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Sports Update: The Knee, Part I

By Thomas Souza, DC, DACBSP

In a continuing series on sports updates, we now turn our attention to the knee. There are several concepts that continue to be reinforced by research, including:

œ specificity of the pain sensitive structures at or around the knee; œ lack of ability to isolate the vastus medialis oblique (VMO) in rehabilitation; œ long-term affects of meniscal repair; œ role of bracing in anterior cruciate ligament (ACL) deficient knees; œ role of early rehabilitation following ACL reconstruction.

We will address each of these with literature specific to each over the next two months in a two-part article.

Pain Sensitivity of Various Knee Structures

It has been assumed that certain knee structures are more sensitive than others if sensitivity is defined as conscious perception of pain. Yet, most of the research has focused on mapping responses with sensory evoked potential in anesthetized patients or summarizing neurosensory output from the entire joint with respect to perception of knee position (i.e., proprioception). A recent study focuses on the conscious perception of pain in a conscious volunteer (one of the authors). Now that's dedication to science.

Dye SF, Vaupel GL, Dye CC. Conscious neurosensory mapping of the internal structures of the human knee without intra-articular anesthesia. *Am J Sports Med* 1998;26(6):773-777.

Using one of the authors as a volunteer, arthroscopic probing of various intra-articular structures was performed. Although local anesthetic was used to create the portals for the arthroscopic instruments, careful attention was paid (through the use of CT images) to isolate the anesthetic to the superficial area of the knee. The volunteer was asked to describe the pain produced by the probing. The volunteer was asked to rate the pain and describe the degree of localization of where the pain originated. Here is a listing of pain sensitive structures based on his perceptions.

œ Probing/palpation of the central ridge and medial and lateral facets of the patella resulted in no pain.

œ Probing/palpation of the odd facet of the patellae resulted in a non-painful awareness that was poorly localized by the patient.

œ Probing/palpation of the suprapatellar pouch, the joint capsule, and the medial and lateral retinaculum resulted in moderate to severe pain that was well-localized.

œ Probing/palpation of the femoral insertions of the ACL and PCL resulted in a non-painful awareness that was poorly localized.

œ Probing/palpation of the tibial insertion and femoral origin of the ACL/PCL resulted in moderate to severe, poorly localized pain.

œ Probing/palpation of the menisci resulted in non-painful awareness that was poorly localized for the inner rim and slight to moderate, poorly localized pain at the capsular margins and anterior and posterior horns.

œ Probing/palpation of the articular surfaces of the femoral condyles, trochlea and tibial plateaus produced non-painful awareness or slight pain that was poorly localized.

These findings support some commonly held beliefs that:

œ Damage to the origin points of the cruciates and peripheral attachment points for the menisci are painful. However, internal derangement (mid-substance tears of the cruciates and deeper meniscal tears) are not in and of themselves, extremely painful. The pain is probably more due to the associated effusion (bloody or synovial).

œ Damage to articular cartilage and hyaline cartilage on the posterior patellae is virtually painless.

œ Irritation or damage to the suprapatellar pouch, retinaculi, and joint capsule cause moderate to severe pain and are often the source of pain when deeper structures are torn (e.g., capsular tearing or distension with internal derangement).

Isolation of the Vastus Medialis Oblique Muscle during Exercise

It has long been suggested that the vastus medialis oblique (VMO) muscle is important for medial tracking of the patellae during knee extension (in particular, terminal knee extension). Due to the fact that the

majority of tracking problems are from lateral tracking, there has been a search (and hope) that there was a specific exercise that would focus on the VMO while decreasing the participation of its reciprocal partner, the vastus lateralis oblique (VLO). It has been assumed that by externally rotating the hip, the VMO would be placed in direct line with gravity (muscle on top concept) and therefore would require more activity. Past studies have not shown this relationship,[1,2] and a more recent study confirms this.

Mirzabeigi E, Jordan C, Gronley JK, et al. Isolation of the vastus medialis oblique muscle during exercise. *Am J Sports Med* 1999;27(1):50-53.

Electromyographic (EMG) evaluation of the activity of muscles about the knee was performed on eight uninjured athletes (mean age 26.5). The following exercises were performed with EMG monitoring:

œ isometric knee extension with the hip in neutral; œ isometric knee extension with the hip in 30 degrees external rotation; œ isometric knee extension with the hip in 30 degrees internal rotation; œ isokinetic knee extension through a full range; œ isokinetic extension in the terminal 30 degrees of extension; œ side-lying ipsilateral and contralateral full knee extension; and œ stand and jump from a full squat.

None of the exercises demonstrated selective increases in VMO activity over other muscles. Ironically, the commonly held belief that the VMO is challenged more with hip external rotation was not supported. In fact, it was found that there was a decrease in VMO activity compared to the VLO. Ninos et al.[2] demonstrated in their EMG study of squatting that turn-out of 30 degrees also did not increase VMO activity. The authors of the current study state that both isometric and isotonic exercises showed predominance of the VLO over the VMO.

References

1. Cryzlo SM, Patek RM, Pink M, Perry J. Electromyographic analysis of knee rehabilitation exercises. *JOSPT* 1994;20:36-43.

2. Ninos JC, Irigang JJ, Burdett R, Weiss JR. Electromyographic analysis of the squat performed in self-selected lower extremity neutral rotation and 30 degrees of lower extremity turn-out from the self-selected neutral position, *JOPST* 1997; vol. 25, no. 5.

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