

**Chiropractic Protocols for the Management of
Patellofemoral Tracking Disorders**

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Abstract

Objective: This paper is a review of literature that keys on the etiology, examination, diagnosis, and treatment of patellofemoral tracking disorders. This paper helps to define patellofemoral tracking disorders and delineates it from similar conditions. The goal of this paper is to compile current data and organize this information in hopes that chiropractic physicians can be made aware of the protocols for diagnosing and treating patellofemoral tracking disorders.

Data Source: A literature search was conducted at the Logan College of Chiropractic library utilizing Medline and Chiroaccess Web databases. The subject heading of "knee" and "patellofemoral" were used. The search was asked to pull selections from 1990 to present. Eighty-five selections were generated of which 25 were chosen for this review of literature. Five textbooks were also used for a total of 30 documents used as sources in this paper.

Data Synthesis: The data was studied to find valid scientific research and case studies to support beliefs in the etiology, diagnosis, and treatment methods concerning patellofemoral tracking disorders.

Conclusion: Patellofemoral tracking disorders are a common source of anterior knee pain. Thorough knowledge of the anatomy involved and the mechanism in this biomechanical abnormality are essential in the treatment. The research shows that conservative care is the treatment of choice for patellofemoral tracking disorders. Due to the commonness of the disorder and the growing acceptance of chiropractic care, people will frequently present to the chiropractor's office seeking treatment. Chiropractic care offers a natural, non-invasive form of treatment with high success rates. The better the understanding of patellofemoral tracking disorders and the different ways to treat them, the higher the success rates will climb as a result of chiropractic care.

Key Words: Patellofemoral, chiropractic, etiology, diagnosis, and treatment.

INTRODUCTION:

Anterior knee pain is among the more common musculoskeletal complaints that bring patients to the primary care physician's office(9). Due to the fact that anterior knee pain is so common, the doctor must be prepared and should have an understanding of the variety of conditions that present with this chief complaint. Patellofemoral tracking disorders should always be included in the differential diagnosis when the patient presents with this chief complaint. Just as it is common for patients to present with anterior knee pain, it is common for the cause to be a patellofemoral tracking disorder. The prevalence of patellofemoral tracking dysfunction in the general population may be as high as 40% and may account for as many as 1 of every 4 running injuries for which medical attention is sought (7). Since patellofemoral tracking disorders are so common in athletes and the general population, chiropractors will deal with these cases routinely in their office. It is essential to have an understanding of patellofemoral tracking disorders and to be able to differentiate them from similar disorders in order to effectively treat the patient's knee condition. According to Brier, the most common type of knee pain in the general population is patellofemoral knee pain and this mechanical pain can affect anyone (1). Due to the amount of people who suffer from patellofemoral pain it stands to reason that there should be extensive research of scientific data, clinical trials, and case studies available explaining the reasons and possible solutions for health care providers to successfully treat and help educate patients on how to prevent the occurrence of patellofemoral tracking disorders. The intent of this literature review is to acquire and compare research available in regard to the etiology, diagnosis, treatment, rehabilitation, and prevention of patellofemoral tracking disorders.

DISCUSSION

In dealing with any complaint of pain a physician always wants to determine the etiology and the mechanism of the injury. The best place to start, as with most cases, is by obtaining a thorough history from the patient and evaluate how the patient presents. Patients with patellofemoral tracking disorders often report having anterior knee pain, which is typically activity related and worsens when a patient negotiates stairs or runs over hilly terrain (6-7). Patients also complain of pain produced from sitting for long periods (1,6,7,9), squatting, and kneeling (8). The pain is usually described as dull and aching, but occasionally becomes sharp with activities (9) and a classic component of patients with patellofemoral tracking disorders is the presence of a "clicking sound" with walking up and down stairs (8). The physician should also inquire as to whether or not the knee is "locking" or "giving out". True locking rarely occurs, but giving out is common with patellofemoral tracking disorders (10). "Locking" or "catching" is usually common with cartilage damage(1). It is helpful to have the patient point directly to the point of pain as this can be crucial in the proper diagnosis. One method proven to be effective in determining the diagnosis is to use a patient drawn diagram in which a standard knee diagram is divided into nine zones and patients note areas of pain in relation to these zones(6). The doctor then correlates his exam with the original patient diagram. It is also important to have a patient determine the level of pain on a Visual Analog Scale (VAS) so it can be used for comparison after treatment has begun.

The mechanism of patellofemoral tracking disorders can develop acutely with trauma, but more commonly are of an insidious onset which usually suggests a progressive

biomechanical abnormality. Common types of trauma which may cause a patellofemoral tracking disorder usually consist of a direct blow to the patella such as in a car accident where the patient's leg drives into the dashboard (1), a hard fall, or contact sports. Patients presenting with anterior knee pain of insidious onset should direct thinking towards anatomic malalignment, flexibility deficits, training errors, or repetitive overuse (1,5). Repetitive overuse may lead to soft tissue microinjury(5) and will often alter the biomechanics associated with the patellofemoral joint. Damage may occur to the articulating surface of the patellofemoral joint because of intrinsic or extrinsic factors. Intrinsic factors include osseous alignment of the lower extremity, structural abnormalities of the trochlear groove of the femur, or shape of the patella(1). The patella is classified as four types based on the size and shape of the medial and lateral facets (8). Types III and IV with either a flat or concave medial facet have been associated with a subluxing patella and are, therefore, more susceptible to articular cartilage damage (8). Extrinsic factors such as postural habits, certain activities, and extensor mechanism strength play a major role in patellar pain , are more common, and magnify the effects of any nonstructural faults (1). These factors relate to the pull of the quadriceps on the patella relative to the relationship of the tibia and femur in the frontal and sagittal planes. The underlying predispositions of patellar tracking disorders are numerous and include structural or functional problems such as anteversion of the hip, genu varum/valgum, tibial torsion, pronation, and weak external rotators of the hip (piriformis) and abductors (gluteus medius)(2). Patients often present with significant muscle imbalances usually consisting of weakened medial structures (VMO) and tight lateral structures (Ilio-tibial band and vastus lateralis) (2).

After a good history is taken, the examination is the next step in determining the diagnoses. It is essential that the examining chiropractor start by looking at the overall gait and structure of the patient and to look not only at the knee, but also to related structures above and below. The Q angle is one of the first things the physician should measure after inspection. William Post M.D. suggests that a Q angle of more than 25 degrees in a female and 20 degrees in a male are considered abnormal (6). According to Brier (1), a Q angle greater than 15 to 20 degrees must be evaluated. Gelfound and DeVore report normal Q angle values to be 8-14 degrees in males and 15-17 degrees in females with an excess of 20 degrees to abnormal. Regardless of the varying degrees considered normal, everyone is in agreement that patients with an increased Q angle are susceptible to patellofemoral tracking disorders. Patellofemoral tracking disorders are more common in females (2,3) as is an increased Q angle which helps to explain the prevalence. In addition to checking the Q angle, the physician should also evaluate the foot for excessive pronation. The basis for linking excessive pronation with patellofemoral tracking disorders is because subtalar joint pronation is always accompanied by internal tibial rotation (11). Internal tibial rotation will affect the tracking of the patella diversely.

After postural and gait disturbances have been assessed, the doctor should perform a thorough regional exam consisting of circumferential measurements superior and inferior to the patellar pole, ROM tests, and a variety of orthopedic tests of the knee to rule out any structural instabilities. The orthopedic tests should be compared bilaterally and focus should be given on patellar apprehension, lateral and medial glide, patellar grind, and patellar tilt. Ober's test should also be performed to assess ilio-tibial band tightness (1,6,7,9) which is often present with patellofemoral tracking disorders. Muscle testing

should include the quadriceps with particular attention placed on the VMO, hamstrings, popliteus, pes anserine group, ITB/TFL, and the gastrocnemius. Because some muscles originate from the pelvis or insert at the foot / ankle, a kinematic relationship exists that must always be considered with evaluation and rehabilitation (2). Positive findings commonly found during the examination which leads to a diagnosis of patellofemoral tracking disorders include the following (2,3,8): femoral anteversion, tibial external torsion, excessive pronation, squinting patellae, mild swelling, irritation of the fat pad, VMO wasting and decreased muscle bulk, weakness in gluteus medius, tight hamstrings, rectus femoris, ilio-tibial band, gastrocnemius, lateral retinacular structures, decreased medial and possibly inferior patellar glide, increased Q angle, apprehension to lateral displacement, and patellar malalignment. While these tests may be helpful, there are no confirming tests for diagnosis of patellofemoral tracking disorder (7). The diagnosis is based on the history and a good thorough exam after ruling out more serious conditions (7).

Radiographs play a key role in assessing the patellar malalignment and include the AP, lateral, and sunrise (Merchant's) view(9). The lateral view is useful in showing patella alta and the sunrise view is most helpful in assessing arthritis and subluxation(9). Radiographs are also helpful to rule out bony pathologies and assess patellar height. Patellar height and shape consistent with a Type II and Type III patella have been found to be associated with patellar pain and tracking disorder(27). Studies show that computerized tomography is the best way to visualize patella alignment. In a study performed by Vincenzo Guzzanti, MD *et al* it was concluded that computerized tomography with and without quadriceps contraction is a useful adjunct to diagnose and

define the type of malalignment in particularly difficult circumstances(24). Kinematic MRI studies have also been shown to reveal patellar tracking abnormalities (26). Both CT and MRI are not often clinically necessary and may present to be a needless expense to the patient. Infrared thermography has also proven to be helpful in the diagnosis and treatment assessment of patellarfemoral tracking disorders (25).

After the diagnosis has been correctly determined, the chiropractor is left with a variety of choices as to how the patient should be treated. The research demonstrates several conservative methods to treat the condition, but the choice of treatment should be specific to the cause of the patients condition. An example would include a patient that has a structural leg inequality or pronation. It is often helpful to have this person fitted for orthotics. Modes of treatment that have been effective in treating patients with patellofemoral tracking disorders include adjusting or manipulation of the patella, other joints in the knee, subtalar joint, pelvis, and lumbar spine, cryotherapy, ultrasound, VMO strengthening, interferential therapy, Russian stimulator, patellar taping, patellofemoral braces, ultrasound, neuro-muscular reeducation, orthotics, stretching exercises, orthotics and modification in daily living.

The chiropractor should have a short term goal of getting the patient out of pain and a long term goal of restoring normal biomechanics to the entire body. In the initial treatment it is generally considered to use rest, ice, compression, and elevation.

Interferential therapy is suggested in the initial treatment (2) and ultrasound has also proven to be effective as an adjunct in treatment (25). It is generally accepted that the patient should avoid any overuse and painful activities in the early stages of care. Rest is helpful in decreasing tensile load and is paramount in the initial phase of treatment.

Cryotherapy is often effective early in the treatment both as an analgesic and to decrease any swelling that may be present (2). It is essential to decrease the forces to the patellofemoral joint to make the treatment worthwhile and an effective mechanism is to limit the amount of knee flexion (3).

Chiropractic adjustments affect the structure and function of the body and helps to heal and restore normal biomechanics. It is no different with the knee. Patellar mobilization has proven to be effective in the treatment of patellofemoral tracking disorders regardless of the technique chosen. One particular study showed objective improvements in the pre and post algometer findings and a better subjective response as a direct response to patellar mobilization (29). Another study involving manipulation of the lumbar spine, sacroiliac, pubic symphysis, and hip joints concluded having positive results (7). Wood, D.C., C.C.S.P. concluded that chiropractic manipulative therapy seems to be valuable in reducing reflex sympathetic dystrophy and improving lumbopelvic kinematics (10). In a journal selection written by Gelfound and DeVore(7), they refer to a study by Sweeting (30) in which he discussed the treatment by manipulation in 16 adolescents with anterior knee pain and found that serial manipulation in side posture to the lumbar spine immediately increased the strength of lower extremity muscle groups by 15-20%. The study suggested that the restoration of the normal physiological mechanisms was attributable to the stimulation of stretch receptors in the ligaments and capsules, which triggered a large number of afferent impulses to the central nervous system.

A technique that is debated by many health care professionals is the use of patellar taping. Patellar taping seems to promote subjective improvements with patients but there are many questions in relation to the scientific data as to how the mechanism of patellar

taping works. One particular study failed to produce any significant changes in patellofemoral congruency and patella rotation angles, however the results of the 12 patients selected for the study reveal significant reduction in pain levels not associated with patella position changes (13). Another study conducted suggests that patellofemoral taping was not effective in improving walking velocity or stride characteristics, but did result in a small but significant increase in loading response knee flexion and a large decrease in patellofemoral pain(14). A majority of studies concur that patellar taping can improve the radiographic position of the patella (15). There are several theories associated with patellar taping and while more research needs to be done to discover the exact mechanism of its effectiveness, it stands that clinical and research evidence supports relief of pain with patellar taping and can be used as a safe and inexpensive adjunct to treatment and rehabilitation (15).

In much the same way as patellar taping is implemented in patient treatment, patellofemoral braces are also used. Patellofemoral braces are designed to minimize lateral patellar subluxation and dislocation, improve patellofemoral tracking and decrease anterior knee pain (16) They are also intended to provide proprioceptive feedback and warm the patellofemoral joint (16). While patellofemoral braces do not appear to alter underlying biomechanical dysfunction, they provide a static restraint that (in most cases) applies a medially directed force to the lateral patella, thereby decreasing abnormal patellofemoral tracking (16). Even though convincing research has not been made available many athletes still seem impressed with the performance of bracing and insist on its use (2).

Most physicians would agree that strengthening the VMO is the key to improving

patellofemoral tracking disorders. A.L. Logan suggests externally rotating the lower leg and doing straight leg raises to start and once the knee is responding well to include resistance exercised gradually increasing flexion as progress develops (4). A study comparing exercises that are supposed to recruit the vastus medialis revealed that the VMO:VL proportion was highest when tibial rotation and knee extension were resisted simultaneously (17). Practitioners also have raised questions as to the best type of exercises for improving patellofemoral tracking. In a study comparing closed kinetic chain training and joint isolation training on muscle performance and perceived functional status, the authors concluded that closed kinetic chain training may be more effective (18). Another study testing the effectiveness of open and closed chain exercise in patellofemoral tracking problems found that closed chain allows for better tracking during full knee extension through 20 degrees of flexion, however open chain strengthening techniques are appropriate after 30 degrees of flexion (19). Open chain leg extension exercises have traditionally been the way to strengthen the quadriceps because this exercise allows for quadriceps isolation. Examples of open chain quadriceps strengthening include straight leg raises, short arc quadriceps, and sitting knee extensions. In open chain exercise, the end segment is free, the axis of motion is distal to the joint, and the muscle action is primarily concentric. Closed chain exercises are considered more functional because there is a normal physiological load through the skeletal system, muscle contractions are synergistic, and normal proprioceptive feedback mechanisms are utilized. Examples of closed chain quadriceps strengthening exercises include the squat, leg press, and step exercises. In these segments the end segment is fixed, the axis of motion is proximal and distal to the joint, and concentric, eccentric, and isometric actions are all displayed through

performance (19). Another study supports the concept of vastus medialis strengthening combined with, ITB band stretching, and joint mobility exercises due to the impressive results of a 6 week program revealing 84% of the subjects pain free after the experiment (22). As a general rule, it is wise to warmup slowly and stretch before performing the exercises and to stretch after to prevent a shortening of the muscle. Many times patients are in too much pain to perform the exercises, so electrical muscle stimulation can be used to initiate rehabilitation of the VMO (21). For training to be effective, the patient must not experience pain while exercising, because pain has a strong inhibitory effect on muscle function(7). Another thing the chiropractor must consider before prescribing excercises is the patients age. In a study performed by Kannus and Nittymaki, they discovered age was the only significant factor in predicting the outcome of nonoperative treatment of patellofemoral pain (20). They revealed the younger the patient, the better the outcome. They do however, suggest that quadriceps rehabilitation is worth trying for every patient regardless of age, sex, body composition, athletic level, duration of symptoms, or biomechanical malalignments in the lower extremities because 70% of the patients in the study experienced complete recovery.

Foot orthotics and heel lifts are another adjunct that aid in the treatment when determined to be clinically necessary. Orthotics are often used when excessive foot pronation is seen on examination. One author states that if the excess motion of the subtalar joint can be prevented with functional orthotic use, it is logical that relief of the patellofemoral joint pain may be achieved(11). On examination of biomechanical variables, Bennet determined a clear demonstration of the link between excessive pronation and the occurrence of patellofemoral tracking dysfunction and suggests the use of orthotics along

with proper footwear and appropriate strengthening of the vastus medialis for patients with patellofemoral tracking disorders and hyperpronated feet (12). One study found that the use of soft foot orthotics was significantly effective in treating patients with patellofemoral tracking disorders(23). The study had two groups perform quadriceps and hamstring strengthening and stretching exercises while one of the two groups used soft foot orthotics. While both groups reported an overall reduction in pain, the orthotics group improved significantly more than the group who had just performed the exercises.

One final mode of treatment and rehabilitation refers to use of proprioceptive exercises. Chiropractors often use exercise balls and wobble boards in the office for many different conditions for the purpose of restoring proper biomechanics and proprioceptive neural input. Proprioceptive exercises improve whole-body balance and coordination and help to improve deficits in the ankle, the knee, the pelvic joints, the lumbar joints, and cervical spine (28). Changes in afferent proprioceptive input entering the central nervous system at cervical spinal levels may induce significant postural changes related to the trunk and lower extremity musculature (5). This provides reason not only for the use of proprioception exercises, but full spine adjusting to treat and prevent biomechanical alterations.

CONCLUSION:

This review of literature provides sound evidence that conservative care is not only an effective treatment, but is usually the treatment of choice before drugs and surgeries for patellar tracking disorders. The research suggests several etiologies and keys on biomechanical defects and malalignment as key players involved in the disorder. Chiropractors prevail in detecting malalignment, postural imbalances, segmental

dysfunction, and gait disturbances by looking at the body as a whole. It is through this procedure that chiropractors will look at the problem from all angles and treat abnormalities above, below, and at the knee to help restore normal function and help to alleviate patellofemoral tracking disorders. The success of treating the disorder is based upon the proper diagnosis, a combination of therapeutic modalities, manipulation, proper stretching and strengthening exercises, and proprioceptive exercises. While there is much open ended research and theories in regards to the etiology and treatment of the disorder, chiropractors have proven to be successful in the treatment of patellofemoral tracking disorders. Patients are seeking conservative care and turning to chiropractors for the solution. It is paramount that chiropractors have a sound knowledge of the protocols used in the diagnosis, treatment, and prevention when that patient presents in the office with anterior knee pain. Although much scientific data and research is still needed in regards to etiology and specific diagnostic tests concerning patellofemoral tracking disorders, there is significant research to support how to successfully treat patients. So while questions are still being pondered and remain unanswered, don't make the patients wait, treat them chiropractically because chiropractic works.

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