INTRODUCTION
Previous literature has demonstrated a link between occupational prolonged standing and low back pain. Studies have shown 40-70% [1,2] of asymptomatic individuals develop transient low back pain during standing. Aids have been developed for people to use while standing that are meant to prevent development of this transient low back pain. For example, sloped platforms have been shown to decrease pain development in those who develop transient LBP at similar levels as those who do not develop transient LBP at all during standing [3]. The purpose of this study was to assess the lumbopelvic kinematics and trunk muscle thickness changes during sloped standing.

METHODS
Eleven subjects (6 male, 5 female) were recruited from a university student population. Subjects stood in three postures (level, incline, decline) for 1-minute quiet standing trials, followed by 16 minutes in each of the standing postures, during which subjects performed a light assembly task. Lower body and trunk kinematics were measured using an Optotak Certus system (Northern Digital Inc., Waterloo, ON). Marker data were imported into Visual 3D (C-Motion, Kingston, ON) to calculate global pelvis, relative trunk, and lumbar lordosis angles. Kinematics were averaged over the 1-minute standing trials in the acute conditions, and every 5 minutes in the prolonged conditions. Muscle thickness measurements of the right erector spinae (ES), external oblique (EO), internal oblique (IO), and transverse abdominis (TrA) (Figure 1) were obtained during the acute trials using ultrasonography (B-Mode, Sonosite, Bothel, WA, USA). The transducer was placed into a jig that allowed for consistent positioning and pressure of the probe. A custom program was used to align the images to ensure that any rotation of the transducer did not impact measurement [4]. All outcome measures were entered into a two way general linear model with a between factor of gender and within factor of standing posture (p < 0.05).

RESULTS
A significant main effect of standing posture was found for each joint angle. Standing on an incline caused significant anterior rotation of the pelvis and an increase in lumbar lordosis compared to level ground standing. The decline posture showed a trend towards posterior rotation of the pelvis (not significant) and a decrease in lumbar lordosis. The kinematic changes found for the acute trials held for the prolonged trials, with no main effect or interaction that included any change over time for the joint angles (Figure 2).

DISCUSSION & CONCLUSIONS
Standing on a sloped platform effected lumbopelvic kinematics, which could be a mechanism that results in a decrease in pain development and gluteus medius co-contraction found previously [3]. No trunk muscle thickness changes were found, which points to a person’s posture as a potential factor linked to pain development in standing. As a result, it is possible that a person’s initial standing posture influences their likelihood of becoming a pain developers and this hypothesis will be examined in future work.

Beyond determining if a standing aid is useful in the workplace, studying the kinematics changes induced by standing aids provides insight into the mechanism of this pain development in those who suffer from this problem. This can be used to guide future research that investigates differences in initial standing lumbopelvic postures between pain developers and non-pain developers.

REFERENCES

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