

Relationship Between Strength of Hip Abductors, Pain Intensity, Duration of Symptoms, and Tightness of Iliotibial (IT) Band in Participants with Knee Osteoarthritis: A Cross-Sectional Study

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ABSTRACT

Background and Objective: Osteoarthritis of knee is very common rheumatological problem with prevalence of 22% to 39% in India. Lower limb strengthening exercises are an important component of the treatment for knee osteoarthritis. Evidence suggests that, strengthening the hip abductor muscles may influence joint loading and/or OA-related symptoms as well as the length of IT band but no study has actually investigated the relationship of the strength of hip abductor muscles with pain, duration of symptoms and the length of Iliotibial (IT) band and the relationship of the length of IT band with pain and duration of symptoms in participants with OA knee; hence, the study aims to see the relationship between these variables.

Methods: Total 18 participants with primary unilateral Osteoarthritis were taken and they were divided into two groups according to side of knee OA; affected and unaffected side. The strength of hip abductor muscles was measured by using hand held dynamometer and the length of IT band was measured by using Ober's test and pain intensity was measured by using NPRS.

Result: Statistically significant difference ($p < 0.05$) in isometric strength of hip abductors was seen on affected side in subjects with OA knee. Statistically significant difference ($p < 0.05$) in length of IT band in subjects with OA knee. A linear relationship was also seen between pain and strength of hip abductors; duration of symptoms and strength of hip abductors; and length of IT band and strength of hip abductors.

Conclusion: Strength of hip abductors is affected by presence of iliotibial band tightness.

Keywords: Isometric hip abductor strength, Pain, Length of IT band, OA knee

INTRODUCTION

Osteoarthritis (OA) knee is a prevalent degenerative disorder, chronic in nature.¹ Knee is the most common weight bearing

joint which can be affected by OA. In Osteoarthritis (OA), there is progressive wear and tear of articular cartilage.² Knee osteoarthritis (KOA) is the most common

degenerative diseases that causes disability in elderly people.³

Osteoarthritis is the second most common disease in rheumatologic problem. It is the most frequent joint disease, prevalence of this disease in India is nearly 22% to 39%. Women are more affected than men. Nearly, 45% of women over the age of 65 years have symptoms and 70% of those over 65 years have radiological evidence.⁴

Symptoms of knee OA are pain, stiffness and difficulty with activities of daily living such as walking, stair-climbing and housekeeping. Pain and disability associated with the disease lead to loss of functional independence and there is reduction in quality-of-life.³

There is no such conservative treatment that can cure this disease but most management is focused on diminishing pain, improving functional ability and restoring balance.¹ Many interventions such as surgical or pharmacological are used for treatment, but these are often associated with adverse effects and complications. Thus, recent knee OA clinical guidelines reinforce the importance of non-pharmacological strategies in the management of the condition.³

Various forms of exercises, use of gait aids, weight management with diet and exercises and patient education are safe and also core treatment options for individuals with knee OA according to OARSI guidelines.¹

The two important and modifiable factors related to progression of knee OA are joint compression and loading, which should be assessed and treated to slow down disease progression.⁵ Knee adduction moment is a widely used measure of medial tibiofemoral joint loading. It is also found to be associated with the intensity of pain and severity of the disease.^{6,7,8}

The knee joint loading and the progression of the disease may be directly affected by the strength of the hip muscles.^{9,10,11} There is an increase in the dynamic load on the knee during walking. During the stance, the ground reaction force travels to the medial aspect of the knee and generates an external

adduction moment. This force causes compression of the medial compartment of the knee and stretching the lateral joint components.^{12,13,14}

Hip abductors are found to be weak in the people with knee OA as a result of which there is a decrease in their isokinetic strength, isometric strength and explosive force.^{15,16,17,18,19} Hip abductor weakness of the stance limb causes a fall in the pelvis of the swing limb, yet lateral tilt or dropping of pelvis can also be a sequelae of tight IT band.^{20,21} Lateral tilting of the pelvis causes medial shifting of mechanical axis of lower limb, that increases loading of medial tibiofemoral joint.

We hypothesized that weakness of hip abductor muscles might be correlated with pain, duration of symptoms and length of IT band in people with Knee OA. Identifying relationship between hip abductor muscle strength and length of IT band in people with Knee OA may provide more insight for rehabilitation of knee OA.

MATERIALS & METHODS

In this paper, we describe a cross-sectional analysis designed specifically to assess the relationships of the strength of hip abductor muscles with pain, duration of symptoms and the length of IT band in participants with OA knee. After obtaining ethical approval, participants willing to participate in the study were screened for eligibility. 18 patients, aged 45-65 years, both males and females, diagnosed as having unilateral OA knee were included in the study. Exclusion criteria were obesity, inflammatory knee disorders, other arthropathies, metabolic bone disease, serious systemic diseases, depression, neoplasms, history of knee trauma or knee surgery, and previous intra-articular injections. After taking demographic details and duration of symptoms, all the participants were assessed for pain intensity using NPRS, isometric strength of hip abductors using hand held dynamometer and length of iliotibial band using Ober's test.

Hip abductor strength was assessed by using Hand held dynamometer. Participants were in sideline position with his bottom leg bent and their top leg was straight, with pelvis stabilized. The involved limb was at the upper most and the hand-held dynamometer was placed over the top of patient's lower

end of thigh, just above lateral condyle of femur. Then patient was instructed to push straight upward against the dynamometer (abduction of the hip). Trick movement like hip rolling backward or posterior was avoided.^{22,23}



Figure 1: Hip abductor strength by using hand held dynamometer

Ober's test was performed to check the length of IT band. Participants were inside lying position on the uninvolved limb so that involved limb was at the upper most position. The uninvolved hip and knee were flexed at 90 degrees. And then one hand stabilized the patient's pelvic to avoid trick movement and with the other hand the involved limb was extended and adducted as much as the IT band allowed. The goniometer was used to measure the range

of hip adduction. The axis of the goniometer was positioned on the anterior superior iliac spine of the upper leg; stable arm of the goniometer was placed between left and right anterior superior iliac spines on the pelvis. Mobile arm of the goniometer was placed in line with anterior superior iliac spine and midline of the patella. Hip adduction angle was measured for the affected hip.²⁴

Total 30 participants were taken in the study.
18 participants were selected who fulfill selection criteria and willing to participate in the study
Based on presence of IT band tightness, participants were divided in to two groups
Group A (with IT band tightness) and Group B (without IT band tightness)
Comparison of both the groups was done by using appropriate statistical test, after screening for normality
Correlation analysis was carried out to see the relationship between IT band tightness and isometric hip abductor muscle strength

RESULT

Aim of the study was descriptive analysis of strength of hip abductors in subjects with knee osteoarthritis (OA) and its relationship to pain, duration of symptoms and length of iliotibial (IT) band.

All statistical analysis were done using SPSS 26.0 software for windows.

Descriptive analysis was obtained by Mean & Standard deviation. Unpaired t test was done to see the difference in hip abductor muscle strength and length of IT band on affected and unaffected side. To check the correlation between NPRS and Hip abductor strength, NPRS and length of IT band, duration of symptoms and Hip abductor

strength, duration of symptoms and length of IT band and Hip abductor strength and length of IT band Pearson's test was used. Confident interval was set at 95% and significance level was kept at 5%.

In the current study comparison was made between strength of hip abductor muscle of

both the sides and range of hip adduction range of motion (Ober's test) between both the side, affected and non-affected knee, using the unpaired t-test. The p values were <0.05, that indicated statistically significant difference between the sides for strength of hip abductors and length of IT band.

Table 1: Comparison of hip abduction strength and hip adduction range of motion (Ober's test) on affected and unaffected side.

Outcome	Group A (mean & SD)	Group B (mean & SD)	t value	p value
Hip abductor strength (KG)	2.86±0.92	3.67 ± 1.07	-2.4201	0.021
Length of IT band	13.33 ± 0.87	18.89 ± 3.52	-3.602	0.0009

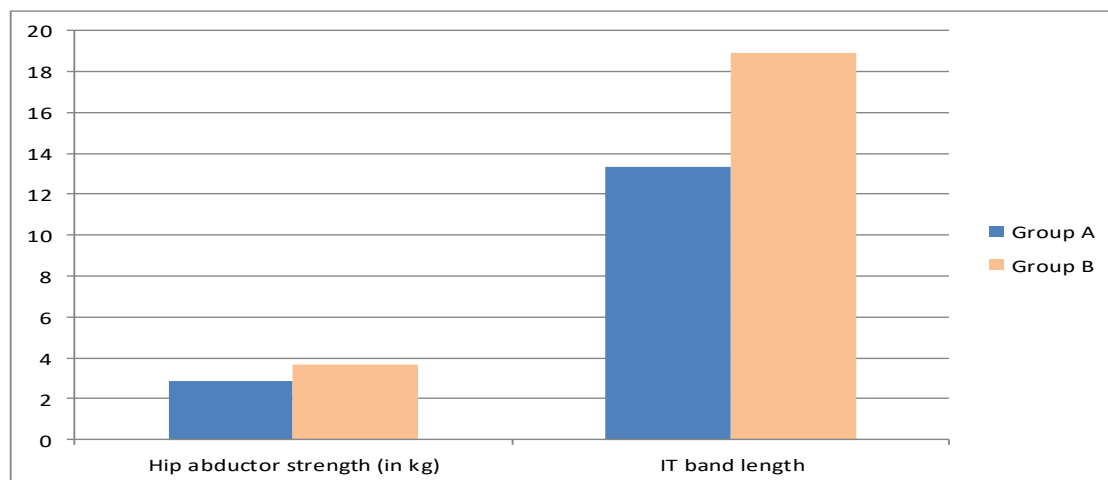


Chart 1: Comparison of Hip abduction strength and hip adduction range of motion (Ober's test) on affected and unaffected side

In the current study, the correlation of Hip abductor strength was made with pain intensity NPRS, Duration of symptoms and length of IT band, by using Pearson's test. And the correlation of IT band was made with pain intensity NPRS, Duration of symptoms, by using Pearson's test. The p values between hip abductor strength and pain, hip abductor strength and duration of symptoms, the IT band length and pain intensity NPRS, the IT band length and duration of symptoms were >0.05, that

indicated that there was no statistically significant correlation between these variables but the p value between hip abductor strength and length of IT band was < 0.05, which shows that there was statistically significant correlation between hip abductor strength and length of IT band on affected side. The r value was 0.659, that confirms a moderate to strong and significant correlation between the tested variables. These values are given in table 2.

Table 2: Correlation of Hip abductor strength and length of IT band with NPRS, duration of symptoms with affected side and the correlation between hip abductor strength and length of IT band on affected side.

outcomes	Hip abductors strength		Length of IT band	
	R value	P value	R value	P value
NPRS	-0.264	0.289	-0.455	0.57796
Duration of symptoms	-0.2916	0.2413	-0.2377	0.3436
Length of IT band	-0.6592	0.00293	-	-

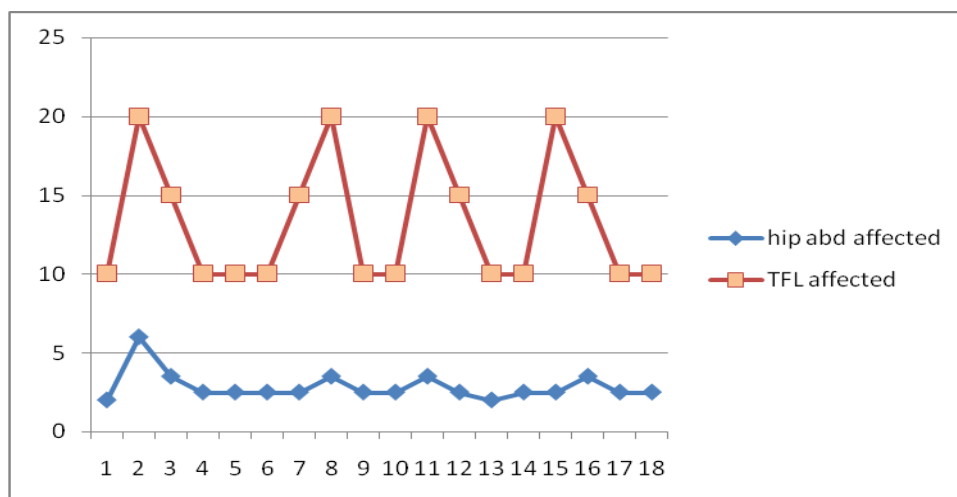


Chart 2: Correlation between strength of hip abductor and length of IT band on affected side

DISCUSSION

The study found that there is hip abductor weakness in participants with osteoarthritis of knee. The study also found that there is IT band tightness in participants with osteoarthritis of knee. The study found that there is moderate and statistically significant ($p < 0.05$) relationship between IT band tightness and strength of hip abductor muscle in participants with osteoarthritis of knee. There is no correlation between pain and duration of symptoms with the strength of hip abductor muscle and IT band tightness.

The findings of the current study can be explained by pathomechanical relationship between strength of lower limb strength and loading of knee. There is compression and loading at the medial compartment of the knee joint and that is caused by knee adduction moment which is responsible for the severity of the disease.²⁵⁻²⁸ Even during walking, the ground reaction force travel towards the medial compartment of the knee. This will further increase the load at the medial compartment of the knee that leads to increase the adduction moment and that force the knee outwards.^{29,30} In order to decrease loading of the knee, patients frequently use lateral trunk lean to decrease KAM. Hip abductors are important for supporting and stabilizing the trunk and responsible for stability of pelvic during stance. Lateral trunk lean causes external hip abduction moment, which leads to

disuse atrophy and eventual weakness of one joint hip abductor muscles. Weakness of hip abductors leads to pelvic drop toward the contra lateral side.³¹ Hip abductors helps to control rotational alignment of the pelvis and stabilizes the pelvis properly during stance phase.^{32,33} Weak hip abductor muscle may cause a compensatory stress on IT band.³⁴ Mechanically, lateral trunk lean and pelvic drop can be achieved by tightening of two joint hip abductor muscle, particularly IT band, because of its location and long tendinous expansion. Tight IT band pulls the patella laterally and extremely rotates the tibia and that will increase the valgus vector at the knee joint.³⁵⁻³⁹ The IT band contributes to early degeneration of the knee joint. The findings of the present study confirms a significantly positive and linear relationship between length of IT band and strength of gluteus medius and minimus muscles.⁴⁰ Strengthening of the hip muscles combined with lengthening of IT band will stabilize the trunk and pelvic and reduce the more compression at the medial compartment if the knee during stance phase. This finding is particularly helpful in clinical practice, that it urges to incorporate IT band stretching exercises in people with knee OA, to reduce pain and improve function. Knee joint loading can be effectively reduced by improving length of IT band and strength of gluteal muscles together.

CONCLUSION

The strength of hip abductor muscles as well as the length of IT band is reduced on affected side in participants with unilateral osteoarthritis of knee. Current review clearly identifies the significantly positive linear relationship between hip abductor strength and length of IT band and no relationship between any other tested variables. Strength of hip abductors is affected by presence of iliotibial band tightness in participants with osteoarthritis of knee.

Clinical implication: Additional consideration to pain control and IT band stretching along with hip abductors strengthening in treatment of OA knee will be helpful.

Declaration by Authors

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