Association between quadriceps strength, pain and functional disability among knee OA patients.

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ABSTRACT: BACKGROUND: - Physical inactivity is common in patients with knee osteoarthritis (OA) and has been linked to serious comorbidities such as cardiovascular disease, obesity, and diabetes. The purpose of this study was to examine the association between quadriceps strength and self-reported physical activity in patients with radio-graphically confirmed knee OA. Secondarily, the authors sought to determine if there were differences in quadriceps strength between knee OA patients with low physical activity (LPA) and knee OA patients with higher physical activity (HPA). A tertiary aim of this study was to examine the effect of gender on physical activity and quadriceps strength in patients with knee OA.

AIMS: - Study to correlate quadriceps strength, pain and functional activities among osteoarthritis knee patients

OBJECTIVES: -
1) To determine whether the quadriceps weakness is a predisposing factor to osteoarthritis.
2) To correlate strength deficit and pain.
3) To correlate strength deficit and function.

METHOD: - From the sitting position, the participant stands up completely up so hips and knees are fully extended, then completely back down, so that the bottom fully touches the seat. This is repeated for 60 seconds. Same chair should be used for re-testing within site. If the person cannot stand even once then allow the hands to be placed on their legs or use their regular mobility aid. This is then scored as an adapted test score.

Conclusion: In conclusion the result of this study indicates that Quadriceps strength is related with pain and disability in patients suffering with Osteoarthritis knee. Patients with more quadriceps strength are found to have less pain and disability.

Key Words:

INTRODUCTION
There is currently no cure for knee osteoarthritis (OA).¹-² Patients with knee OA are at greater risk of developing cardiovascular disease, obesity, and diabetes, all of which can be linked to increased body mass index and physical inactivity.³ Furthermore, disability, impaired ambulation, and decreased physical activity may lead to secondary health complications and increased risk of mortality in patients with knee OA.³,⁴ Interventions that focus on increasing walking have been successful in improving physical activity,⁵ reducing self-reported workplace limitations,⁶ as well as decreasing pain and improving fatigue in patients with knee arthritis.⁷ Identifying factors that may allow for increased physical activity and exercise in patients with knee OA is important for developing clinical methods to improve general health in patients with knee OA.

Improving lower extremity strength is a hallmark characteristic of non-surgical knee OA management.⁸ Specific attention has been paid to the quadriceps musculature, which is important for ambulatory propulsion and energy attenuation at the knee during gait,⁹ and, quadriceps dysfunction is common in patients with knee OA.¹⁰ Quadriceps strength and voluntary muscle activation are associated with physical disability in people with knee osteoarthritis.¹¹ Physical inactivity is associated with quadriceps weakness in patients with chronic diseases¹²,¹³,¹⁴,¹⁵ and even quadriceps muscle wasting in patients with chronic obstructive pulmonary disease.¹⁶ Knee OA patients and people at risk of developing knee OA have demonstrated decreased physical activity,¹⁷,¹⁸ yet the association between quadriceps muscle strength and physical activity remains uncertain.

Associations between quadriceps muscle strength, quadriceps activation, and disability have been evaluated in patients with knee OA,¹⁹,²⁰ while these associations provide information regarding the consequence of muscle weakness on movement patterns, pain, and physical function, the current literature has not evaluated if an association exists between strength and exercise habits or the amount of physical activity in
which people with knee OA engage. Establishing the association between quadriceps muscle strength and the amount of exercise in which knee OA patients participate is important for understanding the effects of physical inactivity on the quadriceps, a group of muscles known to predict disability in knee OA patients. Additionally, an association between the amount of exercise and quadriceps strength may provide evidence that increasing quadriceps strength may positively affect exercise tolerance in patients with knee OA. Therefore, the overall goal of the current study was to evaluate the association between quadriceps strength to leisure-time exercise in people with knee OA. The primary purpose of this study was to examine the association between quadriceps strength and self-reported physical activity in patients with radiographically confirmed knee OA. Secondly, the authors' sought to determine if there were differences in quadriceps strength between knee OA patients with low physical activity (LPA) and knee OA patients with higher physical activity (HPA). A tertiary aim of this study was to examine the effect of gender on physical activity and quadriceps strength in patients with knee OA.

**REVIEW OF LITERATURE**

N A Glass, at al (2013) the relationship between quadriceps muscle weakness and worsening of knee pain in the MOST cohort: a 5-year longitudinal study to determine whether quadriceps weakness is associated with elevated risk of worsening knee pain over 5 years. Quadriceps weakness was associated with increased risk of worsening of knee pain over 5 years in women, but not in men. Alex. N Bastick, at al (2015) What Are the Prognostic Factors for Radiographic progression of knee osteoarthritis? Meta analysis The purpose of this study is to provide an updated systematic review of available evidence regarding prognostic factors for radiographic knee OA. Marlene Farsen, at al (2011) The epidemiology of osteoarthritis in Asia An update of what is currently known about the prevalence of hip and knee OA from population-based studies conducted in the Asian region is presented in this review. Many of the recent studies have conducted comparisons between urban and rural areas and poor and affluent communities. The results of Asian-based studies evaluating risk factors from population-based cohorts or case-control studies, and the current evidence on OA morbidity burden in Asia is also outlined. Stephanie c. Petterson, at al (2008) Mechanisms Underlying Quadriceps Weakness in Knee Osteoarthritis To identify determinants of quadriceps weakness among persons with endstage knee osteoarthritis. Both reduced CAR and LMCSA contribute to muscle weakness in persons with knee OA. Similar to healthy elders, the best predictor of strength in the contra lateral, no diseased limb was largely determined by LMCSA, whereas CAR was found to be the primary determinant of strength in the OA limb. Deficits in CAR may undermine the effectiveness of volitional strengthening programs in targeting quadriceps weakness in the OA population. Fiona Dobson, at al Recommended performance-based tests to assess physical function in people diagnosed with hip or knee osteoarthritis Although the tests in the recommended set were selected based on global expert opinion and available clinimetric evidence, none of the tests fulfill all desirable criteria, limiting the ability for a definitive core set of tests to be defined.

**METHODOLOGY**

- **STUDY DESIGN:** Observational study
- **STUDY SETTINGS:** Subjects will be taken from Stuti physiotherapy clinic, Ahmedabad.
- **SAMPLING TECHNIQUE:** Purposive sampling technique will be used for osteoarthritis knee patients.
- **SAMPLING POPULATION:** 30 radiological confirmed knee osteoarthritis patients will be taken.
- **SAMPLE SIZE:** 30 patients

**CRITERIA FOR SELECTION**

**INCLUSION CRITERIA:**
1. Diagnosed or radiological confirmed osteoarthritis knee patients.
2. Subjects from age 35-65yrs.

**EXCLUSION CRITERIA:**
1. Treatment taken for 6 months.
2. Cases of rheumatoid arthritis and other arthritis taken as well as no post operative patients.
3. Cases of neurological disorder.

**METHOD**

The maximum number of chair stand repetitions possible in a 60 second period (2-4). The chair cannot slide backwards by placing the back of the chair against a wall. Comfortable walking footwear (e.g. tennis
shoes/cross trainers) should be worn. The participant sits in the chair in a position that allows them to place their feet flat on the floor, shoulder width apart, with knees flexed slightly more than 90 degrees so that their heels are somewhat closer to the chair than the back of their knees. The arms are crossed at the wrists and held close to the chest (across chest). The tester stands close to the side of the chair for safety and so as they can observe the technique, ensure that the participant comes to a full stand and full sit position during the test. A practice trial of one or two slow paced repetitions is recommended before testing to check technique and understanding.

**Procedure**

From the sitting position, the participant stands up completely up so hips and knees are fully extended, then completely back down, so that the bottom fully touches the seat. This is repeated for 60 seconds. Same chair should be used for re-testing within site. If the person cannot stand even once then allow the hands to be placed on their legs or use their regular mobility aid. This is then scored as an adapted test score. “For this test, do the best you can by going as fast as you can but don’t push yourself to a point of overexertion or beyond what you think is safe for you.

1. Place your hands on the opposite shoulder so that your arms are crossed at the wrists and held close across your chest. Keep your arms in this position for the test.
2. Keep your feet flat on the floor and at shoulder width apart.
3. On the signal to begin, stand up to a full stand position and then sit back down again so as your bottom fully touches the seat.
4. Keep going for 60 seconds and until I say stop.
5. Get ready and START”.

**Scoring**

On the signal to begin, start the stop watch. Count the total number of chair stands (up and down equal's one stand) completed in 60 seconds. If a full stand has been completed at 60 seconds (i.e. standing fully erect or on the way down to the sitting position), then this final stand is counted in the total. The participant can stop and rest if they become tired. The time keeps going. If a person cannot stand even once then the score for the test is zero.

Next, allow the hands to be placed on their legs or use their regular mobility aid. If the person can stand with adaptations, then record the number of stands as an adapted test score (see score sheet). Indicate the adaptations made to the test.

**RESULT**

Here in this study we have involved 30 individuals to find out the correlation between pain, strength and functional disability. The mean of NPRS, SST and WOMAC was found to be 5.2, 9.067, and 28.1 respectively. In this study we have taken Karl Person’s Spearman’s test. We found correlation between NPRS AND WOMAC which has positive correlation. Second we have found inverse correlation of NPRS and SST. Third we have found correlation of WOMAC and SST which also has inverse correlation. So it says that as pain increases functional ability decreases and second correlation says that as pain increases strength decreases third correlation says that as strength decreases functional ability of osteoarthritis knee decreases.

<table>
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<th>COMPONENTS</th>
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<th>WOMAC</th>
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<tr>
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DISCUSSION

This study correlates quadriceps strength, pain and functional disability among osteoarthritis knee patients. It is observed that higher levels of quadriceps strength correlate with higher physical activity in knee OA patients. We also found that quadriceps weakness was associated with worsening knee pain. Our evaluation also found out that quadriceps weakness predicts worsening knee pain because the quadriceps muscle is a primary dynamic contributor to knee joint stability. By definition, stability at the knee joint requires internal forces of sufficient magnitude to counteract external forces acting at the knee. The quadriceps muscle absorbs loads and provides dynamic stability witness of the quadriceps may alter local contact stress, in a manner detrimental to articular cartilage. It may also lead to increases impulse loading, which has been associated with knee pain and may contribute to knee osteoarthritis. This suggests that if excess loading is predictive of osteoarthritis increases quadriceps strength may protect the knee. Weakness could reduce shock absorption and neuromuscular control and impair structural integrity of the knee joint. This may lead to abnormal loading and subsequent structural pathology associated with knee symptoms, such as bone marrow lesions or bone attrition. Some articles also mention that exact reason that quadriceps strength does not predict the majority of variance in physical activity is unknown but there are likely multiple other factors that influence physical activity in patients with knee OA. Knee OA is a multifactorial condition that includes injury and disease of multiple joint structures. Strength or activation of multiple lower extremity muscles affect contact forces at the knee, many of which may uniquely contribute to explaining a portion of the diminished physical activity seen in patients with knee OA. Additionally, the inability to tolerate pain during locomotion may explain additional variance regarding physical activity, as fear of pain during ambulation may decrease physical activity. Non-physiological factors such as socioeconomic status may be associated with lower leisure-time physical activity. It is possible that severity of joint damage at the time of testing may have contributed to explain a proportion of variance among osteoarthritis knee patients. Although the association between OA progression and strength is not clear, quadriceps weakness remains a hallmark physical impairment. This is what we study contains along with the contradictions we found in research done by others.

LIMITATIONS OF THE STUDY

- Only 35-65 age groups of people were selected in this study.
- Small sample size was taken for study i.e. 30
- As new events are to be performed by the subject, the result greatly depends
- On confidence level and skill of subjects.
- Excessive repetitions if performed by the subject can lead to exertion which affects the result.

FURTHER RECOMMENDATION

- The study can be carried out on more number of subjects.
- Other tests like using dynamometer, sea bags isometric exercise can also be selected for this study.
- In sequence further interventional studies may be done on quadriceps endurance and neuromuscular control of the same.
- Longitudinal studies of this component can help to see their effect on prognosis of osteoarthritis knee.

REFERENCES:


22. N A Glass, at al (2013) the relationship between quadriceps muscle weakness and worsening of knee pain in the MOST® cohort: a 5-year longitudinal study to determine whether quadriceps weakness is associated with elevated risk of worsening knee pain over 5 years. Quadriceps weakness was associated an increased risk of worsening knee pain over 5 years in women, but not in men.

23. Alex.N Bastick, at al (2015) What Are the Prognostic Factors for Radiographic progression of knee osteoarthritis? Meta analysis The purpose of this study is to provide an updated systematic review of available evidence regarding prognostic factors for radiographic knee OA.

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