

The Relationship Between Peak Seat Interface Pressures and the Braden Scale

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ABSTRACT

The primary objective of this study was to determine if there is a relationship between peak seat interface pressure, measured by the Novel Pliance System™, and the Braden Scale. A relationship between these two could provide evidence that the Braden Scale is an accurate predictor of peak seat interface pressures in the elderly. This may provide long-term care facilities an economical predictor of peak seat interface pressure and potential for ulcer formation. Twenty subjects from a local skilled nursing facility participated in our study. All subjects were 60 years of age or older, and could be positioned in a 90/90 degree hip and knee seating position. Subjects were positioned on a Novel Pliance System™ sensor mat (1024 sensors, 1.5 cm² sensor area) and pressure was measured for fifteen seconds. The data obtained resulted in a “pressure map” of the seat interface. Each subject was scored by the nursing staff using the Braden Scale. The scores from the Braden Scale were correlated with the peak pressure values using a Pearson product moment coefficient correlation. Poor correlations were found between the Braden Scale and peak pressure leading to the conclusion that there may be other factors that may effect the Braden Scale score other than peak seat interface pressure, such as moisture level, activity level, nutritional status, sensory perception, and friction and shear. Only .02-10.11% of the variability of the peak interface seat pressure was explained by the Braden Scale score.

INTRODUCTION

Pressure ulcers are a common and costly problem facing geriatric institutions. Pressure ulcers are frequently acquired by the elderly, the malnourished, and those patients with restricted mobility who are hospitalized, confined to a bed or a wheelchair for hours at a time (Day, et al, 1997). A pressure ulcer is physiologically defined as a lesion on the skin surface that results in blistered, broken, or necrotic skin. It has been reported that one out of ten hospitalized patients and twenty five percent of all nursing home patients have a pressure ulcer in varying stages. In 1989, the cost of treating a single pressure ulcer has been estimated between \$1,300 to \$35,000 (Vanden Bosch, et al, 1996).

The Omnibus Budget Reconciliation Act (OBRA) of 1987, federally mandated that residents who enter a skilled nursing facility without a pressure ulcer must not develop one unless the clinical condition makes it unavoidable. This regulation mandates that providers

establish institution-wide skin care regimens standardized by the Agency for Health Care Policy and Research that stress prevention and early intervention. Due to the Perspective Payment System (PPS) changes, Medicare has decreased funding to long-term care facilities therefore making it important to more effectively prevent and treat pressure ulcers.

As a vital member of the medical team, occupational therapists aid in detection and early intervention of pressure ulcers. Due to the close contact that occupational therapists have with patient on a daily basis during activities of daily living, occupational therapists are able to monitor skin integrity changes. Occupational therapists also play a crucial role in wheelchair seating and positioning to decrease the incidence of pressure ulcer formation. By maintaining a proper seat interface with cushions and properly fit wheelchairs, the incidence of pressure ulcers may decrease. The theory of the traditional medical model is that pressure is a leading contributor in pressure ulcer formation, and that by elevating some of this pressure there will be a decrease in ulcers.

With our population aging, and today's emphasis on prevention and quality assurance, the importance of being able to accurately assess and treat maladies such as pressure ulcers increases. Understanding which elements relate to pressure ulcer formation, therapists and other team members may be better equipped to holistically prevent and treat ulcers.

The Braden Scale is used in long-term care facilities to predict pressure ulcer formation and guide subsequent preventative measures. The six subscales of the Braden Scale measure sensory perception, skin moisture, activity level, mobility, nutrition, and friction and shear forces. A lower score on a scale that ranges from 0-23 places the individual at a higher risk for pressure ulcer development. It has been found that the Braden Scale has the highest predictive validity when compared to other scales such as the Norton and the Waterlow (Pang, et al., 1998). The Braden Scale has been shown to have a high reliability ($r=.84-.99$) when assessment of patients is performed by nurses aides and licensed practical nurses (Bergstrom, et al., 1998).

The Novel Pliance System™ is a flexible 32" by 32" capacitive sensor mat connected to a computer that measures peak seat interface pressure. Each sensor measures peak pressure at the seat interface graphically on a computer screen (see Figure 1). The computer assigns numerical pressure values to the colored elevations. The test-retest reliability of peak seat interface pressures of a group of 10 residents showed an intraclass correlation coefficient of .84. This reliability reflects the reproducibility of the participant positioning as well as the peak seat interface pressure measurements (Kernozeck, et al., 2000).

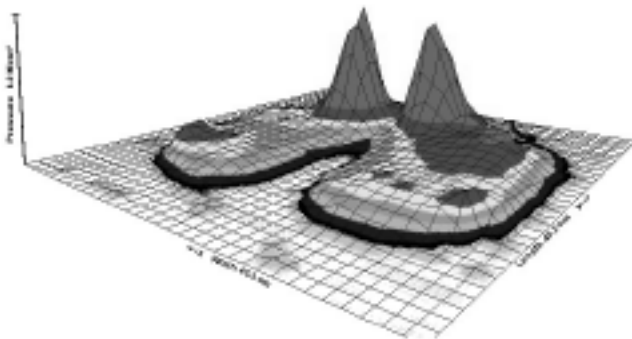


Figure 1: Graphical Depiction of Peak Seat Interface Pressure

The hypothesis of this study was that when there is a high peak seat interface pressure measured by the Novel Pliance System™, there would be a low Braden Scale score. An inverse relationship between the Braden Scale score and peak seat interface pressure was expected, indicating that the Braden Scale is an accurate predictor of peak seat interface pressure.

METHOD

Participating in this study was 20 subjects; male and female who currently reside in a long-term care facility. All participants were required to sign an informed consent form approved by the university IRB guidelines prior to participation in the project. Participants were at least 60 years of age and were required to be able to sit in a 90 degree hip and knee seated position. Each subject was scored using the Braden Scale by the nursing staff at the long-term care facility. The Novel Pliance System™ was placed into a wheelchair and calibrated using a pressure chamber through the measurement range (0.1-3.0 Newtons per centimeter squared) prior to use. The subjects were transferred onto the Novel Pliance System™ and positioned in 90-degree hip and knee flexion. Hip and knee angles were verified using a hand held goniometer. Individuals were measured by the Novel Pliance System™ for 15 seconds resulting in a “pressure map” of the seat interface. The computer assigned numerical pressure values to the colored elevations. The scores from the Braden Scale were correlated with the peak pressure values attained from the Novel Pliance System™ using a Pearson product moment correlation coefficient.

RESULTS

The results from the Pearson product moment correlation coefficient showed a poor relationship between peak pressure and the Braden Scale. As can be seen by Figure 2, there is a slight downward trend when comparing Braden Scale scores to peak seat interface pressures, but it is not statistically significant. The r-value of peak pressure vs. Braden total score is -.107. As shown in Table 1, r-values ranged from -.318 to .095 when comparing peak seat interface pressure to the six Braden subscales. Peak seat interface pressure did not correlate well with age, height, weight, and length of stay in the long term care facility. These r-values

ranged from -.183 to .364, showing no significance.

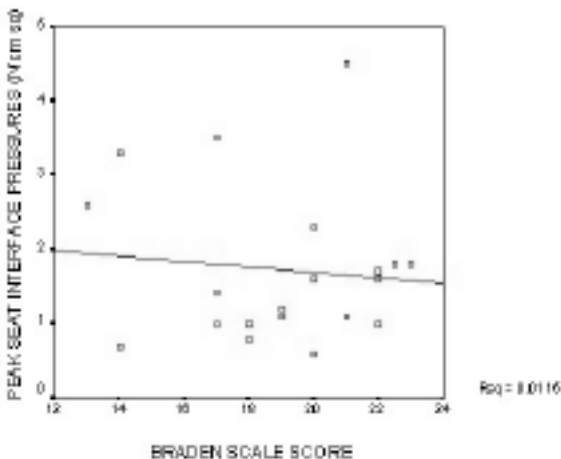


Figure 2: Peak seat interface pressure relationship to the Braden scale scores.

Table 1: Pearson Correlation Coefficient (r) between peak seat interface pressures and the Braden Scale.

	Braden Subscales						Total Braden Score
	Sensory Perception	Skin Moisture	Activity	Mobility	Nutrition	Friction & Shear	
Peak Seat r	.026	.095	-.106	-.016	-.318	-.112	-.107
Interface Pressures r ²	.000676	.009025	.011236	.00256	.101124	.012544	.011449

DISCUSSION

“Guttman forcefully advocated the term ‘pressure sore’ because where there is no pressure there is no sore” (Woolsey et al., 1995). This statement though, uttered in truth has been demonstrated by our research to be an incomplete picture of what may cause pressure ulcers. To avoid the development of pressure ulcer formation, an interdisciplinary approach is necessary. Nursing, dietary, speech therapy, and physical and occupational therapy all need to be represented in the at-risk individual’s care to ensure that all risk factors are being addressed.

Based on the results of the study, we are led to believe that there are more factors than just peak seat interface pressure that are significant in the development of pressure ulcers. Some of these may include friction and shear forces, nutritional status, moisture level, activity level, and sensory perception, all of which are assessed on the Braden Scale. The amount of time spent in a wheelchair throughout the day may also be a contributing factor. According to Woolsey, et al., it has been demonstrated that there are two main variables in pressure sore production: (1) time and (2) compressive force. While peak pressure is still believed to be a factor in pressure ulcer development, pressure ulcers may be caused from a combination of factors. Friction and shear forces can contribute to pressure ulcer formation by occluding subcutaneous blood vessels, resulting in tissue ischemia. Friction and shear forces can occur when skin is moved across bedsheets during transfers in and out of bed or when patients are propped up in bed and then slides down. Under these circumstances, subcutaneous tissues are stretched while the skin remains stationary, resulting in occlusion of blood vessels. Nutrition, activity level, and moisture can also contribute to ulcer formation. Moisture, often resulting from incontinence or perspiration, can lead to tissue maceration and facilitate skin breakdown. Poor nutrition is correlated with the severity of a pressure ulcer, especially low protein intake (U.S. Department of Health & Human Services, 1994). People with poor nutritional status have also been found to heal at a slower rate. Those with a decreased activity level are at an increased risk for pressure ulcer formation. Decreased sensory perception, as seen in patients with spinal cord injuries and diabetes, can lead to pressure ulcer formation. These patients are unable to sense increased pressure or pain due to tissue damage, leading to a delay in detection and intervention of pressure ulcers.

Our research also found that peak seat interface pressure and body weight had a poor correlation. This may be because individuals who have a greater body mass distribute this weight over a larger area. Therefore, peak seat interface pressure may be higher in individuals with more lean body mass who tend to have higher pressures around bony prominences.

Occupational therapy's role in prevention and treatment of pressure ulcers has primarily been through wheelchair positioning and seating. However, the foundation of occupational therapy is a holistic treatment approach. This should apply to the treatment of pressure ulcer development as well. Throughout history occupational therapists have been a vital and necessary part of the medical team. Occupational therapy's foundation in occupations, roles, and motivation makes therapists significant partners in the prevention and treatment of pressure ulcers. Maladies such as pressure ulcers greatly affect the quality of life as well as the individual's overall health. Traditionally, occupational therapists have been key in developing occupations and leisure activities that allow individuals greater satisfaction and quality of life. This aspect of occupational therapy can and should be applied when treating pressure ulcer patients. In treating the whole person, both physically through positioning to decrease pressure, psychologically, through increasing quality of life, and physiologically, by decreasing the amount of time that the individual is stationary in the wheelchair, prevention of pressure ulcers will be more effective. Greater focus has been placed on pressure as being the primary factor of pressure ulcer formation. It is easy then to neglect other pertinent factors that are also important in pressure ulcer formation. Factors such as nutrition, mobility, moisture, and sensory perception are all important in formation of ulcers. Indicative of the importance to work in a holistic team approach when treating and preventing pressure ulcers.

LIMITATIONS

The largest limitation of our study was our limited sample size. Our study only utilized 20 subjects. Outliers may have influenced our data due to this small sample size. Our subjects were also all residing at the same local long-term care facility, therefore, the population sample was not representative of elderly individuals on a large scale. These subjects were also chosen for us by the Director of Nursing, therefore, may not have been representative of the population of the long-term nursing home either. On our initial data sheet, in which age, height, length of stay were recorded it was not noted whether the subjects had any pressure ulcers present. Data was not gathered on the amount of time the individual spent in a wheelchair as well. This information would have been important to know when taking into account the affects of pressure on ulcer formation, and would have been beneficial in our initial data collection.

Our literature review revealed that there is limited research on the development of pressure ulcer formation and its relationship with peak seat interface pressures. The studies that have been done on this topic were done primarily with paraplegic, quadriplegic and amputee patients. Our subjects were all elderly, with the primary diagnosis being cerebral vascular accident. Only one subject was paraplegic. Future research needs to examine this growing portion of the U.S. population.

Our study, though statistically insignificant, has yielded many pertinent questions.

These questions could be addressed through future studies including: (1) comparing the prevalence of pressure ulcers with each Braden Scale component, (2) a study of occupational therapy's effectiveness in treating and preventing pressure ulcers, and (3) a similar study comparing peak pressures and pressure ulcer formation, with a larger sample size and more complete initial data gathering.

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