

AUSTRALIA

Supporting your needs

Postural Challenges and Seating Solutions

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All these play their part



9/ Head 9/ Arms 9/ Trunk <u>_</u> Pelvis <u>_</u>/ Upper legs <u>_</u>/ Lower legs 9/ Feet



Postural Challenges and Seating Solutions

Part 1 – The Lower Body

Underneath the Pelvis – Challenges of Cushion Selection



Tissue Integrity
Positioning
Function

R / Creating a checklist

Tissue Integrity



1. Transfers
2. Pressure Redistribution
3. Friction and Shear
4. Microclimate
5. Fail Safe

Tissue Integrity - Transfers



Transfer considerations and solution Surface and friction Contouring

Pressure Redistribution Separating Immersion from Envelopment Supporting your needs



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OFFLOADING



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without offloading-Peak Pressures with offloading-Loading the Trochanters

Trochanteric Shelf





The **Trochanteric Shelf** Formed by the Greater and lesser Trochanter and the Posterior Femur

Images courtesy of Allen Siekman, Allen Siekman

Trochanteric Shelf



Supporting your needs



Images courtesy of Allen Siekman, Allen Siekman

ISO/TS 16840-12: Apparatus a for cushion envelopment testin



Supporting your poods



Every BODY to Maintain Shape – Adjustability





Adjustability is the ability of the support surface to accommodate the unique shape of the individual, at the initial fitting, and over time. This may be manually performed or automatic (goal: immerse and envelop)

Tissue Integrity – Friction and Shear



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Pressure vs Friction vs Shear

kh Shear Stress and Shear Strain

Rate of Change (Gradient)





adient mode is ON! 10 2 7/2 2.5 1.1 60 84 10 7/1 4/6 2.3 0 1:8 0.4 2.1 7.1 10,6 15.0 18.1 13.8 9,6 8.2 13,1 18.5 20,7 1,4.6 11.8 8,4 2.0 16.0 14.8 17.1 18.2 14.9 14.9 16.7 15.3 13.6 13.5 43.0 11.7 5.8 2.4 10,1 5.7 2.9 7.7 125 111-3 8-1 450 34 90 44 73 22 33 100 13.1 12.1 7.1 4.2 4,5 11.5 419 9.8 21 10.2 11.3 11.4 9 4 8 7 14 3 6 5 13 5 10.3 8.5 11.1 12.2 1.1.8 13.8 9.5 13.0 12.7 14.1 13.6 12.8 18/8 10.8 18.8 15.9 43.1 10/3 9/3 45.0 46.0 0 17.1 11.8 4.3+ 47.2 75 17.2 78+ 46.3 11.4 8. 143 149 150 8.6+ 130 6/6 136 105+ 160 149 132 166 144 0 0 1%1 6/9 11/1 13.7 17.8 120 138 85 2.4 87 11.0 124 18 17 1 92 88 133 149 50 10-2 100 75 50 1 1.7 6/1 9/7 13.0 15/2 19.9 22.4 18.4 22.8 20.0 18.2 18.9 70 49 31 1 1:1 3/0 6.9 3.5 1.0 0.0 0.0 0.2 0.5 0.7 1.7 2.4 1.7 1.6 2.2 1.6 0.5 0.1 0.0 0.0 1.0

Tissue Integrity - Microclimate



Moisture

Maceration

Increased friction and shear

Mark Temperature

Cold affects capillary closing/opening Heat affects metabolic rate and sweating 1° increase in temp = 13% more metabolic demand

Consider materials in your solutions

Materials – Covers Pros and Cons

Impacts on tissue integrity



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Breathability Air flow **Smoothness** Flexibility in depth The closer to the skin (the cover), the more influence on the epidermis and dermis Deeper (cushion) materials influence deeper tissues

Materials – Cushion Pros and Cons



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R Foam

R & Air

R / Gels

k / Elastomers

RAir-Foam





Posture Management



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Biomechanical principles of control



- RA PSIS block
- Re-ischial ridge
- Support under thighs
- Appropriately placed belt



Use of the Wedge



Without wedge 100 15 90 14 80 13 12 70 11 60 10 50 40 30 20 10 mmHg Р 0 Ν КJ 1 HGFED С в м L А

Sensors included217Variation coefficient59.6%Standard deviation14Average pressure23.5Maximum pressure65Center of pressure8.0, 7.0



182
47.2%
10.9
23.1
55
8.9, 9.5

Typical 45° Belt





Positioning Belt in Front of Greater Trochanters





Positioning Belt in Front of Greater Trochanters Benefits



Reduced pressure on Ischial Tuberosities
 Ability to off-lift pressure on ITs
 Greater reach and functionality
 More secure positioning

Remember: these are POSITIONING belts and not restraints

The Evidence





Reaching with belt mounted at 45°



Reaching with belt mounted at 60°

Posture





Neutral Hip Joint Alignment: 5 degrees of abduction





Functionality



- 🕅 Weight
- ka Weight limit
- ka Fail Safe
- Real Comfort
- Enables day to day activities
- kh Low maintenance
- Cleanability
- Ease of transfers
- Rh Size choice
- RA Life
- RA Value for money



The Varilite Evolution from HIA

Meeting criteria

Varilite Evolution



Air-Foam MixValve ControlledAir Content

PSV Settings Fully inflated cushion





Setting #1: Some air released





Setting #2: Optimal immersion





Setting #3: More air released





Setting #3: More air released







Fully inflated PSV Setting #2 FRONT 0 0 0 0 12 12 20 26 6.3 0 0 45 25 44 0 0 7.8 14 11 8.6 0 0 0 0 0 0 0 0 0 0 6.3 28 40 63 45 6.3 0 0 0 6.3 13 26 0 27 10 0 28 0 0 0 0 0 5.5 14 0 0 0 0 0 0 0 8.6 24 0 **50** 42 16 3.1 0 0 13 23 33 35 0 4.7 0 0 0 60 60 0 0 2.4 20 22 31 0 39 1.6 0 0 0 0 36 0 0 17 27 31 54 0 0 0 0 36 28 0 0 24 25 31 38 47 24 0 25 23 16 8.6 0 0 0 13 0 35 28 0 24 25 17 3.1 0 0 16 4.7 11 13 11 0 0 0 1 31 23 30 13 0 7.1 38 44 56 57 0 0 27 31 23 31 11 0 1.6 40 38 36 36 0 43 0 0 9 85 67 56 61 32 0 31 48 66 79 73 0 43 20 0 9.4 34 42 49 8 0 43 87 90 71 73 67 45 54 29 0 0 38 26 58 -16 0 17 0 48 49 45 0 0 73 71 20 89 106 119 0 0 0 53 57 59 30 3.1 39 56 57 51 41 16 0 0 6 56 45 31 0 68 79 92 0 0 30 43 54 62 42 19 67 55 64 64 29 0 47 0 5 48 39 50 33 33 56 3.1 39 31 34 22 0 22 35 47 28 0 0 1.6 4.7 0 0 36 11 18 3.9 0 0 8.6 38 14 25 16 3.1 17 14 34 22 24 0 0 0 0 0 3 0 0 13 5.5 94 0 0 0 0 16 0 15 47 0 0 0 М н G E D С в Ν 0 Μ 1 ĸ J 1 H G F E D С в

Varilite Evolution



X^A Tissue Integrity Dispersion Immersion Cover choice Stretch covers Air and water vapour dissipation **Temperature balance** Fail Safe
Varilite Evolution



R Posture Lateral support **Trochanteral ledge Gluteal support Thigh Abduction Pre-ischial Ridge Neutral Pelvis** Stability

Varilite Evolution





Functionality

Very Light No weight limit **Maintenance Free** Fail Safe Washable Vibration Dampening Comfortable Long Life Choice of sizes (10-24") Ease of transfer



- We have stabilised the pelvis, he won't slide out of the chair, and we're protecting the skin on his butt
- So we can go home now can't we?
 - Not so fast the most important bit is to come
- What about the trunk?

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Why is this the most important bit?



Postural Challenges and Seating Solutions

Part 2 – The Upper Body

Protecting Physiological Function





Respiration Cardiac Function

Digestion

Bladder Function

Benefits of standing



Breathing **Blood circulation Bladder function Bowel function Bone strength** Joint development

Contracture prevention Range of motion **Spasticity Pressure relief Psycho-social Health Economics**

Breathing





Breathing is for blood oxygenation **Restrictive disorders** Paralysis of respiratory muscles **Obstructive disorders** Asthma/COPD Mucus accumulation Fatigue/headache/high BP/ Cognitive impairment

Standing: Anterior tilt > Lordosis > less abdominal pressures > better lung volume Better speech volume Better use of language SCI: 31% of patients reported improved breathing

Blood circulation

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Standing:

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- Immobility leads to: Lowered cardiovascular function Impaired leg muscle pump Increased oedema Lowered clearance of dead cells Increased pain and venous ulcers Increased DVT
- Increased tone in plantar flexors
- Increased tone in knee/hip extensors
- SCI: 42% decrease in swelling in legs and feet

Bladder function



Filling AND emptying – affected by Muscle walls Sphincter control **Pelvic floor** Neurological impairment Medication **Disease and infection**

Bone resorption > hypercalcuria > stones > UTIs > haematuria Standing decreases bone resorption SCI: 53% had improved bladder function

Bowel function



Constipation Standing stretches colon > bowel movement Stomach empties better from sit/stand rotation 50% improvement from allowing effects of gravity 45% improved digestion

Bone strength





Depends on Calcium levels/Vitamin D/weight bearing Cortisone treatment for RA or MS > osteoporosis Active muscles stimulate bone growth Standing benefits: Improves bone mineral density **Delays skeletal deformities** Better shoulder position Better grip Fewer fragility fractures Improved upper body mobility

Joint development





Femoral head/acetabulum ball/socket Joint development needs load bearing Plus retained primitive reflexes more controlled

Contracture prevention



Congenital disorders > scoliosis/ joint deformities Abnormal muscle tone > bone deformation Iliopsoas muscle at hip Hamstring muscles Gastrocnemius muscle Soleus muscle

Standing stretches: Hip flexors Knee flexors Plantar flexors Ham strings

Range of motion Motor skills



Decreased ROM arising from: Joint inflammation Muscle paralysis **Spasticity Standing:** Increase muscle strength with weight loading > better muscle tone Improves proprioceptive input Lengthened hamstrings > ADLs easier 59% decrease in stiffness reported

Spasticity management



Some muscles continuously contracted Standing stretch: **Reduces spasticity** Improved muscle tone **Reduced** pain Improved sleep Safer transfers Better posture

Pressure relief





Standing concentrates the body weight on the lower extremities \$\overline{S}\$tanding offers the best reduction of the load on ischial tuberosities and sacrum

Standing reduces the risk for pressure ulcers and fits in a regimen to prevent pressure ulcers

Psycho-social





Face to face possibilities Self confidence Participation Function Independence Communication Less fatigue/Improved alertness/improved sleep **Reduced medical complications**

Health Economics



Psycho-social benefits Reduced medical complications



Equipment 'byBES' from HIA Standers

Varyflex standard Varyflex wide Hippi Vose standard Vose large



What's the other important function of the trunk?



Supporting the head
Where's and what's the benefit?
Seeing

Angle Affects Colour Perception



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Max Zone for all colour perception: 20 degrees

Max Zone with Head Tilt

From: The Measure of Man and Woman, Henry Dreyfuss

Positioning Influence on Sight Range



End of **Useful Gaze** w/Eye Rotation Head Angle and Perception Ideal Sight Zone Centre of Gat

Supporting the head



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- Swallowing
- Breathing
- Hearing and balance
- Function

Function



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- Proximal to Distal
- 9/ Arms and Hands
- <u>_</u> Living a life







Thorax

Lumbar

Pelvis



8 Cervical vertebrae

12 Thoracic vertebrae

5 Lumbar vertebrae

Sacrum Coccyx





So what can go wrong?



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Spinal Cord Nerve Anatomy

(and associated spinal cord injuries)

CERVICAL

C4 - C6 - Tetraplegia (Quadriplegia) paralisis of arms and legs

THORACIC

T1 and below - Paraplegia occurs when the spinal cord is damaged below the cervical spine. It may be injured in the thoracic spine (mid-back), or lumbar (low back).

LUMBAR SACRAL COCCYX

The spinal cord ends at L2, but SCI injuries are possible below the end of the spinal cord. This area is called the cauda equina. The cauda equina is a bunch of spinal nerves resembling a horse's tail.





So what can go wrong?





Pelvic Obliquity + Scoliosis



Kyphosis, Lordosis, and Scoliosis





Posterior Tilt + Kyphosis



Kyphosis Strategies



1. Accommodate limitation in range of motion of hips and knees - foot position 2. Block ITs from moving forwards 3. Block region below iliac crest 4. Accommodate posteriorly for mid dorsal apex 5. Investigate the need to block the femurs from sliding forwards and trunk backwards (hip and thoracic belts)



Anterior Tilt + Lordosis



What can go wrong? What can we do about it?





What can go wrong? What can we do about it?




Three Points of Control



Two to fix

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- One to adjust
 - As far apart as possible from each other

Fixed or mobile



Three Points of Control





Three Points of Control



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Application to Seating



Terminology Supports

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Positioning

Additional Considerations for the Seating System

Terminology

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Support vs Rest vs Restraint Back Arm Foot



Nomenclature - Height vs Length





F - Seat Surface Height at Front Edge.

Height is a "placement" measure New term: Vertical height Length is a "size" measure



Back Support zones







Trunk Supports



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LateralAnterior

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- Posterior
 - Fixed vs Dynamic
- Other considerations















Anterior Supports



Passive vs Active

Managing fatigue Dynamic supports

















Too High Too Low

Placement of anterior supports Rear pull vs front pull



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Posterior Support

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Can be Static or Dynamic

Icon back support

2-Point position for rotation





Supporting your needs

Icon back supports





Icon back supports



Easy access for adjustment Single tool for all bolt heads Height, width, and angle adjustments – While client in chair



Depth adjustment















Varilock



- Positive Locking Design
 - Will not slip once installed and adjusted
 - Adjustor plate
 - Teeth hold recline adjustment
 - Inset into cane bracket prevents rotation





Varilite Icon Further advantages



Air-foam flotation cushion **Dual Foam** Four channels Rollover at top Breathable cover **Reticulated foam** Machine washable Hook and loop fixings Light-weight aluminium shell Mounting head rests Carry handle Lateral options for Low/Mid/Tall **Tapered Shape**



TARTA A dynamic range



A dynamic supportive exoskeleton



The EMYS





EMYS





EMYS Personalised



EMYS Mounting Options









Once mounted, pads are added and adjusted via velcro attachments. Pads are machine washable at 30°C





- Available in **4 different** sizes: S-M-L-XL Available in **3 different** lengths
- Available in 2 rib shapes: Standard and Contoured
- and..... FLEXIBLE mounting options



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TARTA'S SIMPLICITY



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Flexible

and.... aesthetically pleasing !

TARTA in use








Personalisation



AIRBRUSHED: Each piece is uniquely HANDMADE

"RIBS" in SPECIAL COLOURS









Chair Interface





Connector for rigid wheelchairs Also suitable for tube diameter from 19 to 25 mm

Further considerations around Back Supports



- Mounting options
- Accessibility for mounting and adjustment
- Removability
 - Crashworthiness (ISO 16840-4)
- Flammability (ISO 7176-16:2012; ISO 16840-10:2014)
- Comfort

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Further considerations around Back Supports



Rotation

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- Support heights
 - Mass distribution off ITs
- Joystick position
- ^{*e*} 24-hour needs

Support Materials

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Varilite and Tarta Seating and Back Support Catalogues

- "Postural Challenges and Seating Solutions" Article
- Available from Healthcare Innovations Australia (HIA) sales@hiaus.net.au

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