



# INITIAL ASSESSMENT OF TISSUE WATER CONTENT SURROUNDING PRESSURE ULCERS IN SPINAL CORD INJURY PATIENTS

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## BACKGROUND AND OBJECTIVES

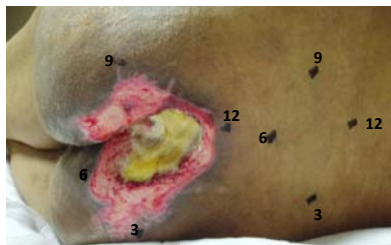
Pressure Ulcers have varied trajectories of healing that are not predicted by stage alone. One of the parameters that might differ between a chronic, non-healing pressure ulcer and one that is healing is the amount of periwound edema. There has been no readily available method of quantifying this except for palpation.

**INSTRUMENTATION** A noninvasive device for measuring relative tissue water has recently become commercially available (MoistureMeter-D, Delfin Technologies Ltd). It uses 300MHz electromagnetic waves to determine the relative tissue water content based on measurement of the tissue dielectric constant. Depth of measurement is controllable by using different diameter



## STUDY DESIGN AND SAMPLE

Sixteen subjects with spinal cord injury (SCI) and chronic stage III or IV pressure ulcers over the sacrum or ischium were studied. Measurements were taken in triplicate at 4 standardized sites (12, 3, 6, and 9 o'clock) spaced circumferentially around each wound. A control area was also measured, located ~4 cm superiorly to the wound for sacral lesions, and on the contralateral uninvolved ischium for ischial lesions. Sites were marked for repeatability and photographic documentation as shown in the figure. The Friedman nonparametric test for repeated measures was used to test significance. It was confirmed via Wilcoxon Signed-Ranks test.



## FINDINGS

TABLE 1. Sample characteristics

N=16	Mean ± S.D.	Range
Age of subject (yr)	60.6 ± 14.6	38-79
Age of wound (mo)	7.0 ± 8.6	0.5-36
Level of injury	# of subjects	
High quadriplegia (C1-C4)	2	
Low quadriplegia (C5-C8)	3	
High paraplegia (T1-T6)	6	
Low paraplegia (T7-L3)	4	
Location of wound	# of subjects	
Right ischium	3	
Left ischium	4	
Sacrum	9	
Stage of wound	# of wounds	
Stage III	4	
Stage IV	12	

TABLE 2. Relative tissue water

N=16	Mean ± S.D	Min	Max	p=0.046
Wound	51.1 ± 8.2	38.9	66.2	
Control	46.9 ± 7.7	28.1	56.4	

## DISCUSSION

Tissue water content was significantly greater around the wounds than around the control areas. While most of the individual measurements conformed with the group average, a few of the wound measurements were far lower or higher in relative tissue water than were their counterparts. Most frequently, this would occur at the 6 o'clock position on a sacral wound, where the subcutaneous tissues had been replaced by scar tissue, and the skin felt as if it were attached to bone.

## CONCLUSIONS

Relative tissue water was easily measured with this hand-held device, which demonstrated increased relative water around pressure ulcers compared to control sites.

## FUTURE RESEARCH

Relative tissue water should be measured longitudinally to see if it correlates with the trajectory of healing.