Strengthening Quadriceps to Alleviate Knee Pain

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Patients visiting doctors for knee pain often hear the same advice, regardless of the condition—whether it's osteoarthritis, chondromalacia patella, or meniscus injury: strengthen your muscles. Many patients are puzzled, asking, "Isn't my knee pain caused by too much activity? How can more exercise help? Isn't this contradictory?"

While excessive use often leads to knee pain, the prescribed exercises focus on non-weight-bearing muscle training, particularly targeting the quadriceps. The quadriceps, located on the front of the thigh, is the largest and strongest muscle group in the body. It plays a critical role in knee extension and hip flexion, providing significant stability to the knee joint.

The Importance of Quadriceps Strengthening

Research has shown that aerobic quadriceps strengthening can significantly improve physical function, slow the progression of osteoarthritis, and offer mild pain relief. Its effects are comparable to pain medications and non-steroidal anti-inflammatory drugs (NSAIDs). The latest *Evidence-Based Clinical Practice Guidelines for Knee Osteoarthritis* by the American Academy of Orthopaedic Surgeons (AAOS) lists strength training as the primary core treatment, stating that all other therapies achieve optimal results only when combined with enhanced muscle strength.

How to Perform Quadriceps Strengthening

Quadriceps training should be done under non-weight-bearing, aerobic conditions. Activities like hiking, long-distance running, dancing, and playing sports, while beneficial for muscle strength, also exacerbate joint wear and tear. Instead,

low-impact exercises such as swimming and cycling are strongly recommended as they don’t place direct weight on the knees while effectively training the quadriceps.

Home-Based Quadriceps Training Methods

Here are two recommended methods for strengthening the quadriceps at home:

Straight Leg Raises

Lie flat on your back with your knee fully extended and your ankle dorsiflexed (toes pointing upward). Tighten the quadriceps in your thigh, which will become firm and raised. Quickly lift your leg to a 60-degree angle, then slowly lower it back down as slowly as possible. Aim for quick lifts and slow descents. Perform 300–500 repetitions daily.

Wall Sits

Bend your knees to a 90-degree angle and your hips to a 90-degree angle. Lean your back against a wall, similar to the stance in martial arts horse-riding practice. Hold the position for at least 90 seconds each time, performing three sets daily, with 20 repetitions per set.

Results and Applications

For patients with osteoarthritis or pain caused by general overuse, consistent adherence to these exercises can significantly alleviate joint pain and make walking easier. Patients who have undergone joint replacement or arthroscopic surgery can also benefit greatly from quadriceps training, as it accelerates the recovery process.