Volume : 5 | Issue : 8 | August 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Original Research Paper

Impact of Prolonged Sitting on Knee Joint Position Sense Among Middle Aged Men and Women: A Comparative Study

Medical Science

KEYWORDS : Knee Joint Position Sense, Prolonged sitting, Middle aged Men & Women, Limb Dominance.

Dr. Manjula	Department of Physiotherapy, Guru Jambheshwar University of Science & Technology, Hisar
Dr. Shabnam Joshi	Assistant Professor,Department of Physiotherapy, Guru Jambheshwar University of Science & Technology, Hisar
Dr. Vikram Singh Yadav	Assistant Professor, College of Physiotherapy , Pt. BD Sharma University of Health Sciences, PGIMS, Rohtak

ABSTRACT

Proprioception is affected by factors such as age, physical activity and muscle fatigue. Proprioceptive deficiency facilitates the injury, altered weight transmission and greater mechanical load on the joint, which in turn may contribute to an early & increased risk in development of degenerative changes in knee joint. In the current study, 120 subjects of 40-50 years age group were recruited via random convenient sampling from banks, offices and community. The subjects were divided into four groups i.e. sedentary men (n = 30), sedentary women (n = 30), non sedentary men (n= 30) and non sedentary women (n = 30). Knee joint position sense was measured using a digital goniometer in terms of mean absolute error (MAE). Impact of prolonged sitting, gender and limb dominance on knee joint position sense was analysed using t-test. Statistical analysis revealed significant differences ($p \leq 0.05$) among sedentary and non sedentary groups but gender and limb dominance have not much of significant impact on knee joint position sense.

Introduction:

The knee joint is one of the largest and most complex synovial joint of the body having predominant dynamic functions (B D Chaurasia, 2013) Proprioception refers to ability of body to sense, its own body part in space without visual input at any given point of time. Accurate proprioception is an integral part of body's voluntary muscle control system to carry daily life activities smoothly. An injury due to repetitive stress, disease or soft tissue lesion may affect proprioception and this in turn affects adversely the work performance of an individual (Carolin Jay, 2010)

Musculoskeletal diseases, neurological diseases, normal aging process, physical stress and poor posture are often cited as the factors best correlated with joint proprioception deterioration (Joel A. Delisa, 2005 & R. Juhakoski et al, 2009). Studies in past have analysed and concluded that lack of physical activity and overloading of a joint results into permanent damage and proved to be fatal for normal healthy living (Leiv Sandvik et al, 1993). Knee joint is more prone to get injured than any other joint of the body (B D Chaurasia, 2013). Occupationally related physical stress factors – lifting, kneeling, squatting and prolonged seating are related to a high prevalence of regional pain syndromes leading to degenerative changes and wide spread body pain (Gareth T Jones et al, 2007). Office workers are more prone to develop knee joint proprioception deficit because of the nature of their work which involves sitting for long hours (Saranya Subramanian et al, 2012).

Awkward posture, undue prolonged stress at workplace cause repetitive injury to joint structures and this can be minimised by identifying the causative factors and providing the appropriate ergonomic advices (Easy Ergonomics). Accurate joint proprioception serves a guarding mechanism against injurious movement and provides stability to the surrounding structures of a joint while doing a movement (Meral Bayramoglu et al, 2007). Joint proprioception deficit has been directly correlated with development of degenerative arthritic changes causing pain and inability to carry out day today activities smoothly (Meral Bayramoglu et al, 2007, Barrack RL et al, 1983, Garsden LR et al, 1999 & Hassan BS et al, 2001). Identification of occupational stressors that cause proprioception deficit and arthritic changes at knee joint and thus adopting preventive measures can be very helpful to prevent knee problems prevalent in office workers. To the best of our knowledge no study has analysed & compared the impact of prolonged sitting on knee joint position sense among middle aged men and women. Thus the current comparative study was planned to analyse the impact of prolonged sitting on knee joint proprioception and then to identify which gender is affected more in terms of knee joint proprioception deficit due to prolonged sitting.

Materials and Methods

Subjects:

A total of 120 subjects were recruited for the study out of 157 screened subjects (sedentary/non sedentary men & women) from banks, offices & community, in & around Hisar. Subjects were divided into 04 group's viz. Sedentary Men, Non Sedentary Men, Sedentary Women and Non Sedentary Women having equal number of subjects i.e. 30 each in all groups. All the subjects participating in the study gave their informed consent in writing. Subjects were recruited according to the following inclusion criteria 1. Age group 40-50 yrs. 2. Sedentary / working men & women involved in desk job and sit for 6-7 hours/day on an average. 3. Non sedentary men and women who were not involved in any kind of desk job. 4. Right lower limb dominant subjects by asking the subjects "which leg would you prefer to kick the football?" Out of 157 screened subjects 37 were excluded from the study as they does not fulfill inclusion criteria and fulfills the exclusion criteria i.e. if they had knee pain due to any problem, knee joint crepitus, early arthritic changes, knee joint surgery, neurological or musculoskeletal pathology.

Instrument:

A digital goniometer (Guymon, Model 01129, Lafayatte instrument, USA, figure 1) was used to test each subject's knee joint position sense in terms of mean absolute error (MAE).

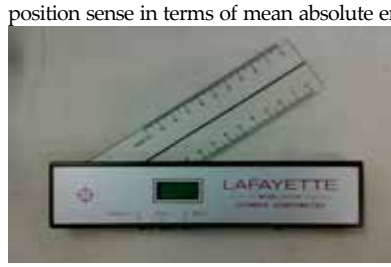

Figure 1: Digital Goniometer

Volume : 5 | Issue : 8 | August 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Procedure:
After selecting the sample of individuals, their knee joint position sense was evaluated. All the measurements were performed for both the knees. Subjects were made to sit on a high couch with folded towel placed below the lower thigh so that thigh appeared horizontal, having 90° angle with trunk & hip joint. In high sitting posture tibia assumed right angle with the femur. A digital goniometer with a precision of 0.5° (Guymon, Model 01129, Lafayette Instrument, USA) was attached to the lateral aspect of testing knee joint (Figure. 2). Subjects were relaxed with eyes open; then the foot of the subject was lightly grasped and the knee was extended passively from resting position (90° knee flexion) to chosen test position (60° of knee extension) which was unknown to the subjects. Then the subjects were blindfolded and the same procedure was repeated. The knee was kept in the selected test position for 5 seconds. The subjects were asked to perceive their knee position. Then the subjects were asked to take the leg to the initial resting position (90° knee flexion). Now the subjects were asked to actively extend the knee to the perceived test position and hold it for 8 seconds and the goniometric measurements of knee joint position sense in degrees were obtained. The procedure was carried out for 60° of knee extension from initial resting position (90° knee flexion). Three trials with a 10 seconds rest in between the trials were performed for both the knees. The degrees deviating from the target angle were recorded ignoring the direction of error. This error was the Absolute Error (AE) and an average of the three measurements was calculated to be the Mean Absolute Error (MAE). The Mean Absolute Error of knee joint position sense was used for statistical analysis (Saranya Subramanian et al, 2012 & Nusren Ozdemir et al, 2009).

Figure 2: Alignment of Digital Goniometer to Measure Knee Joint Position Sense

Data Analysis:
For statistical analysis of data, Statistical Package for Social Science (SPSS) version 15.0 was used. The level of significance of ≤ 0.05 was considered to be statistically significant with 95% confidence interval. To interpret the Data 'Unpaired-t test' was performed to compare the Mean Absolute Error (MAE) scores of joint position sense between sedentary & non sedentary both men & women and for gender differences. 'Paired-t test' was used to compare MAE scores of knee joint position sense between the two sides of the body i.e. dominant vs. non dominant (right vs. left) in different groups of subjects.

Results:
Average age of the subjects participated in the study are sedentary men (46.20±3.52 yrs), sedentary women (44.83±3.33 yrs), non sedentary men (44.93±3.02 yrs) & non sedentary women (45.43±3.17 yrs). The results of present study indicates that measurements of knee joint position sense vary in sedentary & non sedentary groups but there are no gender differences in the knee joint position sense of both right & left limb. Knee joint position sense of sedentary and non sedentary groups of both men and women was compared using 'unpaired t-test' for both the limbs. A statistically significant difference was found among all the four groups when each group was compared with another group, P≤0.05. In all the groups it has been observed that non sedentary persons have less value of mean average error (MAE) as compared to sedentary persons and hence non sedentary persons have better joint position sense than that of sedentary persons. (Table: 1).

Table 1: Comparison of Joint Position Sense (MAE) in both the knees of Sedentary Men (SM) vs Non Sedentary Men (NSM) & Sedentary Women (SW) vs Non Sedentary Women (NSW) using unpaired t test.

Groups	Knee JPS Right (MAE±SD	t value & P value	Knee JPS Left (MAE±SD)	t value & P value
Sedentary Men	4.857°±2.83°	t^{*} = 3.203 P = 0.002	4.687°±2.16°	t^{*} = 2.294 P = 0.025
Non Sedentary Men	2.933°±1.67°		3.490°±1.87°	
Sedentary Women	4.657°±2.51°	t^{*} = 2.285 P = 0.026	4.673°±2.27°	t^{*} = 2.852 P = 0.006
Non Sedentary Women	3.307°±2.03°		3.207°±1.65°	

*** Significant, # Non Significant**

Statistically non significant differences were observed between right and left knee joint position sense of sedentary men, sedentary women and non sedentary women, p>0.05 (Table: 2), however statistically significant differences were observed in joint position sense of right & left limb in non sedentary men, P≤0.05 (Table: 2).

Table 2: Comparison of Right Vs Left Knee Joint Position Sense (MAE) of all the four groups i.e. Sedentary Men (SM), Sedentary Women (SW), Non Sedentary Men (NSM) & Non Sedentary Women (NSW) using paired t test.

Groups	Right Knee JPS (MAE±SD)	Left Knee JPS (MAE±SD)	T value & P value
Sedentary Men	4.857°±2.83°	4.687°±2.16°	$t^{\#}$ = 0.379, P = 0.707
Sedentary Women	4.657°±2.51°	4.673°±2.27°	$t^{\#}$ = 0.037, P = 0.970
Non Sedentary Men	2.933°±1.67°	3.490°±1.87°	t^{*} = 2.347, P = 0.026
Non Sedentary Women	3.307°±2.03°	3.207°±1.65°	$t^{\#}$ = 0.247, P = 0.807

*** Significant, # Non Significant**

Non sedentary men shows less value of MAE in right limb as compared to left limb i.e. better joint position sense in right lower extremity as compared to left extremity. Also statistically non significant differences were observed in knee joint position sense of sedentary men and women and non sedentary men and women, p>0.05 i.e. no gender differences were observed in joint position sense (Table: 3).

Table 3: Comparison of Joint Position Sense (MAE) for gender differences in both the knees i.e. Sedentary Men (SM) vs Sedentary Women (SW) and Non Sedentary Men (NSM) vs Non Sedentary Women (NSW) using unpaired t test.

Groups	Knee JPS Right (MAE±SD	t value & P value	Knee JPS Left (MAE±SD)	t value & P value
Sedentary Men	4.857°±2.83°	$t^{\#}$ = 0.289 P = 0.7	4.687°±2.16°	$t^{\#}$ = 0.023 P = 0.9
Sedentary Women	4.657°±2.51°		4.673°±2.27°	
Non Sedentary Men	2.933°±1.67°	$t^{\#}$ = 0.77 P = 0.4	3.490°±1.87°	$t^{\#}$ = 0.621 P = 0.5
Non Sedentary Women	3.307°±2.03°		3.207°±1.65°	

*** Significant, # Non Significant**

Discussion:

Proprioception is amalgamation of balance, coordinated movement of limbs and a perception of how our body parts function in relation to one another. Proprioception is essential for maintaining posture and to carry out accurate movement of limbs in human (Carolin Jay, 2010). Proprioception deficit may result in a higher degree of functional limitation, accelerate the degenerative changes and it may thus lead to disability making the individual functionally dependent for day today activities (Leena Sharma, 2004).

The aims of the present study were to determine the differences in knee joint position sense among non sedentary and working middle aged men and women involved in sedentary jobs and also to determine which gender is at higher risk of developing degenerative changes. The results of the present study showed that non sedentary subjects have better knee joint position sense when compared to sedentary men and women. Mean absolute errors of knee joint position sense of sedentary men vs. non sedentary men and sedentary women vs. non sedentary women groups were compared for both the knees and the differences were found to be statistically significant ($p \leq 0.05$, table 1). This finding revealed that non sedentary men and women have better knee joint position sense. Thus it was clear that prolonged sitting adversely affected knee joint position sense of both working men as well as women involved in sedentary jobs. This finding is in contrast to a study conducted by Saranya Subramanian and Amitesh Narayan (2012) that compared the knee joint position sense of middle aged working women with non working women and found no significant differences in between the groups in both knees. One of the possible reasons of joint position sense deficit in working group could be because of the lack of employee's physical activity to the lower limit needed for healthy-body functioning. While sitting the knees are generally at a ninety degree angle. Sitting in this position puts pressure on the kneecap and thus decreased feedback from the knee joint receptors in case of prolonged non-weight bearing sitting position can lead to proprioception deficit in sedentary population. Work place physical stress and abnormal posture (bending forwards, stretching below knee level), put enormous amount of mechanical distress on knee joint of employees resulting in musculoskeletal changes and proprioceptive deficit on knee joint (Jones GT et al, 2007).

This study also involves gender comparison to show which gender has more differences in joint position error. When the data was analysed, the results indicated that in this age range, among all the groups i.e. sedentary men vs sedentary women and non sedentary men vs non sedentary women, changes in the knee joint position sense were relatively equal. Differences between mean absolute errors of knee joint position sense of men and women were statistically insignificant ($p > 0.05$, table 3) suggesting that joint position sense is equally affected in men and women and gender has no influence on knee joint position sense. The results of the study conducted by Fateme Ghiasi and Asghar Akbari (2007) to evaluate the impact of gender on knee joint position sense favors the finding of the present study. The results demonstrated that were no statistically significant differences between men and women in angle matching of three target positions (45°, 60° and 90° of knee flexion).

Furthermore, the mean absolute errors of joint position sense of right and left knees were compared in all the four groups to find out whether limb dominance has any impact on joint position sense or not. Comparing the mean absolute errors between right and left knees of various groups did not show any statistically significant differences in three groups ($p > 0.05$, table 2), however one group of non sedentary men show significant differences ($p \leq 0.05$ table 2), with better joint position sense in right limb. This suggests that limb dominance factor has some influence on knee joint position sense. These findings are in contrast to findings of study conducted by Bullock et al (2001) to evaluate the influence of age and limb dominance on joint reposition sense of the knee. They concluded that for, normal, pain-free individuals, there is no age-related decline in knee joint position sense in full weight bearing, although an age effect does exist in partial weight bearing and lower limb dominance is not a factor in acuity of knee joint position sense.

Conclusion:

The conclusion of present study is that prolonged sitting affects knee joint position sense both in men and women involved in sedentary jobs with same working nature and their proprioceptive quality of knee joint is less than non sedentary active subjects. Prolonged sitting markedly reduces knee joint position sense in sedentary population and this can be a major contributing factor for the development of the knee joint degeneration in any men or women at 40-50 years of age. Limb dominance also has some role in joint propriocetion sense. Limitations of present study were inclusion of only a particular age group i.e. 40-50 years and non consideration of joint velocity on position sense error.

References:

1. B D Chaurasia's (2013). Human Anatomy Regional and Applied Dissection and Clinical. Fourth edition, Volume 2, Lower Limb, Abdomen & Pelvis. Page: 143.
2. Barrack RL, Skinner HB, Cook SD, Haddad RJ (1983). Effect of articular disease and total knee arthroplasty on knee joint position sense. J Neurophysiol, 50:684-7.
3. Bullock-Saxton JE, Wong WJ, Hogan N (2001). The influence of age on weight bearing joint reposition sense of the knee. Exp Brain Res., 136(3): 400-6.
4. Carolin Jay Co (2010). Proprioceptive training – A review of current research.
5. Easy Ergonomics-A practical approach for improving the workplace. Salem.www.orosha.org.
6. Fateme Ghiasi & Asghar Akbari (2007). Comparison of the effects of open and closed kinematic chain and different target positions on the knee joint position sense. Journal of Medical Sciences, 7: 969-976.
7. Gareth T Jones, Elaine F Harkness, Elizabeth S Nahit, John McBeth, Alan J Silman, Gary J Macfarlane (2007). Predicting the onset of knee pain: results from a 2-year prospective study of new workers: Ann Rheum Dis, 66:400–406.
8. Garsden LR, Saxton JE (1999). Joint reposition sense in subjects with unilateral osteoarthritis of the knee. Clin Rehabil, 13:148-55.

Volume : 5 | Issue : 8 | August 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

9. Hassan BS, Mockett S, Doherty M. (2001). Static postural sway, proprioception, and maximal voluntary quadriceps contraction in patients with knee osteoarthritis and normal control subjects. Ann Rheum Dis, 60:612-8.
10. Joel A. Delisa (2005). Physical Medicine Rehabilitation – Principles and practice: 4th ed., 419.
11. Jones GT, Harkness EF, Nahit ES, McBeth J, SilMan AJ, Mactarlane GJ (2007). Predicting the onset of knee pain: results from a 2-year prospective study of new workers. Ann Rheum Dis, 66: 400-6.
12. Leena Sharma (2004). The Role of Proprioceptive Deficits, Ligamentous Laxity, and Malalignment in Development and Progression of Knee Osteoarthritis: J Rheumatol, 31(SUPPL. 70):87-92.
13. Leiv Sandvik, Jan Erriksen, Erik Thaulow, Gunnar Erriksen, Reidar Mundal, Kaare Rodahl (1993). Physical Fitness as a Predictor of Mortality Among Healthy Middl Aged Norwegian Men, N Engl J Med, 328:533-537.
14. Meral Bayramoglu, Reyhan Toprak, Seyhan Sozay (2007). Effects of Osteoarthritis and Fatigue on Proprioception of the Knee Joint: Arch Phys Med Rehabil, 88:346-50.
15. Nusren Ozdemir, Sevgi Subasi, Nihal Gelecek, Sukru Sari (2009). The Effects of Pilates Exercise Training on Knee Proprioception – A Randomised Controlled Trial. CILT 23, SAYI 2, (MAYIS), S: 71-79
16. R. Juhakoski, M. Helio¨ vaara2, O. Impivaara, H. Kro¨ ger, P. Knekt, H. Lauren and J. P. A. Arokoski (2009). Risk factors for the development of hip osteoarthritis: a population-based prospective study Rheumatology, 48:83–87.
17. Saranya Subramanian & Amitesh Narayan (2012). Does prolonged sitting work among middle aged women impair knee joint position sense? A Comparative Study. International Journal of Current Research and Review Vol. 04 issue 05.