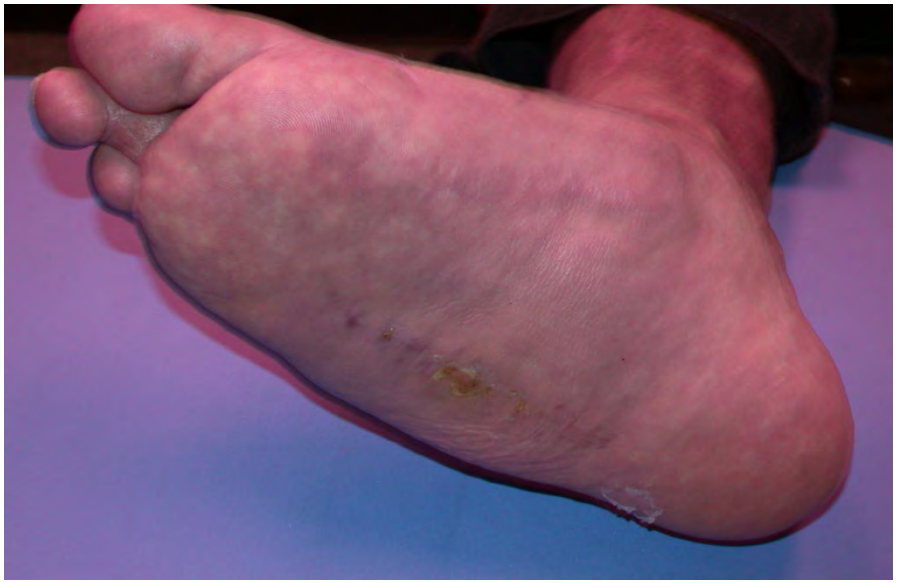
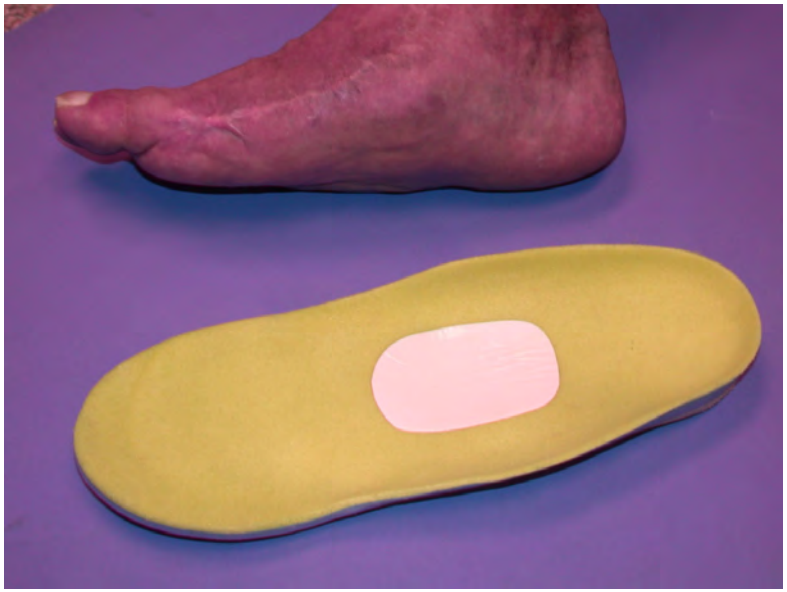
68 y/o Male
Type 1 Diabetes,
Charcot Deformity
Neuropathy, Post ulcerations





Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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70 y/o Female
Arthritis

Midfoot/Toe Deformities

Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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Courtesy of Dennis Janisse, CPed

National Pedorthic Services, Inc.

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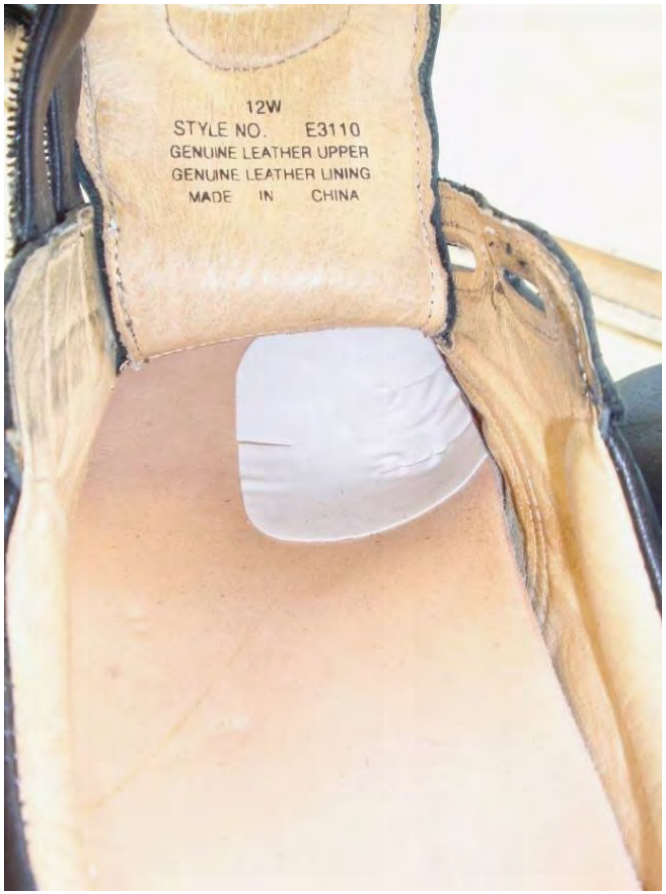
Case Study 1



Courtesy of Charlie Kuffel CPO, FAAOP
Arise Orthotics and Prosthetics

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Case Study 2

Before

After (11 weeks)

Courtesy of Charlie Kuffel CPO, FAAOP
Arise Orthotics and Prosthetics

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Case Study 2

Courtesy of Charlie Kuffel CPO, FAAOP
Arise Orthotics and Prosthetics

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Callus Care

Courtesy of Dane Hupp, PT
National Hansen's Disease Center

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Courtesy of Dane Hupp, PT
National Hansen's Disease Center

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