

Gender Differences in Spinal Posture and User Positioning on a Prototype Seat Pan

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INTRODUCTION

Recent research has documented spinal posture differences between men and women when sitting in an office chair (Dunk and Callaghan 2005). Women were found to have a greater lumbar lordosis and a slightly forward leaning spine compared to men when sitting and they positioned themselves closer to the front of a seat pan. The current study was undertaken to confirm these earlier findings with subjects of a greater range of anthropometrics as well as to investigate possible differences in user positioning on a prototype pivoting seat pan both with and without a backrest (Squig model supplied by KEILHAUER, Toronto, ON, Canada). This seat pan model varies slightly from traditional pivoting seat pans by including an extra degree of freedom that allows for lateral as well as combined A/P and M/L motion of the user.

METHODS

40 subjects (20 males and 20 females), taken from a university population, were tested on the prototype without a backrest for a 15 minute trial and with a backrest for a 2 minute trial. These subjects were free of back pain for at least 12 months and were screened to bracket a wide range of anthropometrics. Mean height percentile was 56.8 (range 12.9-98.7) for males and 43.2 (range 0.2-99.1) for females. Mean weight percentile was 51.1 (range 8.2-99.7) for males and 55.1 (range 12.9-99.6) for

females. Seat pressure profiles and motion analysis data were collected to give center of pressure, peak pressure, spine angles, center of mass and user position on the seat pan for the 15 minute trial. Motion analysis data alone were collected for the 2 minute trial in order to identify if interaction with the backrest altered user positioning. The subjects performed a combination of typing and mousing tasks at a computer workstation. Both desk and chair were adjusted to fit the subject prior to data collection to maintain proper ergonomics. A comfort questionnaire, including a visual analogue scale for discomfort, was administered at the beginning, at the midpoint and at the end of the 15 minute trial and once following the 2 minute trial. Statistical analysis was performed on the seat pan trials only. Information from the backrest trials was to be used in design decisions for optimal placement of the backrest.

RESULTS AND DISCUSSION

The shape and location of the thoracic and lumbar curves over the seat pan were approximately the same for all 40 subjects across all the trials. Some variability was noted in user positioning in the A/P plane, however, this was not related to either the height or mass of the individual. There was virtually no difference in seated spine height or vertical location of the lumbar curve across genders or anthropometrics.

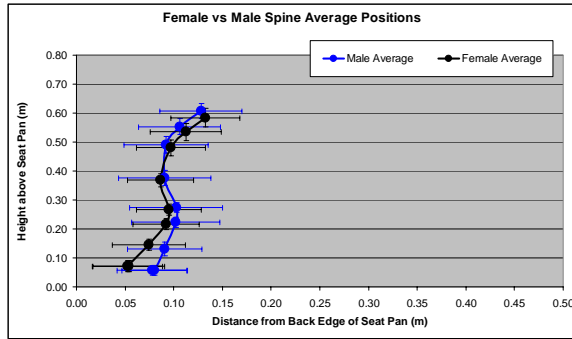


Figure 1: Average spine positions for males and females from back edge of the seat pan.

There was no relationship between percentile and A/P positioning on the seat pan. Some of the tallest subjects sat closer to the front edge of the seat pan, while some of the shorter subjects sat further back on the seat pan.

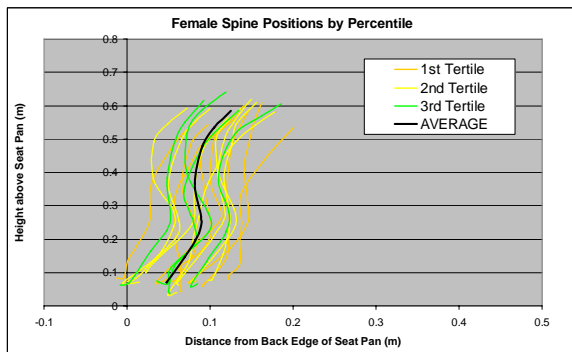


Figure 2: Female spine position on seat pan by percentile.

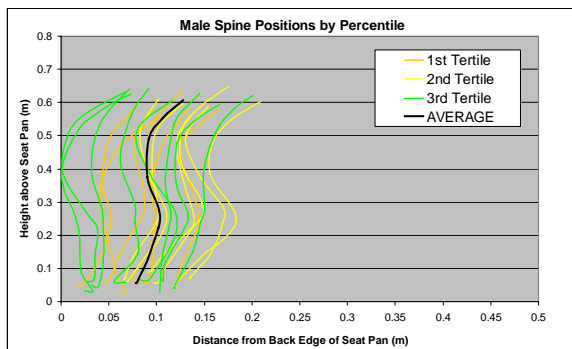


Figure 3: Male spine position on seat pan by percentile.

A major difference in female user position on the seat pan was found. Specifically, the

most posterior part of the buttocks was located closer to the back edge of the chair. A slightly greater lumbar lordosis and a forward leaning posture were noted in the female subjects, agreeing with previous findings by Dunk and Callaghan (2005). A t-test was conducted on user positioning variables for the seat pan trials between men and women. The only statistically significant difference was a greater trunk angle in woman ($p < 0.002479$) as measured from the vertical (more forward leaning). Both male and female subjects sat with an average 10 degree recline during the backrest trial. Seat pressure and discomfort data revealed an asymmetrical distribution of pressure favoring the left side in both male and female subjects.

SUMMARY/CONCLUSIONS

Female subjects may be more sensitive to seat pan type. This would explain the position of their center of mass posterior to the seat base to maintain balance over the pivot point of the chair. Therefore, a potential benefit of this new chair is increased utilization of the backrest. Gender differences in user positioning seen previously appear to be removed by this prototype seat pan. The pressure distribution identified could be attributed to asymmetrical demands of mousing and the additional pivoting degree of freedom in the frontal plane of the chair which warrants further investigation.

REFERENCES

Dunk, N.M. and Callaghan, J.P. (2005) Gender-based differences in postural responses to seated exposures. *Clinical Biomechanics* **20**, 1101-1110.

ACKNOWLEDGEMENTS

This study was supported by KEILHAUER.