Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 5 Issue 5 May 2022

Research Article

A Correlational Study of Mechanical Low Back Pain on Medial Arches of Foot in School Teachers

Priyali priyadarsini[1]* and Shilpi Pal[2]

[1]*Assistant professor, Harsha Institution of Physiotherapy, Harsha Hospital Campus, Nelamangala, Bengaluru, India*

[2]*Assistant professor, Vydehi institute of physiotherapy,vydehi institute of medical sciences and research center, Bengaluru ,India*

***Corresponding Author:** Priyali Priyadarsini, Assistant professor, Harsha Institution of Physiotherapy, Harsha Hospital Campus, Nelamangala, Bengaluru, India.

DOI: 10.31080/ASOR.2022.05.0462

Received: March 23, 2022

Published: April 19, 2022

Abstract

Background: Low back pain (LBP) is defined as pain and discomfort, localized posteriorly below the lower costal margin and above the inferior gluteal folds with or without leg pain. Low back pain is perceived as a familiar occupational problem having a high prevalence between musculoskeletal disorders among school teachers. In the whole lot of the data related to cacophonies, the biomechanical analysis and the exact reason or co-relationship of the incidences of low back pain with biomechanics of other associated structure is completely lost. This study has clearly emphasized on the area of biomechanics and alterations to the foot arches specifically to the medial arch and its co-relationship with the incidence of low back pain among school teachers.

Objective: The objective of this study was to correlate the mechanical low back pain with the medial arch measurement in school teachers.

Methodology: This study involves teachers from different schools of K.R. Puram. 100 number of subjects both male and female who were aged between 31- 50 years participated in this study. The selection was made on the basis of inclusion and exclusion criteria. Modified Oswestry Low back pain questionnaire was used to assess the low back pain and function, Pressure algometer (kg/cm2) was used to measure the back pain and Navicular Drop Test(mm) was used to measure the arches of foot. An informed consent was obtained from all of them before starting the study and the demographic data was obtained from them. Statistical analysis was done by SPSS software and the data was validated.

Results: The study conducted for a period of 6 months indicated that, the statistical value of navicular drop shows strong co-relationship between symptoms severity of Low back pain in school teachers. The result obtained post analysis of Modified Oswestry Low back pain disability questionnaire, shows increased value of navicular drop test is highly co-related with increased scores in Modified Oswestry Low Back Pain Disability Questionnaire which establishes the relation that medial longitudinal arch plays a vital role in improving load distribution in the low back area and therefore decreased medial longitudinal arch is one of the reason for increased incidents of Mechanical low back pain.

Conclusion: The respective study was undertaken to understand the relationship between altered medial longitudinal arches of feet and incidences of Low Back Pain in school teachers. As the study findings reveals that there is significant relationship with altered arches of foot with incidences of Low back pain.

Keywords: Ergonomics; Threshold; Weight Bearing; Chronic; Mechanical

Introduction

Low back pain (LBP) is defined as pain and discomfort that occurs posteriorly below the lower costal margin and above the inferior gluteal folds with or without leg pain2. LBP may be a major pathological state in worldwide. And approximately 12% to 44% people have LBP in the final population [1].

Low back pain is incredibly common in working people under 45 years old. Direct healthcare expenditure for low back pain was reported to be $90.7 billion within the USA in 1998, while total direct and indirect costs are estimated at £11 billion within the UK in 2000 and A$9.17 billion in Australia in 20013 [2].

Mechanical Low back pain is the most common type of LBP (97%) in which tissues such as bones, muscles, tendons, ligaments, intervertebral discs, joints, and nerves are damaged. Mechanical low back pain is referred as unilateral pain without any radiation to the buttock and lower extremity and without any neurological signs [3].

Some causes of mechanical Low back pain are sudden and intense movements, spine trauma, postural and biomechanical disorders of the spine, biomechanical disorders of the lower extremities, weak core muscles, tight back and hip muscles, lower limb length discrepancy, body weight gain, female sex, smoking, sleep deprivation, prolonged driving, sitting for a quit half a piece day, standing form prolonged period of time has been found to extend the low back pain etc. [3].

As we already discussed LBP is additionally caused by biomechanical disorder of lower extremity that the foot is a very important element of the postural system because it requires continuous adaptation to the varied irregularities arising from the body itself or from the external environment [6].

People who have occupations that involve lots of weight-bearing activity, are at higher risk for flat feet. When the pelvis is tilted to the side, scoliosis or a pathological condition of the lumbar spine is triggered, and such postural alteration of the lumbosacral complex increases the possibility of low back pain.

Flatfoot generates an internal rotation of the tibia and femur and consequently at the enarthrosis. This internal rotation may make the head of femur move posteriorly, which consequently shifts the pelvis posteriorly. To regain postural balance, the trunk moves anteriorly to shift the centre of mass anteriorly and this forces the pelvis to tilt anteriorly within the sagittal plane [14].

Additionally, tension within the iliopsoas muscle and cotyloid joint capsule as a results of hip internal rotation generates anterior pelvic tilt. That affects the spine, especially the lower back.

Having flat feet, also called fallen arches, may end up in misalignment. The increased lumbar lordosis causes stress on the lower back muscles leading to mechanical low back pain which might later show complications of the lumbar region. Among occupational groups, school teachers were considered to possess a widely varied prevalence rate of LBP, ranging from 17.7% in Japan to 53.3% in Brazil to 59.2% in China and to 61% in United States [15].

Many studies demonstrated that teachers were at more risk for developing back pain with different prevalence rates. Epidemiological studies have demonstrated that factors like gender, age, length of employment and awkward posture are associated with higher musculoskeletal disorder prevalence rates among teachers [16].

Materials and Methods

Participants

It was an observational study conducted among teachers from different schools located at K. R. Puram. Study was carried out over six months. 100 number of subjects both male and female age between 31 to 50 years, who fulfilled the inclusion criteria were taken in this study. Firstly each individual was made to sign the consent form and the demographic data was obtained from the subject by using assessment form.

Low back pain and function assessment

A Modified Oswestry Low Back Pain Disability Questionnaire is given to assess pain-related disability in persons with low back pain. It is a self-completed questionnaire containing ten topics concerning intensity of pain, personal care, lifting, walking, sitting, standing, sleeping, social life, travelling, employment / homemaking. The teachers were given the Modified Oswestry

Figure 1-3: Materials used

1. Pressure algometer.
2. Printout of Modified Oswestry Low Back Pain Questionnaire Form.
3. Stationeries like pen, paper, and scale.

Disability questionnaire and they were asked to fill according to the instruction given by the therapist. The total score was calculated after filling the questionnaire.

Measurement of back pain

Pressure algometer

Pressure algometer are used to measure deep pressure pain thresholds or tenderness resistance. The gauge is calibrated in kilograms and pounds wherein the kilogram scale is used for clinical purpose. When a particular site of the body is pressed with a rubber disk having an area of 1 cm2, the device displays the pressure and the readings are expressed in kilograms per square centimetre (kg/cm2). The range of the meter is 0 to 20 kg.

Figure 4: Measuring the back pain with pressure algometer.

Procedure

In this study the pressure algometer was applied over the painful most area in the low back and the readings were noted. The subject was fully informed about the procedure. The Position of the subject was prone lying and supported by pillow to allow complete relaxation with their lower back exposed. The PPT was performed at lumber paravertebral points i.e., 2 cm. lateral to the L2 and L4 spinous process. Placed the Pressure algometer over marked tender spot perpendicular to the surface of the area. Then increased the

pressure continuously at a rate of 1kg/sec. During the algometric measurements, the subjects were asked to say "yes" when the pain was experienced. Here the readings were taken thrice, out of which the average of this three were taken to final consideration. Then the Pressure pain threshold score were recorded in kg/cm2.

Foot alignment

Navicular drop test

In this study Navicular Drop Test was used to measure the medial arch of the feet in school teachers. Navicular Drop Test was done for both the feet. Position of the subject was seating position with their feet flat on the firm surface. The most prominent of the navicular tubercle while maintaining subtalar neutral position was identified and marked with pen. An index card was placed at the inner aspect of hind foot with the card placed from the floor in vertical position passing the navicular bone and was marked at the level of navicular tuberosity. While the subject was still in sitting position. Then the subject was asked to bear an equal weight on both the feet and was asked to stand without changing the position of feet. The new position of navicular tuberosity was marked in index card. The height difference between the navicular bones was measured. If the size is greater than 10 mm, the distance is abnormal and represents more plantar arch.

Figure 5: Subtalar neutral position and marked with pen (female).

Figure 6: Talar depression equal on medial and lateral aspect (female).

Figure 7: Navicular tubercle marked on card while sitting position (female).

Figure 8: Navicular tubercle marked on card while standing position (female).

Figure 9: Subtalar neutral position and marked with pen (male).

Figure 10: Talar depression equal on medial and lateral aspect (male).

Figure 11: Navicular tubercle marked on card while sitting position (male).

Figure 12: Navicular tubercle marked on card while standing position (male).

Figure 13: Measures the difference between original height of navicular tubercle in sitting and weight bearing postion.

Data analysis

The statistical analysis of this study was done by the software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Analysis of variance (ANOVA) has been used to find the significance

of study parameters between three or more groups of patients. Pearson correlation between study variables is performed to find the degree of relationship, Pearson correlation co-efficient ranging between -1 to 1, -1 being the perfect negative correlation, 0 is the no correlation and 1 means perfect Positive correlation.

Age in years	Age in years				Total
	31-35yrs	36-40yrs	41-45yrs	46-50yrs	
31-40	25(100%)	25(100%)	0(0%)	0(0%)	50(50%)
41-50	0(0%)	0(0%)	25(100%)	25(100%)	50(50%)
Total	25(100%)	25(100%)	25(100%)	25(100%)	100(100%)
Mean ± SD	33.12 ± 1.27	38.20 ± 1.38	42.64 ± 1.35	48.08 ± 1.44	40.51 ± 5.71

Table 1.1: Age wise distribution of subjects studied.

P < 0.001**, Significant, Student t test.

The table depicts age distribution, there were total 100 subjects (40.51 ± 5.71) out of which 31-35 years old were 25 numbers (100%), 36-40 years old were 25 numbers (100%), 41-46 years old were 25 numbers (100%), and 46-50 years old were 25 numbers (100%). The above table shows that in 31-35 years Mean ± SD was 33.12 ± 1.27, in 36-40 years Mean ± SD was 38.20 ± 1.38, in 41-45 years Mean ± SD was 42.64 ± 1.35, in 46-50 years Mean ± SD was 48.08 ± 1.44.

Gender	Age in years				Total
	31-35yrs	36-40yrs	41-45yrs	46-50yrs	
Female	13(52%)	12(48%)	13(52%)	13(52%)	51(51%)
Male	12(48%)	13(52%)	12(48%)	12(48%)	49(49%)
Total	25(100%)	25(100%)	25(100%)	25(100%)	100(100%)

Table 2: Gender wise distribution of subjects studied.

P = 0.989, Not Significant, Chi-Square Test.

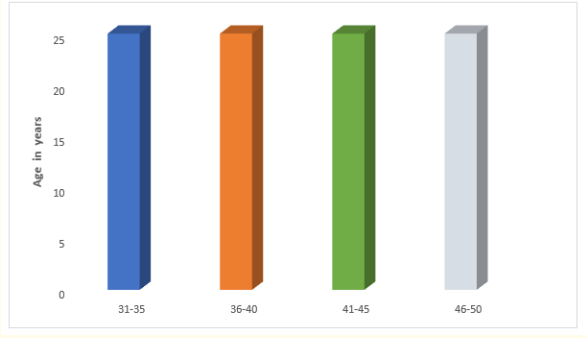
The above table shows the gender distribution of subjects with percentage. The total sample size was 100, out of which 13 females (52%) and 12 males (48%) belong to (31-35) years, 12 females (48%) and 13 males (52%) belong to (36-40) years, 13 females (52%) and 12 males (48%) belongs to 41-45 years, and 13 females (52%) and 12 males (48%) belong to 46-50 years. Totally 51 females (51%), and 49 males (49%) were taken into consideration for this study.

Pair	31-35yrs		36-40yrs		41-45yrs		46-50yrs		Total Score	
	r value	P value	r value	P value	r value	P value	r value	P value	r value	P value
Oswestry score vs Navicular drop test right (mm)	0.425	0.034*	0.819	< 0.001**	0.598	0.002**	0.765	< 0.001**	0.681	< 0.001**
Oswestry score vs Navicular drop test Left (mm)	0.714	< 0.001**	0.483	0.014*	0.484	0.014*	0.375	0.065+	0.564	< 0.001**
Pressure Pain vs Navicular drop test right (mm)	-0.454	0.023*	-0.776	< 0.001**	-0.426	0.034*	-0.755	< 0.001**	-0.637	< 0.001**

Pressure Pain vs Navicular drop test Left (mm)	-0.647	< 0.001**	-0.381	0.060+	-0.427	0.033*	-0.524	0.007**	-0.513	< 0.001**

Table 3: Pearson correlation.

In the above table Pearson correlation for Oswestry score **vs** Navicular drop test (mm) and pressure pain and Navicular drop test(mm) was employed, Oswestry score **vs** Navicular drop test right (mm) in 31-50 years subjects results shown r=0.681, p < 0.001, and left side(mm) results shown r=0.564, p < 0.001. Pressure Pain vs Navicular drop test right (mm) in 31-50 years subjects results shown r=-0.637, p < 0.001, Pressure Pain vs Navicular drop test Left (mm) in 31-50 years subjects results shown r=0.007, p < 0.001. The table shows that moderately significant,# applied Pearson correlation test.



Graph 1: Age wise distribution of subjects studied.

The above bar graph shows the age distribution, there were total 100 subjects out of which (31-35) years old were 25 numbers, (36-40) years old were 25 numbers, (41-46) years old were 25 numbers, and (46-50) years old were 25 numbers.

Graph 2: Gender wise distribution of subjects studied.

The above bar graph shows the gender distribution of the subjects in relation to the age. The total sample size was 100, out of which 13 females and 12 males belong to (31-35) years, 12 females and 13 males belong to (36-40) years, 13 females and 12 males belongs to (41-45) years, and 13 females and 12 males belong to (46-50) years. Totally 51 females, and 49 males were taken into consideration for this study.

Graph 3.1: Pearson correlation between age group (31-35 years).

In the above graph, Pearson correlation between age group of 31-35 years for Oswestry score vs Navicular drop test right (mm) and left side (mm) was employed. In right side, the relationship was found to be moderately positive correlation, whereas in left side the results showed a strong positive correlation. Pressure pain vs Navicular drop test right (mm) and left (mm) results showed moderate negative correlation.

Graph 3.2: Pearson correlation between age group (36-40 years).

In the above graph, Pearson correlation between age group of 36-40 years for Oswestry score vs Navicular drop test right (mm) and left side (mm) was employed. In right side the relationship was found to be strong positive correlation, whereas in left side the results showed a moderate positive correlation. Pressure pain vs Navicular drop test right (mm) result showed strong negative relationship and Pressure pain vs Navicular drop test left (mm) results showed weak negative relationship.

Graph 3.3: Pearson correlation between age group (41-45 years).

In the above graph, Pearson correlation between age group of 41-45 years for Oswestry score vs Navicular drop test right (mm) and left side (mm) was employed. In right side and left side the relationship was found to be moderate positive correlation. Pressure pain vs Navicular drop test right (mm) and left (mm) result showed moderate negative relationship.

Graph 3.4: Pearson correlation between age group (46-50 years).

In the above graph, Pearson correlation between age group of 46-50 years for Oswestry score vs Navicular drop test right (mm) and left side (mm) was employed. In right side the relationship was found to be strong positive correlation, whereas in left side the results showed a weak positive correlation. Pressure pain vs Navicular drop test right (mm) result showed strong negative relationship and Pressure pain vs Navicular drop test left (mm) results showed moderate negative relationship.

Results

The study conducted for a period of 6 months indicated that, statistical value of navicular drop shows strong co-relationship between symptoms severity of Low back pain in school teachers. In this study Pearson correlation for Oswestry score vs Navicular drop test right (mm) was employed, the relationship was found to be positive with $r = 0.681$; and Significant with $P < 0.001$**, higher correlation was observed in the age groups of 36-40 years and 46-50 years compared to other two groups, however the relationship was found to be positive and significant. Oswestry score vs Navicular drop test Left (mm) in 31-50 years subjects results shown $r = 0.564$, $p < 0.001$, Pressure Pain vs Navicular drop test right (mm) in 31-50 years subjects results shown $r = -0.637$, $p < 0.001$, Pressure Pain vs Navicular drop test Left (mm) in 31-50 years subjects results shown $r = 0.007$, $p < 0.001$. The results shows that moderately significant, # applied Pearson correlation test. Therefore it can be established that in teachers with Medial Arch defects who suffers from Mechanical low back pain is highly co –related with the architecture of medial arch.

Discussion

The study was conducted to establish a co-relationship between Medial Longitudinal arches of foot and any possible connection with mechanical low back pain amongst actively working teaching fraternity using Modified Oswestry Low back pain disability questionnaire for understanding the severity of back pain, Pressure algometer as an objective measure for pain pressure threshold and Navicular Drop test to identify any modulation of the medial longitudinal arch. The study conducted for a period of 6 months indicated that, the statistical value of navicular drop shows strong co-relationship between symptoms severity of Low back pain in school teachers.

Low back ache is common in the younger age group and as per WHO estimate of non-progressive musculoskeletal disorder the direct health care burden is around $90.7 billion within the USA in 1998, and likewise varying cost in different economies 2013[2]. It has also been reported that 60-65 percent of reported cases of Low back pain are purely due to biomechanical misalignment and asymmetrical weight distribution and irregular patterns of internal fascial movements however still scientifically low evident at this point on the sphere of biomechanical abnormality but clinicians have reported fascial abnormality which is decreased movement of the fasciae of back leads to Low back ache.

Poor workstation ergonomics has been shown to significantly contribute to the event of Low back pain. Various psychosocial problems, like high stress, low job satisfaction, low social support and effort-reward imbalance also contributed to an increased occurrence of LBP [1]. There were significant relationship between flat foot and low back pain which indicate that foot disorders cause back pain through affecting body posture, balance and gait pattern [4]. A study was conducted on the associations of foot posture and foot function with low back pain in 1930 members of the Framingham Study. They suggested that pronated foot function may contribute to low back symptoms in women [2]. The prevalence of LBP appears to be high among school teachers in Botswana wide range of LBP risk factors [5].

The most overlooked area of significance over the years was the co-relationship between the arches of foot and low back, this study emphasized on the area of connection between the medial longitudinal arch and incidence of low back pain as understood by the biomechanics of the arches it functions as a vital structural divisor of weight and its distribution therefore post statistical validation of the data the results were found to be positively favoring the alternate hypothesis of the study rejecting the null hypothesis. Therefore a possible clinical connection have been established between the integrity of medial arch and incidences of low back pain.

Therefore as discussed earlier low back pain deduces to decreased activity of daily living as well as decreased work related functionality specially effecting the working age groups like as teachers therefore identifying the cause and designing a right intervention strategy is of utmost importance to improve the quality of life and improve the social burden and bio psychological aspect of health care. It is also to be understood that Low back ache not only effects the persons psychology nevertheless it also results to lot of physiological alterations that often remains undiagnosed and misled for the practicing clinicians as well and no research evidence and structural organization exists that gives a clear guidelines to approach this issue in a definitive manner as the scientific evidences including all the factors lacks to address all the aspects of Low back ache and co-related factors, hence designing a right strategy is of sheer importance that addresses all the co-related factors to it conservatively. This study concluded that a strong co-relationship between symptoms severity of Low back pain in the subjects of working age group i.e. in teacher populations.

Conclusion

The respective study was undertaken to understand the relationship between altered medial longitudinal arches of feet and incidences of LBP in working age groups i.e., teachers in this particular study. As discussed earlier, the study was a co-relationship-based study undertaken directly, only to observe the impact of decreased medial arch on Low back ache hence intervention of it was not emphasized on it. As the study findings reveals that there is significant co-relationship with altered arches of foot with incidences of Low back ache.

Bibliography

1. Prawit Janwantanakul., *et al*. *BMC Musculoskeletal Disorders* (2011): 1471-2474.
2. Hylton B Menz., *et al*. *Rheumatology* (2013): 2275-2282.
3. Azar Moezy., *et al*. *Journal of Medical Sciences* 14.4 (2017).

4. Farzad Amoozadeh., *et al*. *Indian Journal of Fundamental and Applied Life Sciences* 5.1 (2015): 79-83.

5. Erick and Smith. *BMC Musculoskeletal Disorders* (2014): 1471-2474.

6. Susan Dsouza., *et al*. *International Journal of Allied Medical Sciences and Clinical Research* 6.1 (2018): 32-39.

7. Kinser Ann M and Sands. *Journal of Strength and Conditioning Research* 23 (2009).

8. Fatema Sdeek., *et al*. *The Medical Journal of Cairo University* 84.1 (2016): 567-572.

9. Sachini NK., *et al*. "Neuromechanics Laboratory". *Department of Kinesiology, Mississippi State University, the Foot* 38 (2019): 81-85.

10. Ju-Eun Lee PT. "*Department of Physical Therapy* (2013): 1059-1061.

11. Salvador Pita-Fernandez., *et al*. *Journal of Clinical and Diagnostic Research* 11.4 (2017).

12. Azar Moezy., *et al*. *Pars journal of Medical Sciences* 14.4 (2017): 51-61.

13. Cláudia dos Santos Borges., *et al*. *Acta Ortopédica Brasileira* 21.3 (2013): 135-138.

14. Biomechanical Assessment of Foot and Ankle.

15. Jerzy Rottermund., *et al*. *Medycyna Pracy* 66.6 (2015): 771-778.

16. Mohammad A., *et al*. *Journal of Manipulative and Physiological Therapeutics* (2014): 702-708

17. Hoy D., *et al*. "The epidemiology of lowback pain". *Best Practice and Research: Clinical Rheumatology* (2010): 769-781.

18. Mohammad Kamrujjaman., *et al*. *Department of Physiotherapy, State College of Health Sciences* (2018).

19. Aregawi Kebede., *et al*. *Occupational Therapy Internationa* 1 (2019).

20. Vianin M. "Psychometric properties and clinical usefulness of the Oswestry Disability Index". *Journal of Chiropractic Medicine* 7.4 (2008): 161-163.

21. Imamura M., *et al*. *Journal of Back and Musculoskeletal Rehabilitation* 29.2 (2016): 327-336.

22. Park G., *et al*. "Reliability and usefulness of the pressure pain threshold measurement in patients with myofascial pain". *Annals of Rehabilitation Medicine* 35.3 (2011): 412-417.

23. Alessandro Chiarotto., *et al*. *Wells, Physical Therapy* 96.

24. Søren Spörndly-Nees PT., *et al*. *The International Journal of Sports Physical Therapy* 6 (2011): 199.

25. *The Journal of Strength and Conditioning Research* (2009).

26. Board member, Swiss Academy for Chiropractic, Department of Postgraduate Studies, Fribourg, Switzerland; staff physician, Clinque Générale, Fribourg, Switzerland". *Journal of Chiropractic Medicine* 7 (2008)161-163.

27. Andrew A Fischer. *Pain* (1987): 115-126

28. Thomas G and Mc Poil. *Journal of Foot and Ankle Research* 3 (2008).

29. Ahdhi GunaSankar., *et al*. "Prevalence of low back pain and its relation to quality of life and disability among women in rural area of Puducherry, India". *Indian Journal of Pain* 30 (2016): 111.

30. Vinicombe A., *et al*. "Reliability of navicular displacement measurement as a clinical indicator of foot posture". *Journal of the American Podiatric Medical Association* 91 (2001): 2628.

31. Deng J., *et al*. "Reliability and validity of the sit-to-stand navicular drop test: Do static measures of navicular height relate to the dynamic navicular motion during gait?" *Journal of Student Physical Therapy Research* 2 (2010): 21-28.

32. Hussein E Elias., *et al*. *African Journal of Primary Health Care and Family Medicine* 11.1 (2019): 1819.

33. Dahiya jyoti., *et al*. *Indian Journal of Physiotherapy and Occupational Therapy- An International Journal* 11 (2017).

34. *Journal of Orthopaedic and Sports Physical Therapy* 32.9 (2022): 447-460.

35. Pengying Yue., *et al*. BMC Public Health 12 (2012): 789.

36. Hafsa Zahid., *et al*. *International Journal of Scientific and Engineering Research* 8.12 (2017).

37. Teresa Kisi Beyen., *et al*. *Occupational Medicine and Health Affairs* (2013).

38. Megan Davidson., *et al*. *Physical Therapy* 82.1 (2002): 8-24.

39. Nishant., *et al*. *Asian Spine Journal* 8.5 (2014): 632-638.

40. Şenay ÖZDOLAP., *et al*. *Physical Therapy* 85.10 (2005): 1085-1092.

41. Mistry Niyati N., *et al*. *Indian Journal of Physiotherapy and Occupational Therapy-An International Journal* 12.4 (2018).