

# The Impact of hoist sling materials on interface pressure : Less Pain, More Gain!

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## Introduction

People with restricted mobility, who use a hoist to transfer, are at high risk of gluteal pressure ulcers. Current guidelines recommend the removal of hoist slings between transfers to reduce this risk but evidence supporting this is lacking and anecdotal evidence supports that people are often left sitting on hoist slings for ease of the carer, time restraints or at the request of the client themselves. There is no objective evidence on the effects of sling materials on gluteal pressures to support or refute these recommendations.

## Study Aims

To investigate and compare the effect of three types of hoist sling materials on :

- Pressure exerted across the gluteal area (buttocks and thighs)
- Peak pressure "hotspots" at ischial tuberosities
- Users perception of comfort whilst sitting on these slings amongst healthy volunteers

## Background to the study

- There are over 200 devices to redistribute pressure while sitting on the market<sup>(1)</sup>. Most devices, such as pressure-relieving cushions, aim to distribute compressive forces evenly across their surface. In practice, cushions are often covered to protect the surface and maintain cleanliness. However, fitting a cover can produce a 'hammock effect' which increases compressive forces at the bony prominences, such as the ischial tuberosities (IT's)<sup>(2)</sup> (Figure 1). Materials with two-way stretch are typically used for the cushion covers to overcome this effect.<sup>(3)</sup>
- For many people with restricted mobility, the pressure-relieving properties of cushions could be further disrupted by the use of a hoist sling.

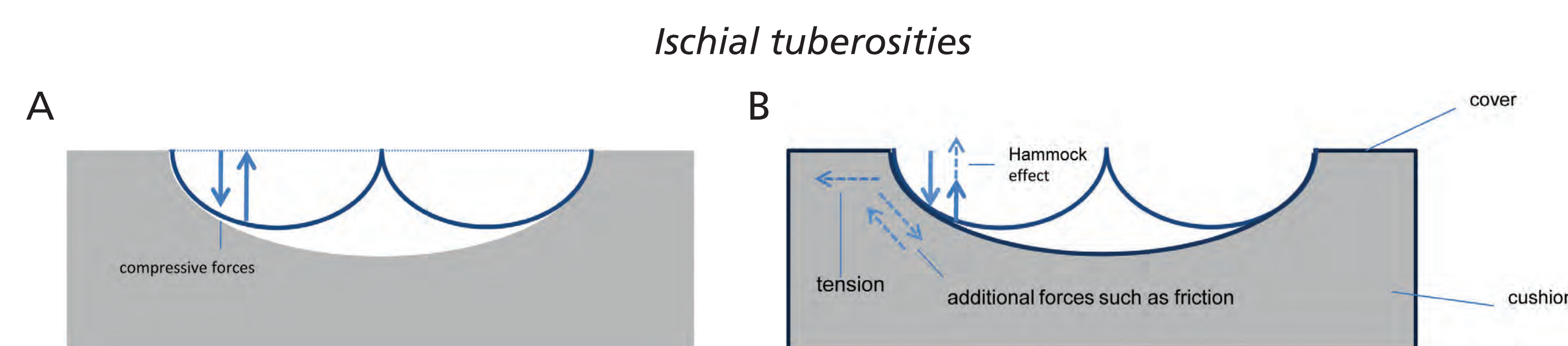


Figure 1 Theoretical model of hammock effect in wheelchair cushion.

(A) The situation without a cushion cover,

(B) The situation with a cushion cover. Friction from the cover develops causing additional tension along the cushion surface producing forces known as the hammock effect (Iizaka et al, 2009)

## The cost of Pressure Ulcers in the UK

Pressure ulcers (PU) are a common, costly, mostly preventable complication for health care services.<sup>(4),(5)</sup> Across Europe approximately 18% of in-patients have a pressure ulcer at any one time, with the sacrum and heels most commonly affected.<sup>(6)</sup> Four percent of National Health Service expenditure in the United Kingdom (U.K)(£1.4 – £2.1 billion each year) is spent managing pressure ulcers.<sup>(7)</sup> As well as the financial cost and burden on health services, pressure ulcers have physical and psychological consequences to the person affected<sup>(8)</sup>, interfering with activities of daily living and quality of life.<sup>(9)</sup>

## Method

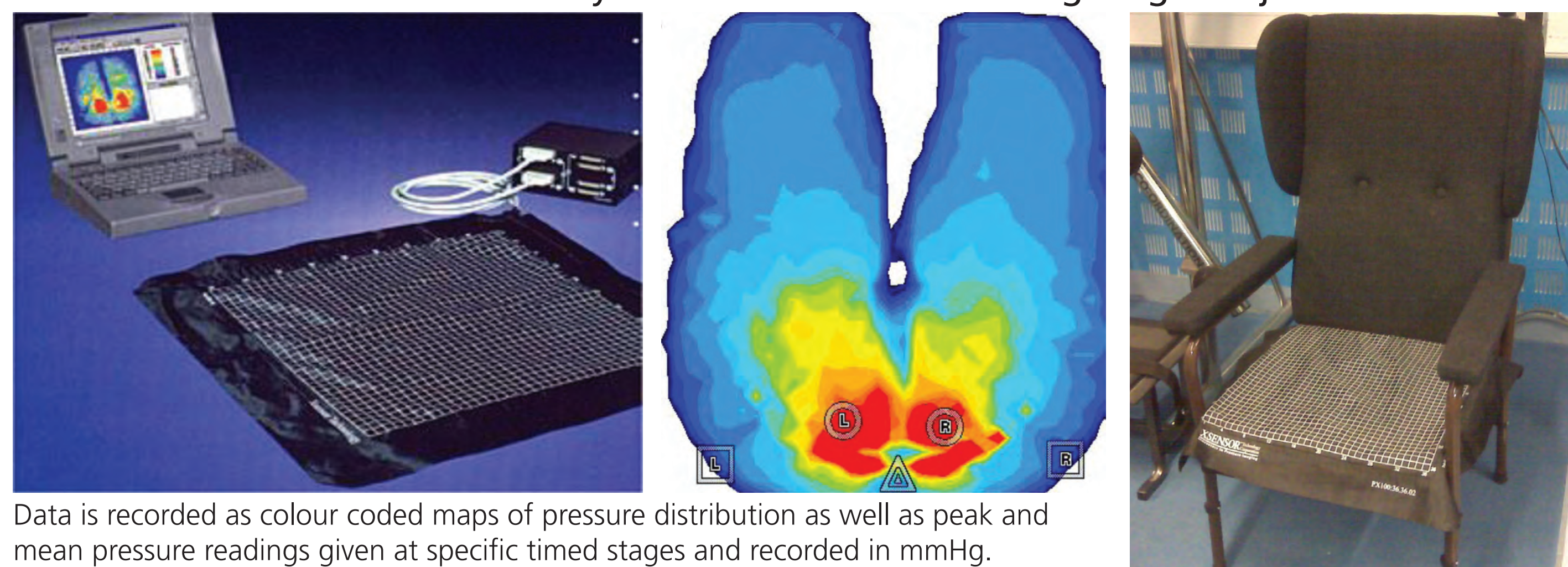
- 60 healthy volunteers recruited from staff and students in School of Health Sciences (Following UoS ethics approval)
- Exclusion criteria - any health condition limiting mobility; and a bodyweight greater than the safe working load of the adjustable height chair (18 stones / 114kg).

Four occasions of pressure mapping as indicated below, conditions randomised:

- Control – Seated on the chair with the pressure mapping mat underneath the gluteal area
- Condition A – Seated on the chair with the pressure mapping mat underneath a sling in polyester fabric (a warp knitted heatset polyester).
- Condition B - Seated on the chair with the pressure mapping mat underneath a sling in slipfit fabric (a plain ripstop, woven parachute silk fabric from high tenacity nylon 66 yarn).
- Condition C – Seated on the chair with the pressure mapping mat underneath a sling in spacer fabric (a warp knitted polyester, similar to the plain polyester but with a monofilament 'spacer' yarn separating the two sides of the cloth).

## Outcome Measures / Instrumentation

X-Sensor Pressure Measurement System from Sumed including height adjustable chair:



Data is recorded as colour coded maps of pressure distribution as well as peak and mean pressure readings given at specific timed stages and recorded in mmHg.

## Collection of data

- Pressure readings were recorded every 30 seconds for ten minutes in each condition with a one minute "walk" inbetween to allow tissue perfusion recovery prior to repositioning.
- Questionnaire to rate the comfort of the fabric on a five point scale of (1 = very uncomfortable; 2 = uncomfortable; 3 = adequate; 4 = comfortable; and 5 = very comfortable) and also whether sweating occurred (yes/no)
- In addition to this participants were also asked for any other comments and ranked each fabric in order of their preference (1,2 or 3 with 3 being the least preferred)

## Data analysis

Data were analysed using one way repeated measures analysis of variance (ANOVA) with Bonferroni adjustment for multiple testing to determine whether:

- There were any differences between the control condition and each of the three sling fabrics in terms of ;
  - surface area,
  - average gluteal interface pressure
  - peak pressures at the right and left ischial tuberosities, right and left greater trochanters and coccyx
- Any sling fabric increased area and reduced interface pressure more effectively than others
- Comfort ratings for fabrics were compared to each other using Friedman's ANOVA. Cochran's Q test was used to determine whether there were any differences in perceived occurrence of sweating between fabrics.
- All analyses were conducted using SPSS version 16.

## Results

- Mean interface pressure across the gluteal region was significantly lower in two (spacer and polyester) of the three fabrics compared to the control condition (ie sitting on the chair only).
- Overall, the breathable spacer fabric increased surface area most and was thus most effective at reducing mean gluteal interface pressure.
- Spacer fabric significantly reduced peak left and right ischial tuberosity pressure.
- Polyester fabric made no significant difference to peak left or right ischial tuberosity pressure although did significantly reduce gluteal pressure in comparison to being seated on the chair cushion only.

	Control mean (SD)	Spacer fabric mean (SD)	Slipfit Fabric mean (SD)	Polyester fabric mean (SD)
Gluteal Area (cm <sup>2</sup> )	1620.65 (154.50)	1672.45 <sup>amx</sup> (144.12)	1646.61 <sup>a</sup> (147.42)	1646.96 <sup>a</sup> (145.14)
Gluteal Interface pressure (mmHg)	36.33 (3.41)	35.32 <sup>am</sup> (3.15)	36.10 (3.34)	35.72 <sup>c</sup> (3.50)
Peak pressure at left ischial tuberosity (mmHg)	66.87 (16.85)	60.00 <sup>amz</sup> (14.44)	67.88 (17.58)	66.18 (21.37)
Peak pressure at right ischial tuberosity (mmHg)	64.70 (16.29)	58.02 <sup>amy</sup> (13.62)	65.68 (18.28)	64.23 (19.27)
Peak pressure at left GreaterTrochanter (mmHg) (n = 48)	19.15 (3.72)	18.42 (2.95)	18.00 (3.51)	18.54 (3.18)
Peak pressure at right Greater trochanter (mmHg) (n = 57)	18.63 (3.95)	19.02 (4.86)	18.79 (4.84)	19.56 (4.65)
Coccyx pressure (mmHg) (n = 56)	32.07 (10.15)	30.88 (9.22)	31.16 (11.49)	31.48 (9.33)

Table 1: Means and standard deviations (SD) for gluteal area and peak pressures at the gluteal interface, left and right ischial tuberosities, right and left greater trochanters and coccyx for the control and three sling fabric conditions (n=60).

## Results from participants perception

The spacer fabric was considered to be the most comfortable (p<0.0005), with a median score of 4 (IQR 4-5) compared to the polyester (median score = 4: IQR 3-4) and slipfit (median score = 3: IQR 3-4) fabrics. Few people reported any localised sweating (spacer n=7; slipfit n=8; polyester n=3) with no differences between fabrics (p=0.22). Overall, participants' preference was for the spacer, followed by the polyester and then the slipfit.

## Conclusion

These findings suggest that being left seated on slings alone may not increase pressure ulcer risk amongst those needing to be regularly hoisted. In fact, if a sling has to be left in situ the spacer fabric is more likely to minimise risk of pressure ulcer development than either the slipfit or polyester. This contradicts current advice<sup>(10),(11)</sup> to always remove a sling following transfers and may go somewhere to providing an evidence base to assist clinicians with their clinical decision making.

Future study should be completed with a disabled population to validate the results.

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