Correlation of Hip Abductors, Quadriceps and Hamstrings to Physical Function in Total Knee Arthroplasty.

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Abstract

Objective: To study the correlation of pre-op muscle strength of Hip Abductors, Quadriceps and Hamstrings to post-op physical function in patients with pre-op and post-op Total Knee Arthroplasty. Materials & Method: - Fifty-one subjects were included in the study. Initially the patient was asked to fill WOMAC questionnaire. Then the muscle strength of hip abductors, quadriceps and hamstrings was assessed with hand-held dynamometer. Then the patient was asked to perform timed up and go test.

Result: - There was no significant correlation between pre-op muscle strength of Hip Abductors, Quadriceps and Hamstrings to post-op physical function in patients with pre-op and post-op Total Knee Arthroplasty.

Conclusion: - Improvement was observed in hip abductors, quadriceps and hamstrings to physical function when compared with pre-op to post-operative data. Improvement in physical function as measured by WOMAC and TUG test was significant in the studied population. No correlation was observed between pre-op muscle strength of hip abductors, quadriceps and hamstrings to post-operative physical function in patients with Total Knee Arthroplasty.

Key words: - Total Knee Arthroplasty, Quadriceps, Hamstrings, Hip Abductors

Introduction

There is a rapid and substantial decrease in knee pain after Total Knee Arthroplasty (TKA).¹ The most common problems faced by patients are reduced walking speed, difficulty in ascending and descending stairs, inability to return to sports played prior to surgery. Investigating modifiable factors that contribute to the functional limitations in TKA patients may help guide rehabilitation protocols and improve functional outcomes. One such modifiable factor is lower extremity muscle weakness. The weakness of the quadriceps muscles has received a good amount of research attention and several studies have tested its contribution to functional limitations after TKA. The quadriceps muscle controls knee flexion during ambulation. Adequate knee extensor strength is needed for eccentric control of knee flexion that is to control the knee flexion demand moment in the sagittal plane. Quadriceps muscle weakness after TKA has been associated with decreased ability to walk and climb stairs and with asymmetrical gait patterns. However quadriceps muscle strength is only necessary for the function and control of knee extensors and to some degree of hip flexors (by the action of the rectus femoris muscle). Lack of strength of lower extremity muscles also may contribute to functional limitations of these patients.¹ Although quadriceps strength has been investigated extensively, less investigation has focused on the strength of other lower extremity muscles before and after TKA. Some studies suggest hamstrings recovers faster than

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quadriceps strength but others suggest hamstrings remain comparably dysfunctional to the quadriceps years after surgery. It is unclear if the hamstrings are as compromised as the quadriceps in the acute postoperative phase but if so both muscle groups should be targeted in aggressive postoperative rehabilitation.2

Hip abductors may contribute to lower extremity function in patients who have had TKA. Studies have suggested that hip abductor weakness plays a role in functional limitations in older adults. The results of these studies raise the question of whether the role of hip abductors in functional ability and performance may have been overlooked in patients who have undergone TKA.1 Thus the purpose of the study was to determine the correlation of hip abductors, quadriceps and hamstrings to physical function as measured by Western Ontario McMaster University Osteoarthritis Index (WOMAC) score and Timed Up & Go (TUG) test in TKA.

**Aims & Objectives**

Aim: -To study the correlation of pre-op muscle strength of Hip Abductors, Quadriceps and Hamstrings to post-op physical function in patients with pre-op and post-op Total Knee Arthroplasty.

Objectives: -

- To compare effect of pre-op and post-op muscle strength of Quadriceps, Hamstrings and Hip Abductors.
- To compare effect of pre-op and post-op Quadriceps, Hamstrings and Hip Abductors.
- To compare effect of pre-op and post-op Components of Western Ontario McMaster University Osteoarthritis Index (WOMAC).
- To compare effect of pre-op and post-op Timed Up and Go Test.

**Materials & Methodology**

Patients suffering from osteoarthritis of knee joint, pre and post-op for Total Knee Arthroplasty. 50 subjects were included in the study.

Inclusion Criteria: - Patients undergoing Unilateral Total Knee Arthroplasty due to Osteoarthritis.

Exclusion Criteria: -

- Patients who have varus angle of more than 20 degrees, fixed flexion deformity of more than 15 degrees, undergone Hemiarthroplasty, undergone Revision Arthroplasty, infection postoperatively, Hip abnormalities, with any type of neurological or psychological disorder.

**Methodology**

All patients included in the study filled the consent form. Initially the patient was asked to fill the WOMAC Index of Osteoarthritis. All patients were evaluated pre-operatively and 6 weeks postoperatively. Initially the patients were evaluated with the above proforma. The muscle strength of Quadriceps, Hamstrings and Hip abductors were checked with the help of Hand- held Dynamometer. Quadriceps muscle was checked in sitting position, Hamstrings muscle was checked in prone lying position and Hip Abductors muscle was checked in supine position with the help of a Dynamometer.

Then the patient was asked to perform Timed Up & Go test. The patient is comfortably seated on a firm chair with arms and back resting against the chair. The patient is then
Instructed to rise, stand and then walk 3 metres, toward a wall at normal walking speed, turn without touching the wall, return to chair, turn and sit down. The duration required was measured in seconds.

The present study was undertaken to find the correlation between pre-op muscle strength of hip abductors, quadriceps and hamstrings to post-op physical function in TKA and to find out if the pre-op muscle strength improves the physical function post-operatively.

Fifty one subjects were selected for the study. Patients having OA knees and are posted for TKA were included in the study. One subject was excluded from the study as patient developed knee stiffness post-operatively. Patients were evaluated a day prior to surgery and 6 weeks after the surgery.

Knee instability has been suggested to be a multifactorial problem. Biomechanical impairments such as muscle weakness, impaired proprioceptive accuracy and high laxity, which are frequently present in knee OA patients, have been regularly hypothesized as important causal factors in self-reported knee instability. Quadriceps and hamstrings muscles are considered to be principle stabilizers of the knee joint by absorbing shock forces and modifying knee joint load.26 Altered muscle coordination strategies in persons with knee osteoarthritis results in an increase in co-contraction of the quadriceps and hamstrings during walking. While this may increase intersegmental joint contact force and expedite disease progression, it is not currently known whether the magnitude of co-contraction increases with a progressive loss of joint space or whether the level of co-contraction is dependent on walking speed.27

TKA is very successful with relatively low risks despite variations in patient’s health status and type of prosthesis. TKA reduces arthritic knee pain and provide most patients with adequate knee range of motion.28 TKA alleviates pain and improves self-reported function but patients continue to exhibit significant impairments in quadriceps strength, voluntary muscle activation and functional performance. A 60% reduction in quadriceps strength is evident 1 month after surgery; volitional muscle activation, explaining more of quadriceps strength loss than cross sectional area is reduced by 17%. Functional performance is reported to worsen 20-25% one month after TKA. These deficits in strength and function do not resolve spontaneously. Most recover to pre-operative status however impairments in strength and function remain below healthy age-matched populations for years after TKA.26

The quadriceps muscles control knee flexion during ambulation. Adequate knee extensor strength is needed for eccentric control of knee flexion that is, to control the knee flexion demand moment in the sagittal plane. Studies have shown significant deficits in quadriceps muscle strength after TKA that remain unresolved for years after the surgery.15 Quadriceps weakness has been implicated in the development and progression of knee OA and is related to a decline in physical function. The focus on quadriceps is due to the association of the quadriceps to normal functional activities such as walking and stair climbing. While the reason is not well understood in TKA patients, it is suggested that a combination of muscle atrophy and neuromuscular activation deficits contribute to residual strength impairments. Strength deficits are existing in people with advanced OA who are considering a TKA. While the reason for quadriceps weakness is not well understood in this patient population, it has been suggested that a combination of muscle atrophy and neuromuscular activation deficits contribute to residual strength impairments. Failure to adequately address the chronic muscle impairments is potentially limiting the long-term functional gains that may be possible following TKA.27

Although quadriceps strength has been investigated extensively, less investigations has been focused on the strength of other lower extremity muscles before and after TKA. Both the quadriceps and hamstrings provide functional stability and shock absorption to tibiofemoral joint. In a healthy joint, co activation of quadriceps and hamstrings occurs to functionally reduce shear forces and strain across tibiofemoral joint but excessive co activation may also increase compressive forces and joint loading causing extra wear and tear of articular cartilage or knee prosthesis. Further, although some co activation during normal lower limb movement may improve movement efficiency by increasing joint stabilization and protection, excessive co activation may result in impaired movement and weakness. Weakness with severe OA has been associated with greater co activation of muscles surrounding the knee. So, profound muscle weakness in the quadriceps and hamstrings muscles early after TKA could further increase muscle activation and compromise normal lower extremity function acutely, yet no clear investigations available. It is unclear if the hamstrings are as compromised as the quadriceps in the acute post-operative phase but if so both muscle groups should be targeted in post-operative rehabilitation.12

Hip Abductors also contribute to lower extremity function in patients who have had TKA. The hip abductors are known to stabilize the trunk and hip during ambulation, control limb alignment and transfer forces from the lower extremities to the pelvis. Studies have suggested that hip abductor weakness plays a role in functional limitations in older adults.19
One study demonstrated that hip abductor weakness was associated with poorer physical performance and another study showed that hip abductor weakness was a predictor of future falls in community dwelling older adults. If it is demonstrated that hip abductor strength contributes to function more than does quadriceps strength these results will serve as the first step to justify strengthening of the hip abductors during rehabilitation after TKA and foster the line of research19.

There is no significant correlation between pre – op muscle strength of quadriceps, hamstrings and hip abductors to WOMAC Score and TUG test post-operatively. This can be due to the follow up period was too short; patients were given or not given pre-op physiotherapy (PT) regimen; PT regimen was not same for all patients; associated co-morbidities like age group of patients, BMI of pts was not taken into consideration; foot deformities like planovalgoid foot, etc was not evaluated. This study indicates the feasibility and merits of incorporating an exercise training prescription or rehabilitation among patients before undergoing TKA. Such rehabilitation could possibly reduce the amount of time spent undergoing rehabilitative physical therapy or the amount of time a patient spends in the hospital after surgery. This may positively impact the overall cost of health care for TKA patients.

If the study is done with a long term follow up period and if other fallacies are also considered then correlation may change or the change in the correlation can be analysed between 3 groups of muscle strength to physical function in unilateral TKA.

**Conclusion**

Improvement was observed in hip abductors, quadriceps and hamstrings to physical function when compared with pre-op to post-operative data. Improvement in physical function as measured by WOMAC and TUG test was significant in the studied population. No correlation was observed between pre-op muscle strength of hip abductors, quadriceps and hamstrings to post-operative physical function in patients with Total Knee Arthroplasty.

**References**

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