Range Of Motion of The Knee Joint And Its Effects On Proprioception


ABSTRACT: This study involves proprioception at the knee joint and is unique in that it involves a population with either arthritic knees prior to total knee replacement, or persons of similar age to patients with advanced knee arthritis that are diagnosed and determined to be candidates for total knee arthroplasty. Previous studies have focused on either young, active subjects, or recipients of knee replacements and their lack of proprioception after surgical intervention.

A patient’s ability to sense joint position and/or motion can be affected by many factors such as age, muscle fatigue, and osteoarthritis. The goal of this study was to determine:

1. if proprioception in arthritic knees differed from proprioception in non-arthritic, age matched normal knees;

2. if proprioception of one knee is reduced by the presence of an advanced knee joint arthrosis in the contralateral joint, irrespective of the presence of arthritis in the non-symptomatic knee;

3. if a person's grade of osteoarthritis is associated with his or her level or proprioception
This study compared the proprioception levels of a group of 117 patients who were scheduled for total knee arthroplasty because of severe osteoarthritis, (mean age = 67.9 years) with those of the control group of 40 patients who were recruited from a hospital-based cardiac rehabilitation program and did not have knee osteoarthritis, (mean age = 68.3 years). The authors defined proprioception as the threshold to detection of passive motion by comparing results and data from Biodex System 2, Multi Joint Testing Rehabilitation System.

The results of this study demonstrated that middle-aged and elderly persons with advanced arthritis were significantly less able to detect passive motion of the knee than were middle-aged and elderly persons without knee arthritis.

Patients who had osteoarthritis in only one knee had a reduced ability to detect passive motion of both knees. There was no significant association between the radiographic severity of arthritis, and the threshold detection of passive motion in patients with advanced knee arthritis.

The authors of this study conclude that knee proprioception in middle-aged and elderly persons with advanced knee arthritis is reduced in comparison with similarly aged persons without arthritis. Such a loss of proprioception is independent of the severity of knee arthritis and may foretell of the development of arthritis. When a patient has reduced proprioception with regard to one knee affected by arthritis, he or she also has reduced proprioception with regard to the contralateral knee, independent of the presence or severity of degenerative arthritis. The authors also point out that when an investigator is evaluating the changes in proprioception after knee arthroplasty, it is best to compare the patient's post surgical knee with patients untreated knee rather than with age-match controls.

**COMMENTS:** Chiropractic treatment and modalities have classically been addressed to increase joint mobility and restore normal joint physiology to the anatomical segment treated. The concept of the chiropractic subluxation has classically dealt with the implications of joint immobility, disruption of normal joint physiology and the sequela of decreased afferentation and muscle stiffness and rigidity. This study reinforces the concept that in middle-aged and elderly individuals with advanced knee osteoarthritis, there is a demonstrable reduction in proprioceptive ability when compared with middle-aged, elderly persons without evidence of osteoarthritis. These findings would fit well into the chiropractic model of joint immobility and dysafferentation as proposed by various chiropractic authors.

Of interest in this study was the fact that there was no significant association between radiographic severities of arthritis and the threshold detection of passive motion in patients with advanced knee arthritis. This raises the question of whether or not patients with radiographic signs of arthritis that have full range of motion manifest increased levels of proprioception. Previous studies have demonstrated that knee proprioception is greatest when measured near full
extension. In studies done with patients with initially acute anterior instability, 20 patients with previous anterior instability, six months after reconstruction restoration of proprioception was seen near full in knee extension and full flexion. In the mid-range position, proprioception was not restored. Approximately three and a half years after reconstructive surgery, there was improvement of proprioception in the mid-range position, but it was still seen to be at a deficit.

In yet another study of joint proprioception, and the effects of joint laxity, joint position, and direction of motion, there was data that suggested capsular tightening as one possible mechanism for increased shoulder proprioception. Remembering the screw-home mechanism of coupled motion in knee extension may lend some insight to the demonstration of increased knee proprioception in full extension as described in the previous post surgical study.

Because this study demonstrated no significant association between radiographic severity of arthritis and proprioception, the chiropractic physician may wish to focus on the benefit of restoration of full range of motion in knee flexion and extension with the goal of increasing proprioception. If the chiropractic physician is able to increase range of motion with regard to functional knee extension and flexion in the osteoarthritic patient, and therefore increased proprioception, it may decrease the time frame until and development of further osteoarthritis.

This article is also interesting from a chiropractic standpoint in that it addresses concepts of unilateral segmental dysfunction having effects bilaterally, thereby reinforcing the holistic paradigm of chiropractic care. This study demonstrated that patients with reduced proprioception with regards to one knee affected by arthritis were also seen to have reduced proprioception with regards to the contralateral knee, independent of the presence or severity of degenerative arthritis. This is reinforced by a study which also demonstrated that patients with unilateral osteoarthritis of the knee had decreased proprioception in both knees. They also noted that impaired proprioception is not exclusively a local result of disease in knee osteoarthritis. Therefore, chiropractic intervention with regards to increasing knee extension and flexion, as well as strengthening protocols to address muscle fatigue, may in fact be beneficial in the reduction and degenerative sequela of contralateral knee osteoarthritis.

In review of other studies evaluating proprioception after surgical intervention, there is a correlation between patient satisfaction and the level of proprioception post surgically. This would also infer possible supratentorial effects on proprioception that may be gained through increased mobilization and increased ability to perform activities of daily living with decreased pain.

In conclusion, it has been demonstrated that proprioception is diminished with age. It has also been documented that patients with unilateral osteoarthritis of one knee are seen to show decreased proprioception in the contralateral knee. End range of motion of extension has been
seen to elicit the most increased proprioceptive input, followed by flexion with mid range demonstrating less proprioceptive input with decreased resolution post surgically. Utilizing a chiropractic paradigm of restoration of normal joint facilitation, as well as rehabilitating of surrounding tissue physiology may well lead to decreased symptomotology, prevention of further osteoarthritic changes in the effected knee, as well as contralateral knee decreased proprioception and its degenerative sequela. Patient satisfaction with care can be seen to increase the effectiveness of treatment, thus making chiropractic care of the osteoarthritic knee joint a viable treatment protocol for knee pain in osteoarthritic patients.

Other authors have found that proprioception is diminished with age, and that regular activity may attenuate this decline. The strategy should be to reduce the incidence of poor proprioception, and the sequela of repetitive knee injury, and/or fall. This may be avoided through regular exercise. This reinforces the necessity of proper joint facilitation in the overall maintenance of joint physiology and preventative degenerative joint disease.

Chiropractic physicians must also be aware of the kinematics involved with normal knee anatomy and function when assessing patients who are candidates for manipulation and rehabilitation of the knee. Pre-existing conditions such as knee gonarthrosis, excessive Q angle, foot pronation, anterior ligamentus instability, and flexion contractures of the capsule, should all be considered when recommending chiropractic manipulation and rehabilitation of the knee.