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The Effect of Different Foams on Posturography Measures in Healthy and Impaired Populations

The Effect of Different Foams on Posturography Measures in Healthy and Impaired Populations

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Introduction and Background

- Balance and maintenance of upright stance is the result of complex interactions between multiple sensory systems[1] (Figure 1)
  - Manipulation of sensory input during static posturography testing (Figure 2) allows for examination of multisensory reweighting ability

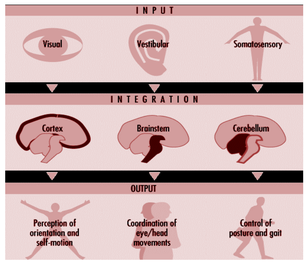


Figure 1: Sensory systems used to maintain balance (image courtesy of http://www.ilo.org/safework_bookshelf/english?content&nd=857170120)

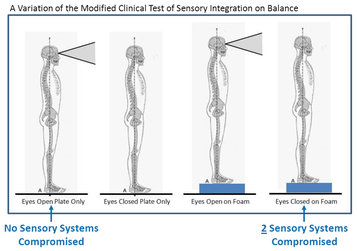


Figure 2: Traditional Static Posturography

- A common method used to perturb balance is to place a foam block under an individual's feet
  - However, no standard has been established which specifies what kind of foam should be used
  - Ex. Studies using static posturography have described foam as "high density visco-elastic foam"[2] or simply "soft foam"[3]

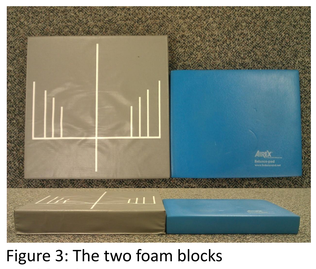


Figure 3: The two foam blocks used for the mCTSIB

- Prior research has determined different outcome measures are affected by choice of foam[4,5], but few have investigated influence on detecting differences between two populations

Research Objective

To compare balance outcome measures of postural control when using two different types of foam blocks to perturb balance. This will be done by evaluating the effect it has on the ability to differentiate between a healthy and impaired population.

Methodology

- 30 subjects participated in this study
  - 15 subjects were in the impaired group and 15 were healthy controls
  - No significant differences in age, height, or weight between the two groups
- Subjects performed a modified clinical test for sensory integration (Figure 2) while standing on two different types of foam (Table 1)

	Type	Dimensions (LxWxH) (cm)	Density (kg/m^3)	UTS (kPa)
Foam 1	Open-cell	50.8x50.8x7.9	32.0	170.3
Foam 2	Closed-cell	47.3x38.4x6.7	55.0	260

Table 1: Foam Specifications

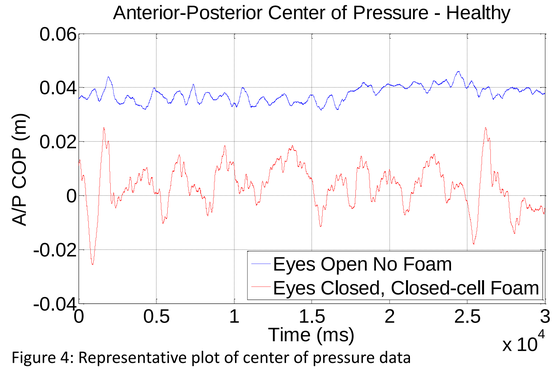


Figure 4: Representative plot of center of pressure data

Data Analysis

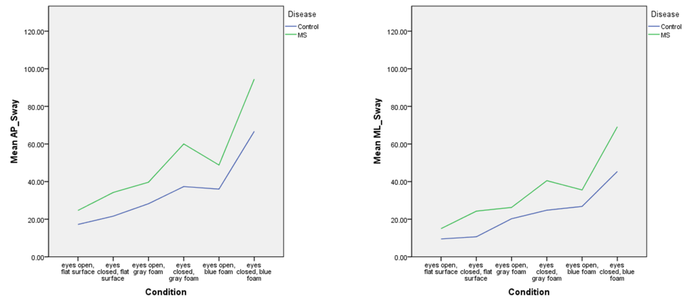
- 3 standard balance measures calculated from filtered center of pressure output from the force plate
  - Anterior-Posterior Sway Range
  - Medial-Lateral Sway Range
  - Mean Sway Velocity
- Results compared using three-way ANOVA

Results

- The surface significantly affected each outcome measure (Table 2)

	F	df	sig/p-value	Est. effect size	Observed power
AP Sway	153.392	2	**>.001**	0.846	0.99
ML Sway	143.835	2	**>.001**	0.837	0.99
Mean velocity	218.357	2	**>.001**	0.886	0.99

Table 2: Surface factor effect



- Post-hoc analysis of Mean Velocity revealed between-subject factor of disease was significant for each surface condition
  - hard flat surface p=0.018
  - open-cell foam p=0.007
  - closed-cell foam p=0.007

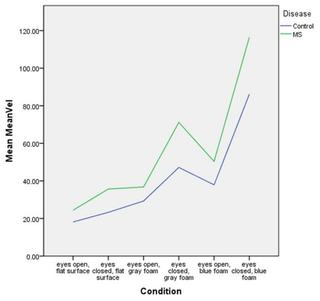


Figure 5: Comparison of mean values

Conclusions

While the surface used in posturography was shown to significantly affect measures of postural sway, findings did not strongly support that there is a single superior type of foam which would best differentiate between healthy and impaired balance. As such, until standardization can be reached it does not appear to matter whether open-cell or closed-cell foam is used, but foam characteristics are important to report to allow study comparison.

References

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