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Comparison of Tractor Seating Under Dynamic Conditions for Farmers with Ergonomics of Difference

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INTRODUCTION

- Agricultural machinery exposes farmers to unique forces within the seating system via environmental, biological, and physical factors. These conditions place farmers at risk for musculoskeletal and vibration related illnesses.
- The purpose of this research is to study the seated pressure distribution of test subjects on a typical contour tractor seat compared to four different wheelchair intervention cushions during dynamic tractor conditions.

METHODS

- Quantitative cross-over design.
- Three subjects: Men with no serious health conditions.
- Under dynamic tractor conditions, each subject completed separate trials on five different seat conditions.
- Seating conditions included a typical contour tractor seat; a 2 inch foam cushion; and a low, mid and high ROHO® air-based cushion.
- ROHO® air-based cushions were customized to ensure air blocks were placed underneath the ischial tuberosities.
- Instrument: XSensor® Pressure Mapping System equipment and software.
- Tractor driven by subjects for 5+ minutes on rough terrain using each seating condition.
- Accepted pressure mapping clinical protocol utilized (Eitzen, 2004).

LITERATURE REVIEW

- Occlusion of blood from tissue secondary to pressure results in ischemia and leads to fatigue (Porter, Gyi, & Tait, 2003).
- Ground forces of moving tractors translate loading forces onto the spine and pelvis (Donati, 2002; Hostens, 2001).
- Tractor seating science has focused on the suspension of the seat vs. microclimate forces in the seat interface (Mehta, et al.; Rakheja, et al.).
- Operators with and without disabilities use aftermarket cushions to gain comfort and support on factory seats (Boggs, 2004; Wilhite, Kennington, & Boeser, 2014).

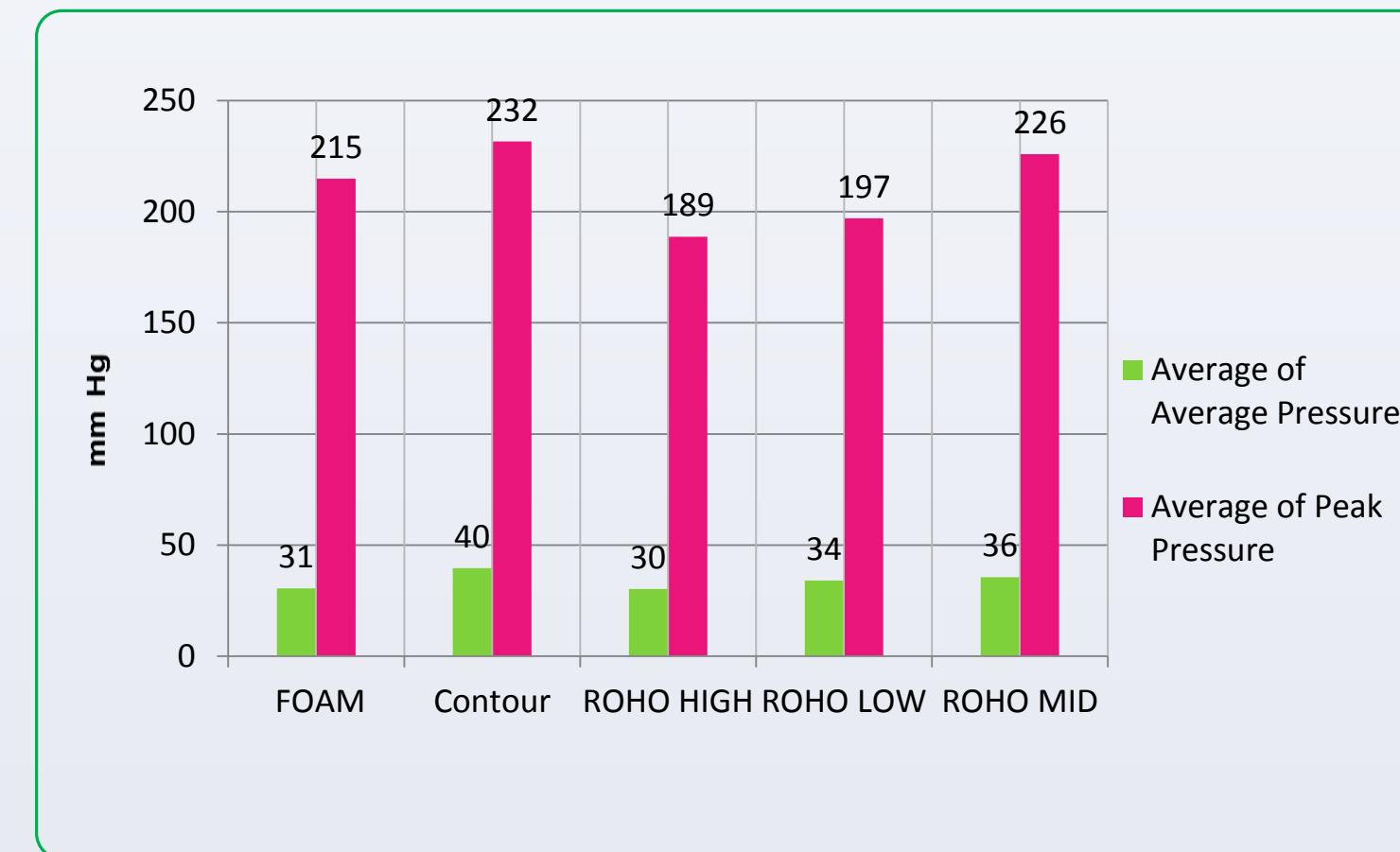


Figure 6: XSensor® : ALL CUSHIONS TOTAL PRESSURE DATA

RESULTS

- For subject 1, the XSensor® pressure mapping data indicated that the intervention cushions provided improved distribution of seated pressure and better immersion compared to the standard contour tractor seat.
- The tractor seat alone did not conform with satisfactory pressure distribution for test subjects.
- In order to accurately recommend best seat interventions for each subject, repeat trials need to be completed. Compare figures 1 thru 5.

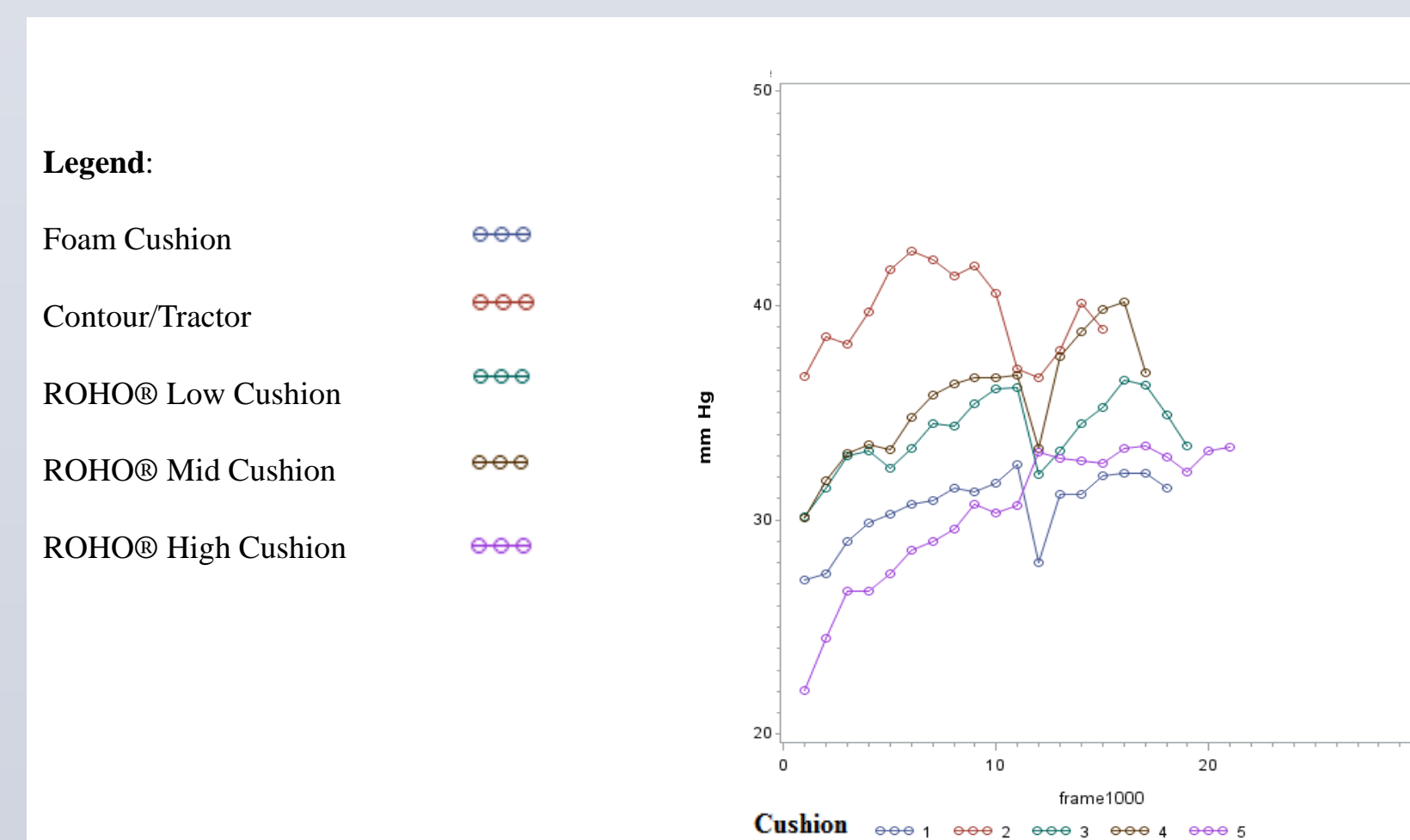


Figure 7: XSensor® : ALL CUSHIONS PRESSURE DATA OVER TIME

XSensor® DISPLAYS for Subject 1 Post Settle

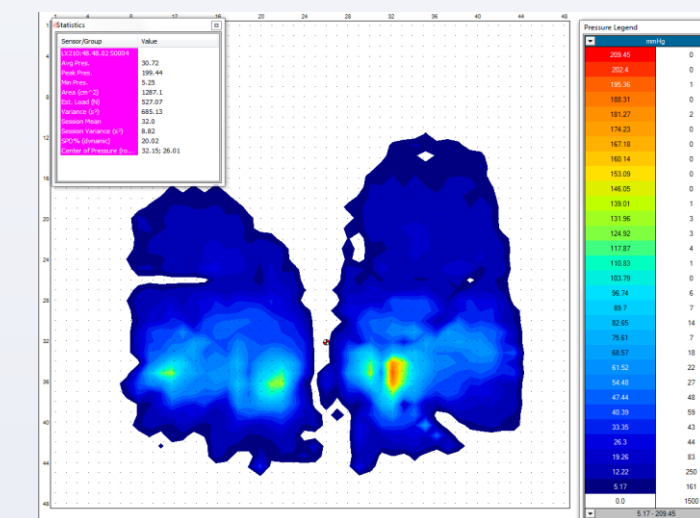


Figure 1: FOAM CUSHION

- Recorded peak pressures above 160 mmHg on right ischial tuberosity.
- When compared to contour tractor seat alone, this cushion offers improved pressure distribution and comfort.
- AVG pressure = 31 mmHg
- AVG peak pressure = 215 mmHg

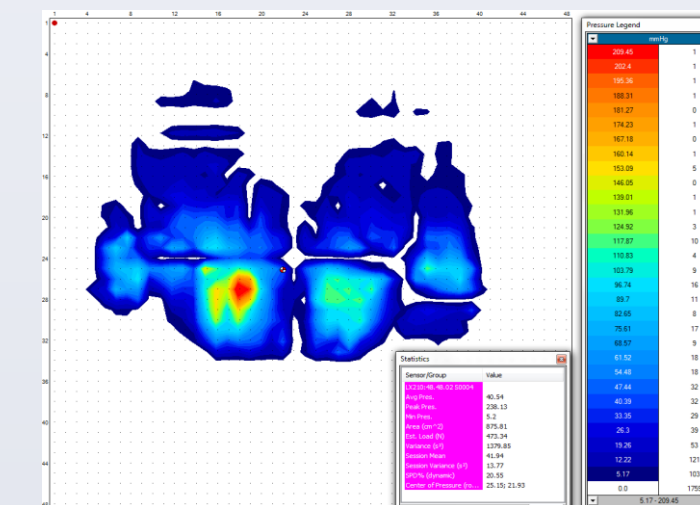


Figure 2: CONTOUR/TRACTOR SEAT

- Recorded sustained pressures above 160 mmHg on Left Ischial Tuberosity.
- For an individual with an SCI, this would present an increased risk factor for developing a pressure ulcer.
- AVG pressure = 40 mmHg
- AVG peak pressure = 232 mmHg

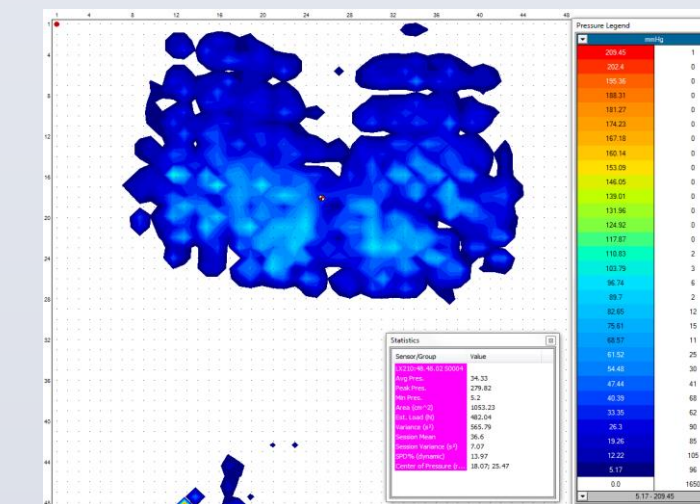


Figure 3: ROHO LOW CUSHION

- When compared to contour tractor seat alone, this cushion provides enhanced pressure distribution and comfort.
- AVG pressure = 34 mmHg
- AVG peak pressure = 197 mmHg

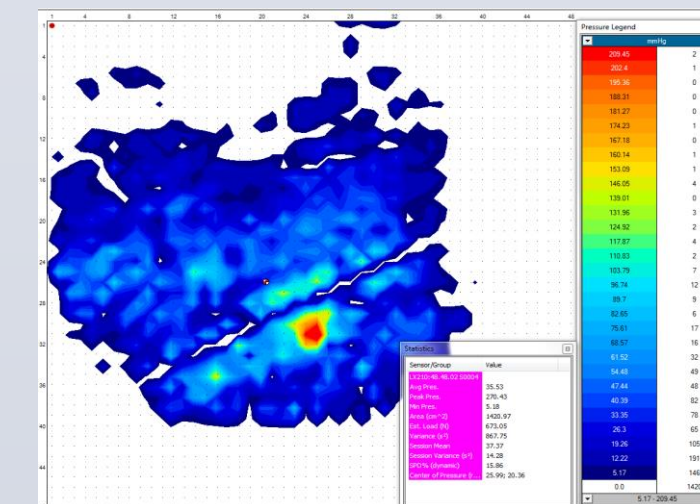


Figure 4: ROHO MID CUSHION

- Recorded peak pressures above 160 mmHg on right ischial tuberosity.
- For an individual with an SCI, this cushion would enhance pressure ulcer risk factor.
- AVG pressure = 36 mmHg
- AVG peak pressure = 226 mmHg

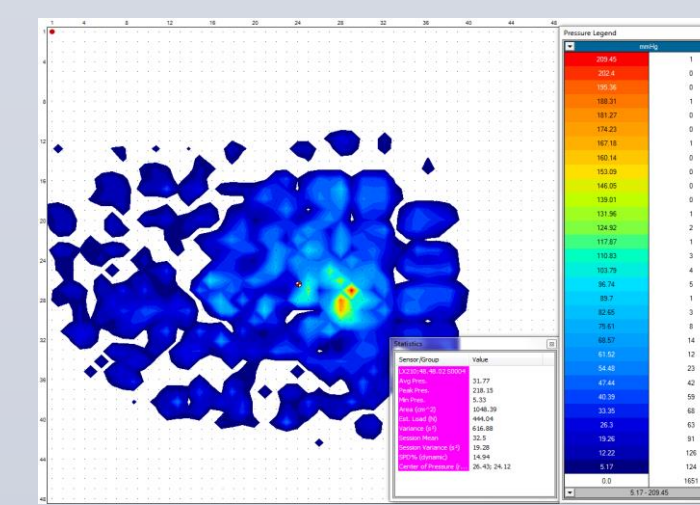


Figure 5: ROHO HIGH CUSHION

- When compared to contour tractor seat alone this cushion provides enhanced pressure distribution and comfort.
- The ROHO® High cushion proved to have the best overall pressure distribution.
- AVG pressure = 30 mmHg
- AVG peak pressure = 189 mmHg

CONCLUSIONS AND RECOMMENDATIONS

- Due to the limited number of subjects in this study, statistical conclusions cannot be made at this time.
- Future tractor seating studies will compare the seated pressure distribution of people with paraplegia during similar dynamic tractor conditions.
- Results revealed a need to increase the duration of testing trials to further investigate the effects of seating pressures using different cushions for longer periods of time.

OCCUPATIONAL THERAPY IMPLICATIONS

- Agricultural machinery is rapidly evolving, but seating, seat materials, and management of seat pressure has remained unchanged or under studied over the past decade (Wilhite, 2015).
- Current product design of seats may not conform to a majority of individuals who vary by size, weight, posture, gender, disability, or health status (Wilhite, 2015).
- Aftermarket accommodations like air cushions demonstrate positive reduction of seating interface pressures under experimental conditions, but the application of an aftermarket cushion may change the seating system in ways that have not been empirically proven safe and effective (Wilhite, 2015).

LIMITATIONS

- Data was collected under dynamic field conditions.
- Only one tractor and contour tractor seat was tested.
- Study findings cannot be generalized to a larger population.
- Limited sample size and non-randomized subjects.
- Variations in clothing wrinkles, pressure map wrinkling, as well as air pressure in the ROHO® air-based cushions.
- Researcher is a new investigator and not blind to the research.

ACKNOWLEDGEMENTS

- Thank you to Dr. Carla Wilhite, OTR/L, and the three subjects who participated in this study; without their help this research would not have been possible.

REFERENCES AVAILABLE UPON REQUEST