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ASSOCIATION OF NON-SPECIFIC LOW BACK PAIN AND DISABILITY INDEX WITH LOWER EXTREMITY ALIGNMENT FACTORS

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ABSTRACT

Background: An array of risk factors contributes to non-specific low back pain. Apart from age, female gender, low educational status, obesity, occupation and psychological factors, postural variations (including variations in the lower extremity) play a significant role in predisposing an individual to low back pain. Hence, while evaluating/examining a patient with back pain, the alignment of the lower extremity should be taken into consideration rather than restricting the evaluation to the lumbosacral region.

Methods: 36 subjects (12 Males, 24 Females) with non-specific low back pain were assessed for pain and disability using the Oswestry Disability Index (ODI). The measurements for lower extremity alignment factors (Pelvic angle, Angle of torsion of the femur, Quadriceps angle, Tibial torsion and Navicular drop) were recorded bilaterally.

Results: There was a positive correlation of non-specific low back pain and disability index with the right pelvic angle (p=0.0012, r=0.51 and p=0.0003, r=0.56 respectively). Non-specific low back pain and disability index had no correlation with left pelvic angle (p=0.9101, r=0.01 and p=0.9794, r=0.00 respectively). Non-specific low back pain and disability index had a positive correlation with angle of torsion (AOT) of femur (Rt: p=0.0027, r=0.48, Lt: p=0.0084, r=0.43 and Rt: p=0.0039, r=0.46, Lt: p=0.0023, r=0.49 respectively), quadriceps angle (Q-angle) (Rt: p=0.0020, r=0.49, Lt: p=0.0014, r=0.51 and Rt: p=0.0019, r=0.49, Lt: p=0.0024, r=0.49 respectively) and navicular drop (Rt: p=<0.0001, r=0.61, Lt: p=0.0053, r=0.45 and Rt: p=0.0002, r=0.58, Lt: p=0.0048, r=0.46 respectively) bilaterally. Non-specific low back pain had no correlation with right tibial torsion (p=0.9269, r=0.01). Disability index had a positive correlation (not significant) with right tibial torsion (p=0.2427, r=0.19). There was a positive correlation (not significant) of non-specific low back pain and disability with left tibial torsion (p=0.1757, r=0.23 and p=0.0703, r=0.30 respectively).

Conclusion: There was an association of non-specific low back pain and disability index with lower extremity alignment factors.

Keywords: Non-specific low back pain, disability, lower extremity alignment factors.

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INTRODUCTION

Worldwide, low back pain is a highly prevalent problem [1]. Until ten years ago, it was primarily thought of as a problem confined to western countries. However, presently, an increasing amount of research has demonstrated that low back pain is also a significant problem in low and middle-income countries [2]. In the Indian population, the prevalence of low back pain was found to range from 6.2% to 92% [3].

According to the definition, non-specific low back pain is tension, soreness and/or stiffness in the lower back region, for which a specific cause cannot be identified. Several structures in the lower back region such as joints, discs and connective tissue may contribute to the symptoms. Some patients with non-specific low back pain may also feel pain in their upper legs, but the low back pain usually predominates [4]. The diagnosis of non-specific low back pain is made when suspected or confirmed pathologies or radicular syndromes are excluded. It constitutes 95% of all low back pain presentations [5].

A variety of risk factors are known to contribute to this condition. These include increased age, female gender, low educational status, obesity, occupation and psychological factors. In addition to these, postural variations (including variations in the lower extremity) play a significant role in predisposing an individual to low back pain by altering the stresses placed on soft tissue structures around the spine [1].

Ergonomic risk factors can result in musculoskeletal disorders of the lower extremities due to abnormal biomechanics and structural adaptations. Abnormal joint loading, muscle imbalances and deviation from neutral alignment which are observed in lower extremity malalignment may cause musculoskeletal dysfunction [6].

The lower extremity alignment factors of the navicular drop, tibial varum, Q-angle, genu recurvatum, anterior pelvic tilt and angle of torsion of the femur are often implicated in both acute and chronic injuries of the lower extremity. Hence, these are commonly measured as part of a lower-quarter screening. Clinicians often attempt to alter these alignments when they are considered excessive (malalignment) [7].

A study by Bird AR et al. 2003, suggests that in the closed kinetic chain, alignment of the lower extremity can lead to the development of low back pain [8]. Abnormal subtalar joint pronation is a suggested mechanism for low back pain which leads to a chain reaction into the pelvis and lumbar spine [9]. Accounting for the alignment of the entire lower extremity, rather than a single segment, may more accurately describe the relationship between anatomic alignment and low back pain, as one alignment factor may interact with or cause compensations at other bony segments[10]. Studies, have been conducted research the individual relationship between the alignment of the pelvis, hip, and foot with low back pain or disability. Considering the potential interdependence of various factors along the kinetic chain, examining only one or a limited number of alignment factors may not describe the position of the lower extremity adequately thus providing insufficient information [11].

Hence, this study was undertaken to determine the association of non-specific low back pain and disability index with lower extremity alignment factors (pelvic angle, the angle of torsion of the femur, Q-angle, tibial torsion and navicular drop).

METHODS

The study was approved by institutional ethics before the commencement. It was a cross-sectional, correlational study including 36 subjects (12 Males, 24 Females). The study was conducted in Mumbai. The sample size was calculated from the pilot study using Primer of Biostatistics software. Individuals with non-specific low back pain in the age group of 19-40 years were included in the study. Individuals having low back pain due to known pathology of the spine (e.g., Spondylolisthesis, PIVD), any known pathological condition of the hip, knee, ankle or foot, any history of spinal/lower extremity injury or surgery and anatomical limb-length discrepancy were excluded.

PROCEDURE

Subjects fulfilling the inclusion and exclusion criteria and willing to participate in the study were selected. The purpose of the study was explained to them and their written consent was obtained. History was taken, followed by a brief evaluation. The subjects were administered the Oswestry Disability Index (ODI) in the language best understood (English/ Hindi/ Marathi). Measurements for lower extremity alignment factors were then recorded for the right and left side. Three readings were taken for each alignment factor,and the average was recorded.

1. Pelvic angle

Pelvic angle was measured in bilateral stance using a pelvic inclinometer. The subject was made to stand barefoot on the floor in a comfortable, erect posture, with feet apart, body weight equally distributed on both feet and arms crossed over the chest. The anterior superior iliac spine (ASIS) and the posterior superior iliac spines (PSIS) were marked using a marker. One of the calipers of the pelvic inclinometer was placed on the ASIS and the other on the PSIS of the same side and the angle was recorded in degrees (Figure 1) [12].

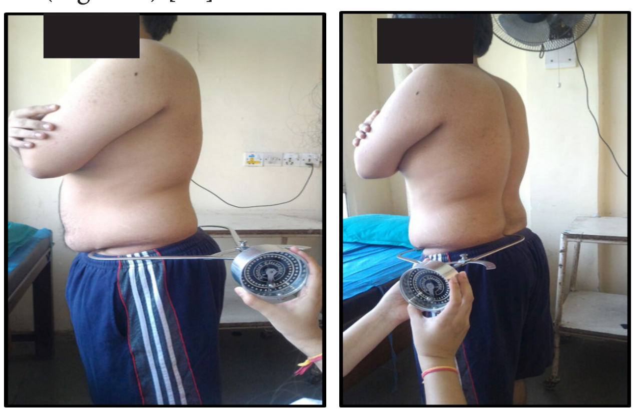

Figure: 1a **Figure: 1b**

Figure 1 a, b: Measurement of a pelvic angle using a pelvic inclinometer

2. The angle of torsion (AOT) of femur (Craig's test):

The angle of torsion (AOT) of femur was measured with the subject in the prone position and with the knee at 90 degrees of flexion. The greater trochanter was palpated and the femur was moved passively into the internal rotation until the greater trochanter could be palpated at its most lateral position,i.e., when it would be maximally prominent. AOT was measured as the acute angle formed by the tibia and an imaginary vertical line. This angle was measured in degrees using a goniometer (Figure 2) [13].

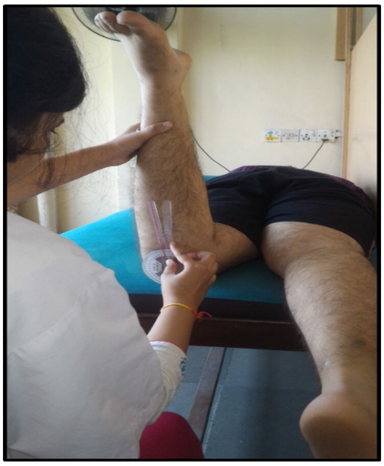

Figure 2: Measurement of AOT using Craig's test

3. Quadriceps angle (Q-angle):

Quadriceps angle was measured in the standing position. Each subject was made to stand barefoot such that the toes were pointing straight forward. Care was taken to ensure that the subject's quadriceps muscles were relaxed. The anterior-superior iliac spine (ASIS) midpoint of the patella and the tibial tuberosity were marked with a skin marker. The two lines, one from the ASIS to the midpoint of the patella and the other from the midpoint of the patella to the tibial tuberosity were drawn (Figure 3a). The angle thus created was measured in degrees using a goniometer (Figure 3b) [13].

Figure: 3a

Figure: 3b

Figure 3a, 3b: Measurement of Q-angle

4. Tibial Torsion:

Tibial torsion was measured in the supine position such that the femoral condyles lie in the frontal plane (patella facing straight up). The apices of both malleoli were palpated and marked with a marker.A line was drawn on the heel which represented a line joining the two apices. A second line was drawn on the heel parallel to the floor(Figure 4b). The angle formed by the intersection of the two lines indicates the amount of lateral tibial torsion. This angle was measured in degrees using a goniometer (Figure 4b) [14].

Figure: 4a

Figure: 4b

Figure 4a, 4b: Measurement of Tibial Torsion

5. Navicular Drop:

The navicular drop was measured as the difference in the height of the navicular tuberosity from the floor during sitting and standing. The initial measurement was taken in the sitting position with both feet on the floor, unweighted and in a subtalar neutral position. The navicular tuberosity was palpated and was marked using a marker. The unweighted navicular position is the distance from the point marked on the navicular tuberosity to the floor (position1, Figure 5a). This position was marked on the white card with the card kept perpendicular to the floor. The subject was then asked to stand and was instructed to keep equal weight on both feet and the measurement was repeated (position 2, Figure 5b). This new position was marked on the white card. The navicular drop was measured as the distance between the two measurements and was measured with a measuring tape in millimeters [13,15].

Figure 5a: Position 1

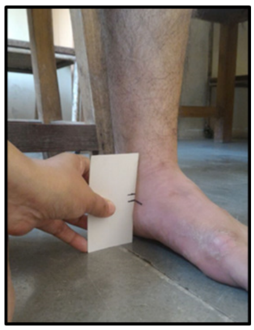

Figure 5b: Position 2

Figure 5a, 5b: Measurement of Navicular Drop

Statistical Analysis

The data was entered using Microsoft Office 2013 and analyzed using GraphPad InStat software version 3.0. Normality was assessed using the One-Sample Kolmogorov-Smirnov Test. Comparison between the right and left alignment factors was done using paired t-test when the data passed the normality (for pelvic angle, AOT of the femur, Q-angle, navicular drop) and Wilcoxon matched pairs test was used when the data did not pass normality (for tibial torsion). Spearman's Correlation Test was used for the correlation between Pain and Oswestry Disability Index (ODI)with each of the lower extremity alignment factors (pelvic angle, AOT of the femur, Q-angle, tibial torsion and navicular drop). A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Distribution of Age

No. of patients	Mean	Median	SD	Min	Max
36	29.05	26.50	6.92	20	40

Table 2: Distribution of gender

Gender	Frequency	Percentage (%)
Males	12	33
Females	24	67
Total	36	100

Table 3: Distribution of BMI

No. of patients	Mean	Median	SD	Min	Max
36	24.17	24.37	3.32	16.60	29.58

Table 4: Means and SD of alignment factors:

Alignment factors		Mean	SD	Median	P value	Significance
Pelvic angle	Right	10.09	3.15	9.83	0.1078	Not significant
	Left	9.05	3.01	9.33		
Angle of torsion (AOT) of femur	Right	6.80	1.66	6.66	0.9126	Not significant
	Left	6.78	1.86	6.33		
Q-angle	Right	16.97	3.81	17.66	0.8917	Not significant
	Left	16.95	3.92	17.33		
Tibial torsion	Right	12.88	2.54	13.33	0.5332	Not significant
	Left	12.95	2.53	12.99		
Navicular drop	Right	6.90	2.79	6.83	0.0072	Significant
	Left	5.94	2.25	6.00		

Table 4: The difference between the right and left alignment factors was not statistically significant for Pelvic angle, AOT of the femur, Q-angle and Tibial torsion. However, it was statistically significant for the navicular drop.

Table 5: Correlation of non-specific low back pain and lower extremity alignment factors

	r	P value
Pain and Right Pelvic Angle	0.51	0.0012
Pain and Left Pelvic Angle	0.01	0.9101
Pain and Right AOT of Femur	0.48	0.0027
Pain and Left AOT of Femur	0.43	0.0084
Pain and Right Q-angle	0.49	0.0020
Pain and Left Q-angle	0.51	0.0014
Pain and Right Tibial Torsion	0.01	0.9269
Pain and Left Tibial Torsion	0.23	0.1757
Pain and Right Navicular Drop	0.61	<0.0001
Pain and Left Navicular Drop	0.45	0.0053

Table 5: Correlation of pain was statistically significant with all alignment factors except for left Tibial torsion (not significant). The pain did not correlate with left Pelvic angle and right Tibial torsion.

Table 6: Correlation of disability index and lower extremity alignment factors

	r	P value
ODI and Right Pelvic Angle	0.56	0.0003
ODI and Left Pelvic Angle	0.00	0.9794
ODI and Right AOT of femur	0.46	0.0039
ODI and Left AOT of femur	0.49	0.0023
ODI and Right Q-angle	0.49	0.0019
ODI and Left Q-angle	0.49	0.0024
ODI and Right Tibial Torsion	0.19	0.2427
ODI and Left Tibial Torsion	0.30	0.0703
ODI and Right Navicular Drop	0.58	0.0002
ODI and Left Navicular Drop	0.46	0.0048

Table 6: Correlation of disability was statistically significant with all alignment factors except for Tibial torsion bilaterally (not significant). Disability index did not correlate with left Pelvic angle.

DISCUSSION

The present study consisted of 12 males (33%) and 24 females (67%) with a mean age of 29.05 ± 6.92 years and mean BMI of 24.17 ± 3.32 kg/m^2. All the subjects were right lower extremity dominant. 84% of the subjects had chronic low back pain, 8% had acute and 8% of the subjects had subacute low back pain. 58% of the subjects had moderate disability and 42% had a minimal disability.

Pain and disability index:

Pain showed a positive correlation with disability index (r=0.75). This correlation was statistically significant (p=<0.0001). Raymond W. Mc Gorryet al. (2000) studied the relationship between pain intensity, disability and the episodic nature of chronic and recurrent low back pain. They found a significant effect of pain intensity on disability. The study concluded that during an episode of low back pain, higher pain levels are related to greater disability and medication use [16].

Pelvic angle:

Pain and disability index (ODI) showed a statistically significant positive correlation with the right pelvic angle(p=0.0012 and 0.0003 respectively). Left pelvic angle did not show a correlation with Pain and disability index (ODI) (r=0.01 and r=0.00 respectively).

Jull and Janda (1987) have described the lumbar or pelvic crossed syndrome to show the effect of muscle imbalance on the ability of an individual to maintain a neutral pelvis. They hypothesized that in this syndrome, there was a combination of weak, long muscles and short, strong muscles which caused imbalance. The weak, long muscles were the abdominals and gluteus maximus whereas, the short, strong muscles were the back extensors and hip flexors (mainly the iliopsoas) [17].The weakness of the anterior abdominal muscles and tightness of the hip flexors causes an increase in the forward tilt of the pelvis since the muscles become incapable of maintaining a neutral pelvic alignment. As the pelvis tilts forward, it increases the lumbar lordosis [18].

David Levine and Michael W. Whittle (1996)studied the relationship between pelvic tilt and lumbar lordosis. They concluded that a change in the pelvic tilt produced an almost equal angular change in the lumbar lordosis [19]. In a study done by Youdas et al. (2000), it was found that a weak association existed between lumbar lordosis and pelvic inclination when the measurements were taken in standing position. They concluded that in patients with chronic low back pain, the lumbar lordosis or pelvic inclination was not more than their counterparts without low back pain. However, they also found that the abdominal muscle force was less in subjects with chronic low back pain than that of the control subjects [20].

A weakness of the abdominal muscles leads to anterior tilting of the pelvis along with exaggeration of the lumbar lordosis. This causes an increase in the compressive stresses posteriorly on the vertebrae and the articulating facets with an undue tension on the anterior longitudinal ligament in the lumbar region. This puts a strain on the structures of the lumbar region causing low back pain[18]. Hence pain showed a positive correlation with the right pelvic angle. Since low back pain has shown a positive correlation (r=0.75) with disability, it can be concluded that increase in pain causes an increase in disability. Hence, this may be the reason that disability also showed a positive correlation with the right pelvic angle.

Hee Sung Lim et al. (2013), determined the relationship between pelvic tilt angle and disability associated with low back pain. Pelvic tilt was measured only on the left side. The results showed no correlation between pelvic tilt angle and disability. However, subjects with low back pain had a significantly greater median pelvic tilt angle (6.0°) than those with healthy backs (3.5°). This indicated that subjects with low back pain and disability tend to change their posture by increasing anterior pelvic tilt or those with increased pelvic tilt are more at risk of having back pain. The researchers further stated that the relationship between pelvic tilt angle and disability exists but is hidden by measurement error. Also, the increase in anterior pelvic tilt was observedin a group of subjects who reported minimal disability [21].

In the present study, mean pelvic angle on the left was less as compared to the right side though the difference was not statistically significant. However, the individual differences between the right and the left side ranged from 1° to 6°. The values of the pelvic angle on both sides were correlated to the common value of pain and disability index. Hence, left pelvic angle may not have correlated to low back pain and disability index.

Angle of torsion (AOT) of femur:

Pain showed a significant positive correlation with right and left AOT (p=0.0027 and p=0.0084 respectively). Disability index (ODI) showed a significant positive correlation with right and left AOT (p=0.0039 and p=0.0023 respectively).

Paula Tansey (2015), highlighted the importance of assessment of angle of torsion (AOT) in a patient who had a four-year history of right hip pain and a one-year history of low back pain. The patient's AOT was 40° bilaterally (excessive femoral anteversion). It was found that by increasing the internal rotation alignment of the patient's lower limbs during the activities of daily living and by performing lower limb strengthening exercises in the new alignment, the patient had a substantial reduction of hip pain and resolution of low back pain. In the second year of treatment, the patient had reduced number of episodes. Thus, the study indicated that there was an elimination of low back pain with treatment solely directed at hip biomechanics and strength [22].

In the stance position with the feet directed forward, the anteverted hip assumes a position towards the end of the external rotation. Hence, increased anteversion effectively increases the range of functional internal rotation while reducing the range of external rotation [23].

Heller et al. (2001), suggested that, with an increase in femoral anteversion, the foot has to be rotated internally to keep the femur head in the acetabulum, resulting in an in-toeing posture. This deformity increases the hip joint contact forces and increases the bending moment applied to the femur [24]. Nyland J et al. (2004) correlated the activation of the hip muscles with the femoral anteversion angle. They found lower electromyographic activation in the vastus medialis and the gluteus medius in the hips with greater femoral anteversion. Increase in the relative femoral anteversion thus suggested reduced frontal and transverse plane femoral control from these muscles. Thus, an increase in femoral anteversion leads to increased loading of the hip joint and dysfunction of muscle forces in the pelvis and hip [25]. Van Dillen et al. (2008) suggested that low back pain is associated with changes in the hip rotation range of motion [26]. Reduced range of external rotation of the hip joint (as seen in individuals with increased AOT of femur) may contribute to increased forces and compensatory motion in the lumbopelvic area leading to low back pain [22]. Thus, it may be inferred that the increase in AOT of the femur is associated with low back pain and disability.

Mean values for AOT in the present study were derived from Craig's test and were 6.80° ± 1.66° on the right and 6.78° ± 1.86° on the left. The mean values reported in the present study were less than the mean values reported by Magee. This may be because of the following reasons:

Stuberg et al. (1989)reported that assessment with a goniometer underestimated femoral torsion by 9° to 12° compared with computerized tomographic measurements of femoral torsion [27]. In a later study, Cusick and Stuberg (1992) suggested that clinical assessment with a goniometer may underestimate femoral torsion by as much as 20°[28]. Davids et al. (2002) created a 3-dimensional model of the proximal femur and found that the location of the most prominent part of the greater trochanter would likely lead to underestimations of femoral anteversion during the clinical examination [29].Richard B. Souza, Christopher M. Powers (2009) found that Craig's test underestimated the true angle of femoral anteversion in 75% of the subjects evaluated. He further stated that the most likely source of error between MRI and clinical measurements of femoral anteversion is the soft tissue superficial to the greater trochanter. As palpation of the greater trochanter is critical for attaining an accurate clinical measurement, the soft tissue overlying the greater trochanter would likely lead to errors [30].

Quadriceps angle (Q-angle):

Pain showed a significant positive correlation with right and left Q-angle (p=0.0020 and p=0.0014 respectively). Disability index (ODI) showed a significant positive-correlation with right and left Q-angle (p=0.0019 and p=0.0024 respectively).

The knee joint is located between the hip and the ankle. The hip joint has indirect influences on the kinematics of the knee joint as well as other adjacent joints in the pelvis [25]. In a study done by Anh-Dung Nguyen et al. (2009), it was found that femoral anteversion had a strong association with Q-angle. Increased femoral anteversion would cause the femur to rotate more medially, thus resulting in a medial displacement of the patella. Also, excessive femoral anteversion is associated with intoeing that is compensated by external rotation of the tibia on the femur which would displace the tibial tuberosity in a more lateral position thus increasing the Q-angle. Thus, the lower extremity alignment of increased femoral anteversion would change the position of the anatomical landmarks used to measure the Q-angle, thus increasing its magnitude [31]. As mentioned earlier, AOT of femur had a positive correlation with low back pain and disability. Hence, as Q-angle was associated with increased femoral anteversion (increased AOT), it may be inferred that Q-angle has an association with low back pain and disability.

Anh-Dung Nyugen and Sandra J Shultz (2009) described a valgus alignment of the lower extremity characterized by positive relationships among greater anterior pelvic angle, quadriceps angle and tibiofemoral angle. The relationship between pelvic angle and frontal-plane knee angles (i.e., quadriceps and tibiofemoral angles) reflect an interaction between the pelvis and femur [11]. The reasons by which the pelvic angle was associated with low back pain and disability have been described in the section of pelvic angle. Since Q-angle has a positive relationship with the pelvic angle, it can be stated that Q-angle has an association with low back pain and disability.

Tibial torsion:

The pain did not show a correlation with right tibial torsion (r=0.01). Disability index (ODI) showed a very weak positive correlation with right tibial torsion (r=0.19). The correlation was statistically not significant (p=0.2427). Pain and disability index (ODI) showed a weak positive correlation with left tibialtorsion (r=0.23 and 0.30 respectively). The correlations were not statistically significant (p=0.1757 and p=0.0703 respectively).

In the literature search, no studies were found to correlate tibial torsion with low back pain or disability. The results of the present study showed a weak positive correlation (not significant) or no correlation with pain and disability.Thus we may infer that tibial torsion may not be associated with low back pain and disability index.

Navicular drop:

The mean navicular drop on the right was 6.90 ± 2.79 mm and on the left was 5.94 ± 2.25 mm. On comparing the navicular drop on the right and left sides, it was found that the difference in the values was statistically significant (p=0.0072). This suggests asymmetry with the navicular drop on the right side being more than the left side.

Pain showed a significant positive correlation with right and left navicular drop (p=<0.0001 and p=0.0053 respectively). Disability index (ODI) showed a significant positivecorrelation with right and left navicular drop (p=0.0002 and p=0.0048 respectively).

Jamie Andrews (2014) explored the potential biomechanical and myofascial influences of pes planus and talocrural joint range of motion (TCROM) on the presence and severity of non-specific low back pain (NSLBP) and concluded that there is a relationship between both pes planus and TCROM with NSLBP.[32] According to Langevin et al.(2004); Langevin(2006) anatomically, it is considered that the fascia is globally continuous [33, 34]. Hence, Jamie Andrews (2014) hypothesized that the foot and ankle status might influence the biomechanical and myofascial function, or dysfunction, even more proximally along its course, manifesting as or contributing towards non-specific low back pain [32].

Hylton B. Menz et al. (2013) studied the association of foot posture and function on low back pain. Foot posture was categorized as normal, planus or cavus using static weight-bearing measurements of the arch index. Foot function was categorized as normal, pronated or supinated. Foot posture showed no association with low back pain. However, a pronated foot function was associated with low back pain in women [1].

Kristina Stenon (2010) observed that there was no association between bilateral navicular drop asymmetry and mechanical low back pain. However, she observed that subjects in the mechanical low back pain group had a higher average navicular drop than subjects in the no mechanical low back pain group. The results suggested a link between mechanical low back pain and increased average navicular drop and a lesser degree of bilateral navicular drop asymmetry. Also, a slight difference was observed in the absolute bilateral navicular drop difference between the mechanical low back pain group and no low back pain group (2.026 and 2.545 mm respectively). However, this difference was not significant [35].

Kosashvili et al. (2008) demonstrated an association between moderate and severe pes planus and intermittent low back pain [36]. Pronation at the subtalar joint leads to internal rotation of the tibia and femur. This leads to the anterior tilt of the pelvis and increases in lumbar lordosis [9] thus causing pain and disability, the mechanism of which has been described earlier. Thus, it may be inferred that an increase in the navicular drop is associated with low back pain and disability.

Brantingham et al. (2007)determined the risk and association between navicular drop, calcaneal eversion and low back pain and concluded that flatfeet did not appear to be a risk factor for mechanical low back pain [37].

Marcel Betsch et al. (2011) studied the influence of foot position on the spine and pelvis. They investigated the immediate effects of different foot positions on the pelvic position and the spinal posture. The results of the study supported the existence of a kinematic chain, where changes of foot position also led to significant alterations of the pelvic position. However, no correlation between foot position and spinal posture changes was found [38].

The study conducted by Brantingham et al. (2007) had a small sample size, broader age group range (16-70 years), low power and lesser prevalence of flatfeet (ND >10 mm) [37]. This could be the probable reason that the results of the present study are different from their Study. The research by Marcel Betsch et al. (2011) [38], mainly focused on the immediate effects of foot positions on spinal posture while the present study included subjects having non-specific low back pain (the majority of them having chronic pain) in whom the alteration in foot positions may have been present for a longer duration. This would have given results that are different from the present study.

Thus the results of the present study suggested that there is an association of lower extremity alignment factors with non-specific low back pain and disability index.

To study the most significant factor contributing to low back pain and disability, regression analysis is recommended. However, since the dependent variable is ordinal, larger sample size would be required for the same.

Limitations

The present study did not have a control group and the correlation was not performed separately for males and females. Also, correlation was not performed separately depending on the duration of pain (acute/subacute/chronic).

CONCLUSION

The study concluded that there is an association of non-specific low back pain and disability index with lower extremity alignment factors.

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