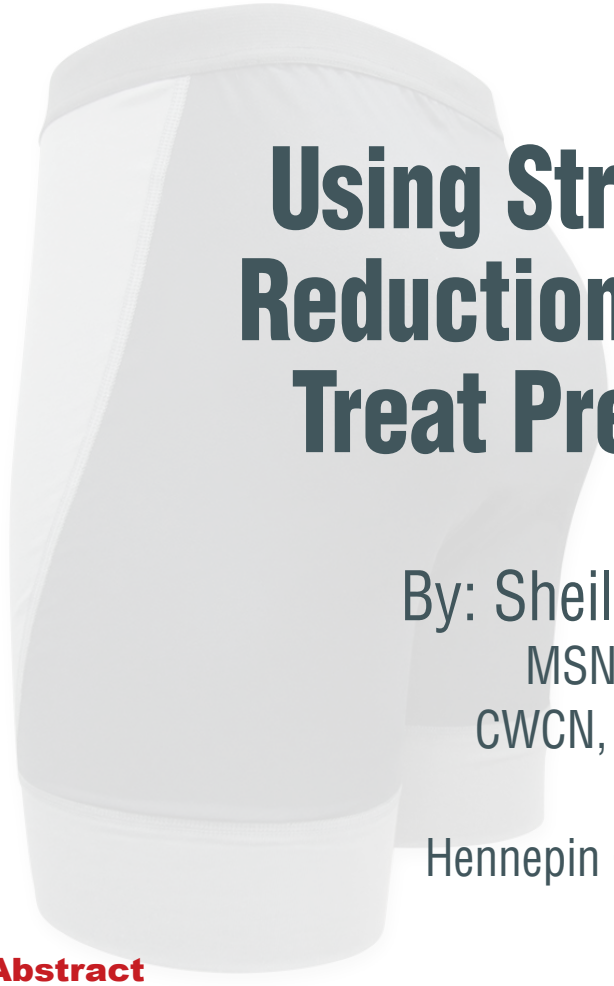


Using Strategic Friction Reduction to Prevent and Treat Pressure Injuries

By: Sheila Howes-Trammel
MSN, APRN, FNP-BC,
CWCN, CCCN, CFCN, CLNC

Hennepin County Medical Center

Abstract

Evidence suggests that friction causes stresses and strains in the tissue of users exposed to prolonged sessions on support surfaces such as wheelchairs and mattresses, leading to increased risk of skin trauma at the surface and in deep tissues. New solutions are needed since simply addressing the 'pressure factor' is incomplete. Due to the shearing stress and strain (distortion) that friction causes it is a significant contributor to skin trauma. Despite the many products focused on pressure management, there are currently very few interventions addressing friction and shear. This presentation highlights a promising new intervention.

Strategic Friction Reduction (SFR) is the deliberate placement of ultra low friction interface materials to target those areas with wounds or those at risk. SFR interface materials can be built into a user's garment (such as a sock or underwear) which covers the at risk zone, or into an external surface such as a wheelchair cushion, or a bed linen. SFR manages contact forces in much the same way as is done for pressure. These contact forces may be from positioning or sitting support equipment, from beds or other devices, and are also present during any and all transfers. Individuals might not remain in their ideal chairs at all times - what happens to them when they are sitting on other support surfaces such as in a vehicle? Practitioners and users are challenged to reduce the harmful friction and shear forces from these surfaces as well.

This presentation discusses how a new SFR technology works and will discuss the positive effect when using these interventions to reduce friction in four case study examples: Deep tissue Injury, Incontinence Associated Dermatitis (IAD), neuropathic ulcer and toe pressure ulcer.

Background

Friction causes shear stress and strain in the load-bearing tissue and leads to increased risk of skin trauma – both at the surface and in deep tissues[1,2]. Wound care protocols do not currently include any means for reducing friction other than to suggest avoiding dragging or sliding across surfaces[3]. The few interventions that clinicians are aware of address friction and shear are intended for assisting transfers. The author found a new dual ply textile friction reducing technology having an extremely low static coefficient of friction (CoF) located in a specific portion of a garment, cushion cover or a prosthetic socket component. This technology employs a concept referred to as "Strategic Friction Reduction" (SFR). SFR targets the wound area, or the area known to be at risk, and reduces local friction only in that area. This preserves neighboring higher friction loads which cause no harm to the skin and are needed for traction and stability. Because devices and support surfaces function to manage pressure, they should also manage friction to reduce shear stress on the skin and extending into the deeper tissue[4].

[1] Thies Berke, C. Pathology and Clinical presentation of friction Injuries. Case Series and Literature review. 2015 J Wound Ostomy Continence Nurs. 42(1):47-61. Lippenkott Williams & Wilkins

[2] Linder-Ganz E, Gefen A. The effects of pressure and shear on capillary closure in the microstructure of skeletal muscles. 2007 AnnBiomed Eng. Dec;(12):2095-107

[3] National Pressure Ulcer Advisory Panel (NPUAP) and European Ulcer Advisory Panel (EPUAP). (2014). Prevention and treatment of pressure ulcers: Clinical practice guideline. Washington, DC: National Pressure Ulcer Advisory Panel.

[4] International review. Pressure ulcer prevention: pressure, shear friction, and microclimate in context. A consensus document. London: Wounds International, 2010

Methods

Strategic friction reduction (SFR) devices were employed in addition to all usual wound treatment protocols in 4 subjects;

Case #1 - For a deep tissue injury (DTI) with Stage 2 open areas on the buttock, a SFR seat cushion cover (GlideWear® Shear Protection Wheelchair Cushion Cover) was used over a commonly used pneumatic seat cushion in addition to all normal wound care protocols

Case #2 - For a right neuropathic foot ulcer, a SFR sock device (GlideWear® Forefoot Shear Protection Socks) was used in addition to all normal wound care protocols

Case #3 - For a pressure injury on the left hallux IP, a SFR sock device (GlideWear® Forefoot Shear Protection Socks) was used in addition to all normal wound care protocols

Case #4 - For Incontinence Associated Dermatitis (IAD), a SFR garment device (GlideWear® Shear Protection Underwear) was used in addition to all normal wound care protocols

Case #1 Deep Tissue Injury/Stage 2 Pressure Injury

RRS is a 88 y.o. man who resides in a nursing home. He has a history of Bipolar, Dementia with behaviors (refusal of care to include bathing and peri-care by the staff.) He has a recliner which is what he sits in all day and sleeps in at night. He gets out of the chair to take himself to the bathroom and to meals in the dining room. He has a good appetite averaging about 75% of his meals. He is continent of bowel and bladder. He had refused cares for about one week when this DTI was noted by the nursing assistant. He had no recent change in condition. After one month this DTI did not make any progress and then developed Stage 2 open areas. RS has never complained of pain in this area. BMI 39.4 PreAlbumin: 26.3 Braden Scale 16, Hgb 9.5

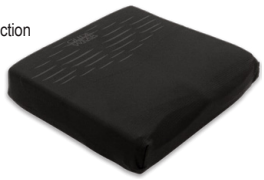
The facility staff, OT, PT, FNP, and WOC nurse had modified the seating cushion to be providing pressure reduction when the DTI developed. The cushion was checked everyday by staff when the patient left the room to go to the dining room. The GlideWear® Shear Protection Cushion Cover was obtained in an attempt to prevent further breakdown. There were no other new interventions attempted at that same time.

Wound Measures:
Left: 13cm X 9.5cm, open 3.5cm X 1.0cm
Right: 10.5cm X 6.5cm, open 2.0cm X 1.0cm

DTI area was present for 1 months, open areas present for 2 weeks with no change in size.

This tissue damage was present for about 1 month with no improvement or deterioration. He did have a pneumatic cushion on the recliner for that month. He was having a Dimethecone product applied q shift as he would allow which usually was once per day or less.

Intervention:
GlideWear®
Shear Protection
Wheelchair
Seat
Cushion
Cover



Wound Measures:
Left: 11.5cm X 10cm, no open areas
Right: 8.5cm X 7cm, no open areas
Area has decreased deep purple coloring

This is a picture **two weeks** later after putting the Glidewear® cushion cover over the pneumatic cushion.

Results: There was a decrease in the deep purple area and resolution of the open areas in two weeks.

The dramatic response to RS's skin by removing the friction was completely unexpected and now poses a more important question: is reducing pressure all we need to do or should we put just as much importance on the reduction of friction at the skin-support surface interface. The results from cases like this certainly make it an important area to research further.

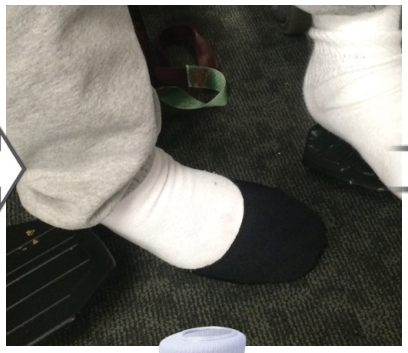
Case #2 Neuropathic Ulcer

JT is a 68 y.o. nursing home resident that developed this wound after his toe hit a table when he was being moved in his geri-chair. He has Type 2 Diabetes, CVA with aphasia and right side paresis. He does have sensation in his legs/feet and is able to respond to pain by pulling his foot away. Appetite is 75%, HgbA1C 6.2, PreAlbumin: 17.8, Weight 205.4 lbs., Braden Scale 13

Wound Measures:
1.5cm X 1.0cm X .5cm
Wound started 1 month prior to the intervention of the GlideWear® sock – there was no change in size of wound.

On this day the GlideWear® Forefoot Shear Protection Sock was introduced and instructions to wear 24 hours per day.

Wound care remained unchanged.



Intervention:
GlideWear®
Shear Protection
Socks

Wound Measures:
0.8cm X .9cm X .2cm
This picture is two weeks after the GlideWear® sock was being used daily.

There is an increase in granulation tissue. Decreased depth and increased epithelialization on wound edges

Wound Measures: :
1.7cm X 1.3cm X .5cm
This was one week later after the GlideWear® sock was lost and therefore not worn for that week.

The wound had increased depth and size.

Results: There was no obvious friction occurring since this patient did not wear shoes, was not ambulatory and does not move independently in bed/chair. However, the intervention of the GlideWear® sock immediately had an effect on the wound healing. Therefore, despite not seeing any obvious friction, the results of the intervention reveal the negative impact of friction on wound healing.

The one week that the GlideWear® sock was not used the wound got larger than the original wound size.

Case #3 Pressure Injury

SY is a 68 y.o male who resides in a nursing home. He has a history of CVA with dysphagia, COPD, Bipolar, Dementia. SY is bed bound, has a G-tube for tube feedings. Incontinent of bowel and bladder. He has had a non-healing pressure injury on his Left great toe. SY had recurrent great toe redness and open areas. He is able to communicate pain and often complained of pain in his feet.

ABI 1.1, pulses +¼, diminished hair growth, capillary filling time < 3 seconds. TCO2 adequate for healing, BMI 39.4, PreAlbumin: 26.3, Braden Scale 16, Hgb 9.5

Wound Measures:
1.3cm X 1.0 cm

The wound was not improving for 1 month so he had a vascular workup to determine the wound healing capability.

The implementation of the GlideWear® sock was started on this day with the continuation of the current wound treatment .

Intervention:
GlideWear® Forefoot Shear Protection Socks

Wound Measures:
0.8 cm X 0.6 cm one week after the implementation of the GlideWear® sock.

Another week of wearing the GlideWear® sock

Wound Measures:
0.2cm X 0.2 cm

Results: The implementation of the GlideWear® sock immediately improved the wound healing of this wound that had previously stalled. The great toes had no further redness or new open areas. He no longer complains of pain in his feet/toes.

Case #4 Incontinence Associated Dermatitis

AH is a 44 y.o. male nursing home patient that has a history of Status Epilepticus, Seizure disorder, Herpes Encephalitis, Encephalopathy. He has G-tube for tube feeding. He is Incontinent of bowel and bladder. AH sits in a geri-chair for 1-2 hours at a time and then has mattresses on the floor due to constant moving and crawling. Most of the day he is in constant movement back and forth while in his chair and on the mattress. He responds to pain but does not communicate verbally. The IAD was a very painful condition for this patient. He would cry with skin care treatments and often become combative because of the pain when he was sitting in the chair. He required pain medications during his shower due to the pain.

BMI 19, Weight 137, PreAlbumin: 40, Braden Scale 14, Hgb 15.1

Wound Measures:
3cm X 10 cm

Perianal area with linear denudation due to moisture from urine and fecal incontinence. Multiple different forms of moisture barrier ointments were used without complete resolution. This area was open for over a year. This area is recurrent and only resolves for 1-5 days at a time before opening up again.

The patient wears a diaper. The SFR pair of underwear was applied over his diaper using the same skin care products. Within one week he was completely healed.

Intervention:
GlideWear® Shear Protection Underwear

A pair of SFR underwear was placed over his diaper and used 24/7. The IAD resolved in 1 week and the skin resolution of IAD has had no recurrence for 5 months. This is a picture of his skin 5 months later.

Results: The introduction of the pair of SFR underwear worn over the diaper was the intervention that eliminated friction and is what healed his IAD and maintained his skin for 5 months. He is no longer requiring pain medications for showering. He is able to sit up in the chair without crying or becoming combative with cares.

Results

Case #1 - For a deep tissue injury on the buttock, a SFR seat cushion cover (GlideWear® Shear Protection Wheelchair cushion cover) was used over a commonly used pneumatic seat cushion in addition to all normal wound care protocols and the DTI area decreased and open areas resolved.

Case #2 - For a neuropathic foot ulcer, a SFR sock device (GlideWear® Forefoot Shear Protection Socks) was used in addition to all normal wound care protocols. The use of the SFR sock device reduced the size of the wound and depth. When the sock was not used the wound returned to previous size.

Case #3 - For a pressure injury on the hallux IP, a SFR sock device (GlideWear® Forefoot Shear Protection Socks) were used in addition to all normal wound care protocols. The SFR sock decreased the redness and the open area decreased in size.

Case #4 - For Incontinence Associated Dermatitis (IAD), a SFR device (GlideWear® Shear Protection Underwear) was used in addition to all normal wound care protocols. This patient had recurrent IAD for over one year and was never able to maintain intact skin until using SFR underwear, which was applied over the diaper. IAD is resolved with no recurrence for 5 months using the SFR underwear.

Limitations

Compliance with the products

Discussion/Conclusions

As clinicians we have implemented interventions to eliminate or reduce friction and shear in our practices. These interventions have been limited to reducing friction when moving patients onto or off of a seat or bed support surface by instructing the patient and caregivers to avoid dragging and to lift when transferring and by suggesting the use of transfer aides. There are low friction transfer aids available and they work well for assisting transfers, but are not functional as a contact loading solution. Transfer aids are expressly task oriented and should not be left in place while a person is sitting or lying for stability/safety reasons. However, we have not had a product that uses SFR technology for contact loading available to us until now. We have four case studies with very different wound etiologies that had dramatic improvement in very short periods of time when intervening with this simple SFR technology.

I believe that we have underestimated the effect friction has on the wound healing process. There have never been products, until now, that directly reduce the friction when sitting or lying. The principal theory behind SFR recognizes two things; 1. Friction is the force, coupled with pressure, that results in shear stress (distortion) in tissue. Both forces always present, pressure and friction, are available to mitigate. 2. Applying a low friction interface focusing on the area of the body where skin damage is, or is at risk of occurring, preserves the otherwise helpful friction in the other areas where skin can tolerate the forces and derive stabilizing benefits or traction. The interface may be worn by the patient, or function as a component of a support surface cover. The SFM approach should not be thought of as a transfer aid to perform a transfer more easily, however, SFM provides very important protection during transfer activities if worn by the patient.

Microclimate is another pressure injury causal factor that deserves to be recognized and mitigated, whenever it is a practical possibility, to facilitate air exchange to help control moisture and temperature on the skin surface at the contact interface. The SFR technology used with these cases has properties friendly to microclimate issues.

Therefore, the negative effect of friction has never been fully appreciated until the SFR products were utilized in conjunction with our current standards of practice in wound/skin care. I have found that the SFR devices are a crucial intervention to the wound healing process. The response that was demonstrated in these cases has been reproduced numerous times in my clinical practice and the technology will become part of our standard of practice when dealing with pressure injury and Incontinence Associated Dermatitis.

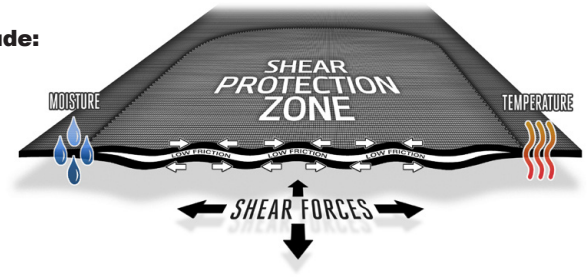
The Technology

Friction causes shear stress in the load-bearing tissue, and along with pressure and microclimate, is known to cause skin damage. GlideWear®, a dual ply textile technology, places a very low friction interface into a specific portion of a garment, support surface cushion cover or as a prosthetic liner component. This technology employs a concept referred to as "Strategic Friction Reduction" (SFR). SFR targets friction reduction to only the wound area, or the area known to be at-risk, providing a more favorable healing and prevention environment. Targeting the area of reduced friction preserves the relatively higher normal friction loads in the other areas where skin can tolerate the stress. This is necessary for retaining positing, stability, and traction.

Applications using Strategic Friction Reduction (SFR) technology include:

- Socks with forefoot, partial foot, or heel/ankle low friction technology installed in at-risk areas
- Undershorts with low friction technology installed in at-risk areas
- Wheelchair cushion covers with low friction technology installed in at-risk areas
- Trans-tibial prosthetic liner patches and trans-femoral prosthesis brim sheaths
- Pillowcase component

For Neuropathic Foot Conditions, Amputees, Wheelchair Users, Bed Surface Users, IAD, and other conditions where support surfaces are necessary



Dual layer, breathable fabric *glides smoothly against itself* ***absorbing friction-induced shear stress*** *to prevent tissue damage in at-risk areas*

References:

Thies Berke, C. Pathology and Clinical Presentation of Friction Injuries. Case Series and Literature Review. 2015 J Wound Ostomy Continence Nurs. 42(1):47-61. Lippenkott Williams & Wilkins

Linder-Ganz E, Gefen A. The effects of pressure and shear on capillary closure in the microstructure of skeletal muscles. 2007 Ann Biomed Eng. Dec;35(12):2095-107

International review. Pressure ulcer prevention: pressure, shear, friction and microclimate in context. A consensus document. London: Wounds International, 2010.

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Contact all authors at Tamarack Habilitation Technologies, Inc.
1670-94th Lane NE, Minneapolis, MN 55449
Email: info@tamarackhti.com