Benefits of natural materials in controlling skin microclimate

Summary
Natural products, such as wool or cotton, are better than synthetic materials in many areas of importance for skin integrity. This presentation looks at pressure redistribution, shear strain reduction, relative humidity, and temperature regulation properties of wool as compared with synthetic materials.

Aims & Objectives
This presentation looks at the scientific evidence supporting the choice of natural materials over synthetic materials in the design of seating products. Reference is also made to how materials can absorb shear strain in preference to the individual's skin tissues.

Background
Sheepskins used to be used routinely for pressure care until concerns about infection prevention surfaced, and there were problems of washing them at high enough temperatures. Artificial sheepskins were developed that could be washed at high temperatures to kill bacterial contamination, but these were made from synthetic materials and with low density of fibre, which meant they had minimal tissue integrity value.

CSIRO (the ***Commonwealth Scientific and Industrial Research Organisation)*** in Australia developed new tanning standards (AS4480.1) in the 1990s that allowed sheepskins to be produced which could be washed at least 30 times at 60C or 80C, thereby allowing medical sheepskins back into the market: these have been shown in clinical trials to be effective in reducing the incidence of pressure ulcers (McGowan et al 2000, Jolley et al 2004, Mistiaen et al 2010). New production techniques have permitted the knitting of wool into greater densities than sheep can achieve in the skins, and allow washing at 100C, improving on the properties of medical sheepskins.

Testing to ISO standards such as 16840-2 shows that these new wool materials have equal or better physical properties than natural sheepskin in protecting skin integrity in relation to microclimate, shear reduction, and pressure redistribution qualities (Call et al 2010).

Discussion
The effects on the integrity of our skin of the materials that we sit on needs to be a major consideration in our choice of cushions, back supports, and secondary supports. Natural materials are much better for skin integrity than man-made fibres. Wool is hydrophilic and will take up to a third of its weight in water vapour (Speakman & Cooper 1936), while man-made materials are hydrophobic, allowing liquid build up. The structure of natural fibres allows air entrapment which gives better temperature regulation. Natural fibres have a structure which encourages them to return to their original shape, providing better resilience. Natural fibres' abilities to slide over each other provide better frictional and shear properties than synthetic materials. There is better biocompatibility. This presentation covers all these aspects with the scientific evidence behind them.

References
Call, E et al (2010) ISO 16840 testing for Shear Comfort XD1900 skin care material *Proc EPUAP* Sept 2010
Jolley, DJ et al (2004) Preventing pressure ulcers with the Australian Medical Sheepskin: an open-label randomised controlled trial *Med J Austr* **180**, 324-327

McGowan, S et al (2000) The role of sheepskin in preventing pressure ulcers in elderly orthopaedic patients *Primary Intention* **8**, 127-134
Mistiaen, P et al (2010) The effectiveness of the Australian Medical Sheepskin on the prevention of pressure ulcers in somatic nursing home patients: a prospective multicentre randomised-controlled trial *Wound Repair Regen* **8**, 572-9
Speakman, J B & Cooper, CA (1936) The adsorption of water by wool. I. Adsorption hysteresis. II. The influence of drying conditions on the affinity of wool for water. III. Influence of temperature on the affinity of wool for water *J. Tex. Inst.* **27,** T 183–196

Barend ter Haar
Email: Barend@bescorporate.net

PS6/2

Solving the mystery of why a wheelchair seat is comfortable in clinic, but not at home!

Summary
Drawing on clinical and ergonomics research, this paper explores the concept of seated discomfort, asking "can comfort be objectively evaluated?" A multifactorial model for wheelchair seated discomfort is presented enabling us to consider comfort in more objective terms. Possible methods for assessing wheelchair seated discomfort are also explored.

Aims & Objectives
1. Define comfort in objective terms
2. Explore seated discomfort as a clinical problem
3. From published research…

a) Identify the key factors influencing seated discomfort
b) Propose a modified model of seated discomfort
c) Explore best practice for assessing wheelchair seated discomfort

Background
Wheelchair users often sit for more than 8 hours (Maeda et al. 2003), often with a restricted ability to change positions. This makes seated comfort a critical issue that directly influences well-being, sitting tolerance and performance (Watanabe et al. 2014). However, comfort remains difficult to define or quantify, creating the perception that it is purely subjective experience. As a result sourcing the funding to address issues relating to wheelchair seated discomfort is often difficult (Watanabe et. al. 2014).

Conversely, there is an abundance of ergonomics research into seated discomfort, which is considered a key factor in vehicle seat design. Can examining this research help us to better understand the multiple factors contributing to wheelchair seated discomfort, and thus guide us towards a more evidence based best practice?

The Oxford Online English dictionary defines comfort as "a state of physical ease and freedom from pain or constraint", while the Collins Online English Dictionary describes it as a "state of ease or well-being". These definitions, however, reinforce the perception that comfort is a subjective experience. Mansfield (2005) proposes that comfort is more objectively viewed in terms of the resulting behaviour. We could therefore consider comfort as…

A situation where an individual, given the opportunity, would choose not to move in order to reduce pain or other unwanted sensations.
The link between increased voluntary movement and seated discomfort is supported by research by Cascioli et al. (2011).

However, the above definitions do not provide us with a clear understanding of the contributory factors which cause the seated discomfort. Ebe and Griffin (2000) conducted research into vehicular comfort proposing a model for seated discomfort which describes the role of both static and dynamic factors, highlighting the role of shock and vibration on seated comfort when a seat is in motion. These dynamic factors are also critical to wheelchair seating, as wheelchairs are subject to shock and vibration which can be higher in magnitude than those experienced by car drivers. Mansfield et al. (2004) continued this research, suggesting a modified model to explain the influence of temporal factors, where discomfort accrues with time.

Discussion
Existing models of seated discomfort are useful in understanding the influence of vibration and shock on seated discomfort. They also help to explain why one seat can be considered more comfortable than another when stationary, but less comfortable when compared in motion. However, they do not describe all the contributory factors in enough detail to form the basis of objective seated comfort evaluations.

In this paper these factors are broken down further, examining the role of pressure, micro climate, postural stability and other factors in the role of wheelchair seated discomfort based on a mix of research and clinical experience. This examination is combined with the earlier models, and a multifactorial model of wheelchair seated discomfort is proposed. This more detailed model enables us to examine comfort more objectively.

A visual analogue scale developed for assessing vehicular seated discomfort is presented (Gyi and Porter 1999). The author then asks “can this approach better empower us with the clinical evidence we need to proactively tackle wheelchair seated discomfort issues?”.

References
Cascioli, V. Zhuofu, L. Heusch, A. McCarthy, P. (2011) Settling down time following initial sitting and its relationship with comfort and discomfort. Journal of Tissue Viability.
Ebe K, Griffin M J. (2000). Qualitative models of seat discomfort including static and dynamic factors. *Ergonomics*. Vol 43:6, 771-790.
Gyi, D.E., and Porter, M.J. (1999). Interface pressure and the prediction of car seat discomfort. *Applied Ergonomics,* 30 (2), 99-107.
Maeda, S., Futatsuka, M., Yonesaki, J., and Ikeda, M. (2003). Relationship between questionnaire survey results of vibration complaints of wheelchair users and vibration transmissibility of manual wheelchair. *Environmental Health and Preventive Medicine* 8(7), 82–89.
Mansfield, N.J. (2005). Human Response to Vibration. *CRC Press*, Boca Raton, Florida.
Mansfield, N.J., MacMull, S.J., Singla, G. and Rimell, A. (2007). Relative influence of sitting duration and vibration magnitude on sitting discomfort in a car seat. Proceedings of the 42nd UK Conference on Human Response to Vibration, University of Southampton, September 10-12 2007.
Watanabe (2014). We don’t pay for comfort. Mobility Matters. September 2015.

Kim Chaney
Email: Kim.chaney@ottobock.com

Prescribing wheelchair back supports – tension adjustable upholstery (TAU) versus solid manufactured

Summary
Little research exists on wheelchair back supports to aid prescription of tension adjustable upholstery or solid manufactured. The benefits and limitations of each are examined in relation to common postural abnormalities. A flow chart is presented which can help determine the specific features required to meet common back support goals.

Aims & Objectives
Identify and list three common postural presentations which require the provision of either a TAU or solid back support to meet client back support goals;
Identify and list at least two clinical benefits and limitations of both tension adjustable and solid back supports;
Describe a clinical reasoned process for the use of both tension adjustable and solid manufactured back supports.

Background
No clinical guidelines or standards exist to aid the prescription of back supports for wheelchair users. The use of conventional TAU and solid manufactured back supports for common client presentations are analysed with case study pictures to highlight specific features required to meet common postural problems. Specifically, the benefits and limitations of each back support type are examined in relation to common flexible and fixed spinal deformities such as kyphosis and scoliosis.

Discussion
Following analysis of each postural presentation a generic set of back support goals are identified. These commonly include reduce back/neck pain, improve comfort and sitting tolerance, improving trunk stability and functional ability, and correcting or accommodating postural deformities (Stone 1996). To address these goals, specific features are required which may be provided by either TAU or manufactured back support. Case studies are presented to help demonstrate how the flowchart may be used to identify the specific back support features required and ultimately guide non brand specific product selection.

The implication for practice focuses on clarifying the common goals associated with different postural problems, and then enabling prescribers to use the flowchart as an aid to clearly match the back support type to the user's needs. This will lead to improved clinical outcomes and reduce the cost to the wheelchair service or equipment provider.

References
1. Macauley J. IC 15: Do You Have Your Client's Back? 27th International Seating Symposium 2011 March 3-11
2. Stone J. Clinical considerations in the selection of Commercial Wheelchair Backs' in Proceedings of the 12th International Seating Symposium 1996 p221-4

Matthew Eveleigh
Email: matthew.eveleigh@sunmed.co.uk