Facilitating VMO Activation with Isometric Hip Adduction (blog posted 2012)


Introduction

It is no secret that sports physiotherapists and physical therapists across the world commonly assess and treat knee injuries. Of these injuries, patellofemoral pain is exceptionally common, accounting for 25% of all sports related knee injuries (Fredericson & Yoon, 2006). In fact, patellofemoral pain syndrome is the most commonly reported injury sustained by runners (Taunton et al., 2002). As many of the aetiological factors that contribute to patellofemoral pain syndrome have not been clearly identified, decision making regarding appropriate rehabilitation and treatment can often be challenging.

This article will discuss the use of isometric adduction during closed kinetic chain lower limb exercises to facilitate vastus medialis obliquus (VMO) activation (Peng et al., 2012).

Background Information

Previous research has demonstrated that athletes (or patients) with patellofemoral pain syndrome display a delayed onset of the VMO when compared with the vastus lateralis (VL) and a lower VMO:VL ratio (Powers, 2000). This is considered pathologically relevant as function of the VMO is important to oppose the lateral force produced by VL (Sakai et al., 2000). Therefore, sports physiotherapists will attempt to restore balance by emphasising activation of VMO during corrective exercises (Fagan & Delahunt, 2008).

Physiotherapists and physical therapists will attempt to manipulate their approach to exercises in an attempt to maximise VMO activity. Researchers suggest that co-contraction of the hip adductors and knee extensors may elicit greater VMO activation (Hodges & Richardson, 1993). The theory behind this research is the anatomical connection between the adductor mass and VMO, as the majority of VMO’s fibers arise from the tendon of adductor magnus. Indeed, this has been previously researched with some encouraging results... whilst other have shown no effect at all (Peng et al., 2012).

Which means we don’t know what to believe! Take us to the new research...

New Research on Facilitating VMO Activation

Peng et al. (2012) have delivered a study with 2 primary aims:

1. To investigate the effect of sub-maximal and vigorous isometric hip adduction on the VMO, VL muscle activation, as well as the VMO:VL ratio during concentric/eccentric phase of 90-degree knee extension/flexion of the leg press
2. To explore the VMO and VL muscle activities, as well as the VMO/VL ratio in six 15-degree intervals throughout the leg press exercise

So they took 10 (...I know) healthy male (yes ... I know) subjects and rigged them up with SEMG. After a quick warm-up and static stretch they asked them to perform 3 exercises (which were randomised in order):

- Conventional Leg Press
- Leg Press and sub-maximal isometric hip adduction (termed LP+)
- Leg press and vigorous isometric hip adduction (termed LP++)

The authors utilised the surface EMG results from VMO, VL and Hip Adductor Longus (HAL) to evaluate the variation between the 3 leg press conditions. They found some interesting results...

Results of The Research

Whilst there were differences in HAL activity, the authors failed to show an effect of eliciting more VMO activity by incorporating isometric hip adduction into a conventional leg press exercise in a general analysis of the concentric and eccentric phases of the LP+ and LP++ conditions. There was, however, a statistically significant effect size for VMO:VL ratio when comparing LP to the LP+ and LP++ conditions (mean VMO:VL ratio improved from 0.85 to 0.90 and 0.88 respectively, it is worth noting that the ideal ratio is considered to be 1.0).

Whilst the authors demonstrated some benefit at specific leg press ranges of motion (most notably in the last 45˚ of extension) adding isometric hip adduction to the leg press exercise through the full range of motion was not supported by this study. This finding was supported by the findings of previous studies which indicated that the addition of isometric hip adduction had no effect on the relative activation of the VMO and VL in healthy subjects (Earl et al., 2001; Hertel et al., 2004; Karst & Jewett, 1993; Laprade et al., 1998).

Limitations of The Research

As is par for the course, there are a few limitations to this study of which the authors are aware. These include:

- The study population consists of healthy males: this means the results may not be generalised to females or patients with patellofemoral pain. As you may expect, there has been research using patients with patellofemoral pain syndrome. Unfortunately, the results of these studies has also been conflicting (Coqueiro et al., 2005; Laprade et al., 1998).
- Small sample size (n=10): the authors state to detect a significant effect for vastus muscle activation with isometric hip adduction during the leg press, at least 42 subjects were needed to have 80% power
- The study uses the leg press: the results may not be generalisable to other closed kinetic chain lower limb exercises (squats, lunges etc) and therefore all clinic settings or home exercise programs

But my big question is (and the biggest potential limitation) ...
Should We Encourage Hip Adduction in PFPS Patients?

Recent studies of females with patellofemoral pain syndrome have identified the presence of increased femoral internal rotation and **adduction** causing a dynamic valgus alignment (Powers et al, 2003; Souza et al, 2009). Furthermore, research into correcting these kinematic deviations in the form of neuromuscular training and strengthening of proximal hip stabilisers, without any strengthening of the vastus medialis obliquus, have yielded positive results (Noehren et al., 2011; Fukuda et al., 2010).

So I have to ask; is doing exercises that *(mildly)* increases VMO:VL ratio but potentially encourages aberrant patterns by eliciting adduction (think the potential ‘turning off’ the patient’s lateral pelvic stabilisers) really going to lead to better clinical outcomes? Whilst of course these assumptions need to be tested in the research, maybe I’m missing something... but I think encouraging hip abduction (or more accurately good form) through pelvic stabiliser contraction when undertaking closed kinetic chain exercises may deliver a more functionally relevant and clinically superior result. Furthermore, to ensure adequate and timely activation of vastus medialis EMG biofeedback is absolutely essential!

**What do you think?** This is something that I would love you guys to discuss in the comments below – tell me I’m dreaming or what you would do clinically!

**References**


Hertel, J, Earl, JE, Tsang, KKW, & Miller, SJ. Combining isometric knee extension exercises with hip adduction or abduction does not increase quadriceps EMG. Journal of Sports Medicine, 2004;38:210-213


