Focus of attention in exercise influences knee landing stability in people with anterior cruciate ligament reconstruction.

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INTRODUCTION

Surgical reconstruction is regarded the optimal treatment for ACL tears, but studies evaluating surgical outcome demonstrate persistent functional limitations after surgery for a substantial number of patients [1]. Rehabilitation focusses on relearning of functional skills using movement feedback. In healthy people the focus of attention (FoA) can have an influence on learning of motor skills [2]. The aim of this study was to determine whether motor learning in knee rehabilitation is affected by FoA. We hypothesised that exercising with external FoA improves dynamic balance better compared to exercising with internal FoA.

METHODS

Twenty three participants with a long-term history of ACL injury and reconstruction were entered into the study and randomised into two groups. They completed one of two exercise programs and were assessed before and after 6 weeks of exercising. Both groups exercised 30 minutes using six weight bearing exercises repeated 3 times a week. Programs were identical except for FoA: the Internal FoA group (n=11) used a reference knee angle (60º flexion) as their exercise target; the External FoA group (n=12) used two reference points on the wall to guide their exercises.

Height, mass, age and gender were recorded and knee range of motion was measured using a clinical goniometer. The Knee injury and Osteoarthritis Outcome Score (KOOS) questionnaire and Cincinnati Knee Rating System were used. Quadriceps and hamstrings isokinetic strength were measured using a KINCOM 125E plus dynamometer.

A maximal single leg hopping test for distance onto a Kistler 925 3A12 force plate (sampling frequency: 1000 Hz) was used. Hop distance was kept constant for each individual throughout the testing. Maximum vertical force on landing and time to stability were determined from the force data. Time to stability was the time between first foot strike and the point when the vertical and anterior-posterior forces were stabilized [3]. The time of stabilized force was detected automatically by means of Matlab software using the criterion that the force derivatives were equivalent to quiet standing values (below mean + 5 standard deviations) for a minimum duration of 1 second. A 2-way ANOVA was used to explore exercise by group interactions in SPSS 14. Legs (uninjured and reconstructed) were tested separately. An α-level of 0.05 was used and assumptions of normality and equal variance were confirmed.

RESULTS

The two groups were well matched (Table 1). With exercise, both groups equally improved in hamstrings strength in both legs ($p<0.05$). Improvements in quadriceps strength were not significant. Both groups showed similar reductions in peak vertical landing force after exercise (Fig 1). Time to stability also improved with exercise ($p<0.001$). The only significant interaction occurred for time to stability (Fig 1). The Internal FoA group demonstrated a greater improvement compared to the External FoA group ($p<0.05$).

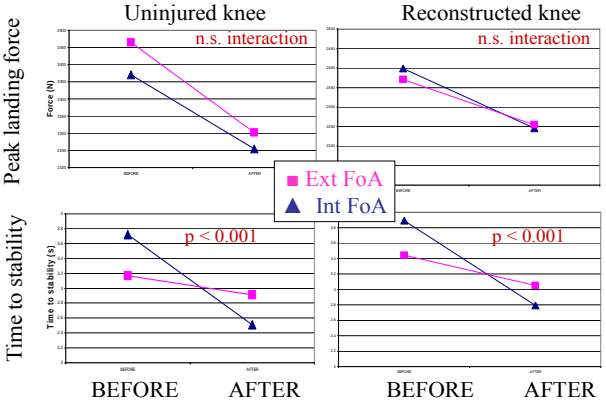

Figure 1: Interaction plots for peak vertical landing force and time to stability for both legs before and after training.

DISCUSSION

Specific exercises aimed at improving dynamic knee stability led to significant bilateral improvements in performance independent of the feedback used. However, it appears that contrary to findings in healthy subjects, an internal FoA is more appropriate for motor learning for patients after ACL reconstruction. ACL injury affects knee proprioception bilaterally [4]. The benefit of focusing on knee angle (Internal FoA) during exercises in this study could therefore be related to such a proprioception deficit. Whether the deficit was due to pre-injury or injury-related factors is however not clear and requires further research.

REFERENCES

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Table 1: Demographic details of the two exercise groups. Means and standard deviations are displayed.

	Height (cm)	**Mass** (kg)	**Age** (yrs)	**Gender** (F/M)	**Time to surgery** (months)	**Time since surgery** (months)
Internal FoA	175.9 ± 9.9	82.7 ± 23.7	37.9 ± 9.9	2/9	32.5 ± 45.7	27.1 ± 17.6
External FoA	172.7 ± 7.6	79.7 ± 13.5	35.5 ± 10.2	3/9	25.9 ± 22.5	31.3 ± 21.3