ALTERING KNEE ABDUCTION ANGULAR IMPULSE DURING RUNNING AS A TREATMENT FOR PATELLOFEMORAL PAIN SYNDROME: A 6-WEEK STUDY

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INTRODUCTION
Patellofemoral pain syndrome (PFPS) is the most common running injury, and is characterized by pain under and/or around the patella during movement [1]. Although no biological cause for PFPS is known, recent biomechanical studies have shown that PFPS may be related to knee joint loading. Specifically, Stefanyshyn et al. [2] found that patients with PFPS experience increased knee abduction angular impulses (KAAI) during running compared to healthy controls. Thus, it is reasonable to propose that a reduction of these KAAIs may have a therapeutic effect for PFPS patients. Recently, Lewinson et al. [3] found that medially and laterally wedged footwear could alter the magnitude of KAAIs during running for healthy subjects. Thus the purpose of this study was to determine if PFPS could be treated by reducing KAAIs during running using wedge footwear. It was hypothesized that subjects who experienced decreased KAAIs would show a greater reduction in pain over a 6-week period compared to those who experienced increased KAAIs.

METHODS
Thirty runners with diagnosed PFPS first completed a computerized visual analog scale to record baseline pain according to “usual pain” during running. Retroreflective markers were then secured to subjects’ lower limbs to record their trajectories at a frequency of 2400 Hz. Subjects were then randomly assigned to one of the two footwear conditions (LW or MW) for a 6-week period. Subjects completed a computerized visual analog scale each week to monitor changes in pain during the study. KAAIs were calculated for each subject and trial using a standard inverse dynamics approach, using the average KAAI across the 5 trials for each condition in subsequent analysis. Regardless of the wedge condition assigned, subjects were grouped based on whether the assigned intervention footwear produced an increase or decrease to their KAAI, determined by comparison to the neutral condition. There were 15 subjects in the increased KAAI group (8 LW; 7 MW) and 15 subjects in the decreased KAAI condition (8 LW; 7 MW). An independent-samples t-test (α=0.05) was used to determine if the change in pain over the 6-week period, expressed as %change, differed between groups. Pearson’s correlation coefficient (α=0.05) was computed to determine if a relationship existed between absolute %change in KAAI and %change in pain for those who improved over the 6 weeks.

RESULTS
Of the 30 subjects, 27 experienced pain improvement. The decreased KAAI group (decreased KAAs by 11%) showed an average decrease in pain of 65%, while the increased KAAI group (increased KAAs by 14%) showed an average pain decrease of 50%. This difference was not significant (p=0.336). When plotting absolute %change in KAAI vs %improvement for subjects who improved (2 outliers removed from analysis), a significant (p=0.030) positive correlation was observed (r=0.434) (Fig 1).

DISCUSSION & CONCLUSIONS
Wedged inserts are commonly prescribed as a treatment for PFPS by physicians; however, this is the first study to identify a mechanical relationship by which they elicit improvements. Contrary to the hypothesis, it appears as though it is not the direction of KAAI change that is important, but the absolute magnitude of the change instead. Specifically, the larger the changes in KAAI, the more pain improvement one can expect. It is possible that by altering the magnitude of the KAAI, the point of contact of the forces acting in the patellofemoral joint are shifted in one direction or the other, and unloading the painful region in either case. It is also interesting to note that until now, only medially wedged footwear was thought to be helpful for PFPS patients; however, results of this study show that laterally wedge footwear can be beneficial as well.

REFERENCES

ACKNOWLEDGEMENTS
Adidas International, CIHR, NSERC