Original Article

Effect of Foot Strengthening Exercises in Osteoarthritis Knee

Cynthia S. Jagtap[1], Mandar Malawade[2]

[1]Intern, Faculty of Physiotherapy, [2]Asso. Professor, Department of Pediatrics,Faculty of Physiotherapy, Krishna Institute of Medical Sciences deemed to be university, Karad, Maharashtra, India.

Abstract

Background: Knee osteoarthritis is one of the leading cause of global disability. Patients with degenerative knee osteoarthritis clinically complain of pain, decreased muscle strength, joint instability, joint stiffness and proprioceptive deficits, all of which lead to a decrease in or loss of function. Foot pain is highly disabling, functional abilities and increases the risk of falls.

Method: This was an experimental study with total of 33 subjects who had knee osteoarthritis with foot disability. Subjects of both genders with age group of 40 – 65 years fulfilling the inclusion and exclusion criteria participated. The outcome measure used was womac scale, for pain Visual analogue scale (VAS).

Result: Statistical analysis of VAS, WOMAC and range of motion (ROM) were found to be extremely significant with a P value of <0.0001.

Conclusion: This study concluded that foot strengthening exercises were effective. It is proved from this study that foot strengthening exercises has significant effect on pain, range of motion and functional status of OA knee.

Keyword: *Foot, strengthening exercises, knee, osteoarthritis, VAS, WOMAC and ROM.*

Introduction

The human foot is a very complex structure, which allows it to serve many diverse functions. During standing , it provides our base of support. During gait, the foot must be stable at foot-strike and push-off.[1] The ankle pain was common in community-dwelling older adults, whereas moderate to severe symptomatic, radiographic ankle osteoarthritis(OA) occurred less frequently.[2]

Knee OA is a major public health problem that causes substantial pain, physical dysfunction and impaired quality of life.[3]

The effect of proprioceptive training on foot progression angle, weight bearing rational knee adduction moment(KAM) in patient with degenerative osteoarthritis of the knee.[4] Quadriceps muscle weakness leads to a change in the biomechanics and axis of the knee joint,[5] negatively affecting joint mobility, posture and gait.[6] There was altered foot posture in people with OA knee. People with medial compartment OA showed more pronated foot type and lateral compartment OA showed more supinated foot type.[7]

A Pescavus or hollow foot or supinated foot is a foot posture in which the longitudinal arches are accentuated and the metatarsal heads are lower in relation to the hind foot so that there is a dropping of the forefoot on the hind foot at the transometatarsal joints.[8] A Pesplanus or flatfoot or pronated foot is a foot posture in which the calcaneus goes in valgus position, whereas the metatarsal region is in pronation.[8]

Knee OA is a leading cause of joint pain and disability in middle and older aged individuals, and is one of the most commonly managed conditions in primary care.[9]Knee OA is one of the leading causes of global disability.[10]

Corresponding author:
Dr. Mandar Malawade
Associate professor, Department of paediatrics
Krishna college of physiotherapy,Karad
Email address: mandarmalawade@gmail.com

The previous research has shown associations between planus foot morphology (flat feet), knee painand cartilage damage. Further many people with knee OA experience foot pain and dysfunction.[10] However, as incident disease is a different phenomenon to worsening OA and risk factors may not be consistent across both, it is necessary to separately establish the association of foot/ ankle symptoms with worsening OA.[3] In individuals at risk of knee OA, the presence of contralateral foot/ankle symptoms in particular increases risk of developing both knee symptoms and symptomatic radiographic knee OA.[9]

Change in foot posture may cause increased mechanical rotational stress on the knee joint and the higher degree of knee OA may also affect foot motion during walking which may lead to a compensatory response to allow typical function of the foot during ambulation and accelerates the degenerative changes at the knee joint.[7] The relationship between ankle and knee biomechanics that indicate a more everted foot posture is correlated with lower KAM magnitudes.[10]

Osteoarthritis also known as degenerative arthritis or degenerative joint disease or osteoarthrosis, is group of mechanical abnormalities involving degradation of joints, including not only articular cartilage but also the synovium, capsule, bone and ligaments leading to subchondral bone attrition and remodeling, meniscal degeneration, ligamentous laxity, fat pad extrusion, and impairments of neuromuscular control[11]

Materials and Method

This was an experimental study of analytical type conducted among total of 33 subjects who had knee osteoarthritis. They were selected after approval from ethical committee. This study was conducted in Krishna institute of medical sciences, Karad. The duration of study was 6 months. The materials used were paper, resistance band, towel, wobbled board, textures. 33 subjects including both males and females with osteoarthritis knee age of 40 – 65 years were included according to inclusion and exclusion criteria. The exclusion criteria consisted of subjects with patients with operative procedure, Limb length discrepancy, Diabetic foot, Congenital foot deformities, deformities of hip. Written consent was taken from the subjects those willing to participate. The subjects were selected by simple random sampling. The outcome measures used were foot prints, visual analogue scale for pain.

Procedure:

After the protocol and ethical clearance the procedure was started. Subjects were selected with age group 40 – 65 years with osteoarthritis knee population according to the inclusion and exclusion criteria.The consent was taken from the selected subjects. The individuals selected were evaluated using visual analogue scale and womac scale and were instructed with all the details about the assessment they were going to undergo.Range of motion of knee were measured in the beginning of the sessions. Foot strengthening exercises were given and ergonomic advice as per protocol. Data was collected in the data collection sheet. Pre and post interventional values were noted down. With the help of pre and post result of VAS, WOMAC and ROM of knee this study will be concluded by statistical analysis.

STATISTICALANALYSIS AND RESULT:

Statistical analysis was done manually and by using the statistics software INSTAT so as to verify the results derived. The statistical analysis between the intra group value of VAS, WOMAC and ROM was done by Paired ‘t’ test. The study has p value <0.0001 which is extremely significant.

1. GENDER DISTRIBUTION

A total of 40 subjects were taken for the study. Out of 35 subjects 19 were males and 16 were females.

Gender	
Male	19
Female	16
Total	35

Table 1 – Gender Distribution

2. AGE DISTRIBUTION

Age group of all patients ranged between 40-65 years.

Age	**Total**
40 – 49	12
50 – 59	17
60 – 65	6

Table 2 – Age Distribution

3. VAS – PRE AND POST INTERVENTION COMPARSION USING PAIRED T-TEST.

VAS	Pre Intervention	Post Intervention
Mean ±± SD	6.25±±1.418	4.79±±1.350
P value	<0.0001	
Interference	Extremely significant	

Table 3 – VAS

4. WOMAC – PRE AND POST INTERVENTION COMPARSION USING PAIRED T-TEST.

WOMAC	**Pre Intervention**	**Post Intervention**
Mean ±± SD	54.14±±16.601	44.14±±16.432
P value	<0.0001	
Interference	Extremely significant	

Table 4 – WOMAC

5. ROM – PRE AND POST INTERVENTION COMPARSION USING PAIRED T-TEST.

ROM of Knee	**Pre Intervention**	**Post Intervention**
Mean ±± SD	136.14±±8.139	145.57±±9.236
P value	<0.0001	
Interference	Extremely significant	

Table 5 – ROM of Knee

Discussion

Knee OA is a leading cause of joint pain and disability in middle and older aged individuals, and is one of the most commonly managed conditions in primary care. Patients with degenerative knee osteoarthritis clinically complain of pain, decreased muscle strength, joint instability, joint stiffness and proprioceptive deficits, all of which lead to a decrease in or loss of function. Foot pain is highly disabling, functional abilities and increases the risk of falls.

Change in foot posture may cause increased mechanical rotational stress on the knee joint and the higher degree of knee OA may also affect foot motion during walking which may lead to a compensatory response to allow typical function of the foot during ambulation and accelerates the degenerative changes at the knee joint.

The study was carried out and the result was drawn by using VAS, WOMAC and Joint ROM scores as the outcome measures. Study place was Krishna College of

Physiotherapy, OPD.

A pre-treatment outcome measure using VAS, WOMAC and ROM score was done. The specific treatment protocol was followed as per and the post treatment outcome using VAS, WOMAC and ROM scores were documented accordingly. An exercise program was designed and a proper ergonomic advice was given.

Comparison was analyzed statistically using paired t test for VAS, WOMAC and ROM Scores.

Foot strengthening exercises like toe curls, toe raise, toe splay, big toe stretch, sand walking, wobble board, resistance band exercises, golf ball roll, Achilles stretch was given for 4 weeks. Toe raise will help to strengthen all parts of the feet and toes. Toe splay was developed to improve control over the toe muscles. It can be done on both feet at once, or alternate feet, depending on comfort. Toe curls build up the flexor muscles of the toe and feet, improving overall strength. Rolling a golf ball under the feet can help to relieve discomfort in the arches and ease pain associated with plantar fasciitis. Achilles stretch tendon is a cord connecting the heel to the calf muscles. It can strain easily, and keeping it strong may help with foot, ankle, or leg pain.

In this study an attempt was made to analyze the effect of foot strengthening exercises in osteoarthritis knee. This study was done to investigate the reduction of symptoms after application of foot strengthening exercises in OA knee patients and its post treatment evaluation in a standardized manner using VAS, WOMAC and ROM scores. The result shows that there is significant difference in improvement of pain, functional performance, range of motion of knee.

Conclusion

Various conservative treatment methods are used in treating Osteoarthritis Knee but this study concluded that foot strengthening exercises were effective. It is proved from this study that foot strengthening exercises has significant effect on pain, range of motion and functional status of OA knee and thus Alternate Hypothesis that There is significant effect of foot strengthening exercises in osteoarthritis knee accepted.

Acknowledgement: Authors acknowledge the immense co-operation received by the subjects and the help received from the scholars whose articles are cited and included in references of this article. The authors are also grateful to authors/ editors/publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Conflict of Interest: There is no conflict of interest concerning the content of the study.

Source of Funding: This study was funded by Krishna institute of medical sciences deemed to be university Karad.

Ethical Clearance: The study was approved by the institutional ethics committee of KIMSDU.

References

1. Patrick O McKeon, Jay Hertel, Dennis Bramble, Irene Davis. The foot core system: a new paradigm for understanding intrinsic foot muscle function. 27 Feb. 2014
2. Yumi Cho, Minkyu Kim, and Wanhee Lee. Effect of proprioceptive training on foot posture, lower limb alignment, and knee adduction moment in patients with degenerative knee osteoarthritis: a randomized controlled trial. J PhysTher Sci. 2015 Feb; 27(2): 371-374
3. Charlotte Murray, Michelle Marshall, TrishnaRathod, Catherine J. Bowen, et al. Population prevalence and distribution of ankle pain and symptomatic radiographic ankle osteoarthritis in community dwelling older adults: A systematic review and cross sectional study. doi: 10.137/ journal.pone.0193662, 2018 April 30
4. Kade L Paterson, Jessica Kasza, David J Hunter, Rana S Hinman, et, al. Longitudinal association between foot and ankle symptoms and worsening of symptomatic radiographic knee osteoarthritis: data from the osteoarthritis initiative. Osteoarthritis cartilage. 2017 Sep; 25(9): 1407-1413
5. Thorstensson CA, Henriksson M, Von Porat A, et al. The effect of eight weeks of exercise on knee adduction moment in early knee OA- a pilot study. 2007, 15:1163-1170.
6. Blanpied P, Smidt GL. The difference in stiffness of the active plantarflexors between young and elderly human females. J Gerontol, 1993, 48: M58-M63.
7. Dr. Shalmali S. Surlakar , Dr. Bindu M. Sarfare, Dr. SnehalGhodey, et, al. Prevalence of altered foot posture in osteoarthritis of knee. DOI: 10.21839/ jaar.2017.v2i3.87; June 2017

8. Pazit Lavinger, Hylton B Menz, Mohammad R Fotoohabadi , Julian A Feler, John R Bartlett, et, al. Foot posture in people with medial compartment knee osteoarthritis, Journal of Foot and ankle research, 2010, 3:29
9. K.L. Paterson, J. Kasza, D.J. Hunter, et, al. The relationship between foot and ankle symptoms and risk of developing knee osteoarthritis: data from the osteoarthritis initiative. 1 Dec. 2016
10. N.M. Krowchuk, J.M. Charlton, A. Graffos, et, al. Relationship between foot, ankle and knee biomechanics during walking in those with knee osteoarthritis. Ostoarthritis and cartilage 25 (2017) S76-S444
11. RK Arya, Vijay Jain, osteoarthritis of knee joint: An overview. Journal of Indian academy of clinical medicine, Vol. 14, No. 21, April-june, 2013