Pressure Mapping for Wheelchair Seating

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Our Goal – Quality of Life
The Problem

Wound measurement using VEV MD
Some Sobering Numbers

- 39% of spinal cord injury (SCI) Veterans in Houston in the 3 Years studied were treated for a pressure ulcer
- 150 day average in Hospital
- $150,000 per Hospitalization.
- Total cost estimated up to $3.6 Billion

SCI Skin Changes

The skin below the injury is not the same as the skin above:

- Collagen catabolism
- Decreased amino acid concentration
- Decrease in enzymes of biosynthesis
- Decrease in proportion of Type I to Type II collagen
- Decrease in density of adrenergic receptors
- Poor collagen synthesis
- Abnormal vascular reactions
- Decreased blood flow
- Decreased PO2 – 5X less than in innervated skin
- Decreased fibronectin, glycoproteins for fibroblast activity
Wounds Are Not All The Same

### Pressure Ulcers Superficial or Deep
Causes are different, so treatments are different

<table>
<thead>
<tr>
<th>Causes</th>
<th>Superficial Stage I and II</th>
<th>Deep (in general) Stage III and IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friction Maceration</td>
<td></td>
<td>Pressure Shearing</td>
</tr>
<tr>
<td>Skin is injured, but underlying tissue is intact</td>
<td></td>
<td>Damage to skin and deep tissue, often before skin shows effects, often widespread damage</td>
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<tr>
<td>Remove source, protect, keep moist and bug-free</td>
<td></td>
<td>Remove source, remove dead tissue, promote angiogenesis and tissue growth</td>
</tr>
<tr>
<td>Re-epithelialization</td>
<td></td>
<td>Fill in defect, then re-epithelialize</td>
</tr>
</tbody>
</table>
Deep Pressure Ulcer Stage IV

Wound measurement using VEV MD
Shear Ulcer Stage III
Summary of Causes

- Immobility
- Incontinence
- Pressure
- Friction
- Shear
- Maceration a.k.a. Heat and Moisture
Pressure Mapping
How Do We Make Sense Of Pressure mapping?

- What can we really do?
- What do the numbers mean?
- How can we make good decisions?
We Can Only Redistribute Pressure

We Cannot:

- Relieve pressure
- Or
- Reduce pressure
Pressure Redistribution
How Do We Decide?

• Keep in mind that we are doing a case study of one, n=1
• No normative data is available yet to guide our decisions for a particular patient type
• The numbers are only bench marks to refer to as we seek a better solution
• Is a proposed position or product affording a better:
  • Pressure distribution?
  • Functional capability?
  • And/or comfort than another?
What About The Numbers?

- A particular statistic at a particular location does not equal success or safety
- Key number to look for in FSA software:

<table>
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<tr>
<th>Key Numbers</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Highest Pressure</td>
<td>• This indicates where the potential trouble is</td>
</tr>
<tr>
<td></td>
<td>• Focuses attention on key risk areas</td>
</tr>
<tr>
<td>2. Sensing Area</td>
<td>• Larger area is better</td>
</tr>
<tr>
<td></td>
<td>• Are we expanding or contracting the area of pressure distribution</td>
</tr>
<tr>
<td>3. Coefficient of Variation</td>
<td>• How evenly is the pressure distributed over the surface</td>
</tr>
</tbody>
</table>
Area of Highest Pressure is Key Risk
Larger Sensing Area is Superior

Sensing Area: 240.68 in²

Larger, improved sensing Area: 259.89 in²
Smaller Coefficient of Variation is Superior

Coefficient of Variation: 92.51%

Smaller, improved Coefficient of variation: 41.80%
How Long To Wait?

- Let the patient settle into the cushion
- Research indicates 6-8 minutes is a good practical time (Stinson 2002)
- Be consistent so you can make valid comparisons
- You need to be observant as it depends on the solution you choose, i.e. air vs. foam
- Some advocate up to 45 minutes. While not practical, you could use remote scanning to confirm a solution’s effectiveness over time.
How Long To Wait for patient to settle?

Foam cushion initial sitting

Foam cushion after several minutes
Dispersion Index

- Percentage of the pressure from the total rectangular sensing area (B) compared to the combined area under the ischial and sacro-coccygeal region (A)

- Evidence supports that a DI > 50% indicates high pressure ulcer risk (Drummond 1985)
Pressure Gradient

- Gradient is the change in pressures per cm or inch
- In other words, how close the high pressures are to the low pressures
- Objective is to try to get the lowest possible (i.e. gentlest) gradient
Do Not Forget Asymmetry

**Asymmetry**: Make sure that it’s the client you are pressure mapping, not a misplaced sensing mat. See next slide.
NOTE: While this pressure map looks symmetric the person still loads 7% heavier on the right side.
Be Confident In Your Data - Calibration Is Important

- Soft surface interface pressure mapping systems need to be recalibrated

- Questions:
  - Do you have an FSA calibration jig?
  - Do you have a protocol governing when, where and who does the calibration?
  - Are you confirming that the calibration was successful?
Calibration Interval?

- Re-calibration schedule depends on the frequency of use and the demands for accuracy
- Frequent FSA mat use requires more frequent calibrations.
- Re-calibrate when:
  - Conducting research
  - Statistically analyzing pressure values
  - Numerical pressure values are critical
- It is not necessary to calibrate a new FSA mat, unless you are using it for research purposes
- Field reports indicate a once a month pressurized inflator bag calibration schedule is prudent
- Monthly or quarterly seems to be a common default
Quick Alternative to Full Calibration

- Use the applied weight technique routinely
- To maintain accurate readings between complete calibrations
- This technique:
  - Requires a human subject be used as the applied weight
  - Recommended for seat and bed mats only
- For seat, place the FSA sensing mat on a typical seating surface, and sit on it
- Lift your arms and legs up so all your weight is supported by the mat
- For bed, place the mat on a typical bed and lay on the mat, in a manner so all your weight is supported on the mat
Be Prepared

- Do not keep the pressure mapping system in storage
- No one wants to wait while you set up
- Have it up and running ready to use
- Install it on all the computers you use
- Know when was it last calibrated
- Download the latest software from www.pressuremapping.com for free
Infection Control

• Wash your hands before and after the evaluation. Gloves?
• Don’t touch the computer unless you clean your hands or remove the gloves
• Make sure you use an isolation bag. Isolation bags come with every FSA pressure mapping system. Comply with Universal Precaution Guidelines
• If mats contaminated with urine or fecal material:
  • May be cleaned with disinfectant wipes
  • However blood or tissue fluids usually results in the mat being disposed
Mat Storage & Maintenance

- Do not fold the mat
- Keep the mat dry. Protect the mat from incontinence, torque and shear forces by using the isolation bags provided
- Place the mat gently on surfaces by using the corners
- Do not pull on or carry the mat by the ribbon cable
- Do not pivot on the mat
- Do not pull on the edges of the mat while it is under a client
- Do not pinch the mat between moving components
- Store the mat flat or in the original packaging (roll the mat around the foam core and store in the blue)
- Clean with medical grade disinfectant-spray or wipes
  - Don’t soak the mat
  - If you get it wet air dry or gently blow dry
Two Classic Questions Of New Pressure Mapping Users

- What is the best number?
- What is the best cushion?
Where Does Pressure Fit In The Assessment Hierarchy? Three “Ps”

- Patient
- Position
- Pressure
Learn About the Patient

• Gather any background information you deem pertinent
• Record in the client information tab
  • Don’t rewrite the patient file
  • But do include the most pertinent information on what is relevant to what you are doing:
    • Learn about their lifestyle and goals
    • Lifestyle can trump good seating
    • Equipment and cushions used for future reference
It’s Not Just The Pressure Map

• Good documentation is key

• “The single most important thing when taking pressure data are the notes on the position, posture and circumstances existing when the data was taken”

• “It is easy to take lots of data but difficult to remember the details of exactly what the conditions were when the data was taken”
Use the FSA Pressure Mapping Clinical Wizard
Six Steps to Completing a Good Pressure Mapping Evaluation

1. Introduce pressure mapping to the client
2. Capture how they are currently doing
3. Demonstrate the client’s challenges
4. Document usual/least costly solutions
5. Provide as necessary an appropriate alternative
6. Communicate Findings effectively
1) Introduce Pressure Mapping

- Explain the process
  - To remove any apprehensions
  - Involve client and/or caregivers in the process
  - Allow them to interact with the technology
    - They won’t be able to while you do the assessment or they will confuse your work
    - Make sure you use your hands to limit hammocking
1) Introduce Pressure Mapping (Cont’d.)

• Place FSA mat:
  • As close to the skin as possible
  • On top of cushion patient normally sits on
  • With consistent orientation (so there is no confusion later)
  • Square on the seat

• Confirm with your hands that the sensing mat is not *hammocked*

• Make sure the client is in a “normal” or neutral position you can replicate with other surfaces
1) Introduce Pressure Mapping (Cont’d.)

FSA mat placed too far right and back, so missing information

Well placed FSA pressure mat
2) Capture Client in Their Existing Seating (Cont’d.)

- Now that they have sat for a while in their existing cushion
- Scan, store and describe
  - Keep your comments related to the specific scan stored
  - General information should be in client information tab
  - Confirm what you see with your hands! Don’t trust all you see on the screen. Confirm it!
  - Make notes with the thought in mind that you need to understand them 3-6 months down the road
  - Make sure you turn the client away from the screen so they can no longer interact with the pressure mapping system.
- This will help answer the question: Why do we need to make changes or spend money?
2) Capture Client in Their Existing Seating (Cont’d.)

- 45 year old SCI client – 25 year post injury C5 Quadriplegia
- Long standing history of right side Stage I ulcer (has been worse)
- Now problems with left side Stage I ulcer and NOT problems on right side
- Cannot stay up longer than 4 hours
2) Capture Client in Their Existing Seating (Cont’d.)

- Capture current complaint:
  - Unable to be up for longer than 4 hours due to redness in both Ischial Tuberosities, with left being the worst
  - Secondary is concern over the tail bone pressure which occurs with current position and/or recline
- Goal of assessment/intervention: able to be up 6 hours min, but preferably 8 hours each day.
3) Demonstrate the Client’s Challenges (Cont’d.)

- If possible have the client sit upright on a firmer surface like a mat table or a foam cushion
- Scan, store and describe where the boney prominences are
- Confirming with hands and noting coordinates on screen
- This will help answer the questions:
  - What is the client’s boney architecture like?
  - Is it all there? Flexible? How rotated is the pelvis, etc.?
  - Why won’t a simple solution be sufficient?
4) Document the Most Commonly Used/Least Costly Solutions (Cont’d.)

- You can use VIEW/COMPARISON from the drop down menu to compare your solutions.
- Scan, Store and describe what you did.
- This will help answer the questions of:
  - How well did the usual solution perform?
  - How well did the least / most costly solution perform for your client?
The Usual Foam Cushion Solution: Pressures still unacceptably high, and highly focused
5) Provide an Alternative Solution if Necessary

- If you’re not satisfied with the “usual” solution try another
- Validate or challenge
- Again this may take recording a number of scans
- Remember to describe what you did as you scan and store
- This will help answer the question of why we are recommending a solution different than the least costly or “usual”? 
Alternate Solution: 8x9 Air insert in foam. Good pressure distribution not as good though as the full air cushion: up only 4 hours
5) Provide an Alternative Solution if Necessary (Cont’d.)

Proposed solution: On a properly adjusted air cushion. F9 is right IT: Good pressure distribution. Up 6 hours am + 4 hours evening. Meeting goal.
6) Develop a Simple Report

- Use comparison view to choose and select the frames that tell the story by selecting the frames you want:
  - Use selected frames for exporting, cutting or printing frames from your FSA file
  - The check mark in the status bar indicates the frame is selected
  - Print off the report
  - Or copy and paste it into a new or existing Word document you use
6) Develop a Simple Report (Cont’d.)

Client sitting in wheelchair, C4/5 quadriplegia for 16 years. Has open area in left buttock on the anterior. Assessment showing corrections to rotation and believed Shear acting around the rotation of the pelvis. 

In normal position with towel still in place along the left side.

After dramatic shift of pelvis to the left by therapist and “hiking” up the side, then allowing ken to reposition.
Use Pressure Mapping As Visual Feed Back

• Client and caregiver “buy in” and compliance
  • No that solution someone else has will not work for you...See for yourself. Better client and caregiver buy in.
  • Don’t over-inflate that air cushion. Use it wisely.
  • How far do they have to go for adequate weight shift using tilt or other means
  • Demonstrate appropriate positioning seat so others do not defeat your work
Some Common Mistakes

• You stop using your hands and let technology make decisions for you

• You try every choice available. Too time consuming
What Do You Do When It All Looks Bad?

- Sometimes you have to leave “well enough alone”
  - Client’s trocanter is over 200 mmHg and has been for some time without incident only alternative is high pressure on proven risk area of right I.T. Monitor it.

- Use the tool to teach movement-help the client find alternate pressure redistributing positions in their seating.
  - T3 and 2 wounds-use pressure mapping as a biofeedback tool to help a nervous T3 discover how much(little) they have to move to achieve significant pressure reduction for at risk areas.
What Do You Do When It All Looks Bad?

• Maybe it’s the tool:
  • Wrinkles in mat
  • Poor placement of mat
  • Hammocking of mat
  • Out of date calibration
  • Damaged mat
  • Get your hands in there and find out
What Do You Do When It All Looks Good?

- Sometimes everything you do in the seat looks good.
- If it does, back up and take a good look at where the wound is or what their history is
- What is not obvious and unseen during the assessment?
- Some research and experience indicates that while the referral is for a perceived seating related pressure issue, 50% of the time the problem is in the bed not the seat.
- So, go pressure map the bed even with a seat mat if you need to.
Multi-System Analysis

- Braden Scale for Predicting Pressure Sore Risk:
  - Validated Long term care Geriatric tool
  - Useful to expand areas of investigation
  - Nutrition, incontinence and out of chair activities
  - See: [http://www.bradenscale.com/braden.PDF](http://www.bradenscale.com/braden.PDF)
  - More information at ISO Working Group Clinical Use Guidelines see:
Remember Our Goal – Quality of Life
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