International Journal of Yoga, Physiotherapy and Physical Education
www.sportsjournal.in
ISSN: 2456-5067
Received: 25-04-2023, Accepted: 12-05-2023, Published: 27-05-2023
Volume 8, Issue 3, 2023, Page No. 24-27

Correlation of hamstring tightness with tibial torsion and foot posture in grade 1 and grade 2 knee osteoarthritis

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Abstract
Background: Osteoarthritis (OA) is chronic degenerative joint disorder. Patients with OA knee are significantly less functionally active, resulting in reduced muscular flexibility. The hamstring tightness is reported to be common in OA. Tibial torsion is the rotational alignment of plateau of tibia and malleoli, and that is altered in Knee osteoarthritis. Since biomechanical variation brought about by the hamstring tightness could be a possible cause for the tibial torsion and alteration in foot posture which is seen OA knee patients. Therefore, the purpose of the study was to determine the relation between hamstring tightness with tibial torsion and foot posture in OA knee patients.
Materials and methods: A Total 160 patients with Grade 1 and Grade 2 osteoarthritis of knee was included in the study. Active Knee Extension Test (AKET) was used to assess the hamstring tightness. Tibial torsion and foot posture was assessed using thigh malleoli method and Staheli plantar arch index respectively. Spearman Correlation Test was performed to correlate hamstring tightness with tibial torsion and foot posture.
Results: There is a moderate positive correlation between hamstring tightness and tibial torsion of Grade 1 (r: 0.2664) and Grade 2 (r: 0.2872) respectively, there is no correlation between hamstring tightness and foot posture (r: 0.0282) and (r: 0.0050) in both Grade 1 and Grade 2 Osteoarthritis knee patients respectively.
Conclusion: The results of the study found that the hamstring muscle tightness had a moderate positive correlation with tibial torsion whereas there was no correlation of hamstring tightness with foot posture in Grade 1 and Grade 2 Osteoarthritis knee patients.

Keywords: hamstring tightness, tibial torsion, foot posture, grade 1 and grade 2 knee osteoarthritis

Introduction

Osteoarthritis (OA) is gradually developing articular diseases that originate in the cartilage and affects the underlying bone, soft tissues as well as synovial fluid[1]. There are many factors that affect the disease progression of OA. Patients with OA knee are significantly less functionally active, resulting in reduced muscular flexibility particularly in the quadriceps and hamstring muscles.

Zachezeweski defined the muscle flexibility is the ability of the muscle to lengthen and allowing the joint to move through a ROM. Flexibility is associated with the extensibility of musculotendinous components that cross a joint. Therefore, muscle flexibility is the essential component of musculoskeletal health. The lack of muscle flexibility is generally increasing the risk of injury. Muscle weakness and lack of adequate flexibility are two major components of joint pain and dysfunction. In the knee joint, muscular imbalance plays the important role in appearance [2].

According to Joshi *et al*. along with quadriceps flexibility, the hamstring flexibility also more affected, as the hamstring muscle have tendency to shorten and tighten which leads to patellofemoral compression and patellofemoral syndrome associated with knee OA[2]

It was also reported that progressive decline in flexibility with age and changes in elasticity and decrease the level of physical activity in participants with knee OA [3-5]. Thus, during the evaluation of muscle dysfunction in relation to knee OA, along with strength of muscles, flexibility of hamstring muscle should be considered [11].

Amongst many measures of lower extremity alignment, tibial torsion has been advocated in this study. Normally the tibia is oriented in the external rotation position in the transverse plane about the knee joint or about the longitudinal axis of femur [6].

Foot complex is an integral part of the lower limb kinetic chain and being the most distal segment, the assessment of its orientation serves to be an important component of lower extremity alignment. Foot posture assessment can be done by measuring many variables such as leg heel alignment, navicular drop, arch index or many scales as well, of which one is Foot Posture Index etc. but in this study plantar arch index has been used as a variable to study the foot posture, which is a relative measure of arch height.

Since biomechanical variation brought about by the hamstring tightness could be a possible cause for the tibial torsion and alteration in foot posture which is seen OA knee patients, analysing the kinematic chain in lower limb and determining its association to hamstring tightness could give us a fair idea to a certain extent regarding the mechanism by which hamstring tightness is related to tibial torsion and foot posture. Therefore, the purpose of the study is to determine the relation between hamstring tightness with tibial torsion and foot posture, as a measure, in OA knee patients in whom the hamstring tightness is reported to be common.

Materials and methods

The correlation study was done on 160 patients with Grade 1 and Grade 2 osteoarthritis of knee. The patients with age of Age 45-65 year, both male and female, BMI less than 29.5, and Positive active knee extension test (Popliteal angle > 20º) were selected. Patients who are having Traumatic injury to the knee, any history of the Hip, Knee and Ankle injury, Surgery prior to the study, any local or systemic infection and Fixed deformity in limb were excluded from the study. Permission was taken from the Institutional Ethical Committee of department of Physiotherapy. The aim and methodology of study was explained to them and their consent was taken. All patients who fulfilled the criteria, an informed consent was taken before participation in the study. The patients were assessed for the hamstring flexibility using Active knee extension test (AKET) for three times and average of all these three values were taken as a final value. Thigh - malleoli Method was used to measure tibial torsion by goniometer, and Foot posture was assess using the Staheli Plantar Arch Index by the footprint method.

Statistics

Statistical analysis was preformed using Microsoft Excel version 2016 and GraphPad Instat Version 3.06. Kolmogorov-Smirnov Test was performed to check the normality of our data according to which the data was not normally distributed and hence the Spearman Correlation Test was performed to correlate hamstring tightness with tibial torsion and foot posture.

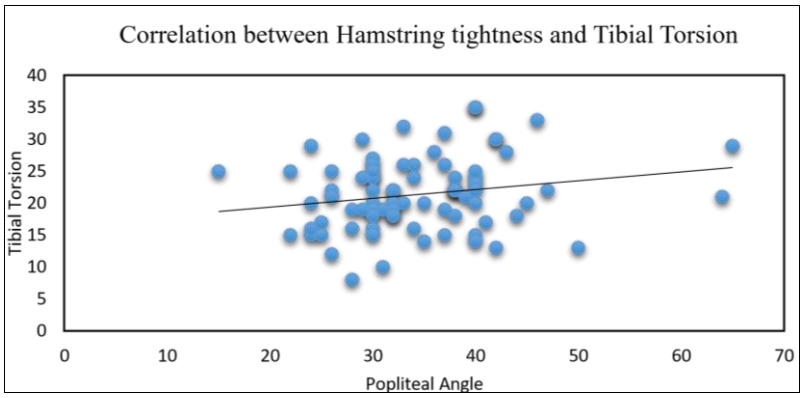
Ethical approval

Ethical approval After seeking permission from the Institutional Research Review Committee of Department of Physiotherapy, P.E.S. Modern college of Physiotherapy, Pune, ethical clearance was obtained.

Results

Table 1: Correlation between Hamstring tightness and Tibial Torsion (Grade 1)

r value	0.2664
Confidence interval	-0.0333-0.3890
Implication	Moderate positive correlation



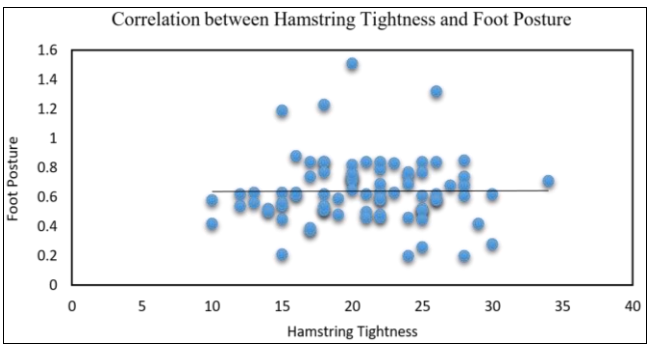
Graph 1: Correlation between Hamstring tightness and Tibial Torsion (Grade 1)

Interpretation

Graph no.1 depicts a moderate positive correlation between hamstring tightness and tibial torsion implying that more the hamstring tightness greater the external tibial torsion in grade 1 OA knee.

Table 2: Correlation between Hamstring tightness and Foot posture (Grade 1)

r value	0.0282
Confidence interval	-0.1913 – 0.2451
Implication	No correlation



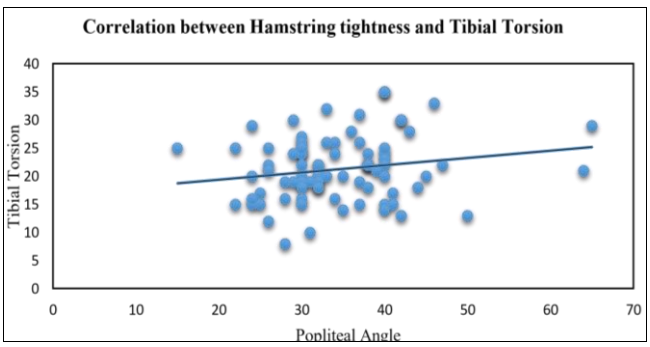
Graph 2: Correlation between Hamstring tightness and Foot posture (Grade 1)

Interpretation

Graph no. 2 suggests no correlation between hamstring tightness and foot posture implying that foot posture remains unaffected with hamstring tightness in grade 1 OA knee.

Table 3: Correlation between Hamstring tightness and Tibial Torsion (Grade 2)

r value	0.2872
Confidence interval	0.0719 – 0.4769
Implication	Moderate positive correlation



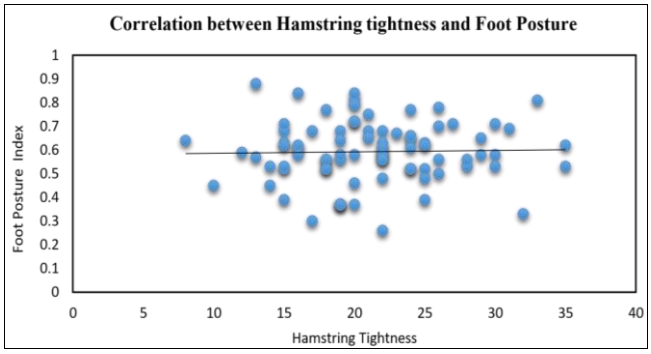
Graph 3: Correlation between Hamstring tightness and Tibial Torsion (Grade 2)

Interpretation

Graph no.3 depicts a moderate positive correlation between hamstring tightness and tibial torsion implying that more the hamstring tightness greater the external tibial torsion in Grade 2 OA knee.

Table 4: Correlation between Hamstring tightness and Foot posture (Grade 2)

r value	0.00503
Confidence interval	-0.2150 – 0.2246
Implication	No correlation



Graph 4: Correlation between Hamstring tightness and Foot posture (Grade 2)

Interpretation

Graph no. 4 suggests no correlation between hamstring tightness and foot posture implying that foot posture remains unaffected with hamstring tightness in Grade 2 OA knee.

Discussion

The study included 160 participants out of which 69 were male whereas 91 were female.

There was female predominance in the study as female are more prone to OA knee than male. A metanalytic study by Srikanth VK, *et al* shows that osteoarthritis of knee is more common in females than in males, because women's hips are wider than men's. The angle form by the hip bones is larger than the knees and it create large stress on the knees, and can be the cause of osteoarthritis, over time in females and the knee is most commonly affected joint in Osteoarthritis [7]

The participants were in the age group of 45-65 years with mean age of 56.6 ± 3.93. The mean BMI for participants was 56.2 ± 2.93, according to classification of BMI the mean weights lie in category of overweight. Takacs, *et al* included age, Body mass index, and knee pain and concluded that patients with a high BMI has a risk factor for OA knee. Because high BMI increases compressive forces on weight-bearing joints leads to the degeneration of Cartilage [8]

Sejal Sailor et.al. conducted study to evaluate the association between the hamstring flexibility and the functional performance of the knee OA patient. In this study, Active knee extension test was used to evaluate the hamstring flexibility while WOMAC, was used to evaluate the pain, physical function, and stiffness in the knee OA and concluded that there is significant positive correlation with hamstring flexibility except knee stiffness but cause was not justified [2]

Sanket Parekh *et al* underwent a study to correlate the Association between the lower extremity biomechanical factors with osteoarthritis of knee and the also found a strong association between knee pain to hamstring length. Due to as age increases alteration seen at cellular level, leads to decreases in the range of motion and muscle flexibility. Therefore, it indicates that loss of hamstring muscle length affects knee joint and its articulation [9]

Sahrmann reported that the hamstrings could be considered to be the controller of tibial rotation. And further added that that excessive tibial rotation would results in poor dynamic knee stability and that repetitive mechanical stress causes microtrauma, potential macrotrauma, and consecutive injury which could be to the hamstring or collectively to the lower extremity [10]

Dong-Soo Lee et.al studied the relationship between the external tibial torsion and the ratio between the thickness of medial hamstrings and lateral hamstrings assessed by ultrasonography. The authors hypothesized that a difference in kinetic variables between the medial hamstring and lateral hamstrings would relate to internal and external tibial torsion respectively but the results reported negligible correlation between the two variables and therefore concluded that lateral tibial torsion is not only affected by medial and lateral hamstring muscles specifically [11].

Also, correlation between hamstring tightness and foot posture was also investigated in this study. It was hypothesized that hamstring tightness would influence foot posture by altering tibial torsion given the relation that excessive subtalar pronation and supination would lead to increased tibial internal rotation and tibial external rotation respectively. Nishita et al correlated a pronated type foot posture with biomechanical variables of the lower limb on 60 subjects between the age of 30-60 years and concluded that there was no significant correlation between foot pronation and pelvic inclination, femoral anteversion, Q-angle and tibial Torsion [12].

Similarly, Nguyen A. *et al*. has measured the lower extremity aligning components to identify relationships between the lower extremity aligning components which involved 218 subjects. He measured pelvic angle, femoral anteversion, quadriceps angle, tibiofemoral angle, tibial torsion and genu recurvatum, and navicular drop and correlated each variable with the other. He advocated the use of navicular drop as a measure of foot posture and found negligible correlation of navicular drop with pelvic angle, femoral anteversion, Q-angle, tibio-femoral angle, whereas there was low correlation between navicular drop and tibial torsion (r = -0.102) and genu recurvatum (r = 0.195) [13].

Based on the above-mentioned studies it can be postulated that an association between hamstring tightness and foot posture would be based on other factors apart from the direct influence of hamstring tightness on tibial torsion in OA knee patients.

Conclusion

There is a moderate positive correlation between hamstring tightness and tibial torsion in Grade 1 and Grade 2 Osteoarthritis patients. There is no correlation between hamstring tightness and foot posture in Grade 1 and Grade 2 Osteoarthritis patients.

Limitations

Tibial torsion was assessed in non-weight bearing position of the knee whereas various reviews have suggested that tibial torsion changes with knee movement and have examined tibial torsion during a dynamic task. Foot posture was assessed in a static stance.

Future scope

Future researches can consider treating malalignment during rehabilitation and can study the effects of the same. Future studies can focus on advocating dynamic measures to examine the kinetic chain in order to achieve a complete clinical scenario regarding a limb during movement.

Acknowledgement

I am glad to present this research here. I would like to thank the God Almighty and My Parents for their constant support throughout the research. I would also give a special thanks to my guide Dr. Sucheta Golhar for allowing me to do this research under her guidance. Her advices and counselling at every stage of the research has made this a successful one.

References

1. Hafez AR, Alenazi AM, Kachanathu SJ, Alroumi AM, Mohamed ES. Knee osteoarthritis: a review of literature. Phys Med Rehabil Int,2014:13:1(5):8.
2. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. Indian journal of orthopaedics,2016:50(5):518-22.
3. Sailor S, Limbani A, Dhola D. Association between Hamstring Flexibility and Functional Performance of Patients with Knee Osteoarthritis. Journal of Integrated Health Sciences,2020:8(2):57-.
4. Gandhi N, Salvi (PT), Rupali. Correlation between pronated foot and pelvic inclination, femoral anteversion, quadriceps angle and tibial torsion. International Journal of Physiotherapy,2017:4(4):229-35.
5. Song KM, Concha MC, Haideri NF. Effects of lower limb torsion on ankle kinematic data during gait analysis. Journal of Pediatric Orthopaedics,2001:21(6):792-7.
6. Kim SH, Kwon OY, Park KN, Choung SD. Correlation between the angle of lateral tibial rotation and the ratio of medial and lateral hamstring muscle activities during standing knee flexion. Journal of Physical Therapy Science,2013:25(4):383-6.
7. Srikanth VK, Fryer JL, Zhai G, Winzenberg TM, Hosmer D, Jones G. A meta-analysis of sex differences prevalence, incidence and severity of osteoarthritis. Osteoarthritis and cartilage,2005:13(9):769-81.
8. Takacs J, Carpenter MG, Garland SJ, Hunt MA. Factors associated with dynamic balance in people with knee osteoarthritis. Archives of physical medicine and rehabilitation,2015:96(10):1873-9.
9. Parekh S, Mehta J, Vaghela N, Ganjiwale D. Association between the lower extremity biomechanical factors with osteoarthritis of knee. Journal of Medical Society,2019:33(2):76.
10. Sahrmann SA, Movement System Impairment Syndromes of the Extremities, Cervical and Thoracic spines; 2nd ed. St Louis, Mosby,2011, 360–372.
11. Dong-Soo Lee, Sung-Dae Choung, Seung-Won Lee, Hye Rim Suh, Jae-Hoon Shim, The ratio of medial and lateral hamstring muscle thickness does not correlate with the lateral tibial rotation angle in the standing position in healthy young adults J. Phys. Ther. Sci,2017:29:618–621.
12. Nishita Gandhi, Rupali Salvi, Correlation Between Pronated Foot And Pelvic Inclination, Femoral Anteversion, Quadriceps Angle And Tibial Torsion, Int J Physiother, August,2017:4(4):229-235.
13. Anh-Dung Nguyen, Sandra J. Shultz, Identifying Relationships Among Lower Extremity Alignment Characteristics, Journal of Athletic Training,2009:44(5):511– 518.