International Journal of Physical Education, Sports and Health 2019; 6(5): 227-231

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2019; 6(5): 227-231

www.kheljournal.com
Received: 25-07-2019
Accepted: 27-08-2019

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Relationship between degree of foot pronation and disability associated with low back pain

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Abstract
A cross sectional study was conducted on 50 subjects of age group 20 – 50 years. Low back pain is a major cause of disability affecting performance at work. Abnormal foot posture and function have been implicated with low back pain. Hence a need was identified to find out correlation between foot pronation and disability associated with low back pain. The mean of ODI score (% disability) for right for 1st, 2nd, & 3rd degree was 24.72±10.31, 32.57 ±8.82 & 27.33±11.71 respectively & left foot was 24.70 ±10.57, 31.64±8.52 & 27, 25.00 ±15.55 with p =0.058, F= 3.0311 & p= 0.081, F= 2.654 respectively.
Conclusion: A negative relationship was found between the ODI score (% disability) and degrees of foot pronation

Keywords: Pronated foot, low back pain, feiss line, oswestry disability scale

1. Introduction
Back pain is a very common health problem worldwide and a major cause of disability - affecting performance at work and general well-being and has high rate of reoccurance [1]. Low back pain is a highly prevalent problem worldwide, and its prevalence increases and peaks between the ages of 35 and 55. In up to 85% of LBP cases the mechanism of the pain is poorly understood and is classified as non-specific, i.e. of unknown origin. Low back pain is the common symptom of the lumbar region that more than 80 percent of people experience in their lifetime [2]. Prevalence estimated at 18% of the general population. The prevalence of intermittent LBP ranges from 33% to 65 % [3]. The prevalence of intermittent LBP is 5% in subjects with the mild pes planus groups, while the prevalence was significantly higher 10% in those with moderate and severe pes planus. McIntosh found that intermittent LBP is a one of the factors which is associated with the reduce in disability [4]. There is a complex array risk factors are known to contribute to the condition, such as increased age, female sex, low educational status, obesity, occupation and psychosocial factors [5]. In addition to these well-established risk factors, postural variations, such as decreased lumbar lordosis [5] and leg length inequality [6] have long been suspected to play a role in predisposition to low back pain by altering the stresses placed on soft tissue structures around the spine. Abnormal foot posture and function have also been implicated, with several authors suggesting that individuals with low back pain are more likely to have planus (low-arched or pronated) feet [7].
The prevalence of acute and CLBP in adults doubled in the last decade and continues to increase dramatically in the aging population, affecting both men and women. LBP has a significant impact on functional capacity, as pain restricts occupational activities [8]. Chronic pain can reduce people's quality of life (QOL) due to suffering, failed treatments, medication dependence, social isolation, difficulties at work and emotional distress. In addition, it limits professional and leisure activities and decreases patients' functional ability. It can also cause irritation, sleep disorders, reduced appetite and severe physiological, psychological and social consequences [9]. Disability negatively affects and strongly influences physical quality of life in patients with chronic low back pain [10].
Planus foot has greater odds of knee and ankle pain, having extremes of foot posture (Pes planus) predisposes individuals to a greater risk of lower extremity joint pain, whereas extremes of foot function may be an independent risk factor for lower extremity joint pain,

other studies suggest foot posture is a predictor of knee pain. The difference in biomechanical function of the foot can be a result of shoes [11]. Several studies implicated pronated foot as possible cause of low back pain (LBP), but there is a lack of evidence linking degree of foot pronation to severity of disability associated with LBP. They suggested that excessive foot pronation may produce lower extremity medial rotation, functional leg length disparity, and pelvic obliquity. Increased pelvic obliquity creates lateral deviation and a functional scoliosis of the lumbar spine [12]. A need was identified to estimate correlation between foot pronation and disability associated with low back pain; whether greater degree of foot pronation is seen with more severe disability associated with low back pain or vise- versa. Result of this study can be used for prevention and designing plan of care in management of pronated foot in patients with low back pain; if any correlation found.

2. Materials and Methods

This cross sectional study was conducted in patients of low back pain fulfilling the criteria, referred by specialists for physiotherapy, from tertiary hospitals. Study protocol was approved by Institutional Ethics Committee. The study population was selected by purposive sampling method. The study was conducted over a period of one year.

Inclusion criteria for the study were: Subjects were age group of 18 –50 years, both genders, Subjects referred for low back pain and with foot pronation deformity, Subjects with history of low back pain 3 months and on/ off low back pain at least 3 episodes, each episodes of low back pain should be at least for 1 week.

Subjects were excluded if: they had history of low back pain with referred pain or radiating pain, history of spinal surgery, history of spinal or pelvic fracture, history of trauma to lower extremity, osteoarthritis or fractures of lower extremity and any history of systemic disease (Arthritis, TB).

2.1 Procedure

This study involved minimal equipment (pen, inch tape, card paper, chair.) Low back pain subjects were recruited from the tertiary hospital fulfilling the criteria referred by specialists for physiotherapy. After initial assessment the participants who met the inclusion and exclusion criteria were explained about the study and informed consent was taken. The procedure was explained to the participants; and were subjected to clinical examination. Feiss Line Test was performed and noted down. Oswestry Disability Index scale were administered and responses noted down and calculated the percentage of disability.

2.2 Oswestry Disability Index Scale

ODI is an index derived from the Oswestry low back pain questionnaire used by clinicians and researchers to quantify disability for low back pain. ODI is a self completed questionnaire contains ten categories concerning intensity of pain, lifting, ability to care for oneself, ability to walk, ability to sit, ability to stand, social life, sleep quality, ability to travel, employment. Each topic category is followed by 6 statements describing different potential scenarios in the patient's life relating to the topic. Each question was scored on a scale of 0-5 with the first statement being zero and including the least amount of disability and the last statement is scored 5 indicating most severe disability. The scores for all questions answered are summed, then multiplied by two to obtain the index (range 0 to 100). Zero is equated with no disability and 100 is the maximum disability possible.

2.3 Feiss Line test procedure

Feiss line test measures the degree of fall of navicular in standing position. Ask patient to sit on the chair with foot on the floor. Mark the navicular tubercle in sitting, again ask patient to stand then again mark the navicular tubercle and see for the navicular fall in standing. If the tubercle falls one third of the distance to the floor, it represents a first degree flatfoot; if it falls two thirds of the distance, it represents a second degree flatfoot; if it rests on the floor, it represents a third degree of flatfoot; shown in following figures.

Fig 1: Markings for Feiss Line Test

Fig 2: Navicular tubercle in sitting position (I)

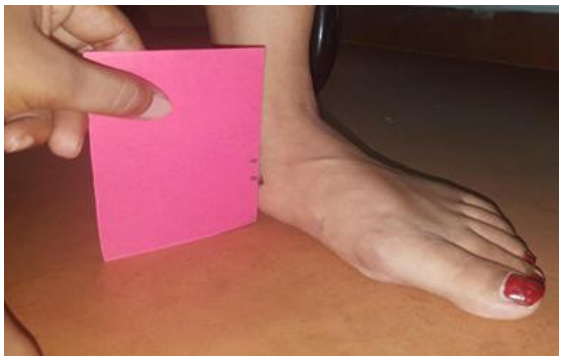


Fig 3: Navicular tubercle in standing position (II)

Fig 4: Markings for positions of (I) and (II)

Fig 5: Difference between sitting & standing fall position of navicular tubercle (II – I)

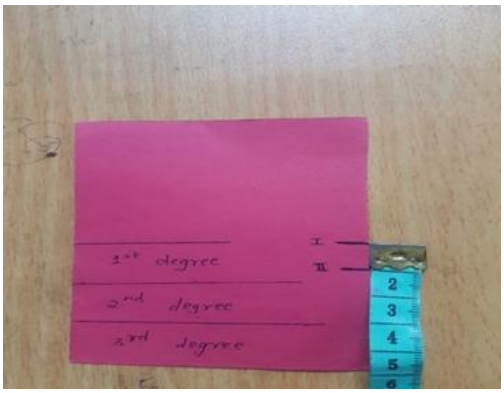


Fig 6: 1st, 2nd & 3rd degree of navicular from floor

3. Results & Discussion

Over a period of 1 year (total study duration), a total number of 118 subjects were screened for the study, inclusive of inmates of pronated foot subject, referred to physiotherapy for low back pain. 50 subjects fulfilling inclusion criteria and willing to participate in the study were enrolled for the study. No subjects dropped out of the study after enrollment. Data from all 50 subjects was analyzed.

A cross sectional study design was used in the present study to determine the relationship between severity of foot pronation and disability associated with low back pain. Correlation studies are stepping stone to the more powerful experimental method, and with use of complex co- relational designs, allow for very limited casual interference

Disability associated with low back pain was evaluated in the present study using Oswestry Disability Index questionnaire (ODI). The ODI was developed by John O'Brien in 1976 to assess the disability of the patients with low back pain [13] and was first published in the journal physiotherapy in 1980 by Fairbank in UK. The Oswestry was revised in 2000 and published in the journal spine. In ODI questionnaire, patients are required to fill the 10 questions and each question is subdivided into 5 questions (score of 0, 1, 2, 3, 4, 5)

As observed in the present study, it may be argued that ODI questionnaire would be tool that researchers and disability evaluators use to measure the functional disability and its self administered leads to know about their own self disability. And also motivates them's self esteem in improvement direction to improve the disability. The ODI has been directly compared with RDQ in several studies. However, the ODI tends to score higher than RDQ; thus it is likely that the ODI is better at detecting change in more seriously disabled patients, whereas RDQ may well have an advantage in patients with minor disability [14].

In the present study the mean value for ODI for 1st degree, 2nd degree and 3rd degree pronated foot was 24.72, 32.57 and 27.33 respectively. According to Fairbank J *et al*. cut off of 21 – 40 percentage indicates moderate disability among chronic mechanical low back pain and is used to measure a patient's functional disability [15].

ODI is the gold standard for measuring the degree of disability and estimating quality of life in a people with low back pain and it is a valid & vigorous outcome measurement. Scoring is as simple as adding the number value on the left side of the form, the total number is the disability index for that patient.

ODI allows clinicians to know about the quality of life and functional status in normal populations and multiple other conditions including spondylolisthesis, primary back pain, psychiatric patients, idiopathic scoliosis, neurogenic claudication, chronic back pain, sciatica, neck pain and other conditions with severe and minor symptoms. It is assumed that disability can be viewed as a continuum from non disabled to severely disabled. Thus, the change has been expressed as a percent of the original score, arguing that it is better to shift a patient from 20 % to 10% than to go from 60% to 50%. Another Approach in reporting is to aggregate the index into several categories, originally 5 levels of the score were suggested (0%- 20%, 21%-40%, 41%- 60%, 61%-80%, 81%- 100%) [14] and also allows clinicians to direct care towards the preventing measures to improve the quality of life and functional status by promoting recovery.

In the present study pronated foot was evaluated by Navicular Drop Test (NDT). The NDT was first described by Brody DM (1982) who used it in evaluating the amount of pronation in a runner's foot. The subjects are placed in a sitting position with their feet flat on a firm surface and with the knees flexed to 900 and ankle joints in neutral position. The most prominent point of the navicular tubercle was marked. Then placed an index card on the inner aspect of the hind foot, with the card placed from the floor in a vertical position passing the navicular bone. The most prominent point of navicular tubercle was marked on the card in sitting position followed by the standing position. According to Brody the differences between both level cut off 10mm or more than 10mm indicates the foot was pronated. Mueller *et al*. reported good intrarater reliability [16].

Feiss Line is the line joining from 1st metatarsal joint to medial malleoli through navicular tubercle. Purpose of this line to test the position of navicular tubercle. It suggests that if the tubercle is above Feiss Line (FL) indicates high arch (Pes Planus), or if the tubercle is below FL indicates pronated foot (Pes Planus). Feiss line 1st described in 1909 by Feiss HO which classified foot type in subtalar joint neutral and subtalar joint resting positions. No studies were found which reported cut-off values or mean values for FL tests. Therefore, no external comparisons with the normal range of 0.9 to -0.1 cm can be made [17]. The degree of foot was estimated by Feiss line test in which subjects should be standing with weight distributed equally and mark the navicular tubercle.1st degree indicates navicular tuberosity falls 1/3rd of distance to floor, 2nd degree indicates navicular tuberosity falls 2/3rd of distance to floor & 3rd degree indicates navicular tuberosity touching the floor.

In the present study, 19 subjects reported anterior shin pain on prolong standing associated with work. It was observed that these subjects appeared to have less heel contact while walking. It was also observed that subjects with 2nd degree foot pronation had more severe disability (32.57 8.8 for right

foot), (31.64 8.52 for left foot)when compared to those with 1st degree foot pronation (24.42 10.31 for right foot), (24.70 10.57 for left foot).

In the present study gender was not associated with severity of disability (p value 0.09). Findings also indicated that the disability mean values was higher as the degree of the pronation increased up to 2nd degree of pronated foot. The mean value of disability for 1st degree and 2nd degree foot pronation for right & left foot was (24.42 10.31), (24.70 10.57) & (32.57 8.8), (31.64 8.52) respectively. It appeared that there is a correlation between the degree of the pronated foot and the severity of disability associated with the low back pain. The mean disability for 3rd degree foot pronation for right & left foot was (27.33 11.71), (25.00 15.55) respectively. However statistical analysis the association between degree of foot pronation & severity of disability was not statistically significant (p= 0.058 for right foot, p= 0.081 for left foot). This may be because of less number of sample (3 subjects) with 3rd degree foot pronation.

Limitations of the study: In the present study the age ranged from 18 – 50years. Several studies have reported that foot pronation found more in children and was decreased by as age increases, less found in adults and elder. Therefore the findings of the present study may not generalised to all age groups) [18, 19].

In the present study, sample size was 50. Out of 50 sample 33 were of 1st degree, 14 were of 2nd degree and 3 were of 3rd degree of pronated foot; for 3rd degree sample size was very small. This skewed sample size may have influenced the findings of the present study.

Future studies may be conducted on on larger samples with even distribution of degrees of pronated foot.

3.1 Tables & Figures

Table 1: Gender distribution

Gender	Male	Female
Total (50)	17(34%)	33(66%)

Table 2: Distribution of age

Age	N	20- 30	30-40	40-50	Mean	Std Deviation
	50	56%	18%	26%	32.60	10.018

Table 3: Distribution of degree of foot pronation

Foot pronation	N	1st degree	2nd degree	3rd degree
Right foot	50	33	14	3
Left foot	50	31	17	2

Table 4: Severity of disability

Severity of disability	N	Mild	Moderate	Severe
	50	17 (34 %)	31 (62%)	2 (4%)

Table 5: Association between gender and severity of disability

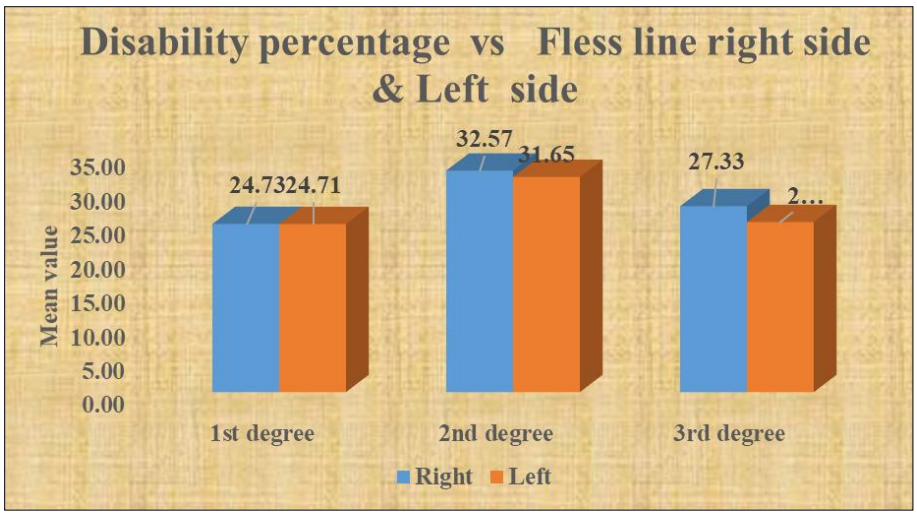
Odi	Female	Male	Total	X^2	P value
Mild	13 (39.4 %)	4 (23.5%)	17 (34.0%)	4.743	0.093
Moderate	20 (60.6%)	11 (64.7%)	31 (62%)		
Severe	0 (0%)	2 (11.8%)	2 (4%)		

Table 6: Comparison of mean between degrees of pronated foot and severity of disability for right side

Degree of foot pronation (Right)	N	Mean	Std Deviation	Minimum	Maximum	F value	P value
1st degree	33	24.42	10.31	8.00	57.99	3.0311	0.058
2nd degree	14	32.57	8.8	20.00	50.00		
3rd degree	3	27.33	11.71	14.00	36.00		

Table 7: Comparison of mean between degrees of pronated foot and severity of disability for left side

Degree of foot pronation (Left)	N	Mean	Std Deviation	Minimum	Maximum	F value	P value
1st degree	31	24.70	10.57	8.00	57.99	2.654	0.081
2nd degree	17	31.64	8.52	20.00	50.00		
3rd degree	2	25.00	15.55	14.00	36.00		



Graph 6.5: Comparison of mean between degrees of pronated foot and severity of disability for foot.

4. Conclusion

There was no association between the degree of foot pronation and severity of disability. Severity of disability was found higher in 2nd degree of foot pronation subjects for both right and left foot (32.57±8.8, 31.64± 8.52) respectively. There was no association found between the Age and severity

of the disability (p value 0.09). There was no association found between the severity of disability and degree of foot for right and left side p value (0.058, 0.08) respectively.

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