

Knee arthritis and muscle strength – the truth is gray

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Quadriceps muscle strengthening exercises are a common intervention in the management of knee osteoarthritis. It is thought, in healthy knees that quadriceps muscle strength protects against new osteoarthritis, and in arthritic knees greater strength may protect joints and thereby delay osteoarthritis progression.

Weakness of the quadriceps muscle has been postulated to be either a result of decreasing muscle size as a result of pain from the knee joint, or possibly due to primary dysfunction of the quadriceps muscle leading to arthritis of the knee. This is the proverbial “chicken or egg” paradox. A common rationale for doing quadriceps strengthening exercises for knees with osteoarthritis is, if the size and stiffness of the muscles surrounding a joint is increased, stress can be absorbed in the muscles instead of being transmitted to the bones and joints. This is analogous to pumping up the air in a bike tire to prevent stress to the metal frame of the tire. However, if the frame of the bike tire is bent and you increase the pressure of the bike tire, compressive forces could lead to further deforming or bending of the metal frame. If the knee is poorly aligned or the joint is lax and the quadriceps muscles are large, strong and stiff, they may exert additional deforming stress to the arthritic joint.

A recent study by Dr. Leena Sharma (2005) raises questions about the common belief that individuals with osteoarthritis of the knee should perform quadriceps strengthening exercises. A prospective, longitudinal research study was conducted on 230 individuals with osteoarthritis of the knee. They were followed over an 18 month period for progression of their osteoarthritis. For patients categorized as having mal-alignment of the knee and a high degree of muscle strength, there was a greater probability of progression of the problem in comparison to individuals with a low level of muscle strength. Similar results occurred in patients with knees categorized as having greater joint laxity and a high level of muscle strength. These

patients demonstrated greater progression of the problem as compared to individuals with low levels of quadriceps muscle strength. In individuals with knee osteoarthritis and mal-alignment or lax knees and strong quadriceps, muscles may, in fact, be linked to an increased progression of osteoarthritis.

As a clinician it is a bit frustrating, and at the very least, challenging, when hard research data contradicts the use of common treatment intervention. Knowing what to do seems so much more exciting than knowing what not to do. I thought I knew that all clients with osteoarthritis of the knee needed to do strengthening exercises for the quadriceps. Now, because of this study by Sharma, I know “it depends.” As one of my former professors would say, “the truth is gray.”

If we shouldn't do quadriceps strengthening exercises for osteoarthritis of the knee, what treatment should we do? Perhaps using external support (knee brace, supportive strapping tape) to align or stabilize the lax knee would allow quadriceps strengthening exercises without detrimental effects. Perhaps remedial exercises for adjacent joints and muscles such as the hip or ankle would result in decreased stress to the knee joint.

Several investigators have studied the difference in the biomechanics of walking between normal individuals and those with osteoarthritis of the knee. Individuals with knee arthritis could potentially experience joint damage and pain due to the presence of either too much or too little knee motion particularly in a side to side direction. An increase in joint motion could indicate inadequate control of the joint. Conversely, a substantial reduction in knee joint motion could lead to an inability to adequately adjust to stress and shock. Lewek, MD (2005) concluded that individuals with knee arthritis demonstrate greater variability in the involved leg compared to the uninvolved leg. This infers therapy should be directed at increasing control and stability of arthritic knees with strengthening/stabilization exercises and/or bracing.

McGihjbum, CA (1999) and Childs, JD (1999) concluded that individuals with knee

arthritis have decreased power in the calf muscles and quadriceps at the end of stance phase in comparison to individuals without knee arthritis. The end of stance phase is when the heel and toe come off the ground and the hip and knee is extending. These same individuals with knee arthritis have greater hip extension muscle power at the end of stance phase. The investigators hypothesize that this configuration of changes in muscle power is a compensation to avoid using the quadriceps muscle to straighten and stabilize the knee at the end of terminal stance phase of walking. Use of the quadriceps muscle may increase pain and stress to the knee joint.

Based on this data regarding alterations that occur at the terminal stance phase in individuals with osteoarthritis of the knee, perhaps aggressive stretching exercises for the calf muscles and hip flexor muscles should be avoided. A weak muscle is often too long and, therefore, stretching exercises should be avoided. Perhaps the body's natural ability to compensate for pain, limited motion and weakness results in longer, weaker calf and hip flexor muscles. Anecdotally, I have observed that runners with arthritic knees often experience Achilles tendon problems.

Perhaps strengthening exercises for the calf muscles, which do not involve using the quadriceps muscle, would be an effective rehabilitation strategy. Perhaps flexibility exercise for the hip extensor muscles or strengthening exercise for long and weak hip flexor muscles would be effective rehabilitation strategies. All of this is speculation and requires an in-depth orthopedic examination to determine specific muscle length and strength impairments.

When definitive research information is wanting and the truth is gray, decisions should be made on a case-by-case basis based on specific evidence gathered from an in-depth orthopedic examination of a particular individual.