

Beyond Pressure

What does pressure mapping really tell us?

Dr Barend ter Haar Bristol, UK

IPM use leads to improved outcomes



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)

Terms

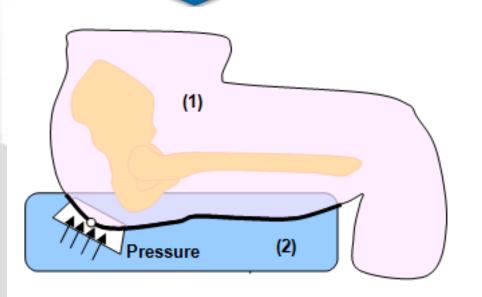
Pressure vs Shear

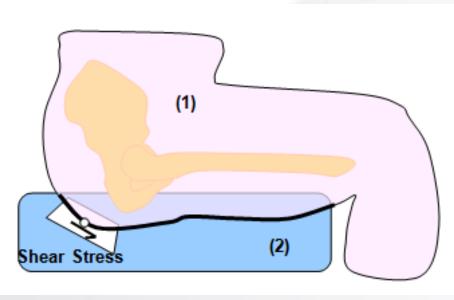




Terms Pressure vs Shear Stress

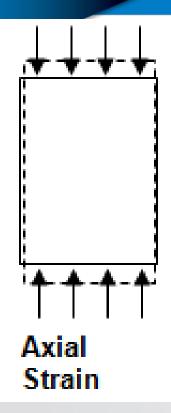


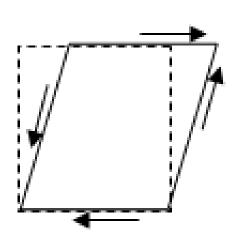




Strains Axial vs Shear



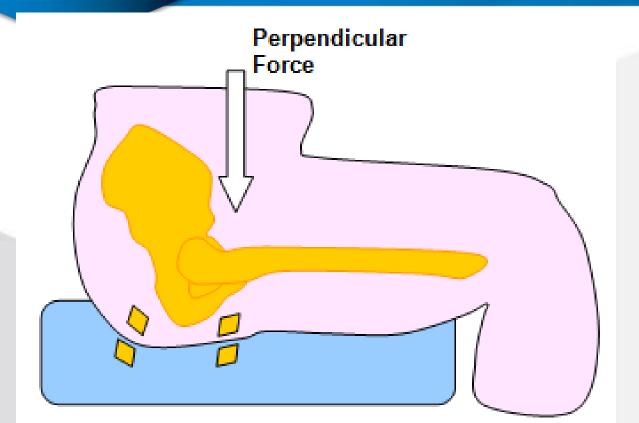




Shear Strain

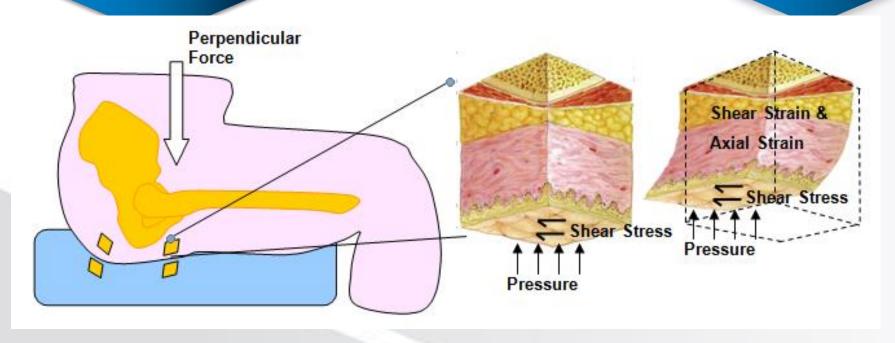
Pressure Distortions





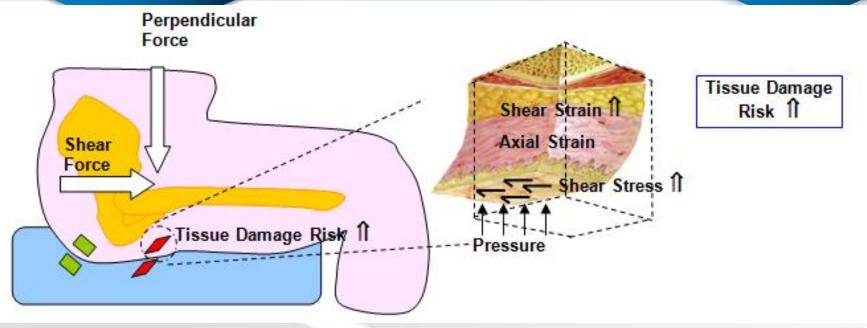
Pressure Distortions

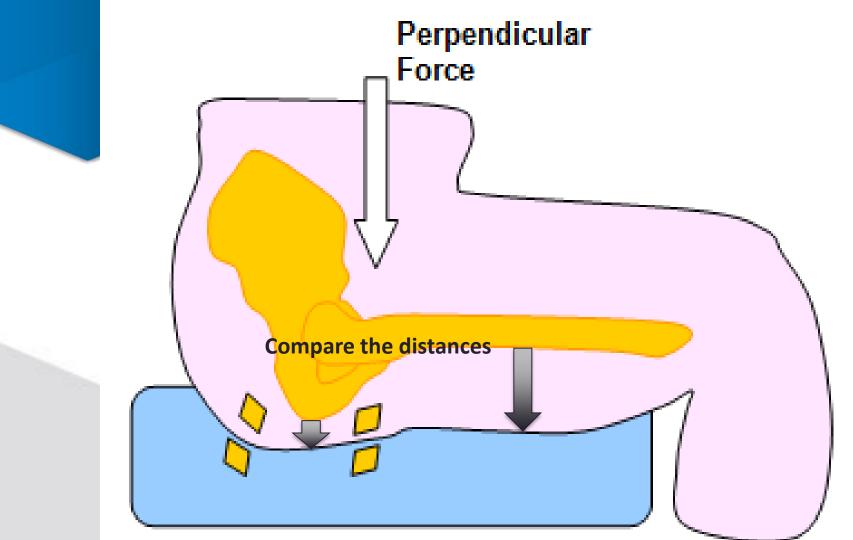


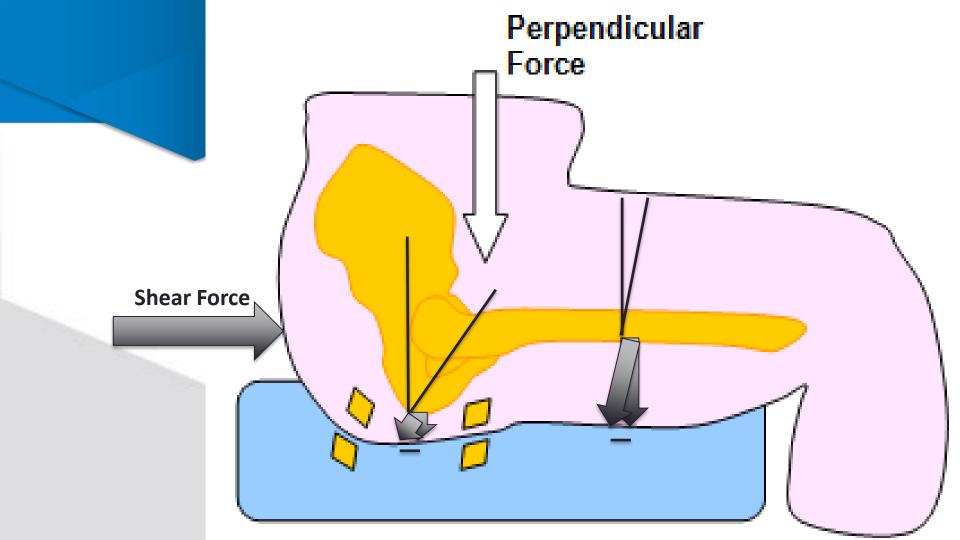


Pressure and Shear Distortions









Gradient

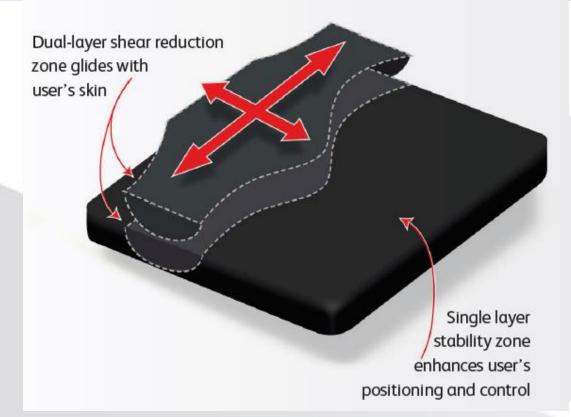


This has introduced an important aspect, and that is of the rate of change, or Gradient

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

GlideWear Cushion cover





GlideWear Underwear

Male or female





GlideWear Socks – and more

Heel and ankle protection
Toe protection
Head protection
EB clothing
Post burn protection



Beyond pressure



When considering influences on tissue integrity, it's clearly more than just pressure – there's

Friction, shear (and pressure)

Cushion design

Positioning

Microclimate

What can we do?

What Can We Do?



- Consider individualized plan of care
- RA Seating assessments
- Reprovide necessary equipment
- **Education**
- Follow-up services for lifetime of client or while requiring specialized services
- Prevent bottoming out, reduce shear, improve positioning Use advanced technology or smart technology such as Interface Pressure Mapping (IPM)

IPM in seat assessment



- Part of physical assessment
- Tools for assessment
- What influences posture?

 - M Sensorimotor 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?





What do we want from an IPM?



- Simplicity of use
- RA Conformable material
- RA Pressure distribution assessment
- Rate of change of pressure distribution (Gradients)
- RA Positioning information
- RA Assessment wizard
- RA Dynamic assessment
- **Affordability**

Recording Butt Prints



Latest technology: BodiTrak

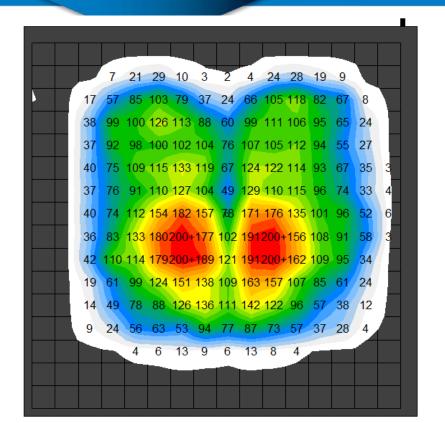
Plug and play straight out of your bag

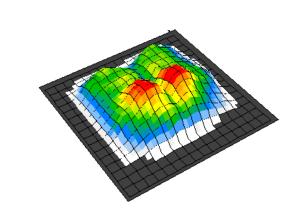




Pressure Distribution View







Maximum (mmHg)	200.00
Average (mmHg)	53.57
Minimum (mmHg)	0.00
Sensing area (cm²)	2070.25
Standard deviation (mmHg)	57.71
Coefficient of variation (%)	107.74

91.1 81.2 71.3 61.4 51.5 41.6 31.7 21.8 11.9 2

200 190.1 180.2

170.3

160 4

150.5 140.6

1307

1208

110.9 101

IPM Value: Skin Integrity



IPM can be:

A Predictive Tool

Pressure is ONE extrinsic factor relating to the development of Pressure Ulcers

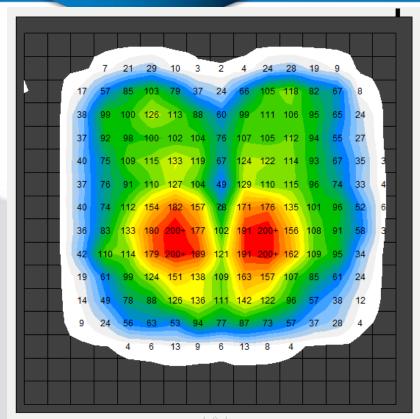
IPM used alongside other tools like assessment scales, experience, hands

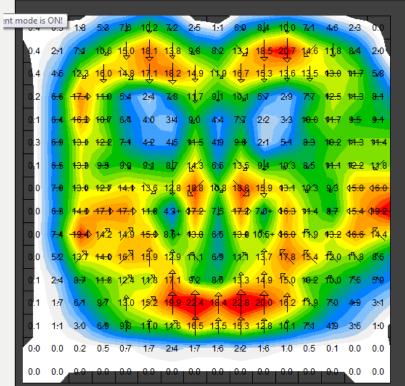
A Preventative Tool

IPM maps bring awareness of location, magnitude and rate of change of pressure distribution – for example:

Rate of Change (Gradient)







IPM Value: Skin Integrity



A Rehabilitation Tool

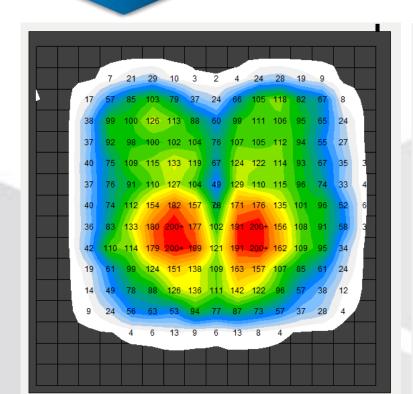
- Educate user, family, team members on the location, magnitude and rate of change of pressure
- Bring it 'alive': makes pressure visible
- Record impact of wheelchair interventions on pressure distribution or is that posture?
- Train for the most effective weight shift

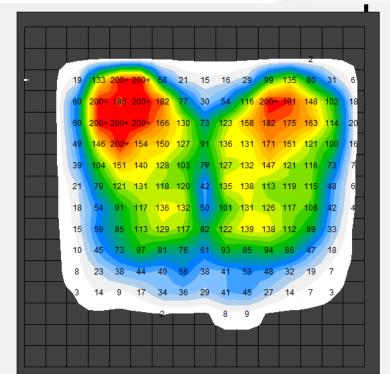
Positioning Feedback

Sitting normally

Leaning forward







Pressure mapping applications



Setting up a chair Setting up a cushion

Practical considerations around IPM



- Absolute pressures?
- Emphasis on pressure vs shear and friction forces
 - Understanding that various factors, not pressure alone, can cause skin breakdown e.g. microclimate, shape of ischia
- Influence of material making up sensor mat
- Static assessment versus dynamic
- Representation of sensor mat
- RA Hysteresis and creep
- Can results be manipulated?

Myths around IPM



- It can take the place of a traditional hands-on assessment by therapist or physician
- Acts as a stand-alone diagnostic device
- It will identify all significant problem areas
- Radia Guarantees support surface performance
- There is a "magic number" or threshold for skin break down

1930 Landis Study



32mmHg being the "Gold Standard" threshold value of when capillary occlusion occurs

Study on healthy individuals

"at the base of the dermis of the nail bed held at heart level"

Average pressure at the arteriolar limb was 32mmHg Etc

Perpetuating the Myth



"Pressures of 12-32 mmHg for more than two hours will result in tissue damage"

Wound Healing Perspectives: A Clinical Pathway to Success. Vol. 2, No.1, Winter 2005 – a publication of National Healing Corporation – www.nationalhealing.com

Interface Pressure Measurement 'Nots'



- Interface pressures do NOT correlate with internal pressures particularly over bony prominences (Le, 1984)
- Capillary closing pressure is not equal to interface pressure (Burman, 1993)
- Interface pressure should not be used as a sole predictor of risk of pressure damage for any individual (Whittemore, 1998)

Is there a risky pressure?



"...precise amount of pressure needed to cause tissue death is still unknown" (Fletcher, 2001)

Pittsburgh study indicated 100 mmHg (Brienza 2009)

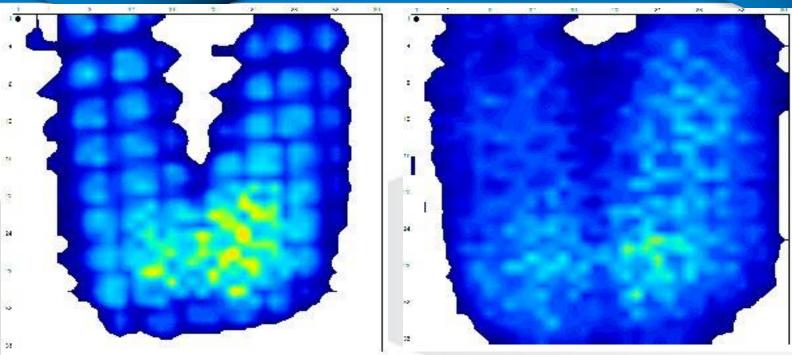
Tissue Integrity Management



- Relieving Characteristics
- **Envelopment**
- RA Distribution
- RA Area

Pressure Measurement: What does it tell you?





IPM Shows Distribution of pressure Measures Envelopment and Immersion



Pressure
Measurement
versus
Pressure Imaging



Analyzing Posture

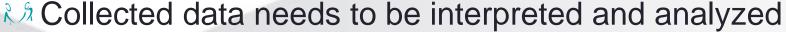


- Replace Part of physical assessment
- Register Posture varies sitting is dynamic
- Regional tendencies rather than posture

Pressure Imaging: Butt Prints?



- The term 'pressure' limits clinical thinking
- Butt prints are unique to the individual
- RAD Data collected needs to be relevant

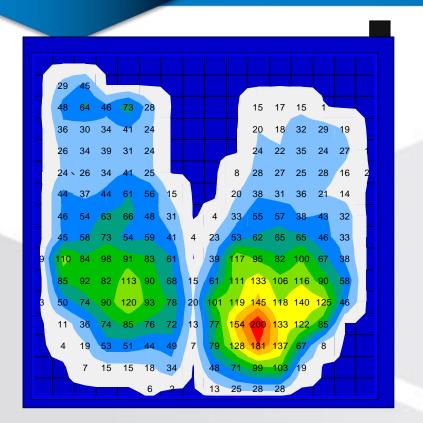


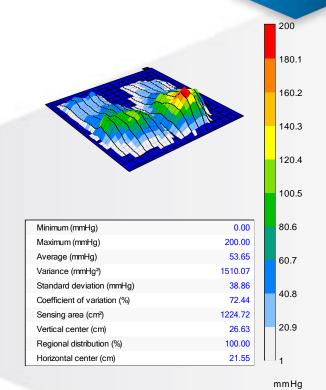
Example: Finger prints, Chinese menu



Assessing a Butt Print







The importance of movement

How dynamic is sitting?



How much mobilization during sitting is enough to help protect the buttocks from pressure ulcerisation?

Mobilization impacts magnitude and duration of pressure effects - Kosiac

Frequency and extent of spontaneous motion to relieve tissue loads in normal individuals seated in a wheelchair

During 70 min, 10 healthy subjects performed spontaneous movements (5 degrees or higher) every 6 min in the sagittal and every 9 min in the frontal plane

E. Linder-Ganz et al 2005 Summer Bioengineering Conference, June 22-26 Vail Cascade Resort & Spa, Vail Colorado

The importance of movement



21 % of paraplegics moved once/hour or less and 55% moved in cycles shorter than 1 hour - more than half of the study population suffered a pressure ulcer

Stockton et al, 2002, Pressure relief behavior and the prevention of pressure ulcers in wheelchair users in the community. J Tissue Viability, Vol. 12, pp 84, 88-90,92

Impaired Dynamic sitting stability is associated with pressure ulcer development

Karatas et al, 2008, Center of pressure displacement during postural changes in relation to pressure ulcers in spinal cord injured patients. Am J Phys Med Rehabil 87: 177-82

Relevant Resting Position



Blindfold your client

(if you dare!)

Take an IPM image

This will give you a Relevant Resting Position

Relevant Active Position



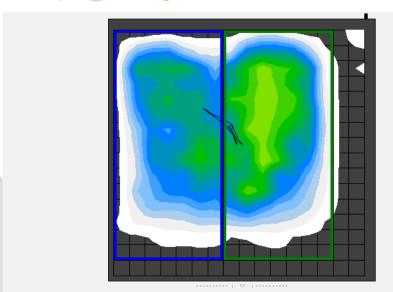
As compared with a Relevant Resting Position, achieved while blindfolded, a **Relevant Active Position** is achieved by performing an activity relevant for the individual

Assess user carrying out his/her daily activities

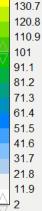
Sitting is an Activity - Dynamic Assessment



Self propelling in wheelchair

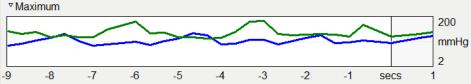


▼ Maximum (mmHg)	95.94	120.72
▼ Average (mmHg)	45.47	63.06
▼ Minimum (mmHg)	0.00	0.00
▼ Variance (mmHg²)	794.87	1364.32
▼ Standard deviation (mmHg)	28.19	36.94
▼ Coefficient of variation (%)	62.01	58.57
▼ Horizontal center (cm)	33.93	17.22
▼ Vertical center (cm)	18.44	17.85
▼ Sensing area (cm²)	752.08	744.00
▼ Regional distribution (%)	42.13	57.80



¬ mmHq

200 190.1 180.2 170.3 160.4 150.5 140.6



Standardised protocols?



6 – 8 minutes is likely to be the optimal sitting time required before stable pressure measurements should be taken – however pressures could increase for up to 20 mins (Stinson 2002, Crawford 2005)

Standardised protocols?



Static

Reaching to left sideways and down Reaching to right sideways and down

Reaching forward

Dynamic (cf Smartwheel)

10m straight run on tiles

10m straight run on carpet

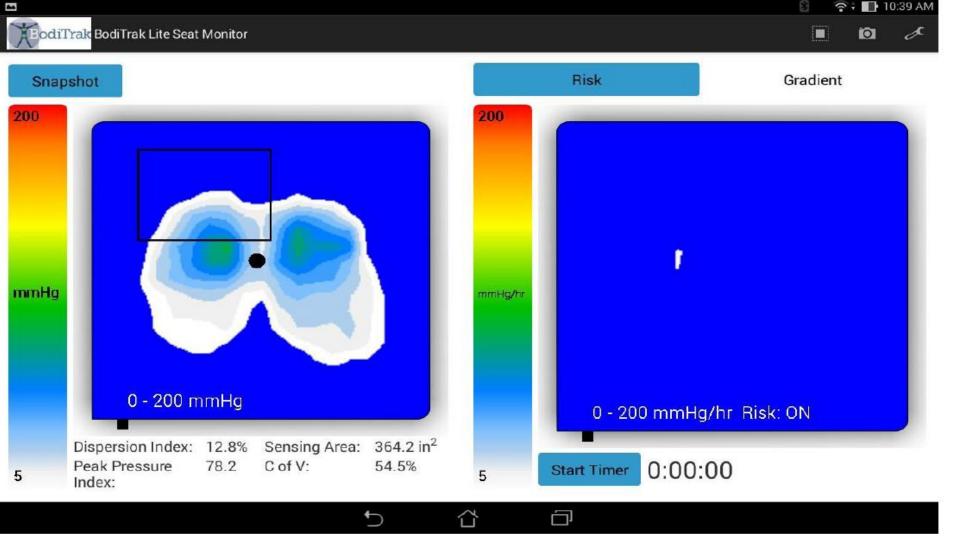
Standard slope

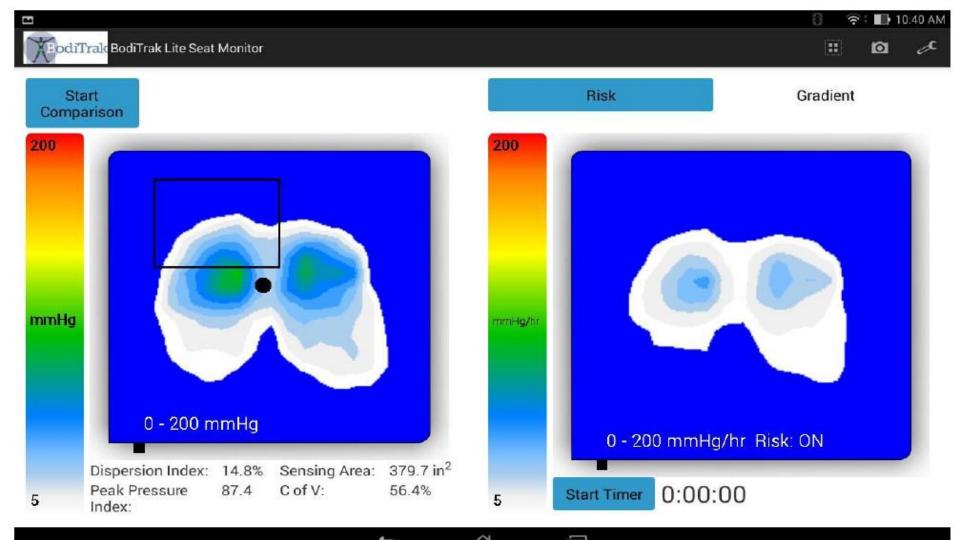
Figure of 8

BodiTrak Lite - Seat Mat



Android tablet oriented software





BodiTrak Mattress Sensor System BTM



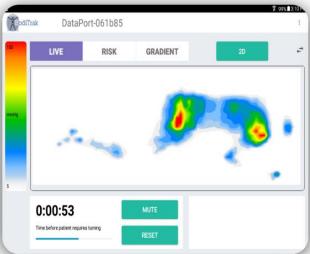
Mat is a mattress coverlet
Software similar to BodiTrak Lite
Pressure map/Risk/Gradient Views
Repositioning timer
Bed exit warning

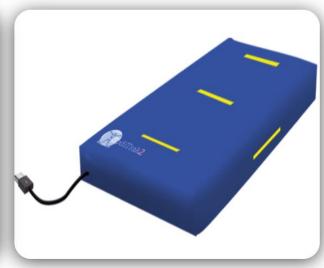
BodiTrak Mattress Sensor System



Pressure View





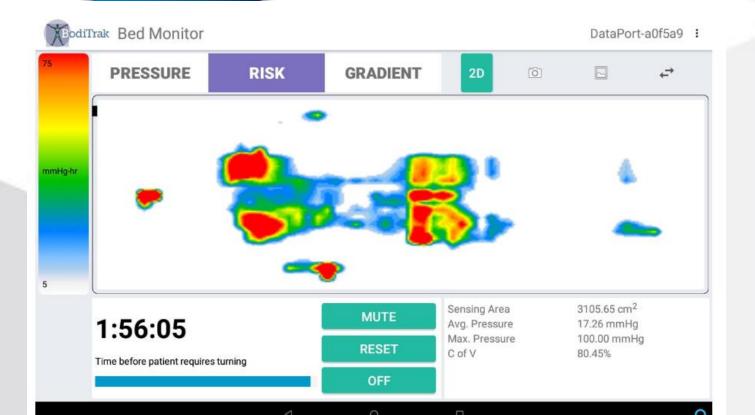


BodiTrak Mattress Sensor System

Supporting your needs

HIIA

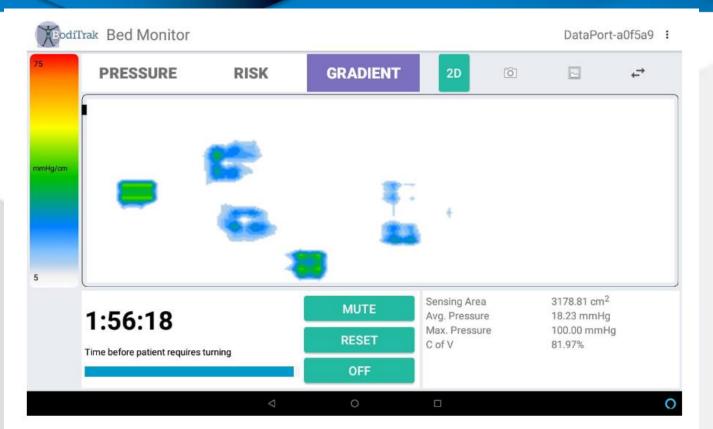
Risk View



BodiTrak Mattress Sensor System

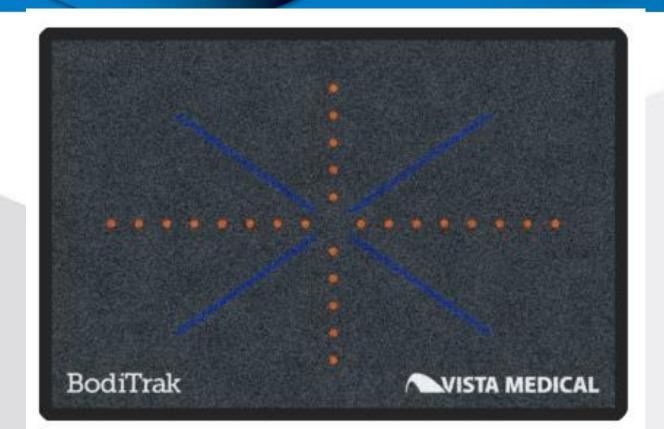
Gradient View





Balance Assessment System

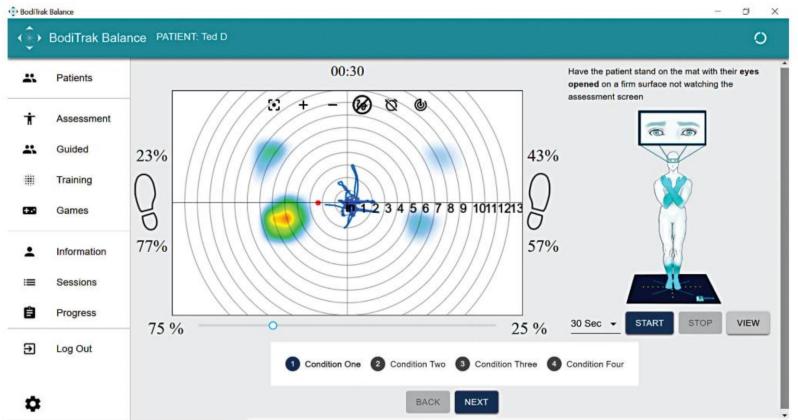




Balance Assessment System



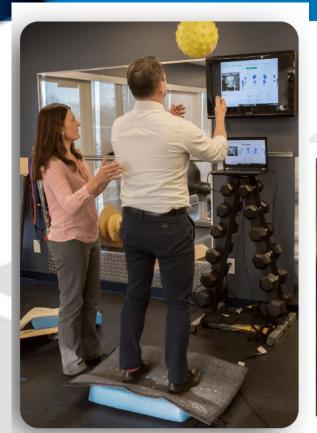
orting your needs



Balance Assessment System











Beyond Standing

- ☑ Use it for upper body strength assessment and training
- ❷ Be creative, its durable and portable.



ISO-TR 16840-9 Pressure Mapping



- Mark Definitions and Glossary
- Applications

Cushion comparison

Wheelchair set-up

Client/Caregiver education

Dynamic activity

Relevance to ADL

- RA Clinical Test Protocol
- RA Documentation
- Interpretation
- **Limitations**

www.pmguk.co.uk Best Practice Guidelines

Getting pressure into perspective Conclusions?



- Resoure Ulcers not necessarily due to pressure
- RAM How does a Butt Print inform us?
- Is it the same for you, me, a colleague?
- RADynamic versus Static imaging
- RA Standardisation:

ISO/TR 16840-9:2015 CLINICAL INTERFACE PRESSURE MAPPING: GUIDELINES FOR SEATING

Contact





barend@beshealthcare.net