NEWFOUND JOINT MOVEMENT OBTAINED FROM STRETCHING PROTOCOLS MAY NOT TRANSLATE TO RANGE OF MOTION IN FUNCTIONAL TASKS
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INTRODUCTION
Rehabilitation and fitness workers often focus on improving hip flexibility and core strength, with the assumption that these improvements will assist with injury prevention. However, evidence that newfound mobility or core stability will transfer to functional activities is lacking.

The purpose of this study was to analyze the effect of a 6 week specific hip stretching/spine stabilizing protocol on motion of the lumbar spine and hip during functional activities in a group of young males with limited hip mobility.

METHODS
Twenty-four young adult males with limited hip mobility were randomly assigned to 4 groups: 1) hip stretching, 2) stretching plus hip/spine motor control, 3) core muscle endurance with hip/spine motor control, and 4) control.

Range of passive hip rotation and extension was measured in all participants, and compared before and after the 6 week exercise regime. Protocols included one weekly supervised session of passive stretching (groups 1, 2) and/or exercise review and upgrade (groups 1-3), with a home exercise program to be completed a minimum of 4 times per week. Exercise progression was documented in groups 2 and 3, while core muscle endurance, using a battery of 4 tests, was measured in group 3.

Body segment and joint motion during functional activities was captured using infra-red motion capture before and after the 6 week program. These activities included: lunge, twist/reach, active hip extension, and exercising on the elliptical trainer. 3-dimensional hip and spine angles were calculated from these data.

RESULTS AND DISCUSSION
Hip extension and rotation increased in every participant in the two stretching groups (Figure 1). Despite these large improvements in mobility, there was no evidence of increased hip motion utilized during functional activities. Interestingly, hip extension actually decreased in the active hip extension trials, as did hip rotation in the twist/reach trials for the stretching only group (average of 2.2° and 4.6°, respectively).

Similarly, while core exercises resulted in increased endurance of 38% to 53% (Figure 2), the only evidence of decreased lumbar motion after 6 weeks of stabilization exercises occurred during the active hip extension trials, where lumbar rotation was significantly less. Specifically, the group who received both stretching and stabilizing decreased their average lumbar rotation from 7.4° to 3.8°. Group 1 (stretching only) actually demonstrated a large increase (5.9°) in lumbar extension post-treatment when attempting to actively extend the hip (Figure 3).

Improved passive hip flexibility did not transfer to functional movements in this study. Participants were not adept at distinguishing where the motion was occurring. Attempts to utilize this newfound motion during active hip extension trials resulted in the motion being misplaced to the lumbar spine. Proprioceptive awareness of hip versus spine motion was
poor, with their objective being purely to move the leg further behind the body. Consequently, attempts to actively extend the hip resulted in increased lumbar extension, as opposed to the spine sparing effect that was intended with the hip stretching protocol. It appears that the concept of constraining lumbar rotation may be more readily incorporated into movement than lumbar extension, perhaps because it provides greater visual feedback and oscillates around an obvious mid-point of 0°. Constraining lumbar flexion/extension was a much more difficult concept for the participants to utilize, yet is one of the motions known to be injurious to the lumbar spine.

CONCLUSIONS
While the protocols presented here resulted in increased static hip mobility, this newfound mobility was not utilized in dynamic functional movements. Greater hip mobility was not utilized, as participants deferred to previously engrained movement patterns. This was especially so in the group that received only stretching, with no associated core stabilizing exercises: they demonstrated an increase in lumbar motion and a decrease in hip range utilized during functional movements, indicating poor proprioceptive awareness as to where the movement was occurring. Those who received spine stabilization exercises tended to demonstrate better spine control, especially in the rotation axis (twist). Further research into this area of transference of mobility and/or strength to function is warranted.

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