

BACKGROUND

•**ACL reconstruction (ACLR)** is a surgical intervention that has been linked to improvement of knee function after ACL injuries.^{3,7}

•Incidentally, 1/3 of individuals who undergo ACLR develop radiographic **post-traumatic osteoarthritis (PTOA)** within the first decade following reconstruction, and 1/2 will develop radiographic PTOA within the second decade.¹ This is concerning considering the high incidence of ACL injury within active young populations (females 14–18 years old; males 19–25 years old).

•Several factors related to ACL injuries and ACLR have been found to **increase the risk of PTOA development** including **aberrant gait mechanics** such as underloading, or **decreased vertical ground reaction force (vGRF)**, on the affected extremity versus the contralateral limb.^{4,6,8}

•**Real-Time Gait Biofeedback (RTGBF)** has been successfully used acutely to improve altered gait mechanics post-ACLR and may be a useful therapeutic tool for gait retraining to mitigate worse long-term outcomes linked to PTOA.^{2,5}

PURPOSE

The purpose of this study was to determine if conducting a 6-week gait retraining intervention using RTGBF would result in sustained beneficial changes in peak vGRF in persons with an ACLR.

Primary Aim: Determine the effect sizes for vGRF between follow-up assessments following a RTGBF intervention to discover if normalized gait biomechanics can be retained in ACLR individuals compared to a control intervention (SHAM).

Hypothesis: Based on preliminary data, the RTGBF gait intervention would lead to increased vGRF at 6 weeks and 8 weeks when compared to their baseline measures. In addition, the RTGBF would lead to increased vGRF at both post-test timepoints when compared to the SHAM group.

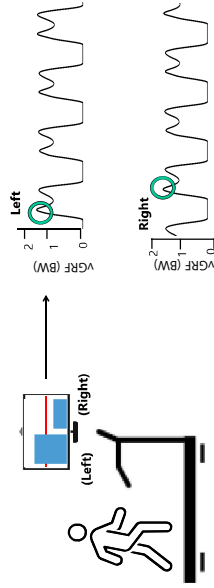
METHODS

This was a crossover study in which participants were block randomized into the RTGBF or SHAM groups. Over 6 weeks, participants (Table 1) completed 18 training sessions of either the RTGBF or SHAM interventions. The RTGBF was designed to cue an increase in vertical ground reaction force (vGRF) while the SHAM was designed to not change gait mechanics. vGRF was collected at baseline (B), and at 6-week (6W) and 8-week (8W) post-intervention.

Table 1. Participant Demographics and Characteristics

	All Participants (n=19)	Training Group (n=9)	SHAM Group (n=10)
Age (years)	22 ± 5	22 ± 5	22 ± 4
Sex (% Female)	84.2%	89%	80%
Height (m)	1.74 ± 0.094	1.73 ± 0.084	1.74 ± 0.109
BMI (kg/m ²)	24.5 ± 4.26	24.6 ± 3.62	24.3 ± 5.09
Months Post-ACLR	22 ± 20	29 ± 21	17 ± 21
Gait Speed (m/s)	1.14 ± 0.116	1.13 ± 0.144	1.16 ± 0.079

METHODS



Baseline (collect baseline vGRF)

Gait Training (18 Sessions detailed in Figure 1)

Post-test 1 (6th week)

Post-test 2 (8th week)

•While the participant walked on the treadmill, force plate data were continuously collected through a custom-built algorithm developed in MATLAB script and integrated into a bar graph for the participant to see. The average of the previous two vGRF impact peaks (heel strike and toe strike) for each limb were visually displayed on a screen as right and left bar graphs (see above).

•Participants targeted a personalized line on a screen in front of them by shifting their body weight. Their steps with this biofeedback increased until 3,000 steps at 9 weeks. After this, they began to walk without feedback. At follow-up post-tests, participants walked without any biofeedback.

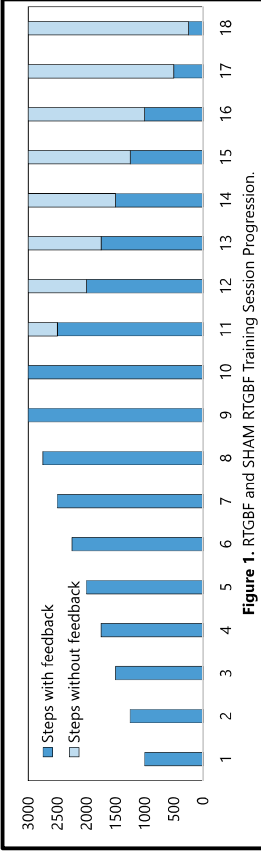


Figure 1. RTGBF and SHAM RTGBF Training Session Progression.

Statistics: Hedge's g effect sizes and 95% confidence interval were used to examine the change from B to 6W and 8W within groups and examine the effectiveness of the intervention by comparing the change in vGRF from B and 6W (B–6W) and B and 8W (B–8W) between groups

RESULTS

RTGBF GROUP

■ Change in 6W vGRF ■ Change in 8W vGRF

SHAM GROUP

■ Change in 6W vGRF ■ Change in 8W vGRF

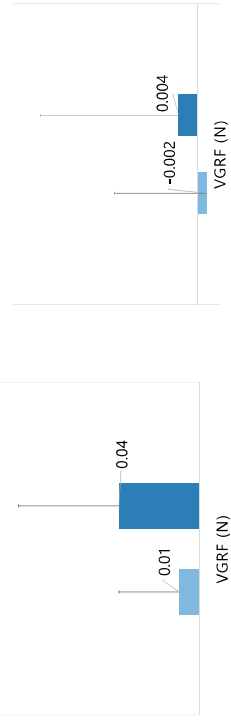


Figure 2. vGRF change between groups at both follow up sessions.

Table 2. vGRFs at the baseline screening, 6th week post-test, and 8th week post-test per group.

	Baseline	6W	8W
RTGBF	1.08 ± 0.03	1.09 ± 0.01	1.12 ± 0.02
SHAM	1.08 ± 0.05	1.07 ± 0.05	1.08 ± 0.04

•Supporting our hypothesis, **RTGBF led to an increase in vGRF (6W: 0.01±0.03; g=0.51; 8W: 0.04±0.05; g=1.28)** compared to the SHAM group (6W: -0.002±0.02, g=-0.02, 8W: 0.004±0.03, g=0.08).

•A medium effect was present between groups from B–6W (g=0.49), and a large effect was present from B–8W (g=0.94), suggesting the **RTGBF effectively increased vGRF compared to the SHAM**, however, these results must be interpreted with caution as 95% confidence intervals crossed 0.

DISCUSSION

•This is the first study to provide the preliminary findings from a 6-week gait retraining intervention designed to improve aberrant gait mechanics in ACLR individuals.

•These preliminary results are significant as they provide evidence that RTGBF gait retraining may improve vGRF profiles in ACLR individuals and may be retained 2 weeks post-training.

•A secondary, important finding was that the SHAM gait retraining did not lead to any changes in peak vGRF in the SHAM cohort.

•This is a critical component for future gait retraining studies and provides an opportunity to conduct robust randomized clinical trial methods to determine the influence of gait retraining interventions.

•Future research with longer periods between post-tests would deem useful for analyzing long-term retention.

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