Innovative New Custom Seat Design: Clinical Case Examples

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Abstract
Pressure, friction, shear, and microclimate are the extrinsic factors contributing to the development of skin and tissue trauma. A US-based rehab technology innovator has developed a strap-based custom wheelchair seat cushion with the design emphasis focus on a "quadruple approach"; optimizing pressure, friction/shear, and microclimate mitigation (temperature and moisture) simultaneously in one single custom seating system. This technology has been clinically applied in over a dozen cases by this author, who is a private practice complex rehab provider. The goal of this presentation is to describe this new design and the patient molding process, from the supplier perspective, and share multiple case examples showing its effectiveness and capability.

References:
1. Pilone, S. et al. 2013. "Use of a custom wheelchair seat cushion with the design emphasis focus on a "quadruple approach"; optimizing pressure, friction/shear, and microclimate mitigation."
3. Tamarack America Inc, Eden Prairie, MN.
4. Mark Payette, CO, ATP; Gary D. Goldish, MD; Andrew H. Hansen, MD-PhD, Minneapolis Department of Veterans Affairs Health Care System, Minneapolis, MN; 2013 Annual Meeting of the American Academy of Orthotists and Prosthetists, Minneapolis, MN, Volume 51, Number 6, 2014.

Background
This poster will present four case studies spotlighting an innovative new custom seating solution. The FlexForm® seating system (cushion) addresses all the risk factors for skin breakdown (pressure, friction/shear, heat and moisture) while creating stability for function.

The subjects all are high risk for the skin breakdown, have a history of skin integrity issues and continuously strive to maintain their ADL function. The individuals I worked with have utilized both custom and out of the box seating but continued to have difficulty with skin integrity, pain and/or function with the other cushions. This poster will address the risk factors, the functional independence, skin integrity history and goals of each individual and the outcomes while using the FlexForm® seating system.

Methods
FlexForm® seat cushions were used in these case studies to manage pressure, friction, shear, and microclimate, with the goal to improve skin integrity, while preserving functional stability.

Results Summary
All four clients are sitting full schedules without limitations.

Case 1: Client has used FlexForm® for 9 months. He has a SCI C5-C6, had skin integrity improving from previously multiple recurrent IT and trochanter pressure injuries, "to marvellous" skin integrity on FlexForm®.

Case 2: Client has used FlexForm® surface 3.5 years. He has a SCI T2-L1 and left TF amputation, tried other custom cushions prior to FlexForm®, but has integrity improving from previously multiple recurrent IT and trochanter pressure injuries and unable to sit due to pain, was able to reduce chiropractor visits and stop pain medication.

Case 3: Client has used FlexForm® 2.5 years. He has a SCI T5 and was unable to sit due to pain, was able to reduce chiropractor visits and stop pain medication once resolving on FlexForm® cushion, and he has ongoing integrity improvements.

Case 4: Client has used FlexForm® for 1.5 years. He has a SCI T6-T7 and was able to improve skin integrity and improve postural stability with a large muscular upper body, and small atrophied lower body.

Discussion/Conclusion
As an ATP, I am continuously on the lookout for new technology that can benefit the individuals I serve. When the concept for the FlexForm® custom seating system (cushion) was presented to me I was immediately impressed. The seat surface is comprised of woven straps, some under high tension, some under low to no tension, to manage pressure using offloading principal to decrease peak pressures under bony prominences while maintaining stability. It allows for custom molding from the underside of the support surface and the sitting patient allowing the bony pelvic areas to be identified and relieved by molding the woven surface to the individual’s anatomy. The support surface can accommodate pelvic orientation asymmetries or provide correctional forces when there is sufficient flexibility and that is desirable. The unique ability to palpate and mold from underneath while the individual is seated functionally and undisturbed in their wheelchair has proven to be of great value and success. The nature of the construction provides a durable support surface by avoiding the variations resulting from compressing foam and/or maintaining liquid or air volumes. While the support surface is durable, future changes from weight changes or other reasons can be accommodated by revising the strap configuration.

Additionally, due to the woven design of the seating surface and the relinked spacer fabric, air flow is allowing ventilation to decrease the risk factors of both heat and moisture, maintaining a healthy microclimate which is crucial to good skin integrity.

Lastly, friction/shear is addressed through the unique cover which utilizes GlideWear®. GlideWear® utilizes an approach referred to as 'Strategic Friction Reduction' - this places a low friction interface under the pelvic bony anatomy which is at risk of injury and a comparatively (normal) higher friction fabric under the distal thighs. This strategic combination of high (normal) and low friction zones allow frictional force reduction under the areas that cannot be tolerated, while utilizing low risk areas, such as the thighs, to stabilize the individual on the seating system. Incorporating such an interface is a way to add safety for the skin of a seated individual from compression loading as well as during any micro-movements that would be normal, and unavoidable, during wheeling and functioning in a wheelchair.

I have utilized the FlexForm® custom seat cushion with several individuals with very successful outcomes.