ISB 2013 BRAZIL
XXIV CONGRESS OF THE INTERNATIONAL SOCIETY OF BIOMECHANICS
XV BRAZILIAN CONGRESS OF BIOMECHANICS

MOTOR PERFORMANCE OF INDIVIDUALS WITH PATELLOFEMORAL PAIN SYNDROME DURING STEP DOWN

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SUMMARY

The patellofemoral pain syndrome (PPS) is characterized by anterior knee pain. Some authors report biomechanical alterations being the most common risk factors of PPS. Considering that functional activities such as stepping down stairs are often associated with pain reports, this study evaluated the motor performance by analyzing the ground reaction force components, in individuals with PPS during step down. The study included 22 women with PPS, and 20 control women. Vertical and anterior-posterior Ground Reaction Force (GRF) components were analyzed during the step-down using a force plate (AMTI) fixed on a second step from the bottom of a 5-step staircase. Kinetic data was sampled at 240 Hz. Each volunteer performed 3 trials of stepping down with the habitual cadence. The painful limb for the PPS group and the dominant limb for the group without PPS were selected for analysis. The student t-test was used to compare impact, active, braking and propulsion GRF peaks between groups, with significant level at 5%. Results for all peak GRF values, during stepping down showed no differences between the groups. Individuals with PPS did not change their strategy to absorb the impact or to realize propulsion during the step down, as observed in individuals with moderate to high pain, as in individuals with osteoarthritis.

INTRODUCTION

The patellofemoral pain syndrome (PPS) is characterized by intermittent and diffuse pain of low to moderate intensity in the anterior knee [1,2], causing reduced physical activity levels and diminished quality of life. These pain reports are evolved with activities that require major movement control as stepping down and run [3]. Furthermore, PPS is considered a public health issue, as 70 to 90% of cases evolve chronic pain. Some authors report PPS has a multiple factor nature, with biomechanical alterations being the most reported risk factors of PPS [2]. Among the biomechanical evaluations, kinetic analysis provides important information for understanding movement control. Elderly women with chronic knee pain show an increase impact and propulsion peak GRF during gait, indicating knee overload [4], however, it remains to be seen if this is also true for younger persons.

Zeni and Higginson [5] evaluated GRF for different pain levels of OA individuals and found that vertical force, propulsion force, and braking force increased in subjects with moderate and severe pain. These authors observed a reduced adduction moment in severe knee pain, moreover these subjects also showed decrease velocity and knee movement during gait possibly as a compensatory strategy to decrease the GRF's and reduced knee overloading.

There are no studies in literature that have evaluated GRF peaks in woman with PPS. These subjects present with quadriceps and hip abductor weakness that could affect eccentric activities [6]. We hypothesized that individuals with PPS have anterior-posterior and vertical GRF peaks greater than persons without PPS. Thus, the objective of this study was to evaluate the motor performance by analyzing the ground reaction force's in patellofemoral pain syndrome subjects.

METHODS

The study included 22 women with PPS, mean (CI) age of 21.9 years (20.7; 23.1), height of 161 cm (158.2; 163.6), weight of 59.2 Kg (54.3; 64.03) and 3.1 cm (1.85; 4.35) at visual analogue scale during step down and 20 control women, mean (CI) age of 21.1 years (20.2; 22.1), height of 163.5 centimeters (161; 166.5), weight of 57.1 kg (52.7; 61.5) and no knee pain during step down. Inclusion criteria for PPS group was pain at least 3 centimeters using a VAS and pain during functional activities (stepping down and up, run, sitting for a periods great than one hour). All subjects were examined by a Physical Therapist prior to testing for joint ROM, muscle strength, swelling, and pain. The study was approved by the Ethics Committee of the Clinics Hospital of the School of Medicine at the University of São Paulo.

Biomechanical analysis of step down was performed using a force plate (AMTI) fixed on a second step from the bottom of a 5-step staircase. Kinetic data was sampled at 240 Hz using Motion Monitor software™ (Innovative Sports Training Inc., Chicago, IL- USA).

For the step down test, the individuals stepped down on a 5 step staircase (steps height of 18 centimeters) with the subjects habitual cadence [6]. Each volunteer performed 3 trials of stepping down GRF force-time curves for vertical force (Fz) and anterior posterior force (Fy) were the primary outcome measures. The first and second peak-impact peaks from Fz and the braking peak and propulsion peaks from Fy are shown in figure 1 All values were normalized to each individual's bodyweight. The painful limb for PPS group and the dominant limb for control group were select for analysis. To compare passive peak, active peak, braking peak and propulsion peak between groups was realized student t test with $p<0.05$ (SPSS software).

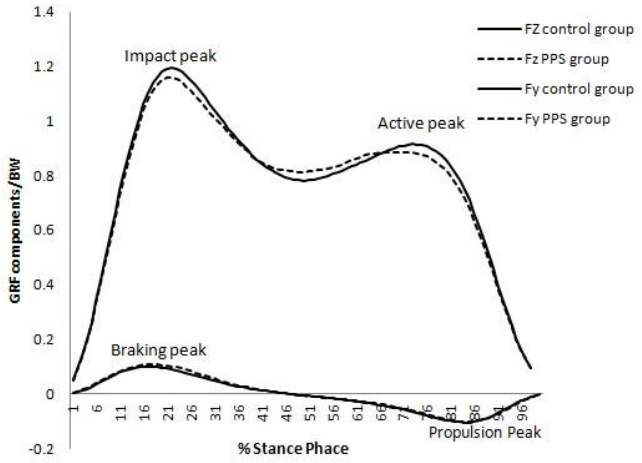

Figure 1: Mean GRF Components Fz and Fy normalized for body weight during stance phase in Control and PPS groups.

RESULTS AND DISCUSSION

The GRF components data showed no statistical difference for any parameters evaluated between groups (figure 1 and table 1). During the functional evaluation, the PPS group showed hip abductor weakness (22.9 Kgf/Kg and CI: 21.1; 24.7) when compared with control group (27.7 Kgf/Kg and CI: 24.2, 24.6) ($p=0.02$), but no difference in quadriceps strength. Despite hip abductor weakness and low to moderate pain level in the PPS group, our data do not support our initial hypothesis that PPS individuals have GRF peaks greater than control group (table 1). Although no studies analyzing GRF responses have been found in PPS young women. Zeni and Higginson [5] observed moderate knee pain level produced lower vertical and braking peaks than severe pain level. PPS subjects could show movements and speed alterations as a compensatory motor strategy to decrease knee overloading and provide better stability for the lower limb, especially during eccentric activities. Further, Zhang et al. [7] showed that sedentary individuals have decreased impact and braking peaks compare to active subjects and this current work evaluated sedentary subjects, this fact could produced a decrease kinetic parameters for both group.

CONCLUSIONS

The findings suggest that subjects with and without anterior knee pain reports do not show differences related in impact, propulsive, or braking forces during eccentric step-down movements regardless of their pain levels.

ACKNOWLEDGEMENTS

The authors thank FAPESP (process number: 2008/00487-9) for financial support.

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Table 1: Peak Values and Standard Deviation of Ground Reaction Force Peaks (Fz and Fy components) in PPS and Control Group.

Ground Reactions Force Peaks		
	PPS group	**Control Group**
Passive Peak (BW)	1.15 (0.23)	1.19 (0.26)
Active Peak (BW)	0.88 (0.18)	0.91 (0.17)
Braking Peak (BW)	0.09 (0.06)	0.11 (0.06)
Propulsion Peak (BW)	-0.10 (0.04)	-0.10 (0.05)