



INCREASED PHYSICAL ACTIVITY AND IMPAIRED BALANCE ARE CORRELATED IN MICE WITH SURGICALLY SPRAINED ANKLES BUT NOT CONTROLS

UNC CHARLOTTE

College of Health and Human Services

Department of Kinesiology

Jason H. Cline, Michael J. Turner, Tricia Hubbard-Turner, Erik A. Wikstrom

University of North Carolina at Charlotte, Charlotte, NC, USA.



SEACSM Annual Meeting
Greenville, SC 2014

INTRODUCTION

- Lateral ankle sprains are one of the most common injuries suffered during physical activity and sport and are known to impair postural control.
- Fatigue also impairs postural control and preliminary evidence in humans suggests that those with a history of ankle injury are more susceptible to fatigue induced impairments in postural control than healthy individuals.
- A mouse ankle sprain model was recently developed and quantified impairments in postural control and decreases in physical activity for up to 4-weeks post injury (Turner et al. 2012).
- However, the effect of a mouse's physical activity level on postural control or the interaction of ankle sprain history and physical activity level remains unknown.

PURPOSE

- To quantify the relationship between physical activity levels (i.e. distance run) and a history of a surgically induced ankle sprain in mice.

METHODS

- Thirty male mice (CBA/J), from Jackson Laboratory (JAX; Bar Harbor, ME) were randomly placed into one of three groups: the transected calcaneofibular ligament (CFL) group, the transected anterior talofibular ligament and CFL (ATFL/CFL) group, and a SHAM group.
- Mice were housed in a vivarium with 12-h light/dark cycles and standardized temperature (18-22°C) and relative humidity (20-40%). Water and standard chow were provided ad libitum. The UNC Charlotte Institutional Animal Care and Use Committee approved all study procedures as meeting the USDA and the Animal Welfare Act guidelines for the appropriate treatment of animal subjects.

METHODS

- Under anesthesia and using proper sterilization techniques, all mice received a small curvilinear incision behind the lateral malleolus of the right hind foot. The respective ligaments were then transected for the CFL and ATFL/CFL groups but no ligaments were damaged or the SHAM group. Incisions were closed using surgical adhesive before post operative care was administered over 72-hours.
- Balance was assessed before and every 6-weeks post surgery by counting the number of right hind foot slips that occurred while the mice crossed an inclined (15°) narrow round beam, 1m long with a 19mm diameter (Figure 1). For this investigation, balance data from the 24-, 30-, and 36-week post surgery assessment were submitted for statistical analysis.



Figure 1: Exemplar image of a mouse crossing a narrow and inclined rounded beam. From: Brooks and Dunnett. Tests to assess motor phenotype in mice: a user's guide. *Nature Reviews Neuroscience* 2009;10;519-529 (supplemental information).

- Physical activity (i.e. distance run) was measured using a solid surface running wheel (127 mm, Ware Manufacturing, Phoenix, AZ), magnetic sensor, and digital odometer (Sigma Sport BC600, Olney, IL) (Figure 2). Daily running wheel measurements were recorded beginning four days after surgery. For this investigation, the distance run the night before balance was assessed was submitted for analysis.



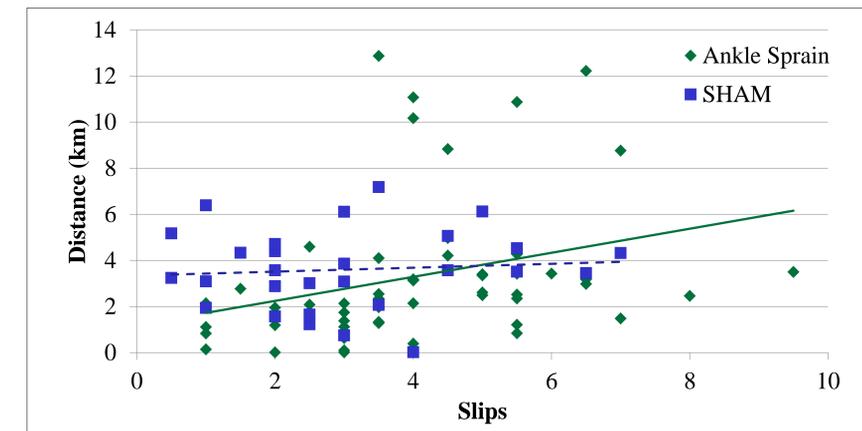
Figure 2: Cage set up including running wheel, magnetic sensor, and digital odometer.

- Pearson Product Moment Correlations were run to determine the relationship between distance run and the number of hind-foot slips for the SHAM group alone (29 data points), and a combined ankle sprains group (56 data points).

RESULTS

- Group demographics can be seen in the table below.
- For the SHAM data set (n=29) no relationship was identified between distance run and right hind foot slips ($r=0.154$, $p=0.425$, $R^2=0.01$).
- In surgically sprained ankles (n=56), a significant relationship was identified between distance run and right hind foot slips ($r=0.305$, $p=0.022$, $R^2=0.15$).

Table: Group Demographics		Mean	Std. Deviation	p value
Slips	SHAM	2.95	1.76	<0.01
	SPRAIN	4.16	1.80	
Distance	SHAM	3.48	1.84	0.87
	SPRAIN	3.37	3.09	



CONCLUSIONS

- Increased physical activity, liberally defined as fatigue, may amplify the postural control impairments observed in those with a history of an ankle sprain.
- These results demonstrate similar relationships as those observed in humans with a history of ankle sprains.

ACKNOWLEDGEMENTS

- This study was funded by the Faculty Research Grants program at UNC Charlotte.



Biodynamics Research Laboratory at
UNC Charlotte