The Role of Anatomy and Osteopathy In The Treatment and Diagnosis of Knee Injuries

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The osteopathic approach to treating a patient with knee pain incorporates osteopathic manual therapy into a treatment plan that may include medication (American), rehabilitative exercises, nutrition, surgical procedures (American) and lifestyle counseling. Through proper education on health promotion and disease prevention, osteopathy emphasizes the overall wellness of its patient. The benefits of mobilization allows osteopaths to establish homeostasis. This initiates the healing process through natural means and develops a therapeutic relationship with the patient (DiGiovanna, 2005).

Knee pain is a common reason to visit an Osteopath. There is a wide range of causes and diagnosis' for knee pain. Osteopaths use a combination of a detailed history and osteopathic exams that consist of joint and muscular tests for finding potential causes and treatments that can assist in alleviating pain. When taking a history of a patient with knee pain, it's important to focus on the origin, duration of pain and possible connection to trauma. Traumatic injuries are most often answered based on the history which can be confirmed by physical exam findings.

In order to recognize the etiology of knee pain and injury, it is important to understand the anatomy of the knee. The knee joint is a complicated articulation and the largest joint of the body with range of motions of 0 degrees extension, 140 degrees flexion and 8 to 12 degrees rotation. The knee joint is surrounded within a synovial capsule and functions as a hinge joint with three articulations: the medial, lateral femorotibial articulations and the patellofemoral articulation. The knee has motion that contribute to instability and should be assessed: flexion/extension, internal/external rotation, varus/valgus, anterior/posterior translation, medial/lateral translation, and compression/distraction. There are variations of these motions that can be considered normal or abnormal depending on the patients symptoms. For example, genu valgus. It is a posture where the feet are spread apart but the knees are close together which is more commonly found as normal in women but can be abnormal based on the joint pathology causing this. Genu varus is the opposite and is when the feet are close together but the knees are far apart. It is important to understand that knee joint stability is also dependent on foot biomechanics which can absorb mechanical stress from ground contact and can have effects on postural alignment at the knee joint. Patients with fat feet or have a high arch are more likely to establish knee pain and medial tibiofemoral cartilage damage. Knee joint stability is maintained by the soft tissues of the capsule: ligaments, tendons, and menisci. The ligaments provide static stability to the knee joint while the muscles and tendons provide dynamic stability. The knee can be divided into four compartments: medial, anterior, posterior and lateral. This classification has both anatomical and clinical implications (Elbert, 2013).

The medial aspect of the knee is the most commonly injured compartment in knee pain. It contains the medial collateral ligament (MCL) which is the most commonly injured ligament

in the knee, the medial meniscus, and the medial patellofemoral (MPFL) ligament. The muscles of the compartment are the semimembranosus, sartorius, gracilis, and semitendinosus. The MCL is the primary resistor to valgus strain and is injured by lateral force to the knee. The MPFL is the primary stabilizer of lateral patellar motion and is often involved in patellar dislocations which are common in females due to an increased Q-angle. The Q-angle is a measurement of the angle between the quadriceps muscle and the patella tendon. A high Q-angle on a physical exam means that the patella has abnormal movement over the front of the knee joint which overtime can lead trauma to the posterior cartilage of the patella (Williams, 2001).

The anterior aspect of the knee is the second most common region involved in knee pain. The anterior compartment contains the patellofemoral articulation which consists of the quadriceps tendon, patella and the patellar tendon. These are involved in conditions like tendinitis, Osgood Schlatter and Sinding-Larsen-Johansson syndrome. Tendinitis is the inflammation of a tendon and can be either patellar or quadriceps. Osgood Schlatter and Sinding-Larsen-Johansson are both conditions that affect teens during growth but involve infammation of different attachments of the patella tendon. All of these ligaments and tendons are collectively involved in patellofemoral syndrome. In addition, this compartment contains the anterior cruciate ligament (ACL), the intermeniscal ligament and the bursae. The ACL is the main stabilizer to anterior translation of the tibia. It is commonly associated with non contact pivoting injuries. This is often seen with athletes who compete in sports such as soccer that involve acceleration, deceleration, landing and pivoting maneuvers (Williams, 2001).

The posterior compartment is comprised of the posterior cruciate ligament (PCL), meniscofemoral ligament and the oblique popliteal ligament. In regards to muscles, it is made up of the popliteus, gastrocnemius and plantaris muscles. The PCL is the primary resistance to posterior translation of the tibia and is the least injured ligaments of the knee. Most posterior compartment pain is not associated with direct structural injuries, but with effusions present within the knee. An effusion in the back of the knee is often aggravated by flexion and can result in the posterior displacement of fluid as a baker's cyst for example. Posterior pain can also result from extra articular causes such as deep vein thrombosis (DVT) and popliteal artery aneurysms (Williams, 2001).

The lateral compartment of the knee is less commonly implicated in knee pain and contains the lateral collateral ligament (LCL), lateral meniscus, popliteofibular ligament (PFL) and arcuate ligament. The muscles of the lateral compartment include the iliotibial band (ITB) and biceps femoris. Pain along the lateral joint line is most often associated with lateral meniscal or LCL injuries, while pain localized over the lateral femoral condyle is characteristic of Iliotibial band (ITB) syndrome (Williams, 2001).

The risk factors for knee pain vary by etiology but can generally be divided into modifiable and non-modifiable. Major modifiable risk factors are excess body mass, joint injury, muscle weakness, structural malalignment, and occupation. Non-modifiable risk factors include gender, age, race, and genetic predisposition. Addressing modifiable risk factors via weight loss, bracing, strengthening exercises and activity modification which is often the initial treatment goal in non-traumatic knee pain.

Osteopathy is used as a measure for pre and post surgery, preventations and maintenance. It is difficult to establish success from a surgery due to its progressing time. To optimize a patient's return to normal function after surgery, osteopathy can address preoperational musculoskeletal findings as well as somatic dysfunctions that develop during rehabilitation. Anterior cruciate ligament tear is one of the most common and debilitating knee injuries. A case report by Felson 1998, “presents a 27 year old patient who was actively treated with Osteopathy after undergoing ACL reconstruction. Osteopathy was used to address specific somatic dysfunctions in the patient’s neck, thoracic, and lumbar/ sacrum/pelvic areas. The patient was able to return to his athletic activities without restrictions 6 months following the reconstruction”.

The need for radiographic imaging to rule out a fracture may be determined by the Ottawa knee rules. If a patient meets at least one criterion and is positive for a fracture on X-ray, they should be referred to an orthopedic or sports medicine specialist. If the x-ray is negative or a patient does not meet the criteria, special tests can be performed to rule out ligamentous, muscular and meniscal injury. This is where a thorough physical exam is the most important, as it determines if an Osteopath should refer their patient for advanced imaging or should follow up with conservative treatment options (Zuckerman, 2006).

When evaluating a patient with knee pain, it is important for osteopaths to perform a thorough osteopathic exam. This includes closely observing the patient’s gait during the visit and noting any signs of discomfort, imbalances and collapse of the arch. Patients with knee pain often present with a limp because they're unable to load weight on one or both knees. Such a change in a walking gait may indicate loss in the patient’s knee function due to a decrease of muscular or ligamentous support. Considering the relationship between anatomical structures and function, surrounding musculature and fascia should be palpated for any tissue texture and temperature change. Other potential causes should always be considered such as, leg length discrepancies, functional muscle imbalances and Q angle. It is important to exam somatic dysfunctions within the lower extremity and throughout the rest of the body. Somatic dysfunctions in proximal regions like the hip can often lead to the body compensating elsewhere in order to maintain normal gait and posture. This can lead to referred pain in areas like the lower back or the knee. Diagnosing and treating all somatic dysfunctions throughout the body is hence critical before a patient’s knee pain can be directly attributed to the knee itself (Miller, 2008).

Conservative management should be initiated in the majority of cases of knee pain presenting in the primary care setting. The level of clinical suspicion for a fracture can be assessed using the Ottawa Knee Rules and confirmed with x-rays. The Ottawa Knee rules are highly sensitive, evidence-based guidelines dictating that an x-ray is required in a patient with acute knee injury only if one or more of 5 criteria are met: Age 55 years or older; tenderness at head of fibula, isolated tenderness of the patella, inability to flex to 90 degrees and inability to bear weight on the leg immediately following injury. Patients who are older tend to have more fragile bones and are more likely to have fractures (Zhang, 2011). Other criteria's are based on common symptoms seen in acute knee fractures. Surgical referral should be considered in the presence of specific types of ligamentous or meniscal injury. If the patient is young or an athlete, if meniscal injury results in locking of the knee due to a displaced fragment or if a high degree of instability is present. Immediate treatment of acute knee injury should begin with the application of rest, ice, compression, and elevation (Calmbach, 2003).

Combination of manual therapy with exercise have been shown to decrease pain and improve functioning in patients suffering from a variety of chronic knee pain conditions. The most common conditions for which nonpharmacologic management is used are osteoarthritis and patellofemoral pain syndrome. A study showed that a combination of manual therapy applied to the lumbar spine, ankle, and pelvis yielded a significant functional benefit in patients with OA of the knee as well as delayed the need for surgery. The strengthening of the quadriceps muscle was shown to improve joint stability and significantly decrease pain. Studies have also shown that there is some gluteal muscle strength weakness in those with patellofemoral pain syndrome, and hence gluteal strengthening can be an effective treatment. In approaching the management of non-traumatic knee conditions, it is important to conduct a careful exam of the knee, hip, foot and ankle joints and identify restrictions in ROM, tender points and somatic dysfunctions. To evaluate and treat the osteopathic findings, common principles of techniques should be applied to the area of dysfunction and treated according to the anatomic region of the knee (Deyle, 2000).

With knee pain accounting for almost a third of primary care visits, Osteopaths play an important role in improving their patient’s overall quality of life. While the differentials for patients presenting with knee pain is considerable, it is important to combine knowledge of knee anatomy, the common causes of knee pain, a detailed history, and a complete osteopathic structural exam to come up with an appropriate diagnosis and treatment plan. Osteopathy provides an approach to the management through incorporating principles into their diagnosis and treatments including mobilization has been shown to reduce pain and improve functionality in patients with a wide range of knee pain etiologies, special tests that include musculoskeletal, somatic, ligamentous, neurological, imaging and referrals.

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