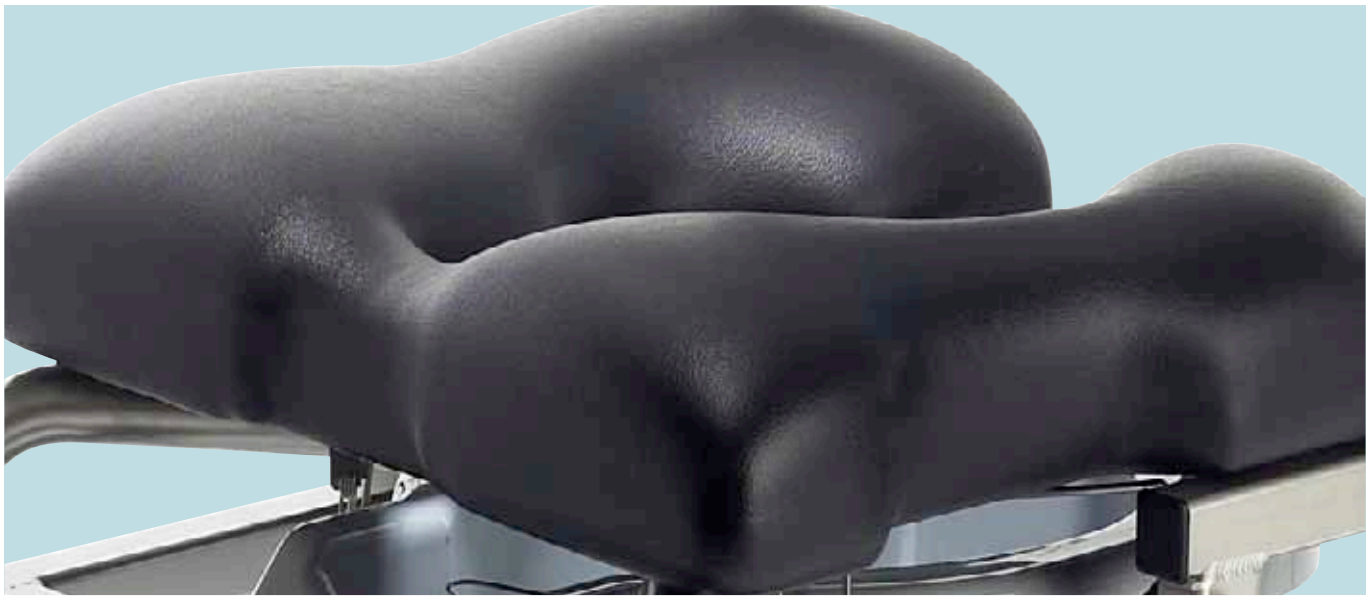


Reduce the pressure

Managing pressure in shower commode chairs, particularly in the case of spinal injury patients

This whitepaper describes Wealden Rehabs view of the challenges faced by spinal injury patients using shower commode chairs particularly in relation to managing pressure and how patients can benefit from a shower commode chair that has been specifically designed for postural support and pressure relief.

The National Pressure Ulcer Advisory Panel (www.npuap.org) defines a pressure ulcer as "a localised area of tissue necrosis that tends to develop when soft tissue is compressed between a bony prominence and an external surface for a prolonged period of time." More simply put, tissue death results when the soft tissue gets squeezed between a firm spot and something external to your body. The area of damage is the pressure ulcer or sore.
NB: NPUAP now state that "pressure injury" is a more accurate label than "pressure ulcer" because some presentations of the phenomena are not open ulcers; yet all can be legitimately classified as tissue injuries."

Introduction

Every year, around 180,000 new patients suffer from a pressure ulcer or tissue injury. The patients present with diverse backgrounds, elderly, young and those in-between. Obesity is a growing concern globally, and often complicated with the added burden of diabetes (referred to as diabesity).

Groups at particular risk of having a pressure ulcer have been reported in depth in the RCN guidelines (2001) and are summarised here. In brief an individual's potential to develop pressure ulcers will be influenced by the following intrinsic risk factors:

- Reduced mobility or immobility
- Acute illness
- Level of consciousness
- Extremes of age
- Previous history of pressure damage
- Vascular disease
- Severe, chronic or terminal illness
- Malnutrition

In addition to these factors, extrinsic factors include the following:

- Skin temperature
- Moisture
- Shear
- Posture
- Pressure
- Time in sitting

At particular risk are the group of patients with a spinal injury or acquired brain injury. More specific risk factors related to SCI patients include:

- Paralysis and sensory impairment (if you are unable to feel things normally, you won't know if something is irritating your skin).
- Changes in collagen metabolism (the way your skin and connective tissues are able to build new tissue and heal) caused by SCI. Wound healing may take five times longer below the level of SCI due to these changes
- Muscle atrophy (shrinking) can leave the bony prominences on your backside (or other areas) less padded, so that there is less protection over these areas.
- Altered circulation can reduce the blood supply to tissues, which not only increases your risk for skin problems, but slows the healing process if you do develop a pressure sore.

Data shows that about one-third of patients with SCI develop pressure injury during their initial hospitalisation.

The Causes of Pressure Injuries

1. Pressure

This is the most common cause, and it's important to be aware of how different amounts and duration of pressure can cause damage to skin. All of these conditions can be damaging:

Long periods of low pressure — it is estimated that between one and six hours of constant low pressure can cause some tissue damage.

Recurrent pressure, such as frequently bumping your elbow against a table, desk, or arm rest many times each day.

Short periods of high pressure, such as accidently whacking yourself hard against a surface when doing a transfer.

Body tissues vary in their tolerance or their sensitivity to pressure. Skin is actually the most pressure-resistant compared to other body tissues. Muscle, because it is so metabolically active, can start to have problems more quickly than other tissues. That is why it's possible for muscle underlying the skin to be damaged while the skin above it is still intact.

2. Shear

Dragging skin or body parts across a surface, as when transferring without lifting your backside off the surface, can damage your skin.

3. Positioning

Abnormal or less than ideal positioning in your wheelchair, vehicle, or other equipment can increase pressure over specific bony areas.

4. Skin moisture and maceration

Skin that is exposed to moisture for extended periods can become macerated (softened and weakened) and vulnerable to breakdown. Exposure to urine and faeces due to incontinence is of most concern, but sweat can also be a problem.

WHY ARE WE SO CONCERNED ABOUT PRESSURE INJURIES?

1. **A common cause of hospitalisation:** Once they go home after rehab, most SCI patients would rather they never had to visit hospital again. However 39% of patients who are re-hospitalised in the first year after SCI are admitted for pressure ulcers.
2. **Increased care needs:** Having pressure ulcers likely means you require extra help with your personal care. This means patients can go from mostly or completely independent to needing a lot of help and losing that independence.
3. **Expense:** about 25% of the total lifetime cost of medical care for a person with SCI is related to pressure sores. SCI is an expensive situation and that cost needs to be reduced where possible.
4. **Personal cost:** Pressure sores have a dramatic impact on the life of a person with SCI and have multiple negative consequences. Loss of income, increased care costs, loss of usual activities and sources of life satisfaction are just some of the personal costs.
5. **Death:** About 7-8% of deaths in the SCI population are related to a pressure sore, and most likely result from sepsis, an infection that spreads through the body in the blood and tissues.

Background and Problem Statement

Effective bowel management is essential for the future well-being of the individual. When we consider the use of shower commode chairs in the case of SCI patients, several challenges are clear.

1. By the very nature of the design of the seat of a shower commode chair (it requires an aperture of reasonable size), there is a reduction in the surface area available to spread the patient load. Thus the interface pressure is increased in the area where the patient contacts the seat.
2. The seat aperture needs to be of a size which allows adequate access for cleaning and application of medication (use of suppositories or enemas is common) or use of an irrigation system
3. As a result of the injury, peristalsis is often less effective and constipation is highly likely. This results in the user needing to remain sitting on the hygiene chair for longer periods, often around 1.5-2 hours at a time.
4. Loss or partial loss of muscle strength and sensory input in the trunk and/or the limbs leads to reduced control of sitting balance, making personal hygiene routines complicated and difficult to manage. Traditional seat apertures may exacerbate this by restricting access to the body.
5. Loss of sensation makes it almost impossible for a user to determine if they are sitting on a surface which is free of wrinkles or edges, whilst aiding their postural balance.
6. That in as little as 2 hours, sufficient cellular deformation can take place to create the environment for pressure injury development.

It becomes clear very quickly that we need to pay more attention to the protection of the skin whilst the patient is using a shower commode chair. By helping to give focus and providing solutions in this area, we anticipate that patients will feel more confident that using their shower commode chair will be comfortable, encourage activity, support their posture and protect their skin.

Whilst there is significant choice to OT's when it comes to shower commode chairs, feedback from clinicians, OTs and patients suggests that many products fall short when the specific requirements of a SCI patient are considered.

Wealden Rehab were encouraged by the Senior OT at a spinal injury outpatient unit to sponsor the study of interface pressures recorded across a range of the available products. To this end we set up two separate trials, the results of which are represented here.

Both trials were conducted using a FSA and Boditrak digital pressure mapping unit with a standard BT1510 455mm x 455mm seat mat with 256 sensors, calibrated to a maximum of 300mmHg and connected to a laptop which allows recording of the process and results.

Case Study 1 – 50yo male, in hospital outpatient department

The standard chair on the ward at the time of the trial is the Prism T70. The user was able to transfer himself from his wheelchair to the shower chairs, and then bridge to enable the Boditrak sensor to be placed in the correct position.

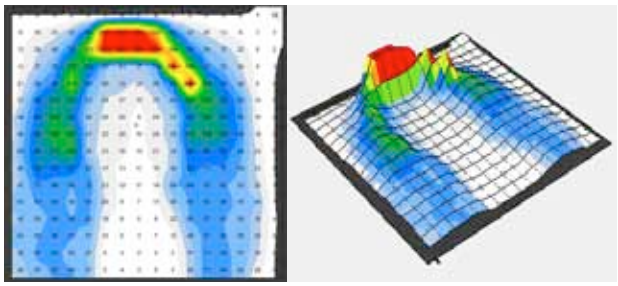
The Senior Outpatient OT was specifically searching for a chair which could provide maximum pressure relief whilst maintaining usability for the patient.

The patient was mapped on two different chairs with 4 seats in total: the T70 with a Medium Horseshoe seat module, the T70 with a large horseshoe module, on the RAZ AT with a 19" deep moulded seat module, and on the RAZ AT with a 19" deep visco seat module.

He also transferred to the Aquatec Ocean VIP which was equipped with an ergonomic soft seat. However he could not tolerate the seat for long enough to have mapping done, and the OT advised him to move off the chair to prevent tissue damage.

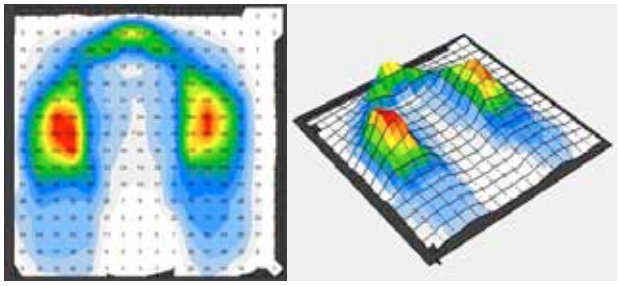
As the Prism T70 is a self-propel chair and the RAZ AT is a tilt in space chair, comparison was made objectively of the seat interface pressure in flat seat only.

The patient transferred onto the Prism chair first and we recorded these pressures with the first seat, the medium horseshoe module:



This demonstrates the core issue: that peak pressure area at the sacrum exceeds even the higher limit of our recording device at 300+ mmHg.

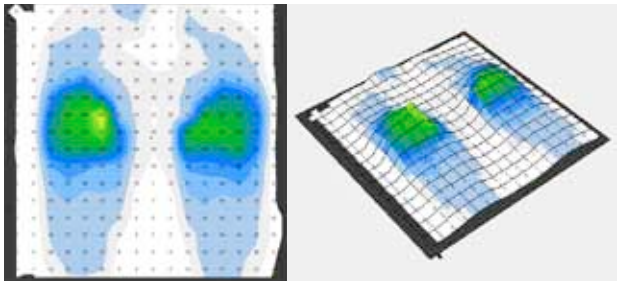
The chair was then fitted with the large horseshoe module to evaluate the differences between the seats.



This shows a big relocation of pressure across the seat surface, but the peak pressure areas are still reading at 300+ mmHg. The max pressure areas are now at the IT's however the pressure is very peaky, and still gives readings of over 200mmHg at the sacrum.

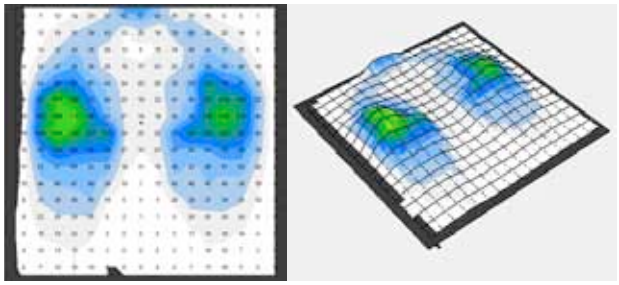
The patient then transferred to a RAZ AT (tilt in space model, seat at 0˚) which was fitted with a standard 19" moulded foam seat. Again the patient bridged to allow us to position the sensor mat in the correct location.

The mapping showed the following pressures:



This shows a max pressure of 204.53mmHg, and the pressure peaking over the ITs, with very little loading at the sacrum. This seat shows a dramatic reduction in the peak pressure on the seat.

The seat module was then exchanged for the 19" visco foam seat and the patient transferred onto the chair.



With this seat we see a max pressure of 173.71mmHg. peaking over the ITs, whilst there is a touch more contact at the sacrum. This is probably down to the fact that the visco style provides more envelopment of the pelvis and more of the patients pelvis would be in contact with the seat top.

In this simple trial it becomes obvious that some seats offer significantly more by way of pressure reduction than others.

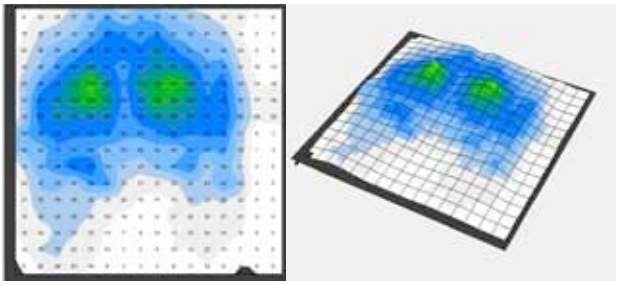
Case Study 2 – 30yo male, at home

This patient offered to assist us with research into shower commode seats. As a SCI patient advocate he was interested in accumulating knowledge around ways to reduce interface pressures in shower chairs and wheelchairs.The patient uses a very old showerchair in the home and a RGK wheelchair with a Varilite seat cushion.

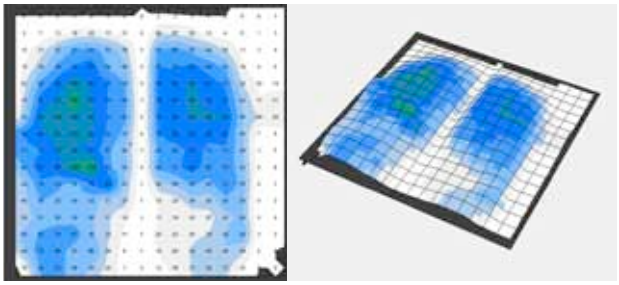
Wheelchair seat comparison

For initial exercise and comparision with the shower chair seat cushions, the patient asked us to map the wheelchair cushion.

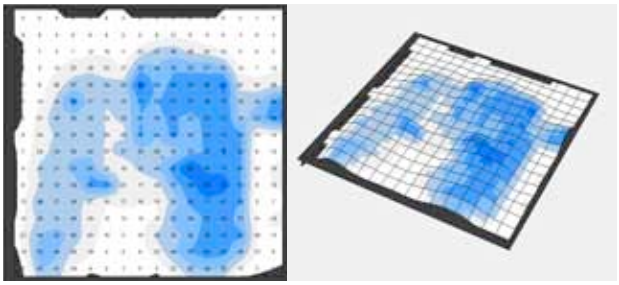
This is the result, with the patient sitting midline and relaxed, a maximum of 160mmHg and pretty even distribution as expected.



The pressure map recorded the patient performing weight shifts, both forward…



…and to the side…

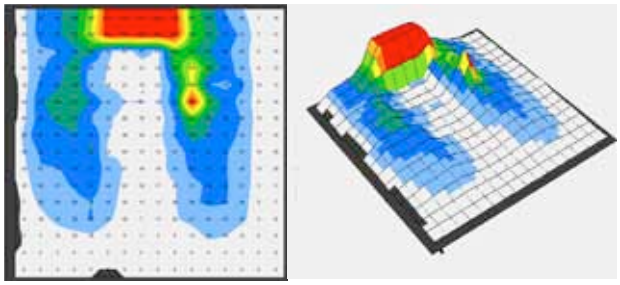


…proving the huge value of the weight shifts in releasing pressure on the seat tissues. Max interface pressures of 118mmHg in a forward lean, and just 93.5mmHg in a sideways leans.

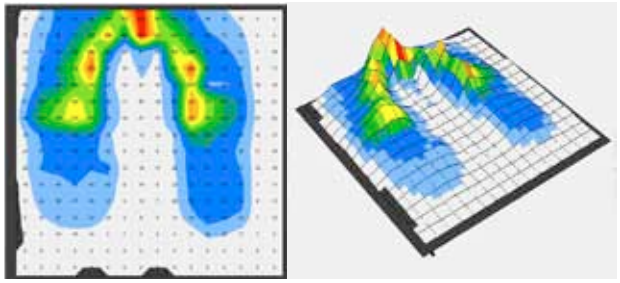
Prism T80 comparison

The next chair to trial was the Prism T80. Equipped with the standard 16" deep open-front seat module, we decided we should measure the pressures both for a flat seat, but also as the chair went through the range of tilt.

The interesting observation was the peak pressures recorded as the patient went through the initial transfer to the chair. The image looked like this:



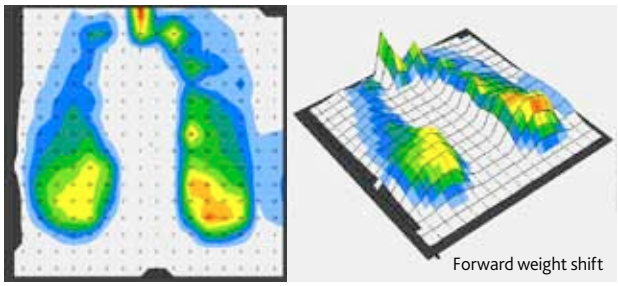
Whilst the patient felt no particular discomfort, he did comment on feeling less stable than he would aim for. The pelvis was clearly too far back over the aperture so we recommended a shift in position. By bringing the pelvis forward on the seat, the pressures appeared more even and lowered as far as they could, however the scan still shows in excess of 300mmHg at the sacrum, and ±270mmHg at the ischial tuberosities.



Unfortunately this meant that the patient was forced into sitting with a posterior rotated pelvis which brought with it complications. The position for voiding the bowel was awkward and likely impossible (we didn't try). The sacrum was clearly in contact with the seat top in preference to the immediate surrounding area. The seat was correspondingly too short leading to adduction of the knees. (This single issue could have been solved by 'prescribing' a longer seat module and lowering the footplates slightly.)

CASE STUDY 2 – 30YO MALE, AT HOME CONTINUED

Having seen the benefit of weight shift earlier with the wheelchair cushion, we decided that we should record the effect of this on this seat.

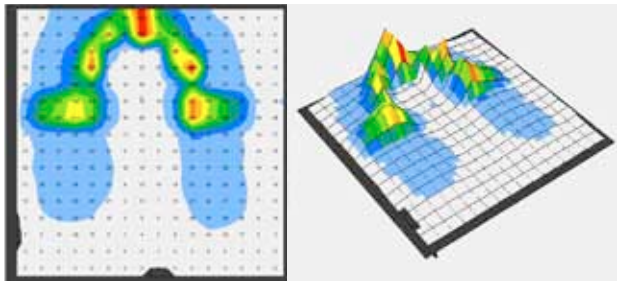


Forward weight shift

Whilst this reduced the average pressure across the surface from 54.85mmHg to 24mmHg, there was still visible peaks around the sacrum. The patient gave feedback that he wasn't able to perform this weight shift effectively as the pelvis was in such rotation initially.

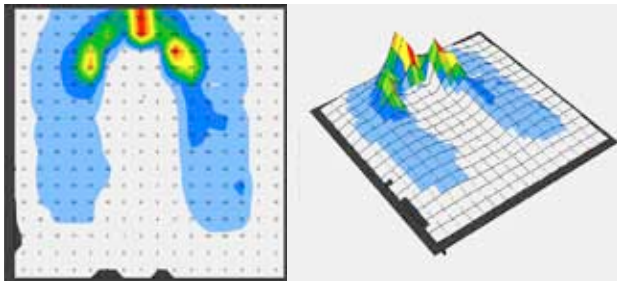
In order to evaluate the efficacy of tilt-in-space we then took the chair through its range and stopped at arbitrary points to measure the pressure through the seat cushion.

The first stop was at 17 degrees, with the patient sat with his elbows resting on the armtops.



In this midway position, the average pressure had started to reduce (now 44.31mmHg) but there was still points at the sacrum and rearwards of the IT's which identified with over 300mmHg.

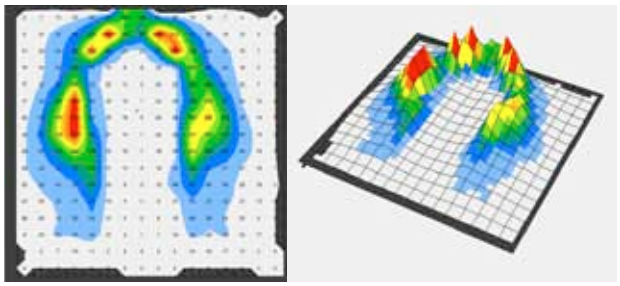
Moving into full tilt at 25 degrees, the average pressure is again reduced this time to 34.8mmHg , but the sacrum is still under significant pressure with peak readings of 300+mmHg.



Aquatec Ocean comparison

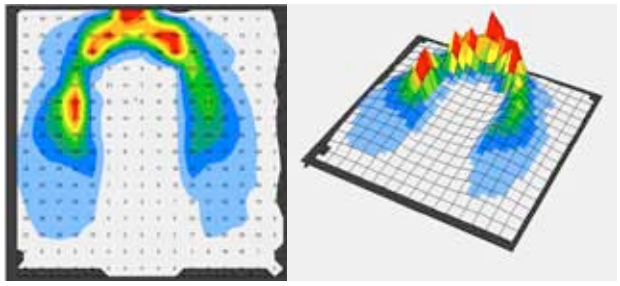
The second commode chair to trial was the Aquatec Ocean VIP with the soft seat top accessory (Invacare product code 1470075).

The chair proved a little difficult to transfer into as the soft seat top tended to move a little with any scrub as the patient moved across. Once the patient was seated and relaxed the first scan was taken.

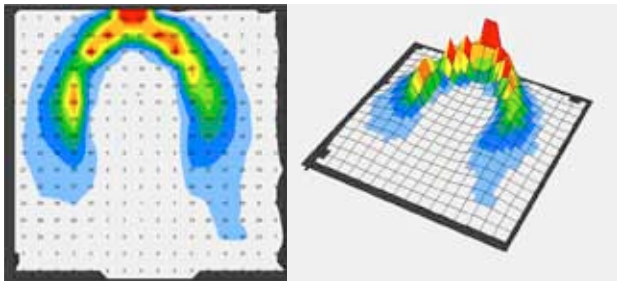


With the footplates adjusted, the seat provided a good spread of pressure, however the peak pressure was recorded at 300mmHg both at the rear of the pelvis and around the sides of the commode aperture.

Tilting the chair demonstrated that pressure could be reduced overall across the seat with measurements taken at 20 degrees (maximum still showing at 300mmHg, but average pressure reducing to 45.4mmHg)…

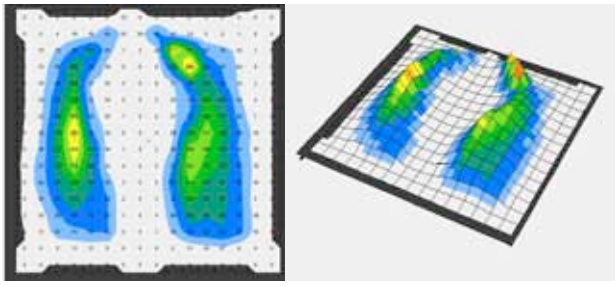


…whilst moving through to full tilt at 40 degrees shows a reduction in average pressure to 40.85mmHg. However the tilt has introduced a pressure buildup at the coccyx with large areas of tissue being subjected to pressures of over 300mmHg.



CASE STUDY 2 – 30YO MALE, AT HOME CONTINUED

In the flat seat position, we recorded the action of performing a weight shift by leaning forward. This demonstrated that all the pressure could be relieved from the coccyx and that good distribution could be achieved under the femurs.

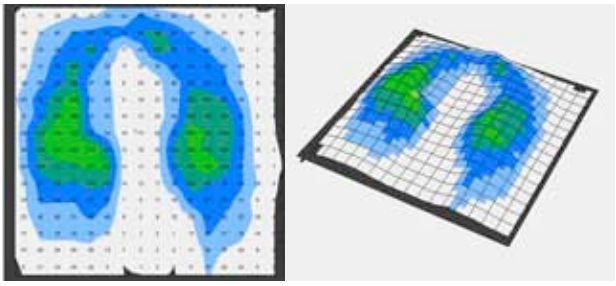


RAZ AT comparison

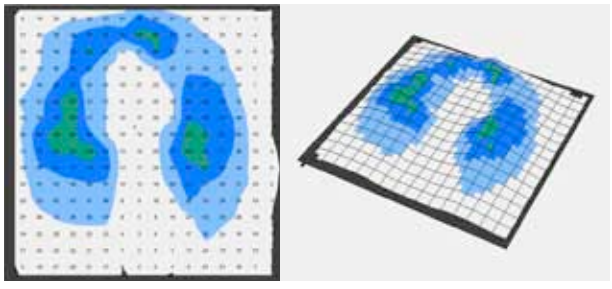
The third chair we trialled was the RAZ AT fitted with the 19" visco seat with an open front (Wealden Rehab product code N656).

The first study we carried out was to look at the effect of a correctly adjusted arm height on the seated pressure. The first scan was the client sat with the seat adjusted to suit his pelvic position. In this first instance however his arms were resting on his thighs.

In this position the max pressure is reading at 154.43mmHg, and the average at 46.54mmHg.

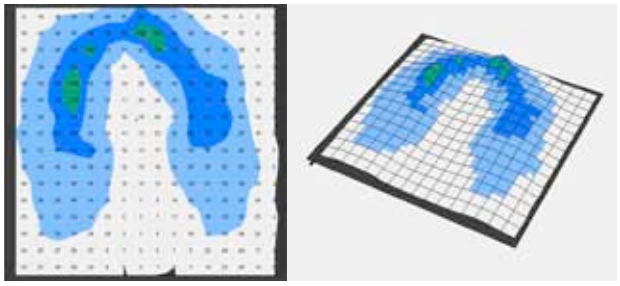


With the chairs arms adjusted to the correct height and the patients arms resting comfortably, the scan shows a reduction of max pressure to 120.89mmHg and average pressure to 35.81mmHg. This proves simply the value of supporting the arms at the correct height – by ensuring that our patient is using the arms we can reduce the interface pressures considerably (21.7% max pressure/23% average pressure reduction in this case).

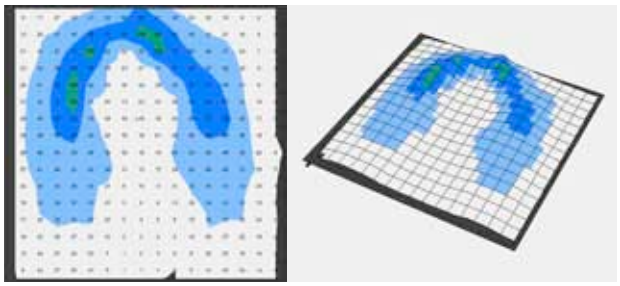


Taking the chair though its full tilt range demonstrated even more pressure relief.

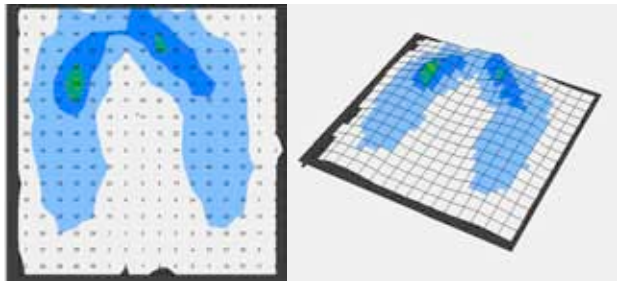
At 15 degrees, the max pressure was 121.5mmHg and average 33.75mmHg.



At 25 degrees the maximum pressure has fallen to 109.68mmHg and average to 30.68mmHg.



…and at 41 degrees the max pressure is 133.86mmHg with the average falling to 28.21mmHg.



The interface pressure exerted whilst using this chair seems considerably less than that of the other chairs trialled using the same patient.

The design of the visco seat cushion coupled with the extra tilt of RAZ presents serious opportunities to reduce interface pressure for those patients most at risk of pressure injury. The ability to move the commode aperture under the pelvis (using the RAZ IPAS system) allows us to position the pelvis in the most advantageous position for the user. Adjustment of the arm height can bring further reduction to the interface pressure.

TABLE OF PRESSURES

Product/Seat Item	Notes	Seat Angle, degrees	Max pressure (mmHg)	Average Pressure (mmHg)
CASE STUDY 1				
Prism, T70, Medium Horseshoe module		0	300+	54.82
Prism, T70, Large Horseshoe module		0	300+	59.28
RAZ AT, Moulded seat		0	204.53	36.93
RAZ AT, Visco foam seat		0	173.71	33.74
CASE STUDY 2				
Varilite Seat Cushion		4	160.28	45.22
Varilite Seat Cushion	User, leaning forwards for weight shift	4	118.66	42.84
Varilite Seat Cushion	User, leaning to left for weight shift	4	93.50	30.87
Prism T80, medium horseshoe module	Initial seated position	0	300+	54.18
Prism T80, medium horseshoe module	Adjusted seated position	0	300+	54.82
Prism T80, medium horseshoe module	User, leaning forwards for weight shift	0	116.62	24.05
Prism T80, medium horseshoe module		17	300+	44.31
Prism T80, medium horseshoe module		25	300+	34.81
Aquatec Ocean VIP, soft top seat accessory		0	300+	46.25
Aquatec Ocean VIP, soft top seat accessory		20	300+	45.40
Aquatec Ocean VIP, soft top seat accessory		40	300+	40.85
Aquatec Ocean VIP, soft top seat accessory	User, leaning forwards for weight shift	0	244.34	39.60
RAZ AT , Visco foam seat	User, sitting with arms folded across hips	0	154.43	46.54
RAZ AT , Visco foam seat	User, sitting with arms resting on armrests	0	120.89	35.81
RAZ AT , Visco foam seat		15	121.50	33.75
RAZ AT , Visco foam seat		25	109.68	30.68
RAZ AT , Visco foam seat		41	133.86	28.21

LIMITATIONS OF THIS STUDY

Whilst we approached this with the best intentions, to get even more accurate results we would like to carry out the study in more controlled circumstances. With a specialist in control of the environment and measurement, we believe that the results could be presented as clinically accurate. However given that this is not a precise science, the extra accuracy may not give us extra depth of insight.

There are limitations to interface pressure mapping – IPM predominantly measures pressure not shear, needs training to get the best results, and does not take into consideration any intrinsic risks. In this respect, it is just a snapshot and a screenshot is not representative of the entire process.