



MRI Evaluation of Changes in Deep Tissue Thickness for a Novel Alternating Pressure Overlay (APO)

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BACKGROUND

Moderate to long duration (3 hours and longer) surgeries significantly increase the risk for developing Pressure Ulcers post-surgery. Commonly used pressure ulcer prevention strategies, such as repositioning patients and use of active support surfaces cannot be employed during most surgical procedures. Active surfaces such as alternating pressure (AP) mattresses are typically not used for pressure relief in operating rooms (ORs) as they may cause body movements during surgery. Understanding the interaction between the various types of support surfaces and the physiological changes taking place in the deep tissues is important to effectively evaluate support surfaces.

OBJECTIVE

To evaluate the effects of covered foam OR Pad and a novel alternating pressure (AP) overlay on deep tissue structure using magnetic resonance imaging (MRI).

METHODS:

One healthy male and one female participated in this pilot study. A two-inch thick OR pad with highly resilient foam was used. Magnetic resonance imaging (MRI) was performed to quantify anatomical changes taking place in the deep tissues. Subjects were asked to lie supine over OR pad alone and with the AP overlay placed on top of the OR pad. Changes in thickness of deep tissues under bony prominences due to compression and deformation were analyzed.

“Tissue decompression observed during the deflation cycles may allow enhanced perfusion thus limiting risk for developing PUs.”

RESULTS:

The AP overlay provided adequate decompression of the tissues during the deflation phase despite the low profile design. The average tissue thickness between the ischial tuberosities (IT) and the skin-support surface interface for the male subject (BMI of 25.1) was 5cm and 4.8cm (female subject: BMI of 18.9, 4.65 cm and 4.4 cm) at time 0 minutes and 60 minutes respectively for the OR Pad. The tissue thickness under the ITs during the inflation and deflation cycles of the AP overlay at time 0 minutes was 5.1cms and 5.9cms (female: 4.25 cm and 4.8 cm) respectively and at time 60 minutes 4.95cms and 5.8cms (female: 4.2 cm and 4.8 cm) respectively.

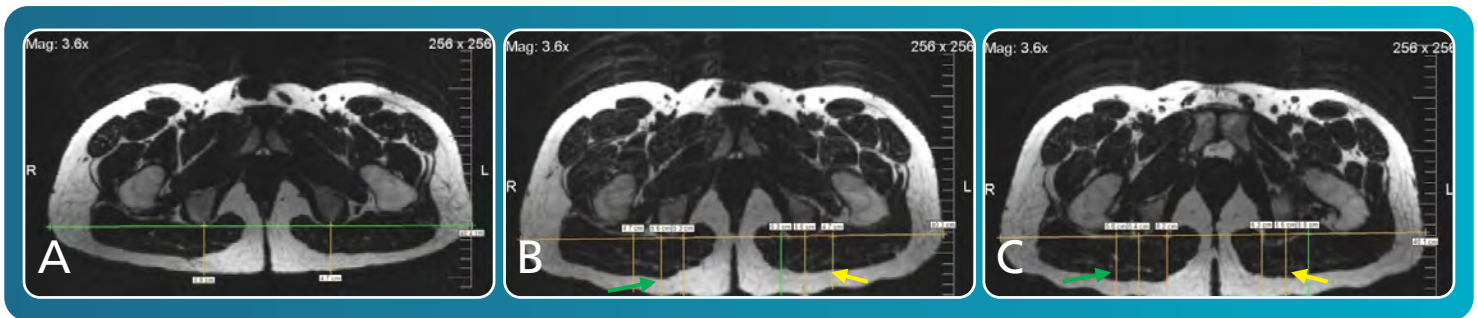


Fig A: Cross-sectional MRI of pelvic area while lying on the OR pad alone. The compression on various tissues are continuous while lying supine on the OR pad.

Fig B and C: MRI images while lying supine on the AP overlay. The green arrows indicate areas of decompression and yellow arrows indicate areas of compression.

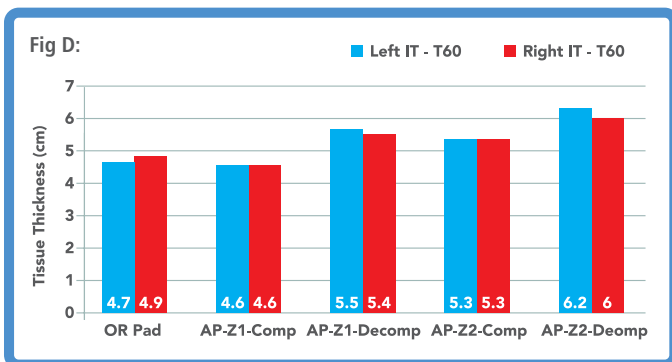


Fig D: Graph shows the tissue thickness under the ischial tuberosities (IT) for the OR pad alone and OR pad + overlay during the inflation and deflation phases.

CONCLUSION:

The tissue decompression observed during the deflation cycles may allow enhanced perfusion thus limiting risk for developing pressure ulcers from ischemia and constant loading. The relatively small height differential between the inflated and deflated zones minimizes skin stretch and the risk for shear stress related injury is reduced.

1. Reddy M, Gill SS, Rochon PA: Preventing pressure ulcers: A systematic review. JAMA 2006; 296:974–984
2. Reger SI, McGovern TF, Chung KC. Biomechanics of tissue distortion and stiffness by magnetic resonance imaging. In: Bader DL, (ed): Pressure Sores-Clinical Practice and Scientific Approach. London: Macmillan Press Ltd. 1990:177-90.