



Supporting your needs

Postural Challenges and Seating Solutions

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Inappropriate Wheelchair Seating

- Prevalence of inappropriate wheelchair seating in long term care facilities reported to be 58.6% (1,2)
- Common implications are (3,4):
 - Discomfort
 - Poor positioning and mobility
 - Skin integrity issues

1. Canada S. Participation and Activity Limitation survey 2006. Ottawa: 2008

2. Giesbrecht EM, Mortenson, WB, Miller W. Prevalence and facility level correlates of need for wheelchair seating assessment among long term care residents. Gerontology. 2012; 58(40:378-384

3. Mortenson WB, Miller WC. The wheelchair procurement process: perspectives of clients and prescribers. Can J Occup Ther. 2008; 75:167–75.

4. Bourbonniere MC, Fawcett LM, Miller WC, Garden J, Mortenson WB. Prevalence and predictors of need for seating intervention and mobility for persons in long-term care. Can J Aging. 2007;26:195–204.

Postural Challenges and Seating Solutions




Supporting your needs


 Feet

 Legs

 Pelvis

 Trunk

 Arms

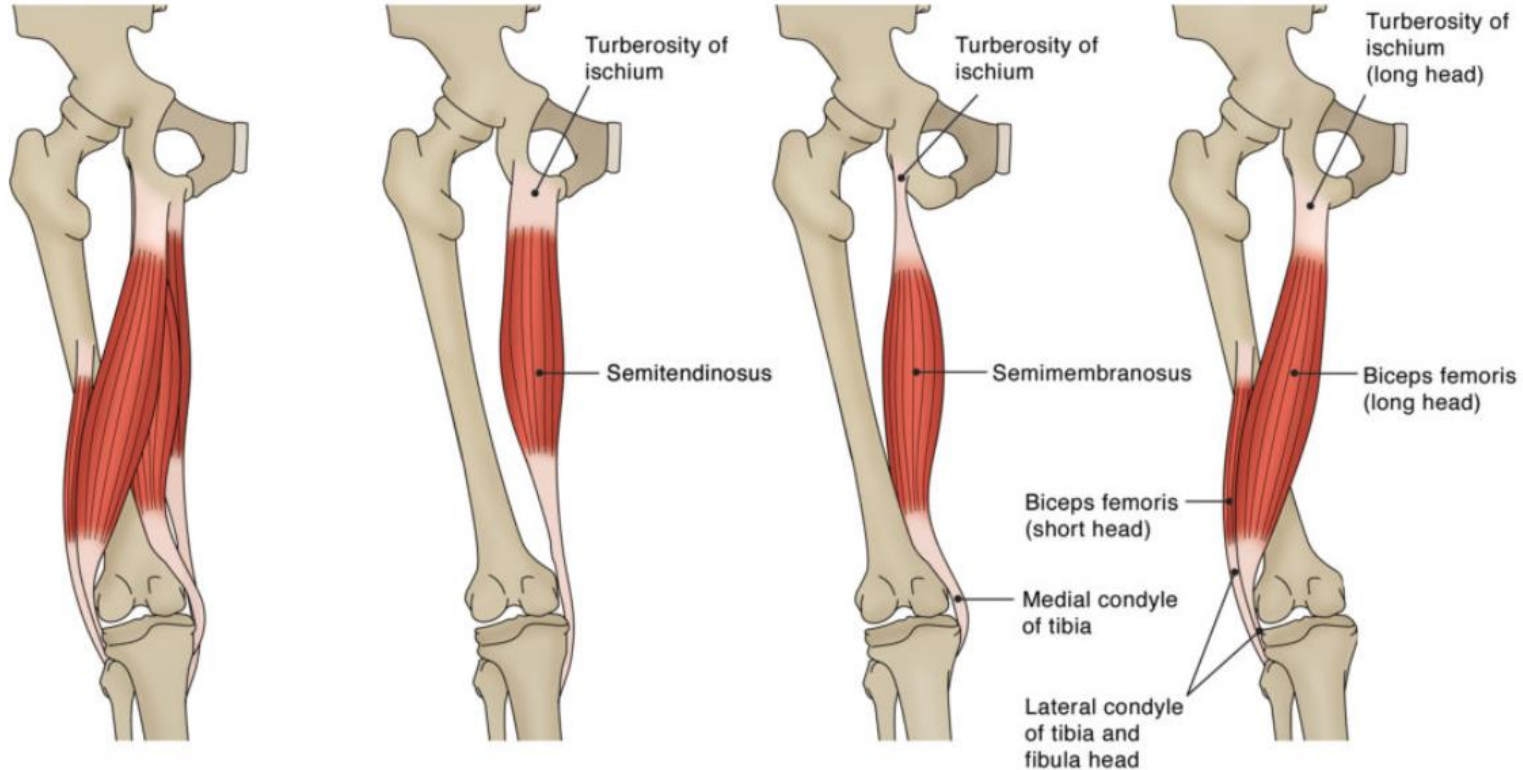
 Head

Postural Challenges and Seating Solutions

Part 1 – Lower Body






Foot Support Position

Hamstring Group Posterior view



Starting Underneath the Pelvis

Primary Considerations for Cushion Selection

-  How many considerations?
-  Tissue Integrity
-  Positioning
-  Function
-  Creating a checklist

EXTRINSIC RISK REDUCTION



Extrinsic Factors of Wound Development



Prolonged Pressure

Friction/Shear



Microclimate

Factors that stem from the outside environment and/or seating or support surface

The therapist can prevent the harmful affects of extrinsic factors through proper wheelchair positioning and surface choices

Back to cushions!



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Starting with Tissue Integrity

Tissue Integrity 1

Transfers



Transfer considerations:

Surface and friction

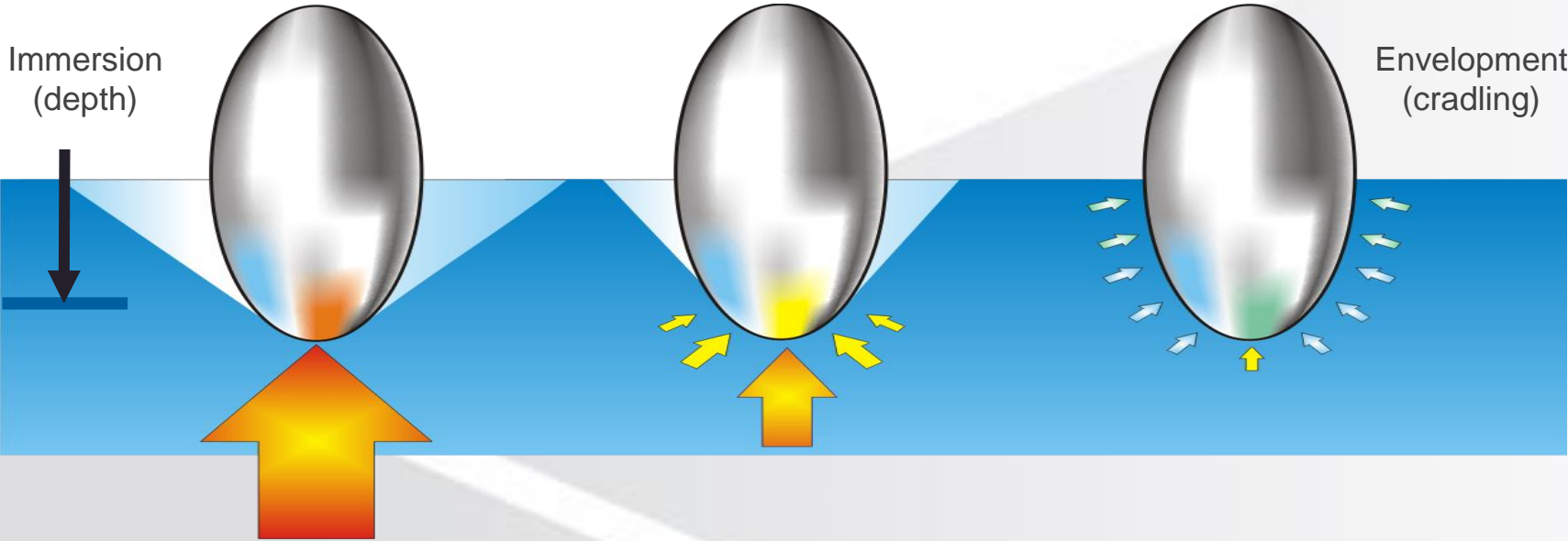
Contouring

Tissue Integrity 2

Pressure redistribution

-  Immersion
-  Envelopment
-  Dispersion
-  Offloading
-  Adjustability

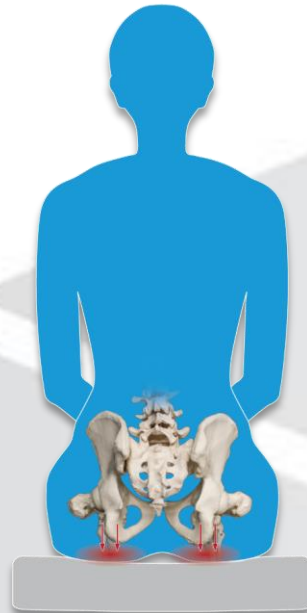
Separating Immersion from Envelopment



IMMERSION and ENVELOPMENT

The principle of **conforming** to the person's curvature by "sinking the body in".

We allow the cushion and/or back support to take the body's shape, **alleviating the body prominences** from **unwanted peak pressure** to maximize **pressure redistribution**



*without immersion and
envelopment -
Peak Pressures*



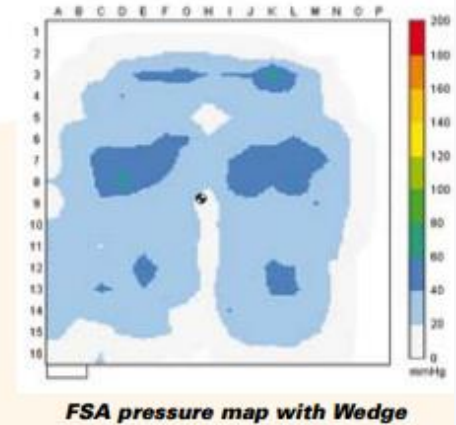
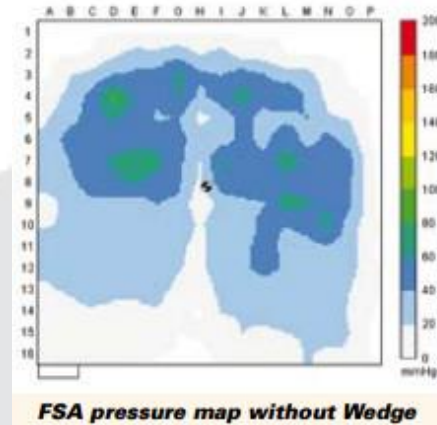
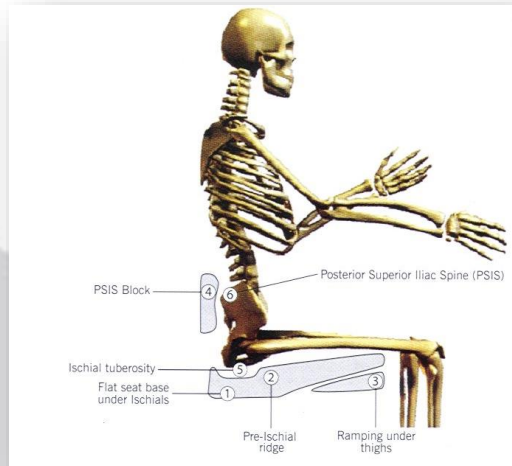
*with immersion and
envelopment -
Even Pressure
Redistribution*

Tissue integrity 2

Pressure redistribution



Dispersion



OFFLOADING



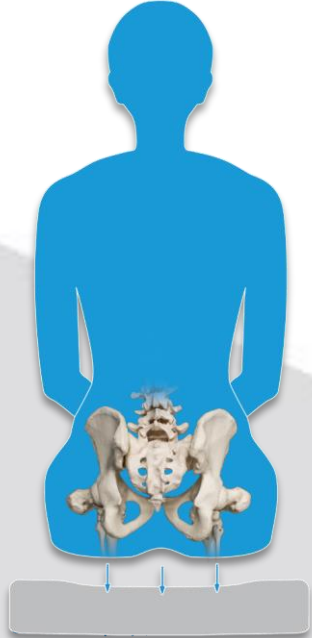
OFFLOADING



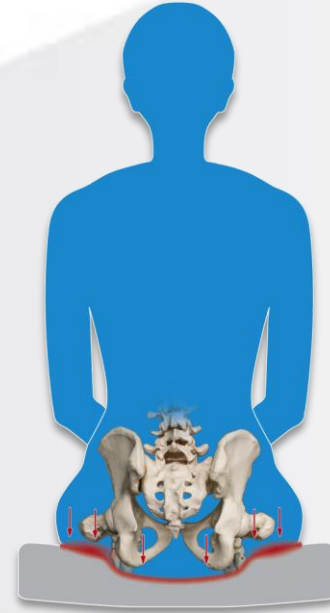
HEALTHCARE INNOVATIONS
AUSTRALIA

Supporting your needs

The principle of **taking pressure off one area** and **loading it onto an alternate area** of the body that can withstand more pressure to prevent unwanted skin breakdown. Deformation is minimized in a **vulnerable area**

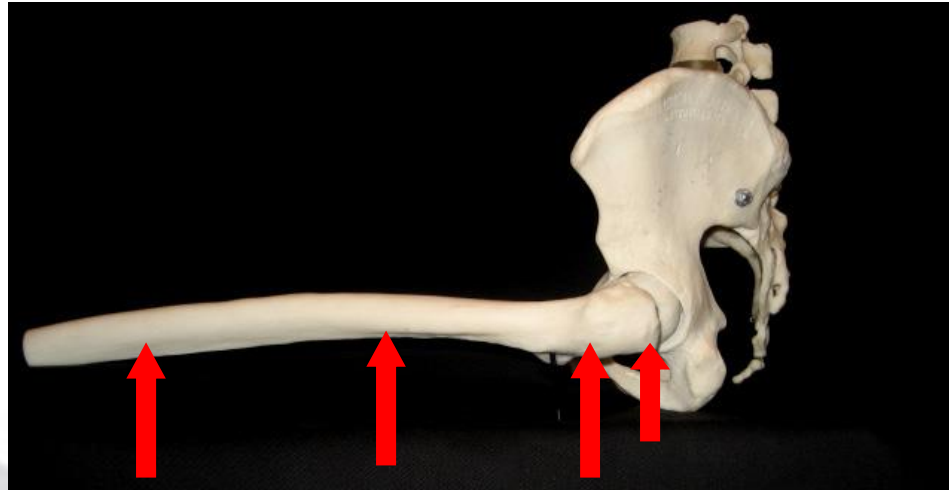


*without offloading -
Peak Pressures*



*with offloading -
Loading the Trochanters*

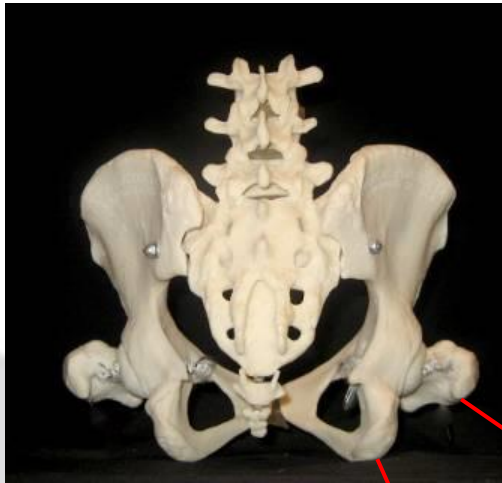
Trochanteric Shelf



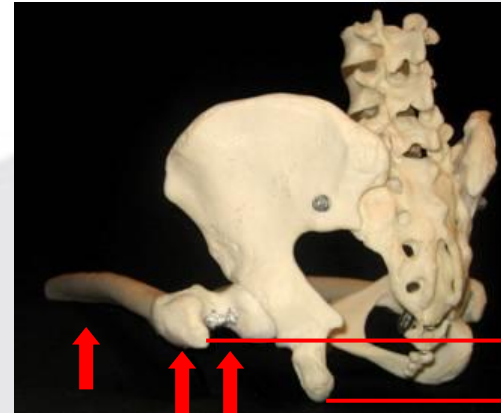
The Trochanteric Shelf

Formed by the Greater and lesser Trochanter and the Posterior Femur

Trochanteric Shelf



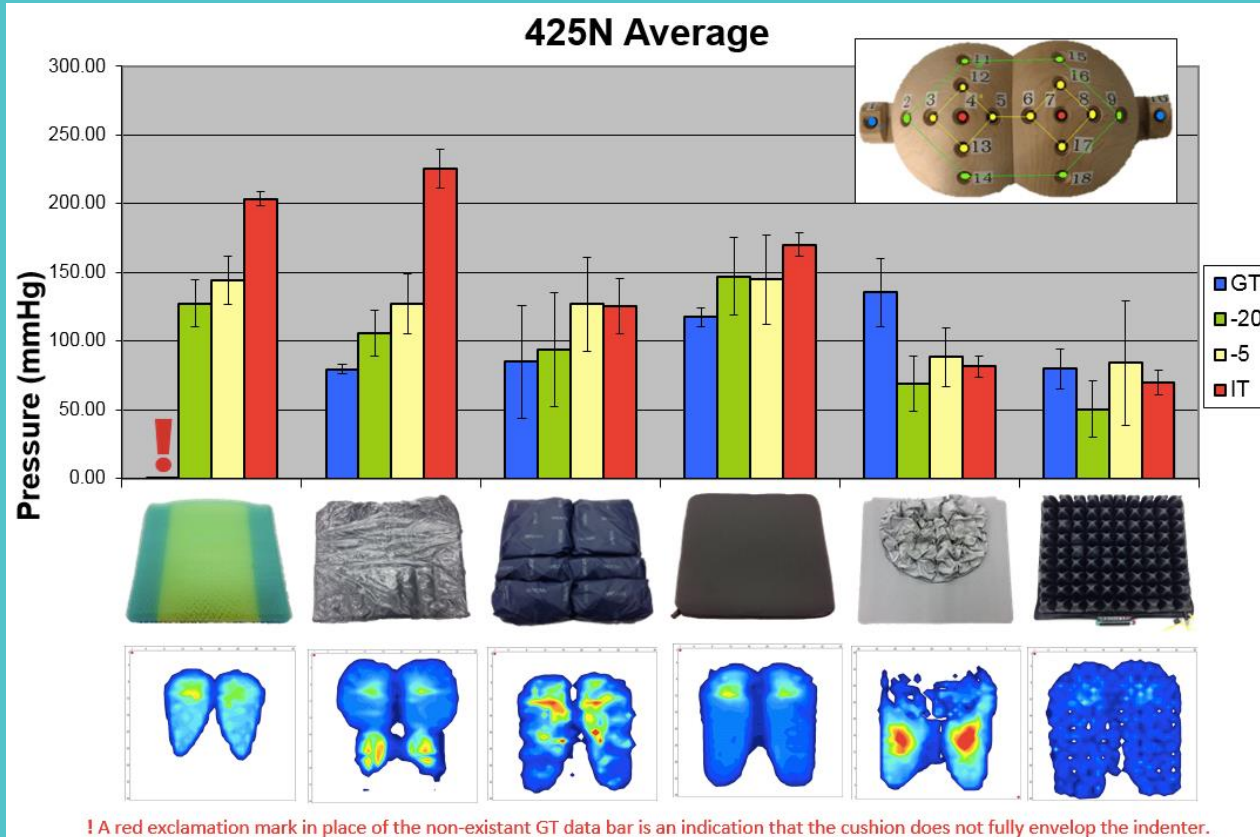
Trochanter



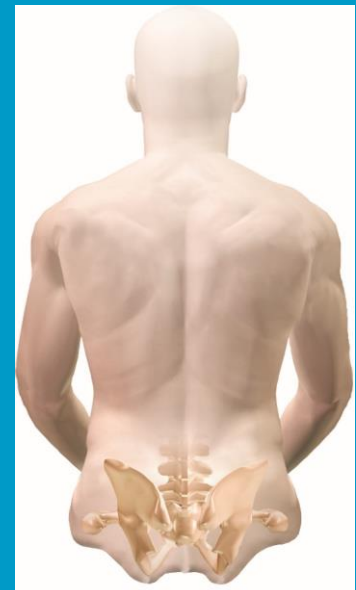
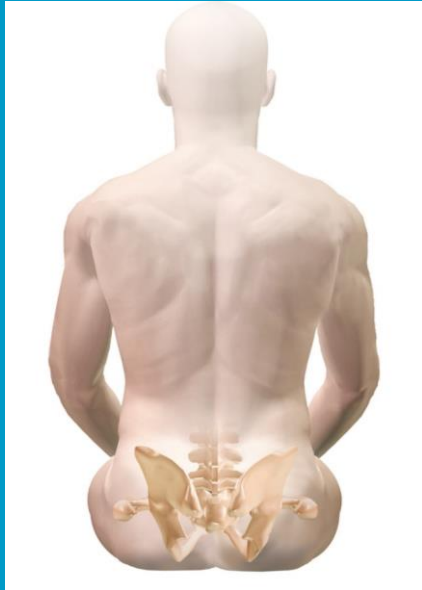
30 - 40 mm

Ischial Tuberosity

ISO/TS 16840-12: Apparatus and method for cushion envelopment testing



Protect 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 performed manually or automatically. (goal: immerse and envelop)

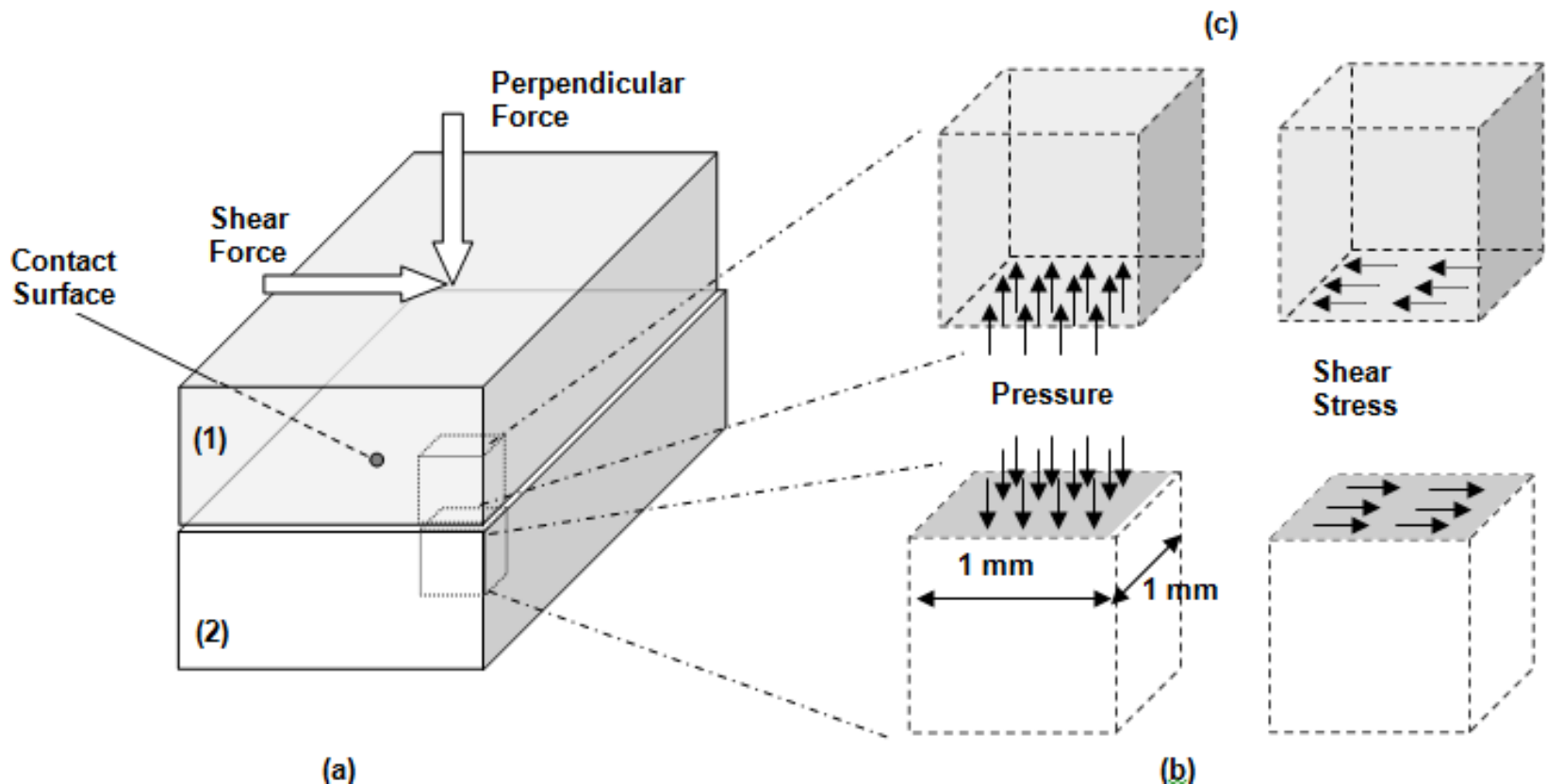
Tissue Integrity 3 - Shear

 Friction vs Shear

 Shear Strain vs Shear Stress

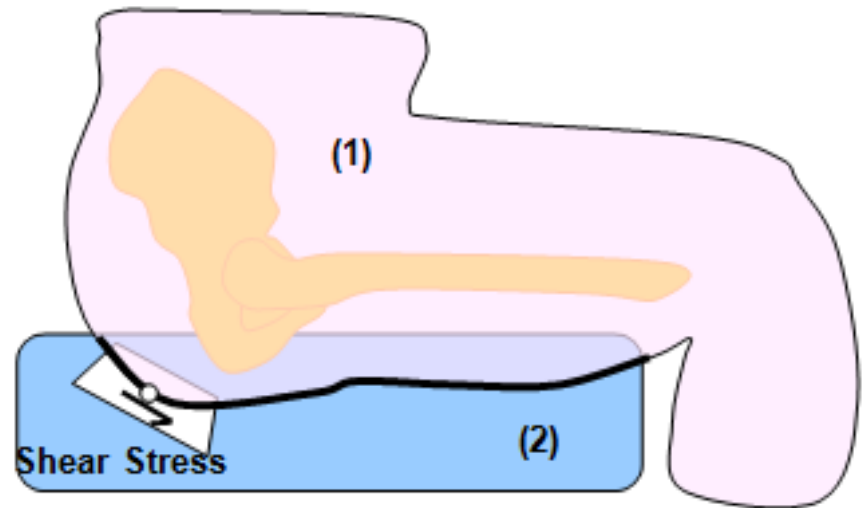
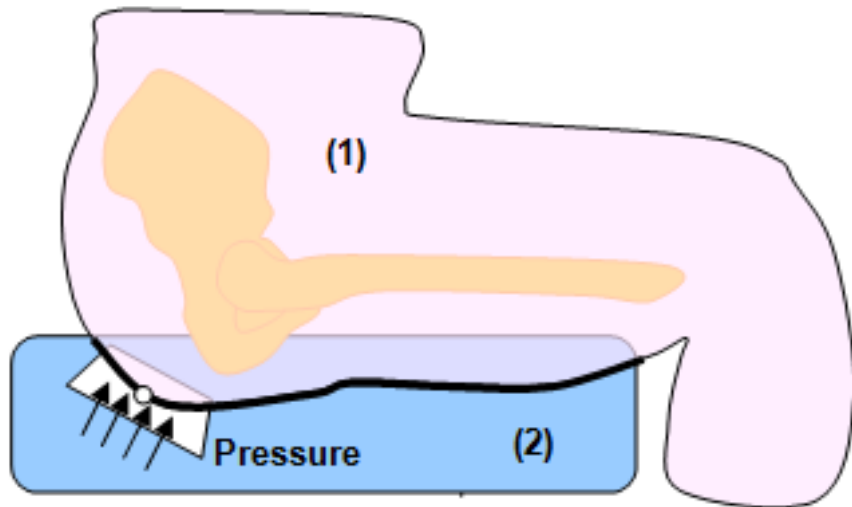
Terms

Pressure vs Shear



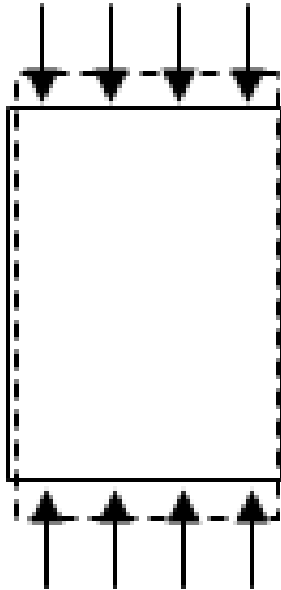
Terms

Pressure vs Shear Stress

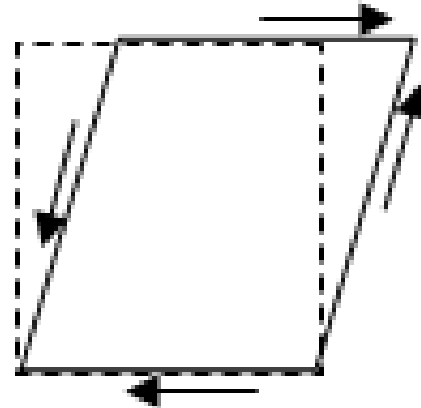


Strains

Axial vs Shear

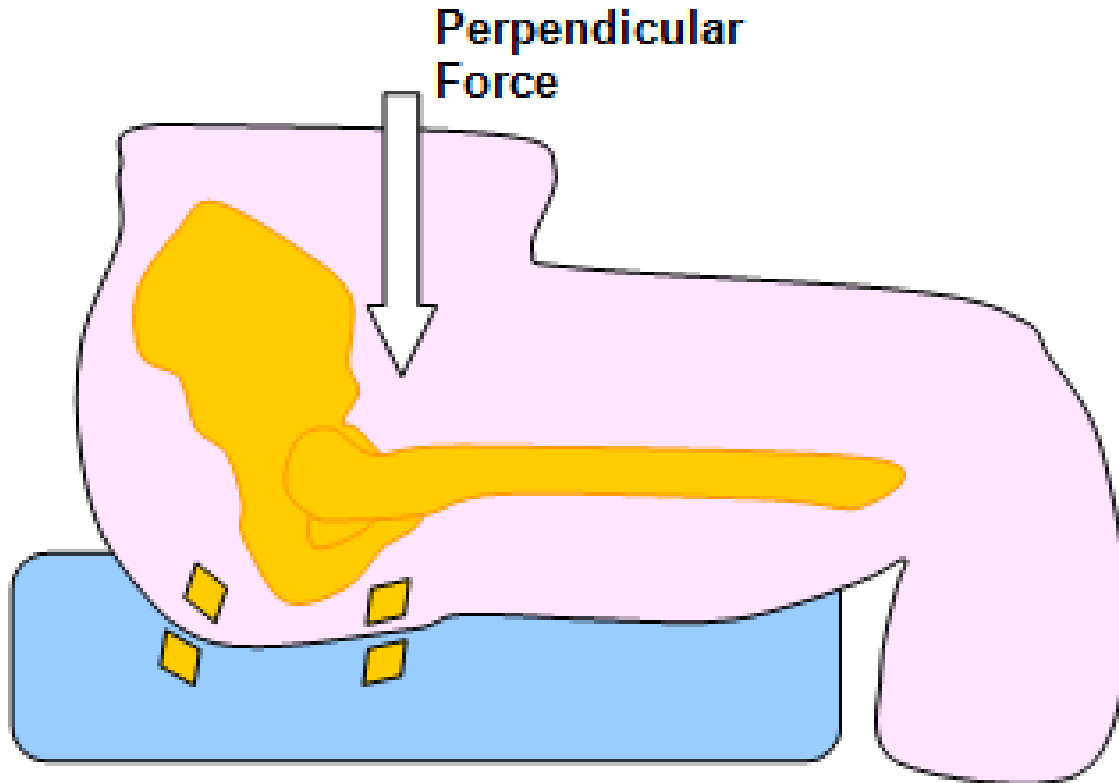


**Axial
Strain**

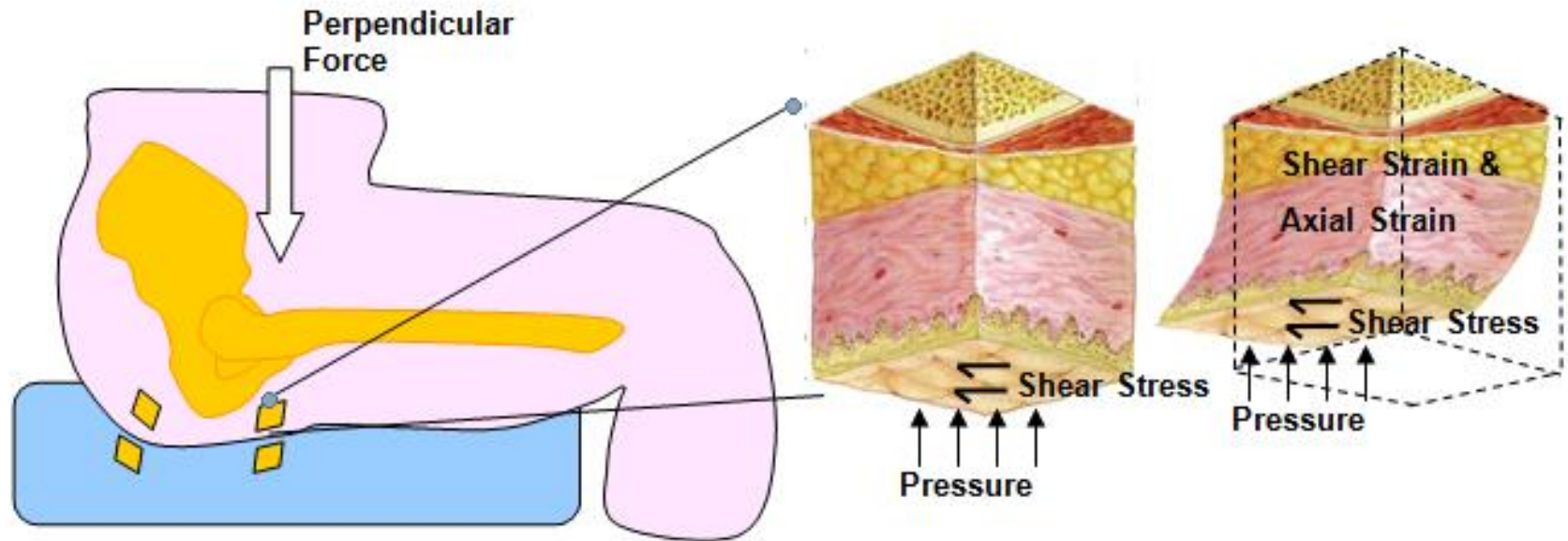


**Shear
Strain**

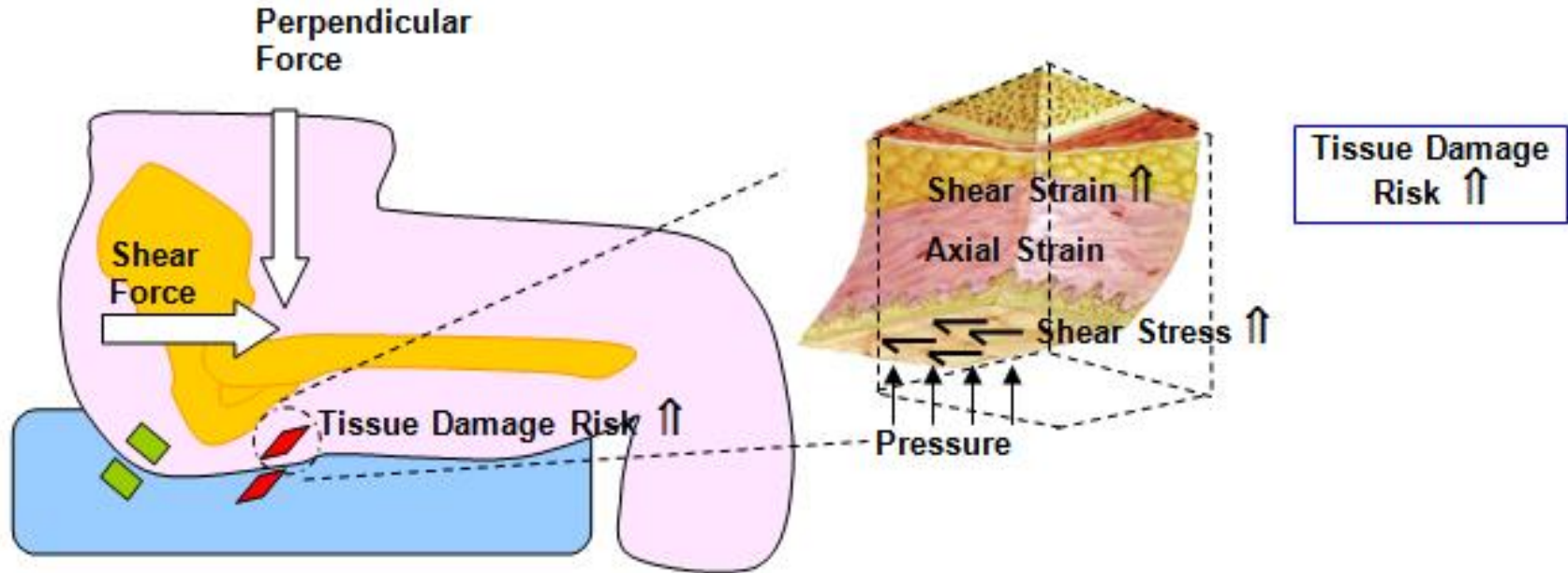
Pressure Distortions



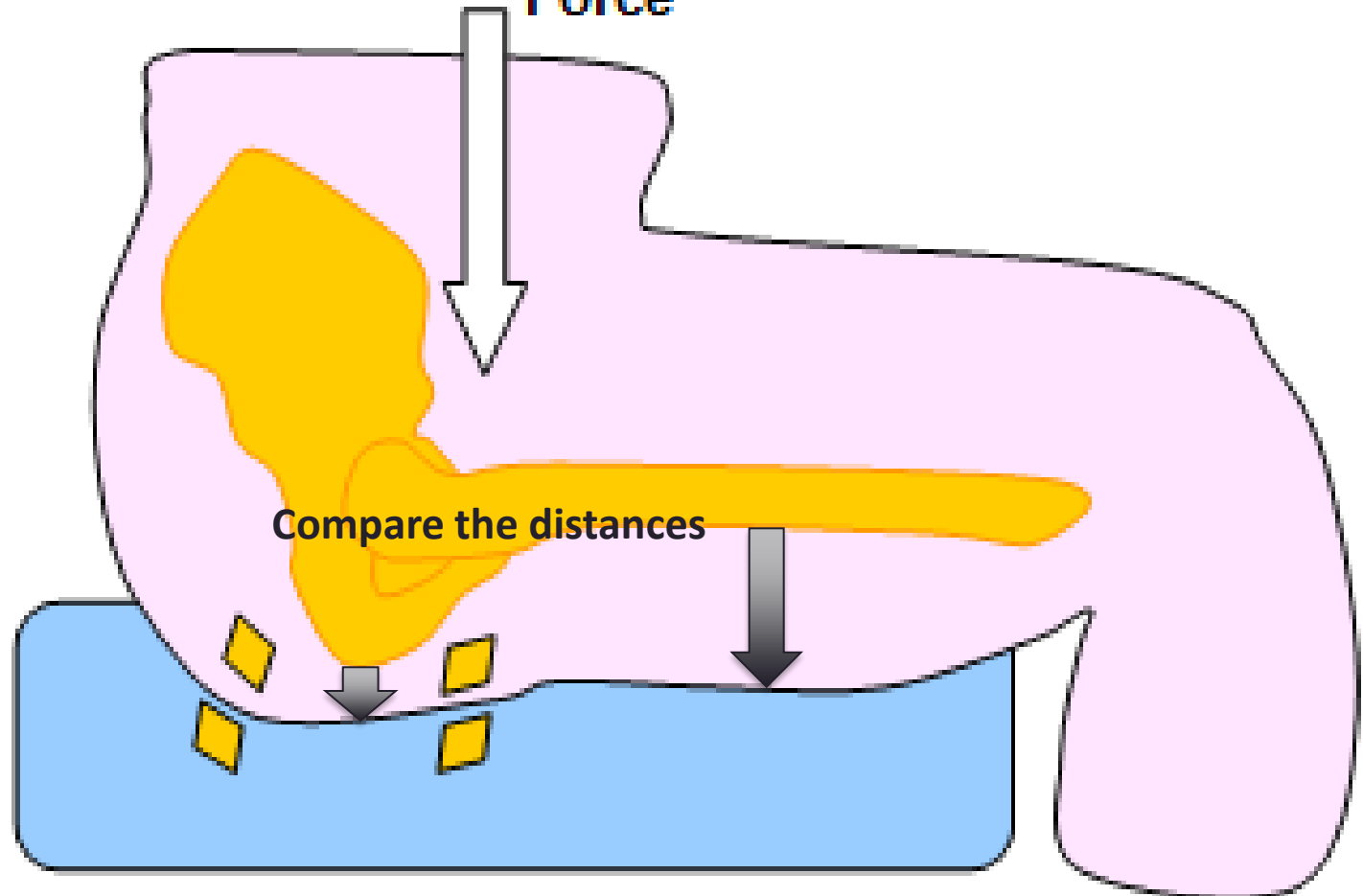
Pressure Distortions



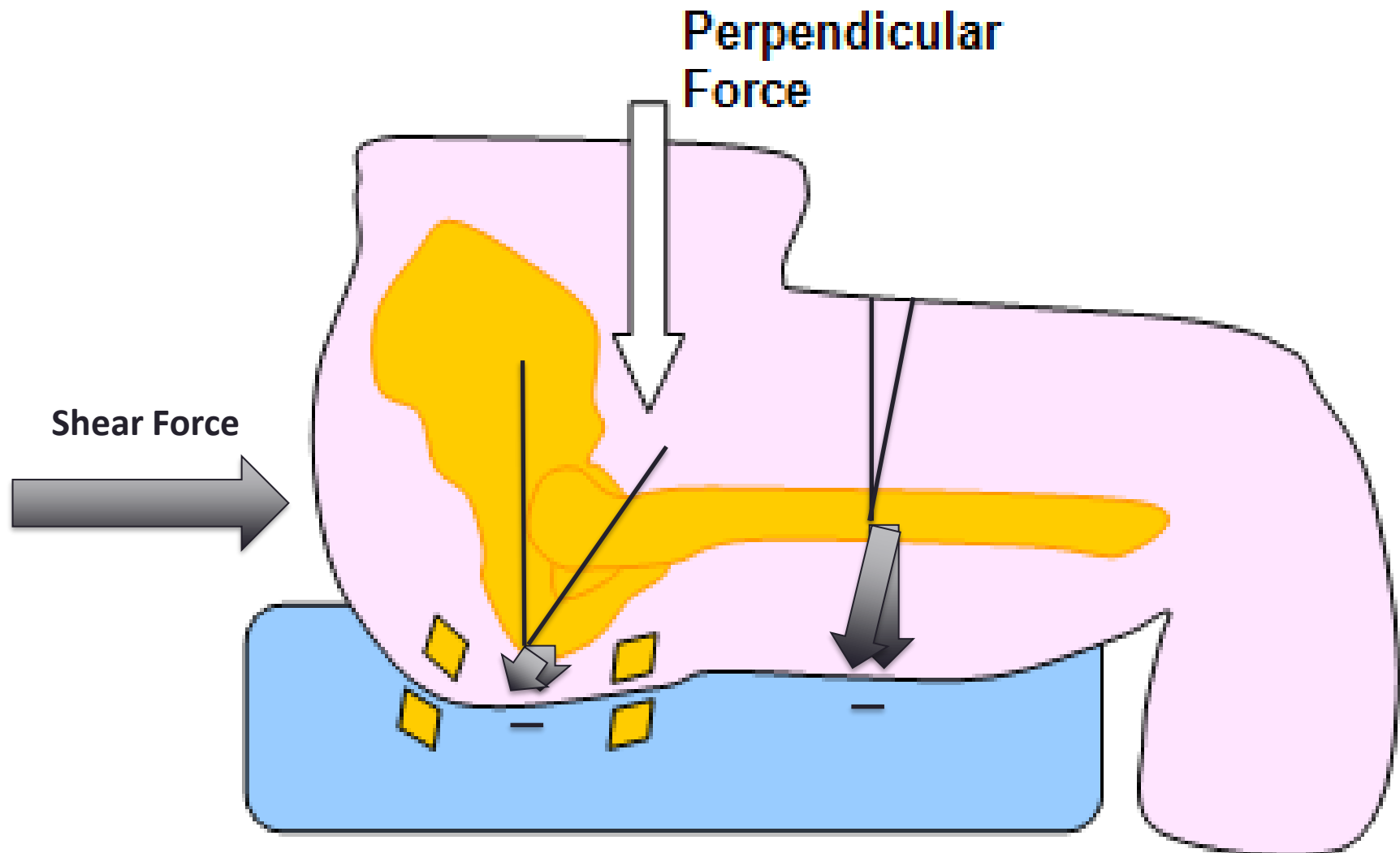
Pressure and Shear Distortions



**Perpendicular
Force**



Compare the distances



Gradient

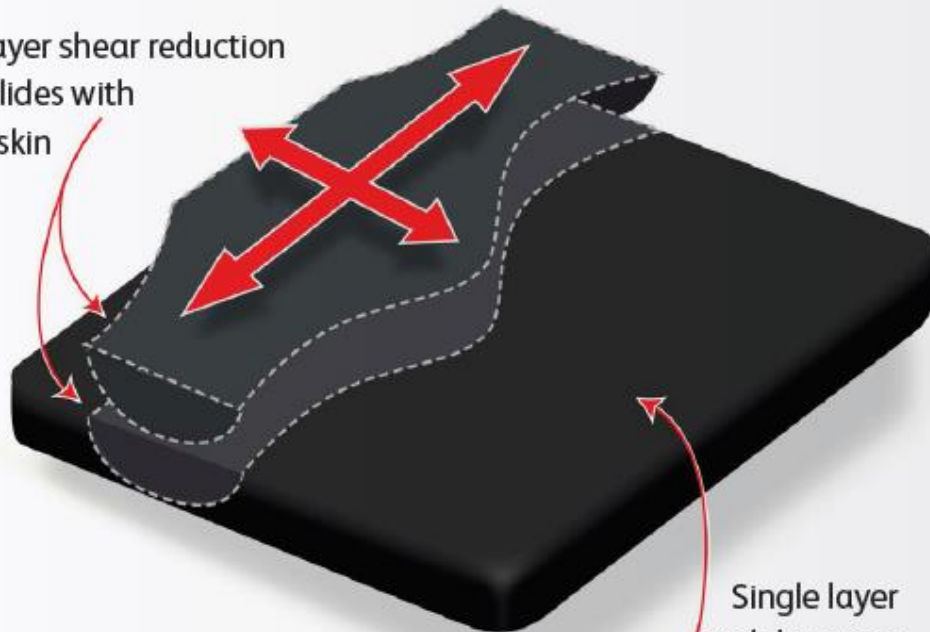
This has introduced an important aspect, and that is of the rate of change, or Gradient

Can we use materials that will reduce the gradient in the at risk areas?

GlideWear

Cushion cover





Dual-layer shear reduction
zone glides with
user's skin



Single layer
stability zone
enhances user's
positioning and control






What causes the damage?

Traditional view

-  Prolonged occlusion or deformation of capillaries, leading to
-  Limited blood flow – decrease in oxygen and nutrients, leading to
-  Cell ischaemia, leading to
-  Tissue necrosis

What causes the damage?

Current view

-  Shear forces distort cell walls (and blood vessels) leading to
-  Disrupted nutrient transport across the cell wall
-  Leakage of cell contents leading to
-  Cell death in first 24 hours
-  (Ischaemia takes 4-6 days)



Refs: Sustained cell deformation with increased loads (Ryan, 1990, Bouten, 2003, Stekelenburg, 2007, Gefen 2012)

What causes a pressure ulcer?

Modern view

Stage 1 – Epidermis and Stage 2 – Dermis


 Moisture

 Heat

 Friction

 Shear

Stages 3 and 4 – come from inside out

 Pressure and shear around bony prominences

An Important Rule of Thumb

What is close to the surface of the skin affects the surface of the skin

I.e.: What is in the outer layers of a support surface affects the dermis and epidermis

Conversely: What is deep in the support surface affects the deeper tissues of the person

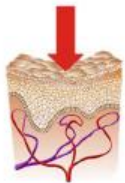
Modelling with Finite Element Analysis



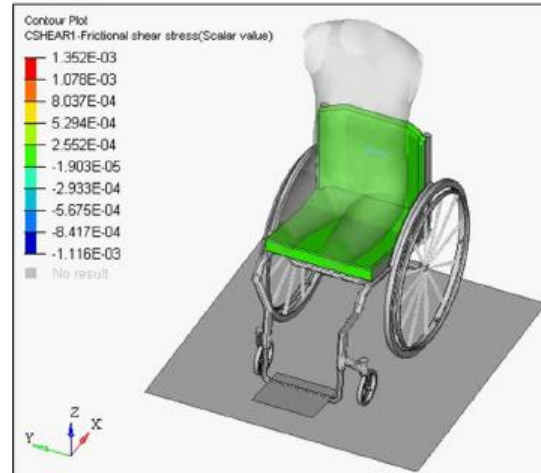
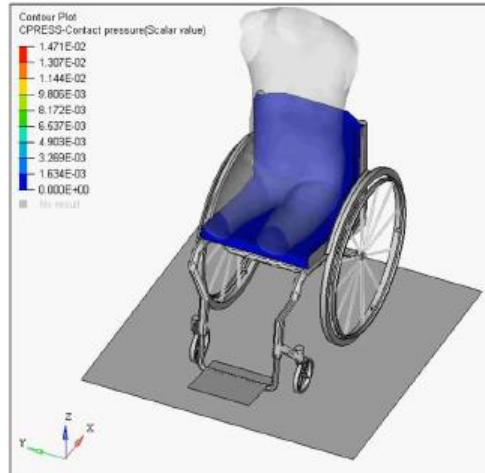
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FEA with 'Jo' – from Dr A Siefert



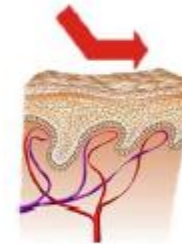
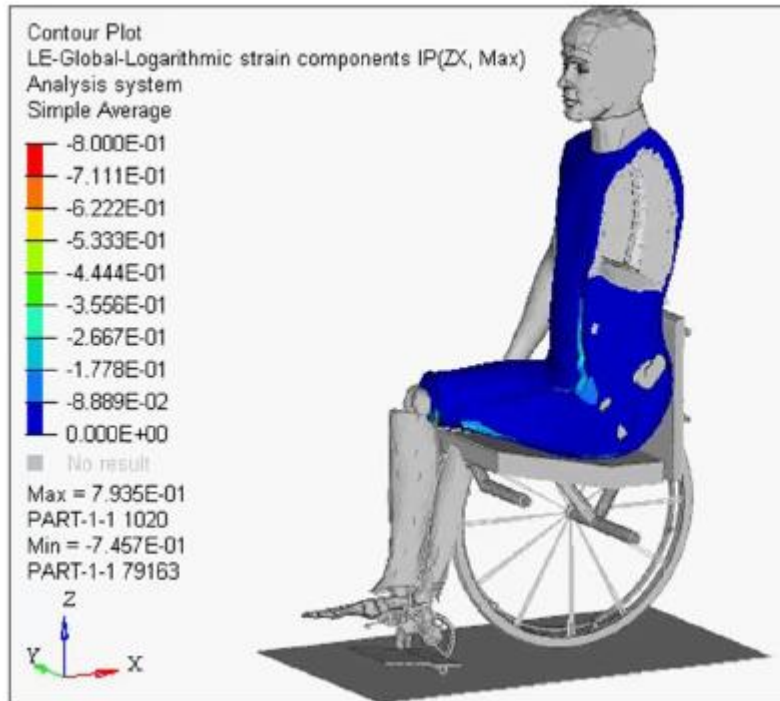
Pressure



Friction

Modelling with Finite Element Analysis

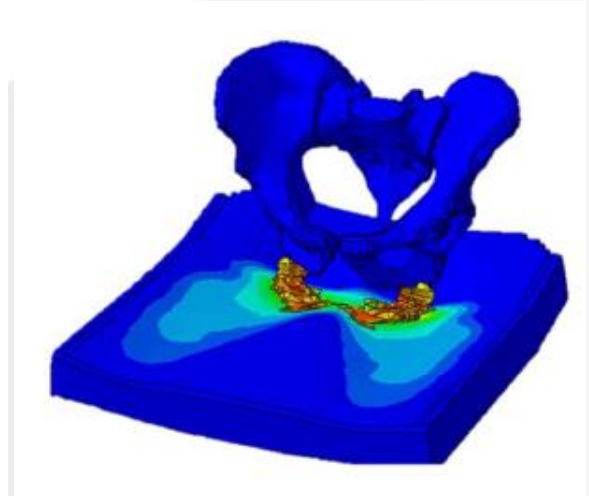
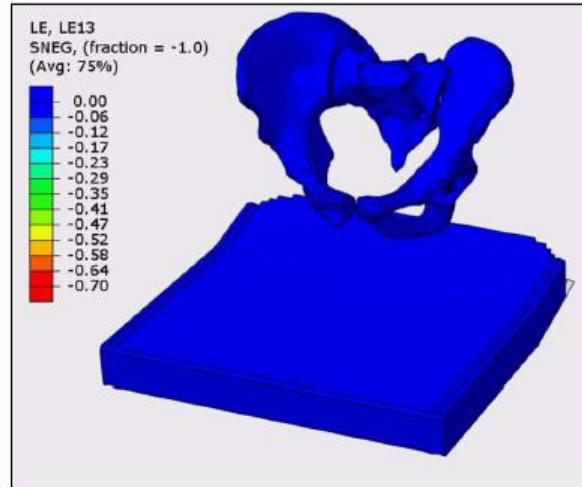
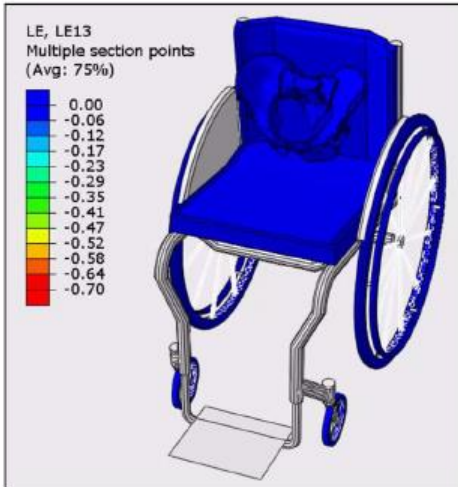
FEA with 'Jo'



Shear

Modelling with Finite Element Analysis

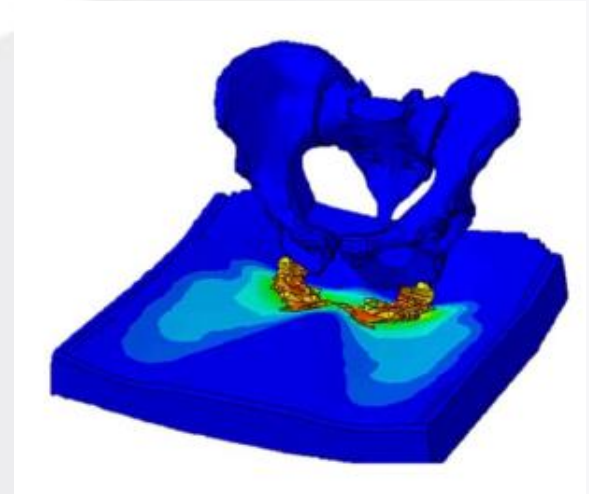
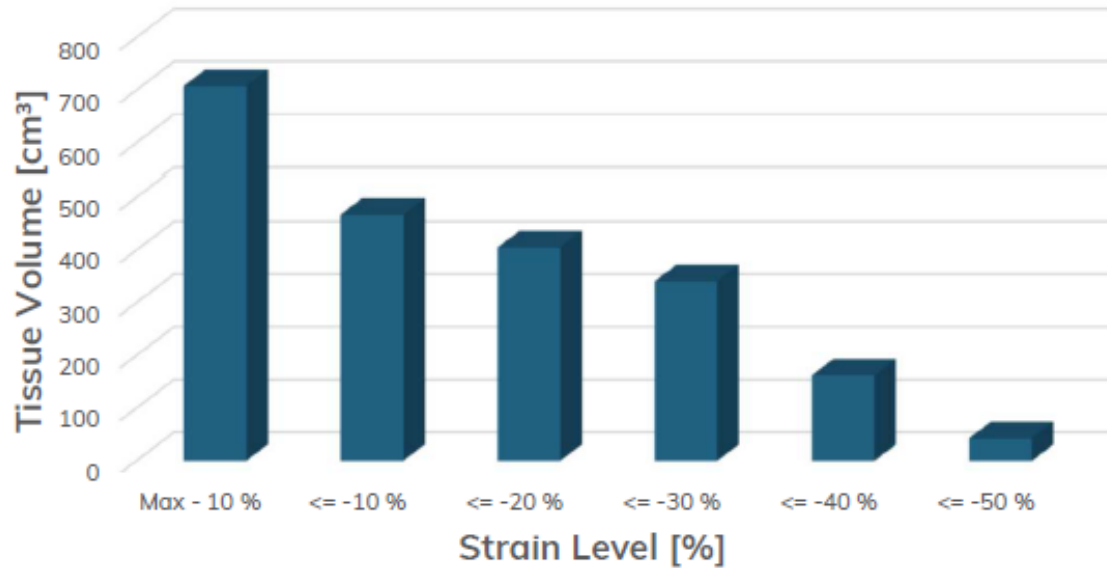
FEA with 'Jo'



Modelling with Finite Element Analysis

Effects of tilt in space

VSD Plot - Upright Seating



Tissue Integrity 4 - Microclimate

What is Microclimate??

The climate of a very small or restricted area, that differs from the climate of the surrounding area

It usually occurs under a bony prominence where pressure is at its peak

Microclimate is created due to excessive heat



and moisture



Tissue Integrity 4

Microclimate



Moisture

Increased humidity or skin surface moisture due to:

- sweat
- urinary or faecal incontinence
- drainage from wounds

Maceration

Increased friction and shear



Temperature

Cold affects capillary closing/opening

Heat affects metabolic rate and sweating

1°C increase in temp = 13% more metabolic demand

Consider the effects of the materials in your solutions

ISO 16840-7 Cushion Heat and Water Vapour Testing

The temperature and moisture level of the skin have both been shown to play roles in skin breakdown.



Materials

Pros and Cons



Foam



Air



Gels



Elastomers



Air-Foam



Covers



Moving onto Positioning











Posture and Positioning






What is Posture?

What does what is happening in one place reflect on what's happening elsewhere in the body?

Analyzing Posture

-  Part of physical assessment
-  Tools for assessment
-  What influences posture?
 -  Orthopaedic influences
 -  Sensorimotor influences
 -  Cognitive/Psychological influences
-  Posture varies - sitting is dynamic
-  Postural tendencies rather than posture

Tools to analyze posture

-  Hands/eyes/experience
-  Goniometers and measures
-  Functional scales
-  Cameras
-  **Butt prints**

What's this Butt print thing?





Recording Butt Prints



Latest technology: BodiTrak

Plug and play straight out of your bag



IPM use leads to improved outcomes

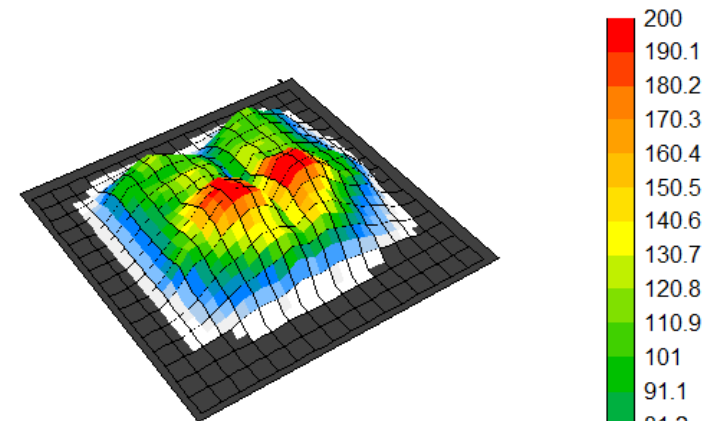
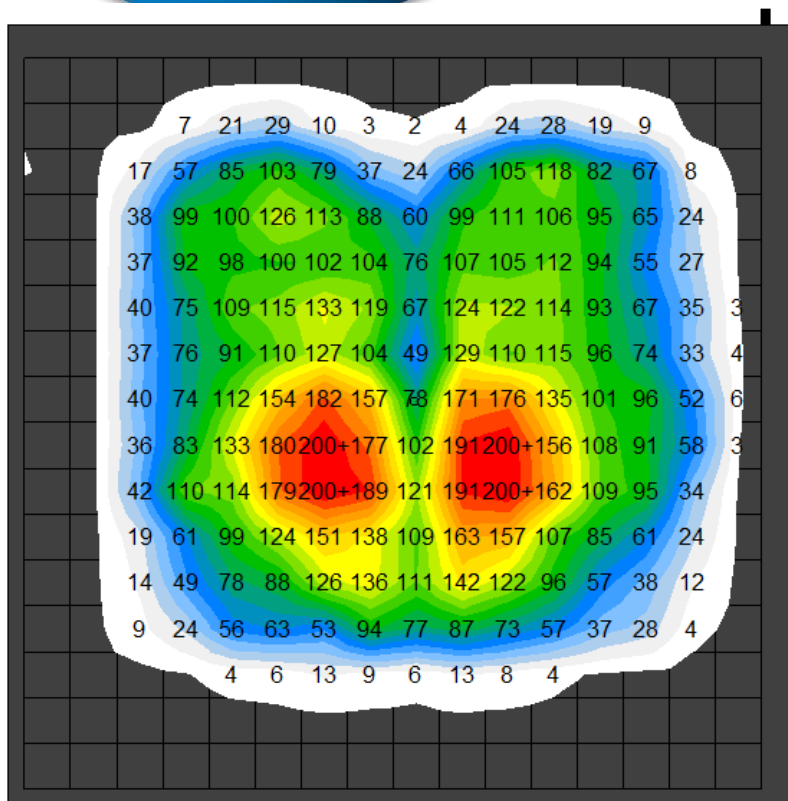


Supporting your needs

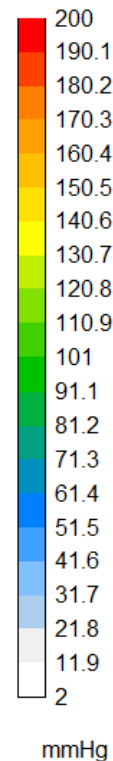
Data from cushion study showed that on clinical judgement on its own, 21% developed pressure ulcers, while clinical judgement plus IPM, only 9% (Allegretti et al 2009)

In an ICU, no use of IPM on 320 people: 16 Stage 2+
With IPM: 307 people: 1 Stage 2+ (Siddiqui et al 2013)





Pressure Distribution View



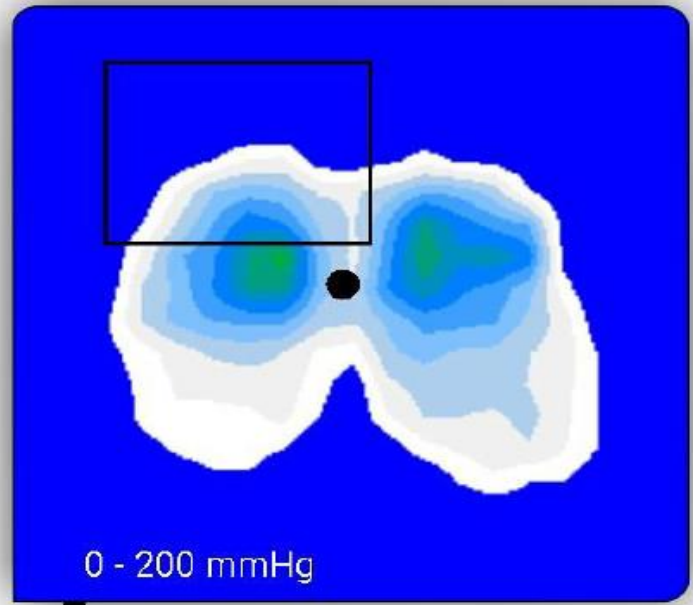
Maximum (mmHg)	200.00
Average (mmHg)	53.57
Minimum (mmHg)	0.00
Sensing area (cm ²)	2070.25
Standard deviation (mmHg)	57.71
Coefficient of variation (%)	107.74



A Rehabilitation Tool

-  **Educate** user, family, team members on the location, magnitude and rate of change of pressure
-  Bring it 'alive': makes pressure **visible**
-  **Train** for the most effective weight shift
-  **Record** impact of wheelchair interventions on pressure distribution *or is that posture?*

Snapshot



Dispersion Index: 12.8% Sensing Area: 364.2 in²
Peak Pressure 78.2 C of V: 54.5%
Index:

Risk

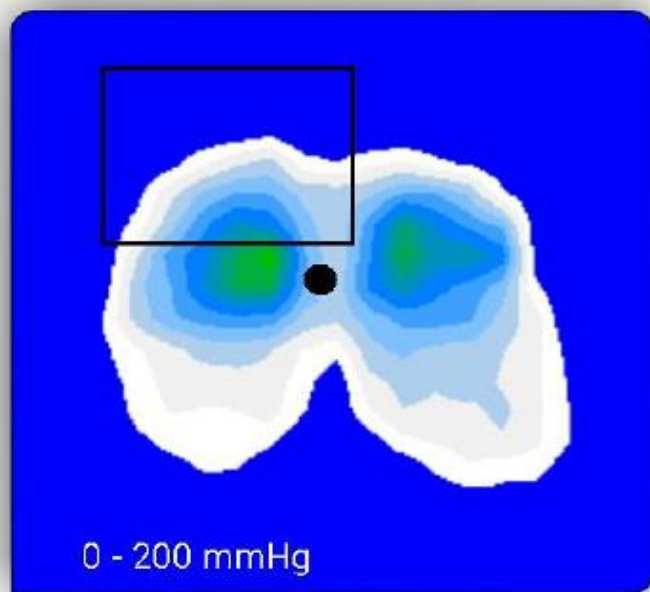


Start Timer 0:00:00

Gradient



Start
Comparison



Dispersion Index: 14.8% Sensing Area: 379.7 in²
Peak Pressure 87.4 C of V: 56.4%
Index:

Risk

Gradient



Start Timer

0:00:00

Positioning 1

The Pelvis



Rotation in 3 Dimensions

Sagittal – posterior/anterior tilt

Frontal – obliquity

Transverse – rotation



Fourth Dimension – Time



Sitting is an activity








Active vs Passive sitting

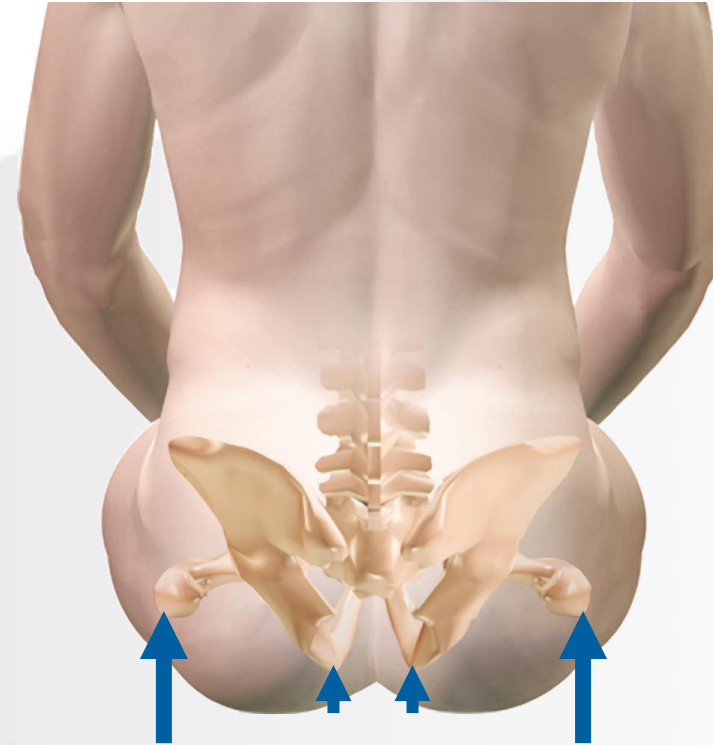


Stability vs Comfort vs Function

Positioning 1

The Pelvis

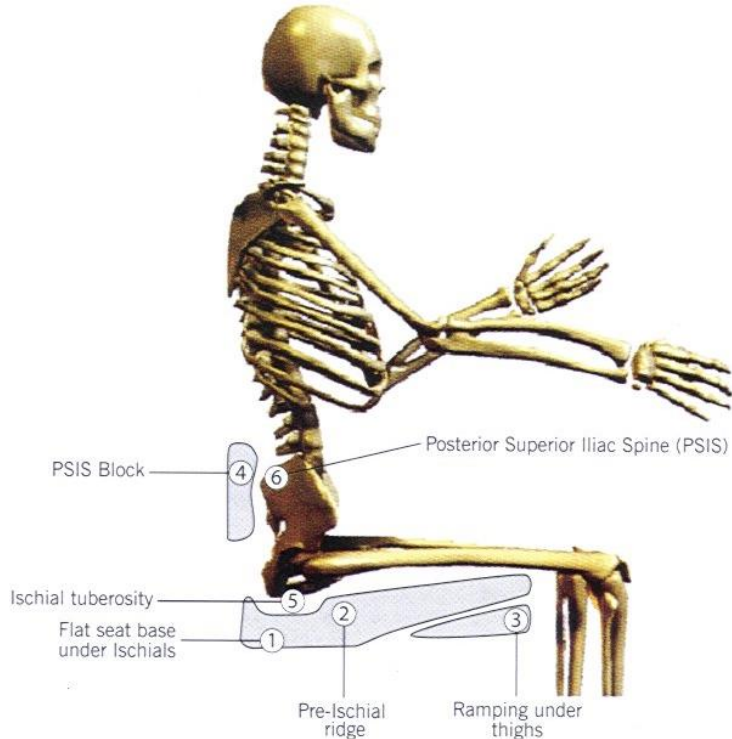
-  Stability vs Comfort vs Function
-  How broad is the base of support:
-  ITs 11-12cm apart
-  GTs 33cm apart
-  How dense is the material at the point of support



Positioning 2

Posterior Tilt Management

3 points of control
PSIS block
Pre-ischial ridge



Appropriately placed belt

Positioning 2

Appropriately placed belt

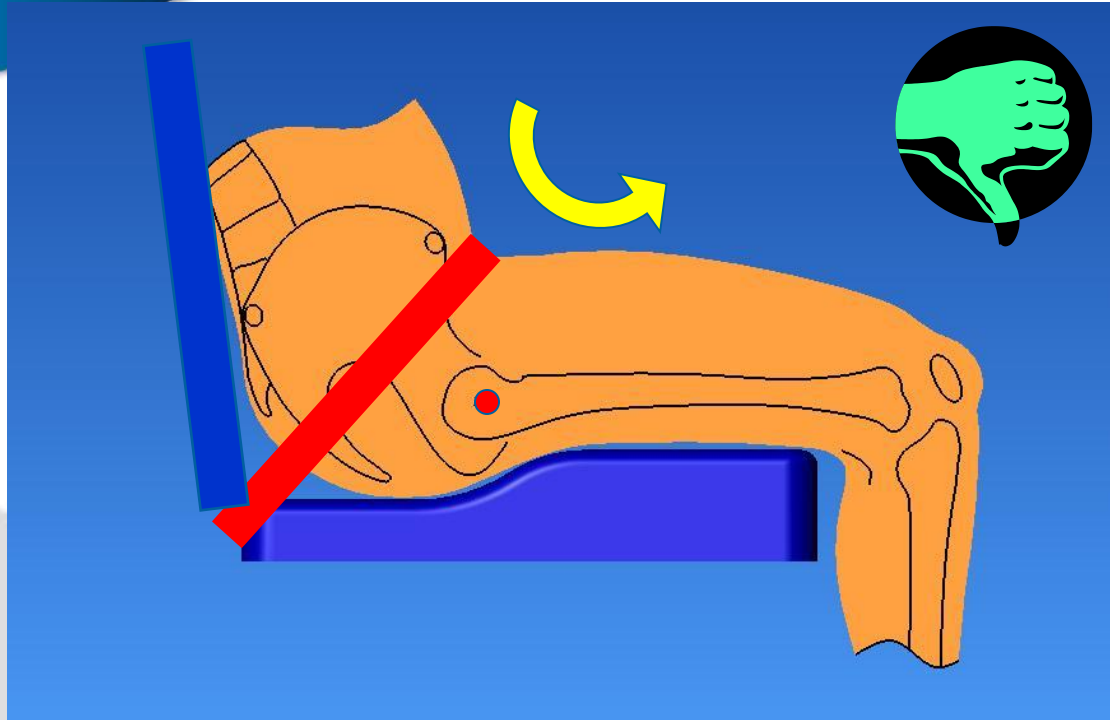
Data obtained from MHRA in the UK:

4 deaths from inappropriately fitted belts

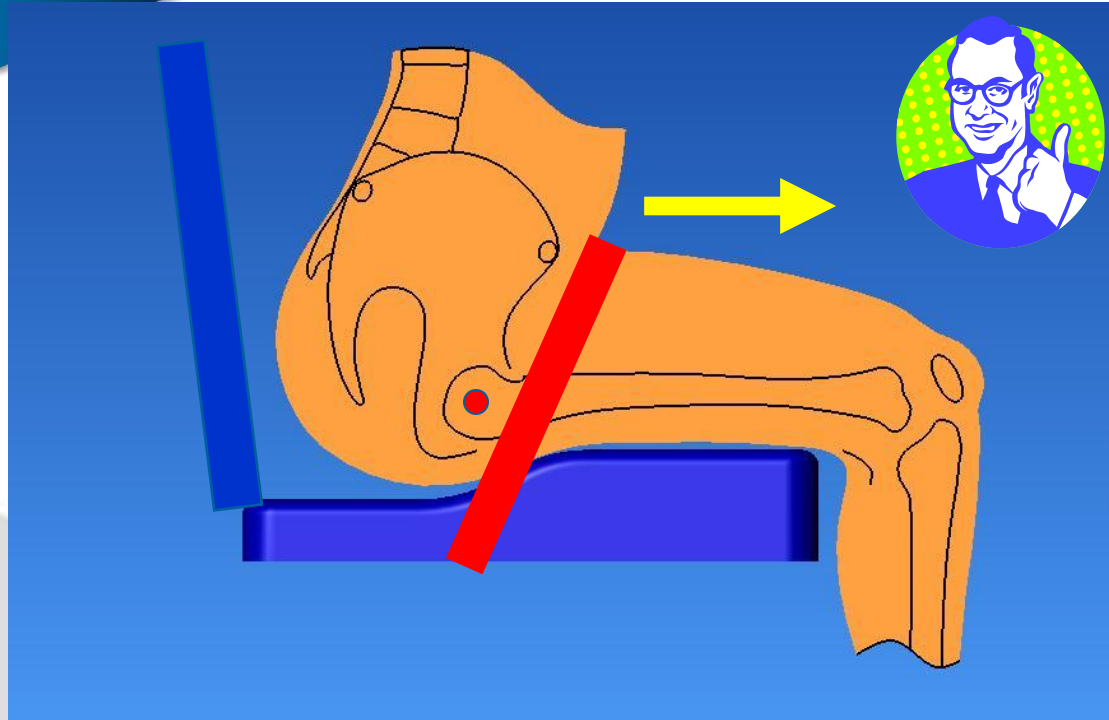
17 serious injuries

New standard: ISO 16840-15 Selection, placement and fixation of flexible postural support devices in seating

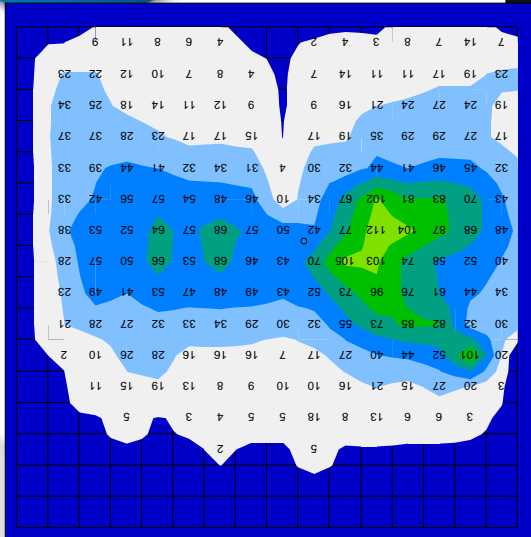
Typical 45° Belt



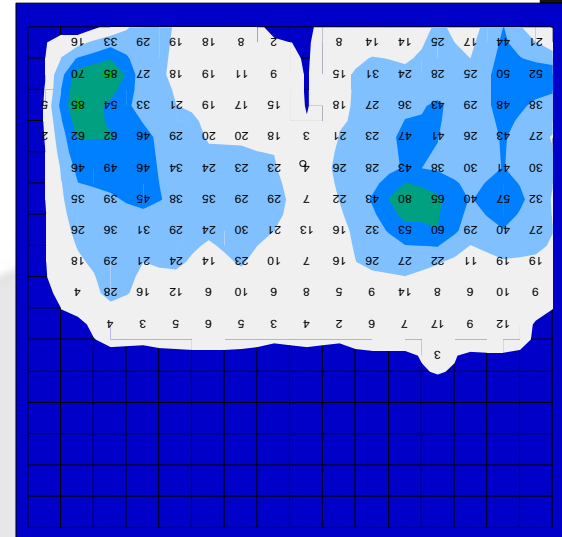
Positioning Belt in Front of Greater Trochanters



The Evidence








Reaching with belt mounted at 45°




Reaching with belt mounted at 60°

Positioning Belt in Front of Greater Trochanters

Benefits

-  1. Reduced pressure on Ischial Tuberosities
-  2. Ability to off-lift pressure on ITs
-  3. Greater reach and functionality
-  4. More secure positioning
-  5. Less shear strain on skin tissues

-  Remember: these are POSITIONING belts and not restraints

Positioning 3

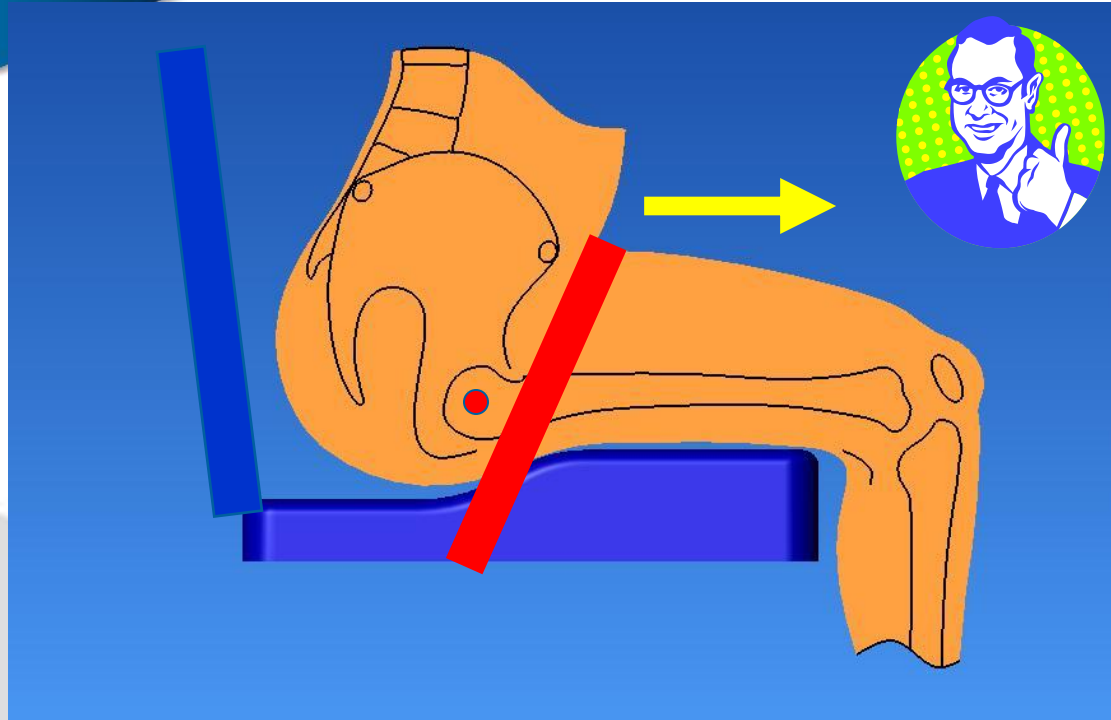
Obliquity

Compensation or correction?
On its own or with another element?
Appropriate seating

Appropriately placed belt



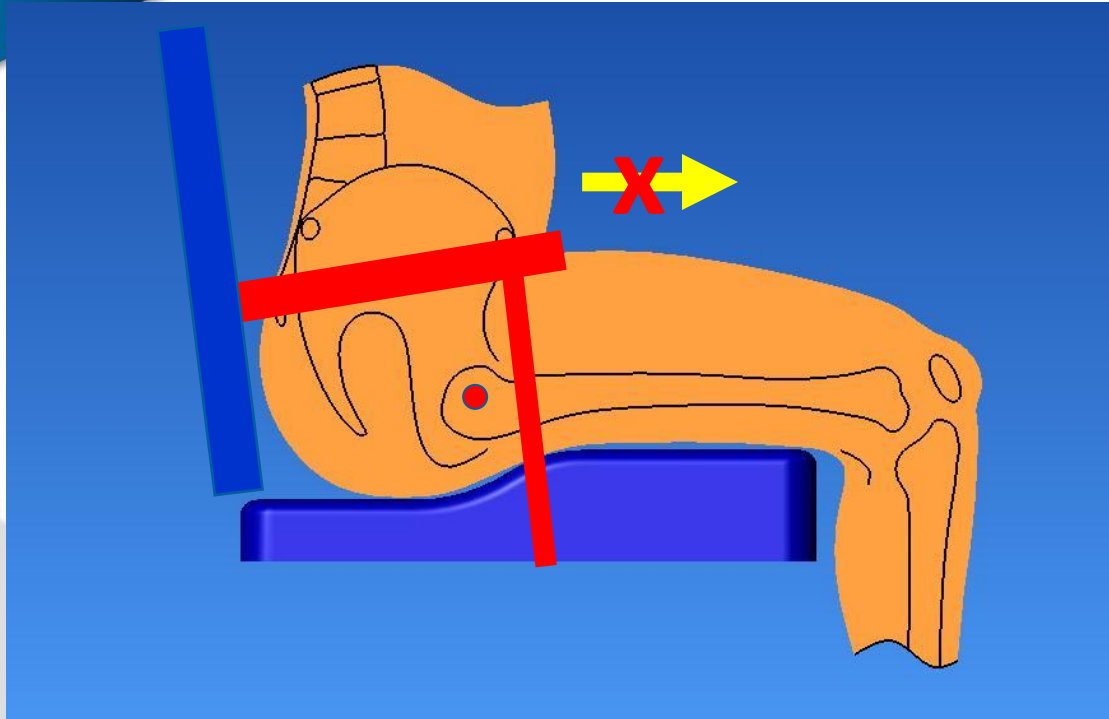
Positioning Belt in Front of Greater Trochanters



Rear-pull Belt?

Positioning 4




Anterior Tilt



4 Point Belt

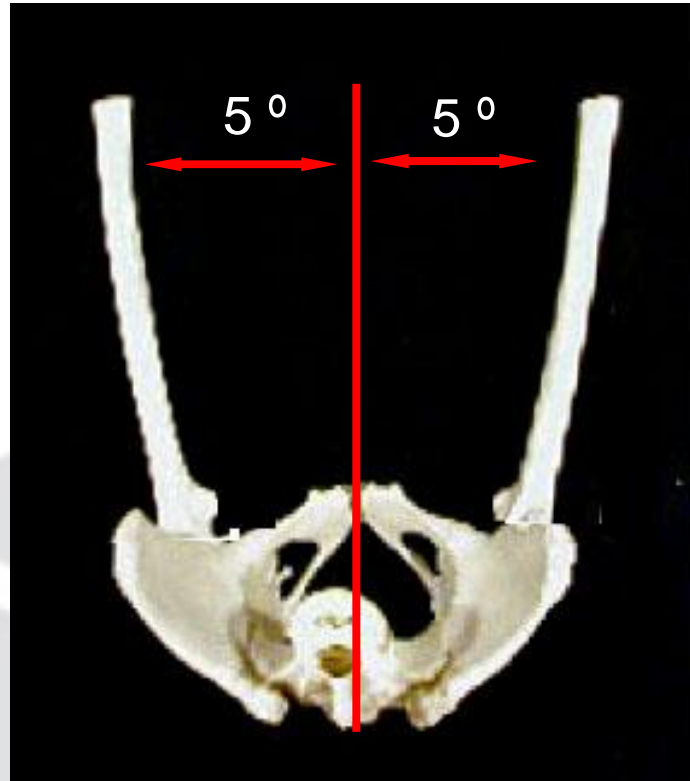
Positioning 5

Rotation

-  Correct sized chair
-  Thigh troughs
-  Femur abduction angles



Neutral Hip Joint Alignment: 5 degrees of abduction

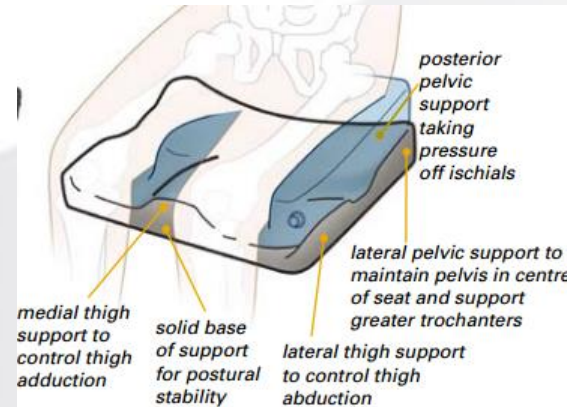


Positioning 5

Rotation

☞ Lateral and medial supports

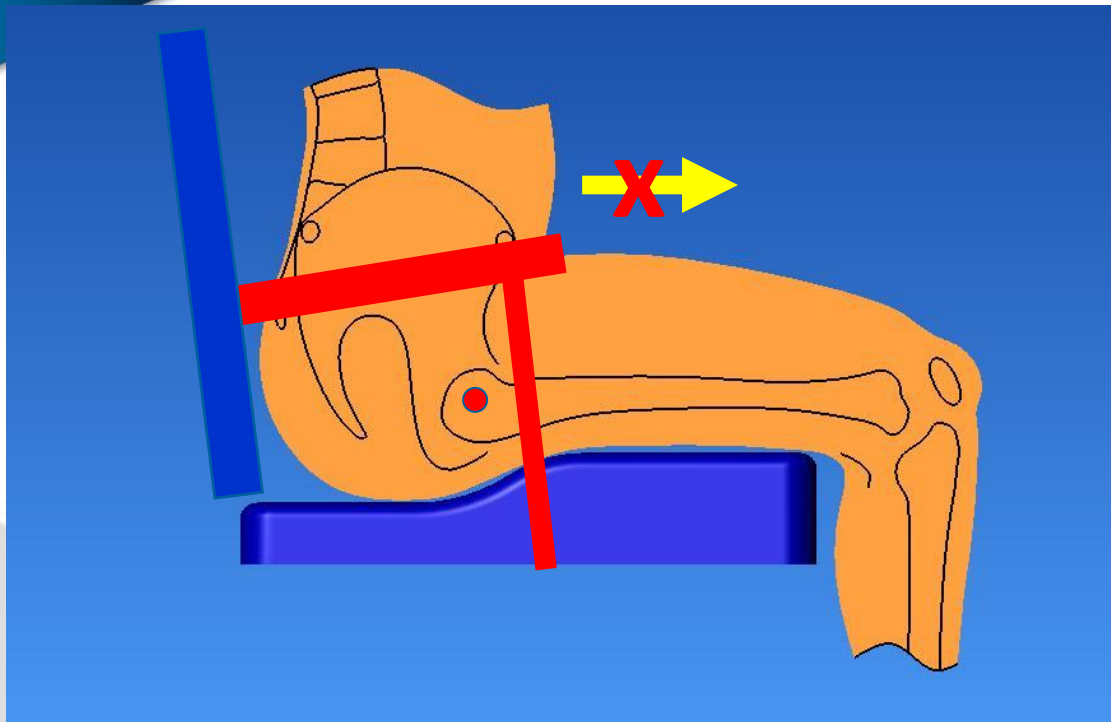
☞ Posterior support











☞ Appropriately placed belt

Controlling Rotation

4 Point belt



Functional Considerations

-  Cushion weight
-  User weight
-  Comfort
-  Removability
-  Maintenance
-  Cleanability
-  Fatigue Reduction/Vibration Dampening
-  Durability

The Check List

Transfers
Friction
Shear
Pressure Redistribution
Microclimate (Heat/Moisture)
Fail Safe
Adaptability
Preischial Ridge
Gluteal support
Trochanteral Ledge
Lateral support
Thigh abduction
Stability

Cushion weight
User weight
Ease of transfers
Comfort
Removability
Low Maintenance
Cleanability
Fatigue Reduction/Vibration Dampening
Durability

Cushions from Varilite

Meeting Criteria



Supporting your needs

Varilite Evolution










Air-Foam Mix



Varilite Evolution








Tissue Integrity

-  Dispersion
-  Immersion
-  Cover choice
-  Stretch covers
-  Air and water vapour dissipation
-  Temperature balance
-  Fail Safe

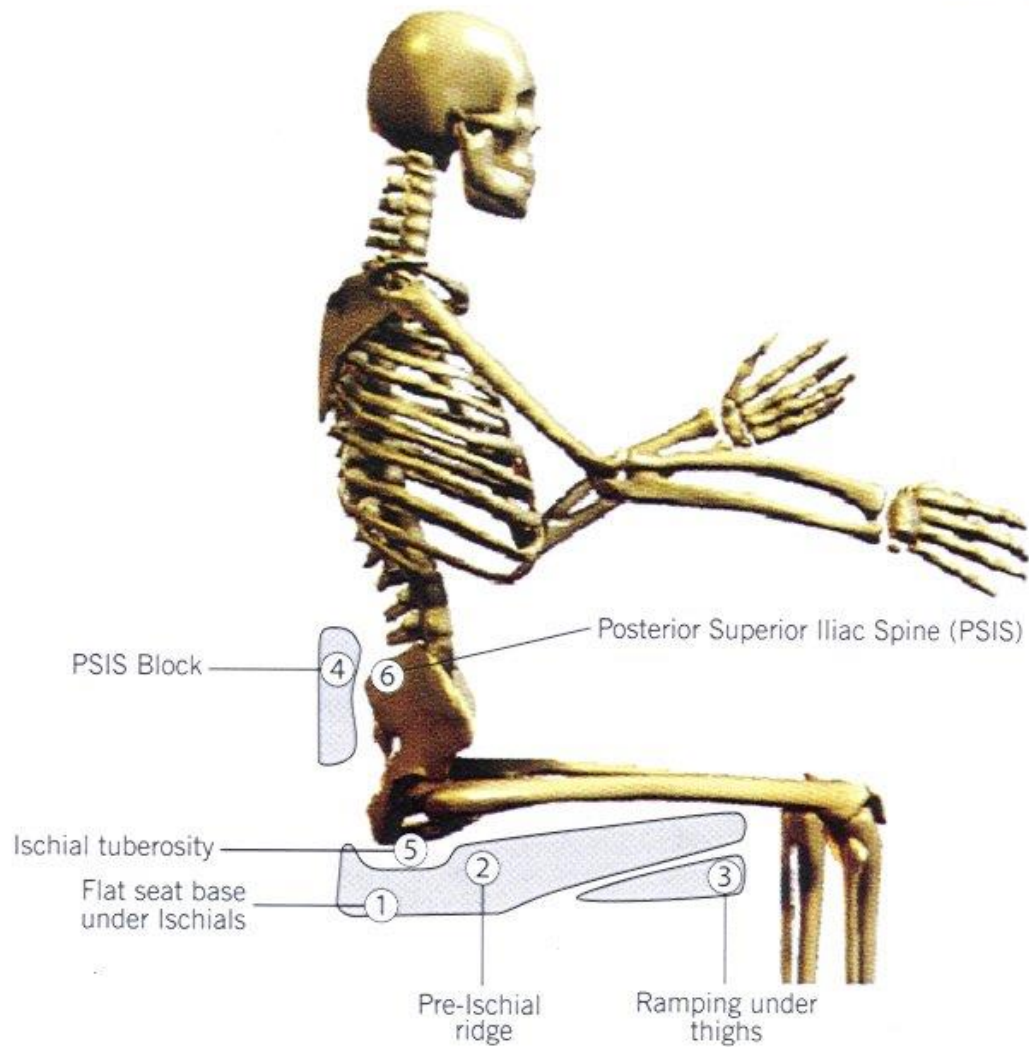


Varilite Evolution

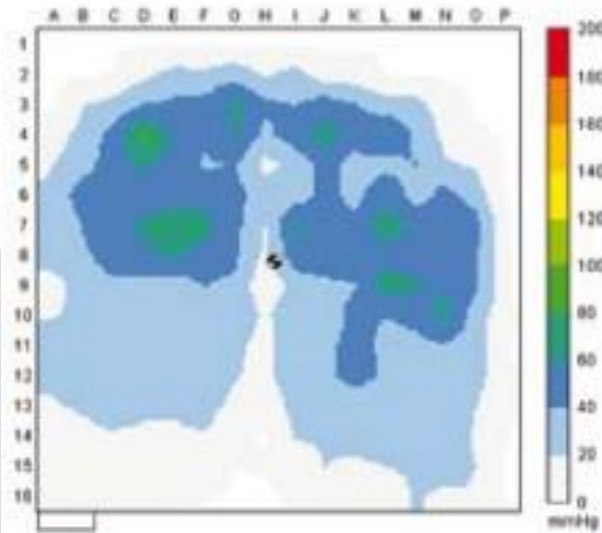
Posture

-  Lateral support
-  Trochanteral ledge
-  Posterior (Gluteal) support
-  Thigh abduction
-  Pre-ischial ridge
-  Stability
-  Neutral Pelvis

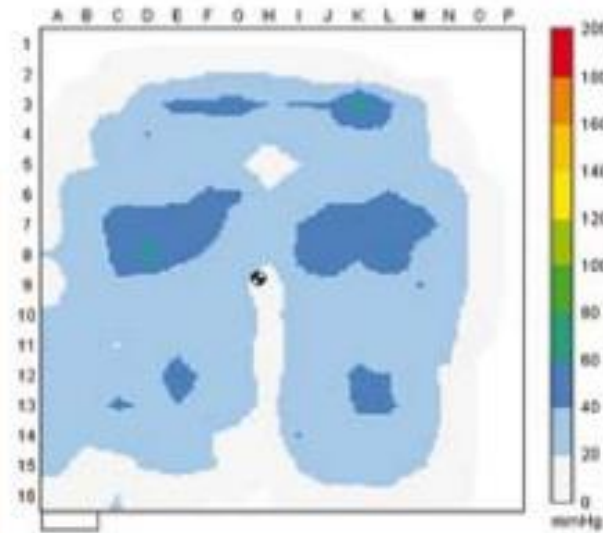




Benefit of wedge




FSA pressure map without Wedge



FSA pressure map with Wedge

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



Varilite Evolution



Supporting your needs

Setting up the cushion

Options

Standard vs PSV Valve

Wave Bases

Meridian

Varilite Reflex





Air-Foam Mix



Self Adjusting



Varilite ProForm

-  Customisable Off-The-Shelf
-  Air-Foam mix



Varilite ProForm



Can be adapted to accommodate:

Obliquities

Surgery of the pelvic area

Leg length discrepancies

Foot propellers

Wind-sweeping





Using Varilite Cheat Sheets for minor adaptations








Cushions from HIA

Meeting Criteria

-  **From the simple to the more complex:**
 - Varilite Reflex
 - Varilite Evolution
 - Varilite ProForm
-  **Meeting Tissue Integrity, Posture, and Functionality Criteria**
-  **Options for all budgets**

Further Information

-  Article in HIA Seating catalogue: “What are you looking for in a cushion?”
-  Booklet: “What makes a good cushion?”
-  website: www.hiaus.net.au
-  sales@hiaus.net.au
-  barend@beshealthcare.net

Sitting is an activity

Seating solutions discussed so far are static

We are not static when we are seated

Where and when do we need to provide dynamic personalised solutions?

Dynamic seating



Supporting your needs

Protect the equipment

Protect the occupant

Passive assistance

Active assistance

Neurological and neuromuscular disorders



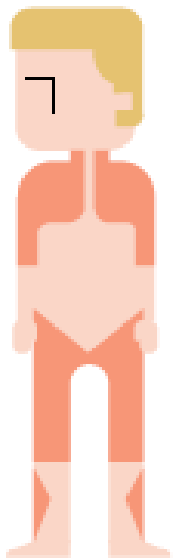
Supporting your needs

Greater tendency to fatigue as day progresses

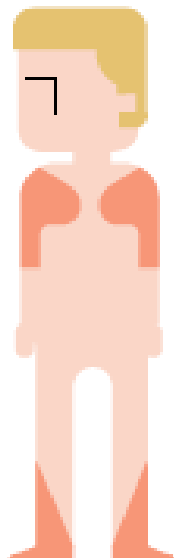
Multiple sclerosis

Muscular dystrophies

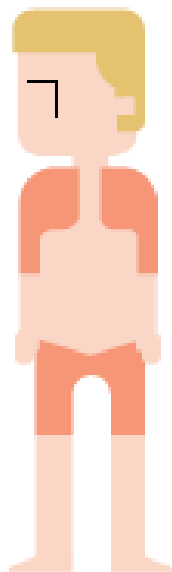
Early life muscular dystrophies



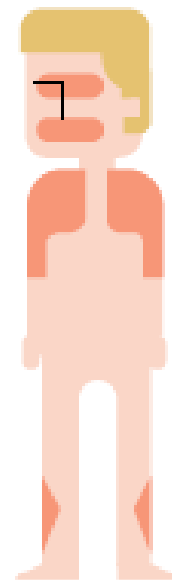
Duchenne and
Becker



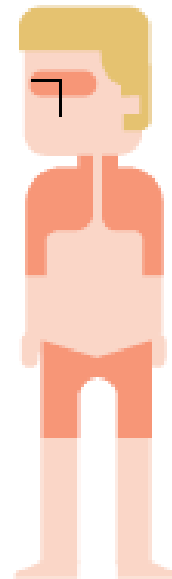
Emery-Dreifuss



Limb Girdle



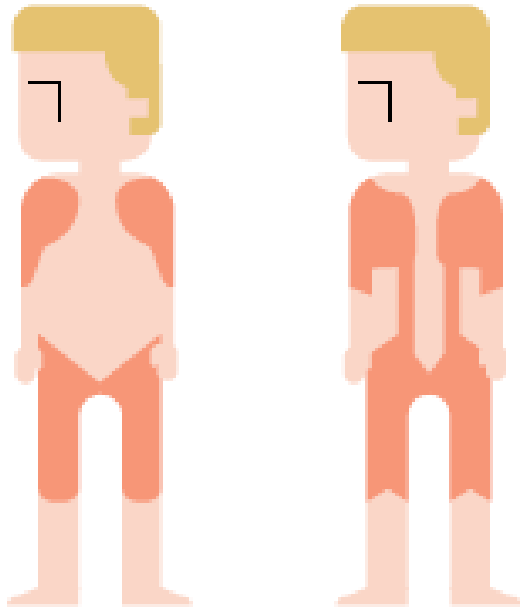
Facioscapulohumeral



Oculopharyngeal

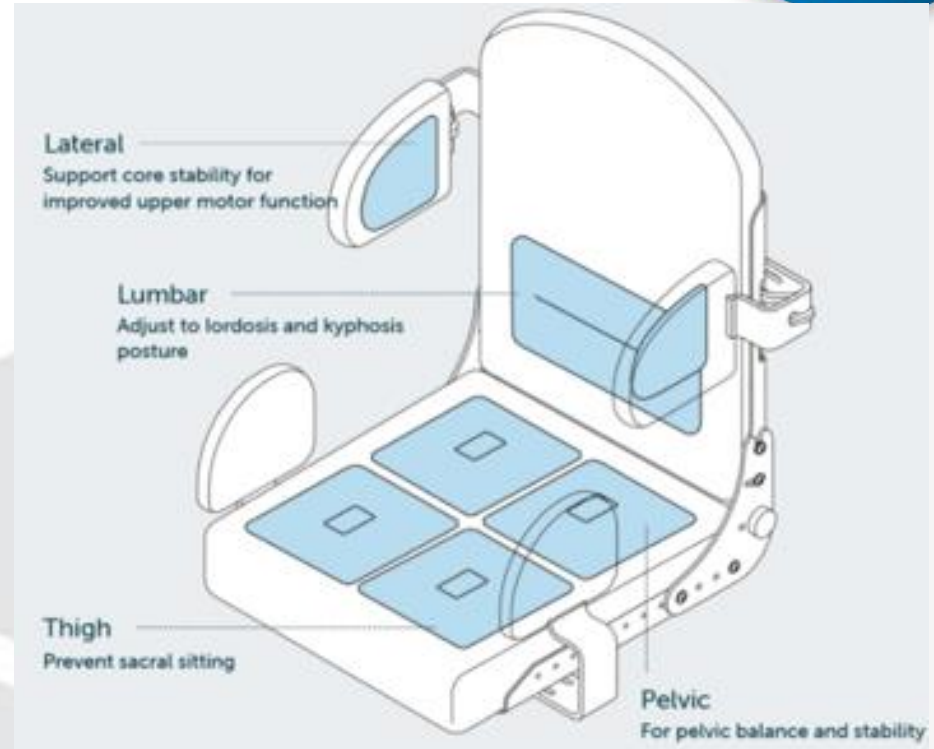
Early life muscular dystrophies

Spinal Muscular Atrophy



SMA is caused by a deficiency of Survival Motor Neuron (SMN) protein, and effects weaknesses in muscles closest to the centre of the body: shoulders, hips, thighs, and upper back.

Aergo PS provides active dynamic support



Dynamic postural management



Starting point: Prescribed setting by clinician



Sensing postural deviation

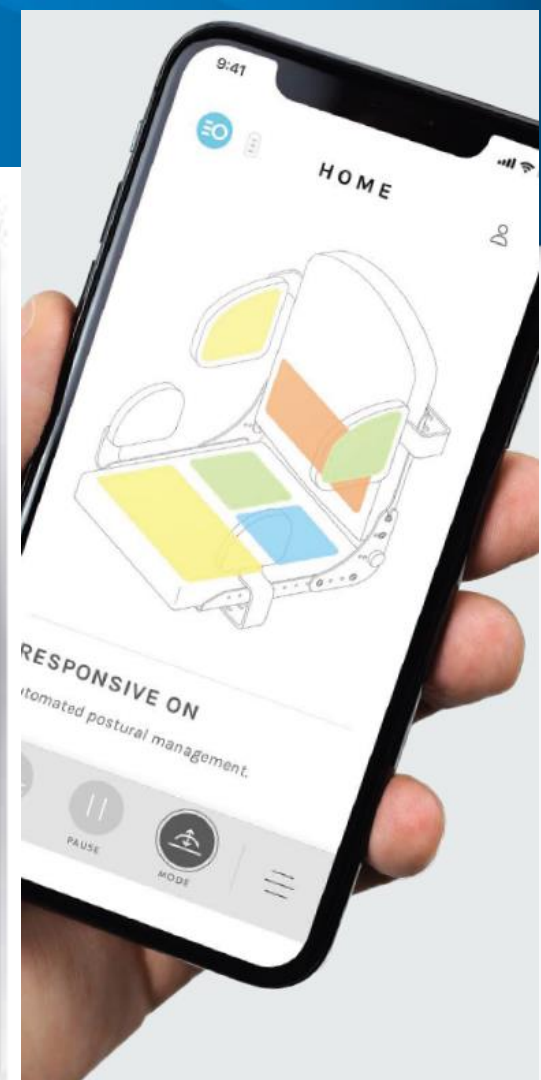
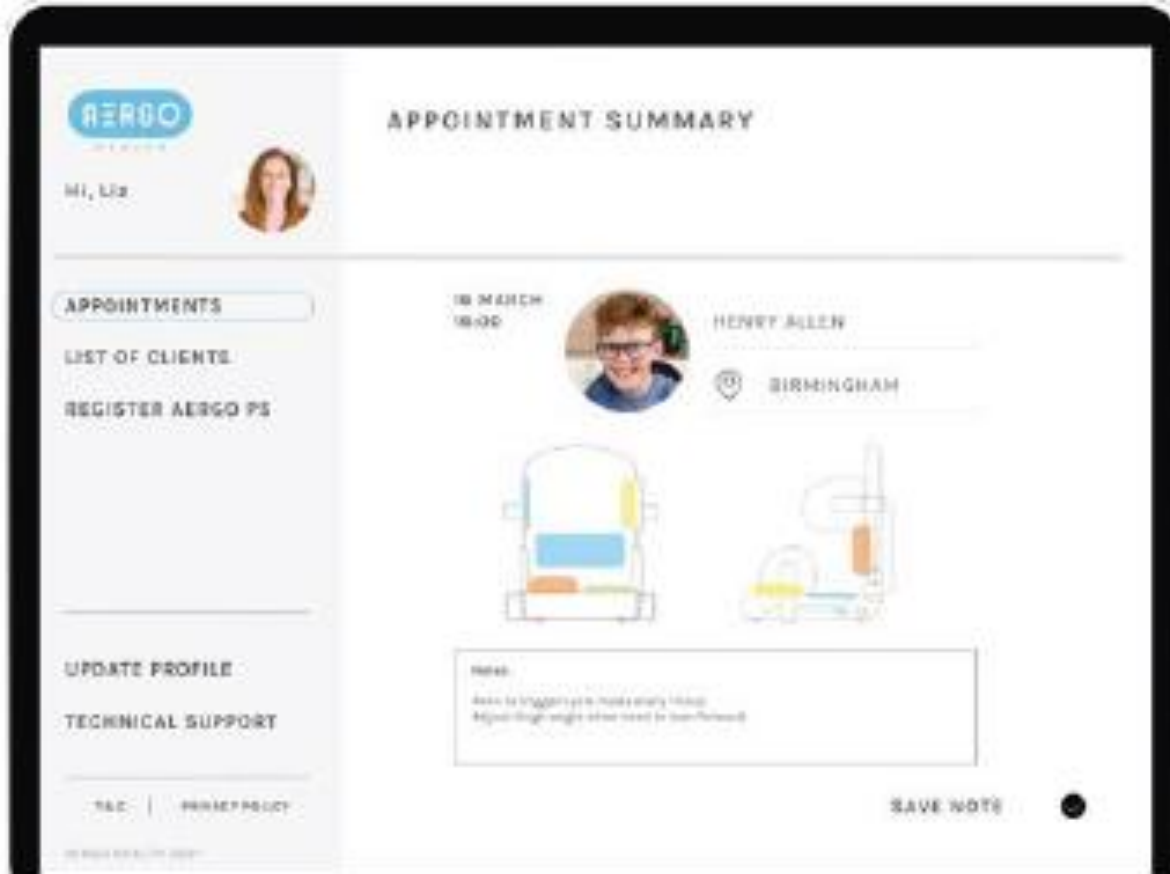


Adjust inflation to correct deviation



Monitor and reactive management

Telehealth and patient interfaces



Further Information



Supporting your needs

 sales@hiaus.net.au

 barend@beshealthcare.net