GARMENTS FOR FRICTION MANAGEMENT

for Wheelchair or Extended Bed Surface Users

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BACKGROUND

Friction causes shear stress and strain in the load bearing tissue of wheelchair and prolonged bed users leading to increased risk of skin trauma – both at the surface and in deep tissues. There are currently very few interventions addressing friction and shear available for clinicians and users. An intervention must not only **be effective** at reducing/controlling friction (which causes the shear stress/strain, but must **be practical and easy to use** for clinicians and consumers.

Movements associated with performing any activity, whether in bed or sitting in a chair, are not only unavoidable, they are often desirable and necessary. These "**micro movements**" should be recognized as contributors to shear stresses and strains (tissue distortion) throughout the day. The consumer would benefit from an intervention that increases skin safety by **reducing friction in the at risk areas** which causes potential for skin damage from shearing.

A physically active consumer will find themselves in multiple situations and various locations – not just in bed or their primary wheelchair, but in other seating/function locations or support structures such as standing frames, motor vehicle seats, furniture, and sports and recreational equipment. A perfect seat support surface is necessary and beneficial while sitting in the wheelchair, but is not available in these alternate places. The "perfect seat" may manage pressure well, but if it does not have a targeted friction reducing interface incorporated into the cover, it will not be as safe as if it did.

Transfers increase the risk of skin damage from shearing. No wheelchair user can be expected to perform perfect transfers 100% of the time. Small bumps and scrapes can occur during transfers - occasionally in the best cases, frequently in difficult cases – which gradually accumulate and increase the risk of damaging the skin.

Standing frames and multiple position wheelchairs, such as recliners and sit-to-stand chairs, offer many benefits for consumers. Most modern equipment offering these variable positions have designs to reduce the shearing which is unavoidable during position changes. However **shear stresses remain** when the consumer is weight bearing against the support surface because the joint axes of the equipment simply cannot match the alignment of the anatomical skeletal joint locations and duplicate their movements closely enough.

Small traumas which accumulate from micro-movements, positioning changes and the inevitable bumps and scrapes during transfers can be minimized or avoided by **incorporating simple friction management strategies**. This presentation demonstrates a friction management technology and how incorporating strategically placed low friction interfaces directly into garments, such as underwear and socks, can provide skin protection wherever/ whenever the consumer needs, without having to otherwise plan for or have independent devices constantly available.

THE REALITIES OF EVERYDAY LIFE

While sitting, **micro movements** occur with any functional activity and repositioning, even slight, including; reaching, leaning, bending, rotating, propelling, position shifts, etc. These micro movements introduce shear stress and increase risk of trauma to the skin and underlying tissues – the movements and activity of a person sitting are desirable and necessary for function and are thus unavoidable. However the negative aspect – shear - can be reduced or avoided.

Transfers from or to any support surfaces present an opportunity for a shear causing mishap (and worse). A perfect transfer cannot be expected to be performed 100% of the time, so bumps and scrapes occur and contribute to increase the risk of trauma to the skin and underlying tissue. This, unfortunately, is usually in the same areas normally found to be at risk from pressure.

Sitting on other surfaces is a needed or chosen normal daily occurrence for many wheelchair users. These alternate seat surfaces are not typically optimized for pressure distribution, shear prevention, or microclimate factors. This leaves the person at increased risk of skin and tissue damage from the less than desirable surface condition.

Using variable position equipment - sit to stand wheelchairs or frames and reclining wheelchairs - offer many benefits for a consumer. Despite elegant designs incorporated by equipment manufacturers to eliminate or reduce shearing, this kind of equipment is only able to partially reduce the shear imposed during position changes – sit to stand or reclining – because the mechanical joint axis on this type of equipment cannot align closely enough with anatomical joint axis to match the movements.

Lying on a bed with the upper trunk/head elevated, even slightly, increases the tangential forces placed against the body most commonly causing increased risk of problems in the coccyx/sacrum and posterior heel areas. Usually the person will slowly, gradually slide down to the foot end of the bed, needing to be boosted back up into proper position. Repositioning also introduces trauma potential. Even if no sliding occurs (or occurs very slowly) there is tremendous shear loading in place due to friction being the force preventing or slowing the sliding. Difficult positioning as shown in this photo presents even greater challenges.

COMMON METHODS TO MANAGE FRICTION

1. **Avoid sliding or dragging a person across any surface**
2. **Reduce tangential forces ("tendency to slide") while seated**
   - Postural controls componentry (pelvic control straps, knee blockers)
   - Seat contouring to cradle the person sitting (combined seat and back support)
   - Horizontal or slightly inclined thigh angle (seat surface)
   - Avoidance of back recline
   - Orientation in space (tilt)
3. **Reduce tangential forces ("tendency to slide") while lying in bed**
   - Remain horizontal/flat
   - When unavoidable, gatch knees up if hip range of motion allows
4. **Increase support surface contact area**
5. **Skin lubricants**
   - Lubricants typically work only until absorbed into the skin – then result is higher friction than without due to increased hydration
   - Messy
6. **Dressings**
   - Function as armor
   - Usually are high friction – may transfer shear forces to the at-risk area
   - Dressings may peel off skin prematurely due to friction (provides evidence of friction)

OPPORTUNITIES AND SOLUTIONS

Wear a garment designed with a low friction interface panel covering areas at risk of shear stress damage, usually where bones are close to the surface of the skin.

Use Low Friction Interfaces, targeting "at-risk" areas:

- As a **garment** or incorporated into a cushion cover or is moving
- Interfaces worn will provide protection **anywhere** the consumer is positioned
- Garment and seat cover interfaces may be used simultaneously

WHEELCHAIR USERS

- Ischial tuberosities
- Greater trochanters
- Coccyx/sacrum

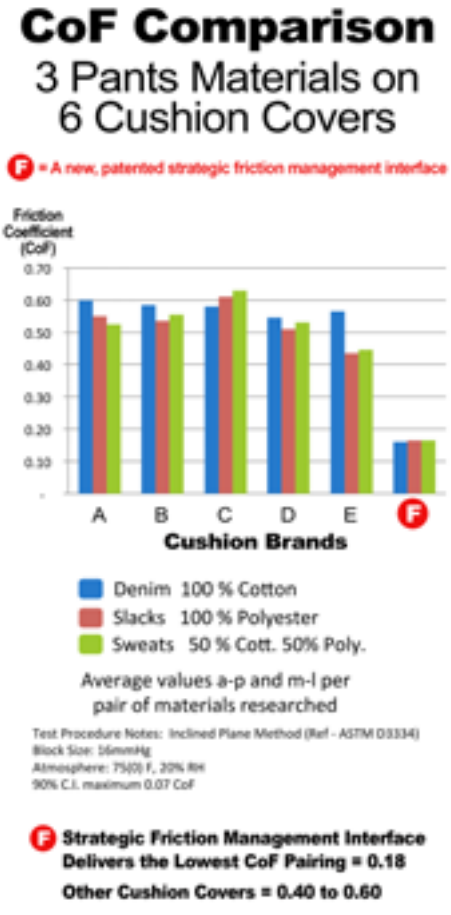
BED SURFACE USERS (LTC)

- Ischial tuberosities
- Greater trochanters
- Coccyx / sacrum
- Posterior calcaneous
- Maleoli
- Lateral aspects of foot and knee

STRATEGIC FRICTION MANAGEMENT INCREASES THE MARGIN OF SAFETY AND IMPROVES COMFORT

STRATEGIC FRICTION MANAGEMENT TECHNOLOGY

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



CLINICAL EXAMPLES

Case 1

Courtesy of Augustana Care, Minneapolis, Minnesota - used with permission

This case represents a common long term care scenario which allows foot contact with the floor for self-propelling. This position and activity increases tangential forces due to the position of the hips and thighs. Crossing legs is common and normally unavoidable for comfort and repositioning – it introduces additional shear stress from rotational movements.

This person is experiencing posterior ischial "buttocks" skin trauma accompanied by pain when sitting. She is usually positioned on one side or the other when in bed.

Intervention:
Garment with strategic low friction interface

After using garment 6 days
Significant improvement seen using underwear garment targeting a low friction interface over pelvic region. Immediate pain relief while sitting reported by the user.

Case 2

With permission and courtesy of the wheelchair user shown - Osseo, Minnesota

Active individual, SCI, T6-7 Para, Asia A - post ischial surgical closure showing signs of recurring. He drives from the van driver's seat, and uses various alternate seat surfaces every day, all requiring many transfers. This individual is a 1992 and 1996 USA Paralympian (pressed 501.7lbs!).

Introduced a low friction garment – underwear with shoulder straps to keep in place – used day and night with high compliance. He likes to wear this garment and found it easy to don and to deal with bathroom functions. He found no stability sacrifice while sitting, and has multiple pairs for laundry rotation.

Use of the prototype garment, with a low friction interface panel targeting the sub pelvic bony prominences, resulted in immediate quieting of the skin trauma signs. The wound/scar continues to be closed and without signs of trauma after using 6+ months (as of 2016 ISS). The time in use is being monitored and later reports will have updates.

Case 3

Courtesy of Adam Johnson, DPM Medical Director Center for Wound Healing, Hennepin County Medical Center, Minneapolis Minnesota

DX SCI C-4 Asia A Quad, Stage 2 wounds, bilateral leg involvement - right side shown as both sides duplicate the problem and resolution. These wounds are attributed to night positioning. The individual received extensive focused wound care for > 1 year which progressed slowly then stalled. Home evaluation identified cause as night time positioning. The individual is immobile and alone all night. Each night he rotates the side he is positioned on, so the destructive combination of pressure and shear was a continuous factor for non-healing.

Intervention is a low friction leg sleeve covering the wound areas (head of fibula, lateral tibial condyle, and lateral malleolus). The sleeve is used on the "under" leg, so rotated each night. All pre-intervention wound treatment efforts continued (the low friction technology garment was the only change).

Night position and equipment used (including the friction management garment). The leg splint is not contributing to the wounds (no contact on wound locations). There is a pillow between the legs, completely covering the lower limb (not shown here for photography). This position rotates each night to alternate the over and under leg placement.

The individual was very compliant with use of this intervention. PCA staff found the garment very easy to don and doff. Wound closing improvements were measurable within 2 months and closed entirely at 6 months. They remain closed, and the garment remains in use 2 yr 7 mo afterwards (as of 2016 ISS conference). Further monitoring and updating will be done on this case.

Case 4

Courtesy of Augustana Care, Minneapolis, MN used with permission

Geriatric fragile skin with skin tears and subdural bruising (long term care setting)

Intervention is a fabric arm sleeve incorporating low friction interface material, worn bilaterally

Outcome after wearing for 2 weeks.