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Navicular Drop Gender Differences Among College Students: A Cross Sectional Study

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ABSTRACT

Knee injury associated with abnormal foot biomechanics can lead to foot, knee injury because knee and foot were working simultaneously so it was clinically important to know about abnormal foot biomechanics in the prevention and treatment of injury.[1] During standing position or full weight bearing, all the joint of lower limb working as interactive segments means with foot pronation, internal rotation of the tibia occurring simultaneously. Aim of present study was to investigate the influence of foot length, age, gender, and BMI on the navicular drop in weight bearing relaxed erect position. 20 college going students were recruited from hisar City College; Present study was cross sectional study; 18-25 years normal young adults of both sex and they were cooperative and obey command. Demographic details of student were taken. 30 students (15 M; 15 F) with mean age 20.97±1.85 years participated in the study. The data was not normal so we have done non parametric correlation (spearman's) of navicular drop with weight, height, BMI, age, gender and foot length was examined. The correlation of Right ND with left ND and age was significant, but no significant correlation was found between RND and height, weight, foot length and BMI. The correlation of Left ND with height, weight, foot length, age and BMI of individuals was not found significant. The present study revealed the incidence of navicular drop more than normal value (6mm-9mm) in college aged students.

KEYWORDS: Gender; Adults; Navicular drop

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INTRODUCTION

Knee injury associated with abnormal foot biomechanics can lead to foot, knee injury because knee and foot were working simultaneously so it was clinically important to know about abnormal foot biomechanics in the prevention and treatment of injury.[1-3] During standing position or full weight bearing, all the joint of lower limb working as interactive segments means with foot pronation, internal rotation of the tibia occurring simultaneously.[2]

Normally navicular bone in humans is situated medially, and articulates talus proximally, cuneiform distally and cuboid laterally and only one muscle (tibialis posterior) attached with this bone. 2%-14% general population may have an accessory navicular bone.[4-5]

Foot pronation was measured by Navicular drop clinically which is the change in height of the navicular bone when the subject's foot transferred from neutral position of foot to weight bearing in erect position[3]. Normal navicular drop was calculated as 6-8 mm and it may expresses as excessive or abnormal if it was greater than 10-12 mm.[6-7]

Abnormality of navicular drop has been associated with anterior cruciate ligament patients, medial tibial stress syndrome and patellofemoral pain syndrome. Other researcher also revealed excessive navicular drop with plantar intrinsic muscle fatigue. Position of measurement of navicular drop also affected foot biomechanics; therefore it may helpful for patients with overuse symptoms of the lower extremity.[8-13]

Navicular drop occurs due to structural abnormality and atrophy of the muscles that supports the arch. Navicular drop characterized by visible swelled reddened bony prominence medially and severe pain in mid of the foot. Navicular drop may be influenced length of foot, age, gender, and Body Mass Index (BMI). [14-16]

So our aim of present study was to investigate the influence of foot length, age, gender, and BMI on the navicular drop in weight bearing relaxed erect position.

METHODOLOGY

Study Participants

20-collage going students were recruited from hisar City College. Present study was cross sectional study which included 18-25 years normal young adults of both sex and they were cooperative and obey command. Subjects were excluded if they had Structural abnormality of feet, any neurological lower limb and spine problem, any lower limb pathological conditions like

osteoarthritis of knee, past history of lower limb injury, Congenital abnormalities of foot, pregnant females, abnormality in limb length and amputation of Lower limb amputation. Demographic details (age, height, weight, BMI) of each subjects was taken. Then Subjects were selected for study by giving consent to study and they have explained whole procedure of study.

Navicular Drop Test

It was a clinical instrument to measure the navicular height in sagittal plane first given by Brody 1982 which described pronation of foot. Reliability and validity of test was already calculated and it was valid test for calculation. Measurement in sitting and standing position and the difference between two test position measurements is called navicular drop. Instrument required for test measurement was a pen, card, measure tape and markers and all the measurement were recorded on data collection form.[13, 16-17]

Measurement procedure

Subjects were sitting in a comfortable position with flat feet on normal surface. The subject was asked to flex knee to 90^0 and placed ankle joints in neutral position and we palpated most prominence of the navicular bone tubercle in neutral sitting position and marked with a pen on card that besides the foot. Then the same procedure was applied in standing weight bearing position without change in distribution of equal weight on feet again same reading was taken in the standing position and relative position of prominence of navicular tubercle bone was marked on the card. At last, the difference between the height of prominence of navicular tubercle bone in relaxed sitting position and weight bearing erect position was noted with a measuring tape revealing the navicular drop. Displacement of more than 10 mm in erect position weight bearing is considered as significant overpronation of the foot. Repeat the procedure with other leg and compared the difference.

Data analysis

Data analysis was done with help of SPSS 16.0 version. The Kolmogorov's Smirnov test was used for assessing normality of data. Mean and IQR were assessed for the demographic characteristics and ND since the data was not normally distributed. Comparison of male and female ND was done with Mann-Whitney U test because data was not normal. Correlation of navicular drop with age, height, weight, foot length and BMI was calculated with spearman's test. A p-value ≤ 0.05 was considered for significance of study.

RESULTS

30 students (15 M; 15 F) with mean age 20.97±1.85 years (18-25 years) participated in the study. Descriptive statistics of demographic variables were shown in Table 1.

Table 1: Descriptive statistics

	Range	Mean	Std. Deviation
Age	18-25	20.97	1.847
Weight(kg)	42-80	60.87	12.235
Height(cm)	152-185	172.70	8.133
BMI	15-29	21.39	3.375
Foot length(cm)	14-27	22.63	3.538
Right ND(mm)	5-14	9.21	2.094
Left ND(mm)	5-16	9.27	2.651

Table 2: Outcome variables

Sex	Variable	Age (years)	Weight(kg)	Height(cm)	BMI	Foot length(cm)	Right ND(mm)	Left ND(mm)
Male	**Mean**	21.00±2.04	65.40±9.69	176.60±5.85	21.75±2.37	23.47±2.95	9.13±1.73	10.00±2.24
	Median	21.00	66.00	176.00	22.94	25.00	9.00	9.00
	Range	7	27	16	6	7	6	7
Female	**Mean**	20.93±1.71	56.33±13.12	168.80±8.38	21.03±4.20	21.80±3.97	9.29±2.49	8.53±2.90
	Median	22.00	56.00	170.00	21.09	22.00	10.00	8.00
	Range	5	38	30	13	13	9	11

Study variables (height, weight, BMI, foot length, Right ND, Left ND) among different sex were calculated as shown in table 2. The Kolmogorov's Smirnov test was used for assessing normality of data. Mean and IQR were assessed for the demographic characteristics and ND since the data was not normally distributed.

Comparison of male and female ND was done with Mann Whitney U test because data was not normal. The result was not statistically significant on right side but significant on left side as shown in table 3.

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Table 3: Comparison of right leg with left leg navicular drop

	Right ND	Left ND
Z statstics	-.291	-1.97
P-value	.771	.049

The data was not normal so we have done non parametric correlation (spearman's) of navicular drop with weight, height, BMI, age, gender and foot length was examined. The correlation of Right ND with left ND and age was significant, but no significant correlation was found between RND and height, weight, foot length and BMI. The correlation of Left ND with height, weight, foot length, age and BMI of individuals was not found significant as shown in table 4.

Table 4: correlation between different outcome variables

Variable	Spearman'sro	Weight	Height	BMI	Footlength	Right ND	Left ND	Age	Gender
Foot length	Correlation	.662**	.585**	.601**	1.000	.014	.125	-.198	-.196
	Sig.	.000	.001	.000	.	.944	.510	.294	.299
Right ND	Correlation	-.199	-.265	-.120	.014	1.000	.478**	-.392*	.055
	Sig.	.302	.165	.534	.944	.	.009	.035	.777
Left ND	Correlation	-.002	.176	.053	.125	.478**	1.000	-.248	-.366*
	Sig.	.990	.353	.782	.510	.009	.	.187	.047

DISCUSSION

Our study findings suggest that hypothesis of study was not accepted as output of study outcome variables was found insignificant. Present study results were in agreement with Ashok Aenumulapalli et al., 2017 study results that ND difference between gender were statistically insignificant.[18]

In addition, some other researchers have used different types of measurement methods to calculate Navicular Difference and they found navicular difference of 15 mm[13], 13 mm[17] and 10 mm[19]. Ashok Aenumulapalli et al., 2017 found the median values with inter quartile range for navicular drop for male students was [right leg 6 mm (4-8); left leg 6 mm (4-9)] and for female students was [right leg 6mm (4-10) ; left leg 7mm (3-8)].[18]

Fukano M et al have also claimed that navicular difference was affected by various different variables like height, weight, foot length, age, gender and BMI of subjects.[20-23] But this study did not found any correlation with weight, height, foot length and BMI but significant correlation with gender (left ND) and age (right ND).

Based on research evidences we stated that excessive navicular difference results in abnormal overpronation of foot which was associated with abnormal biomechanics of lower limb at pelvis, hip and knee joint. So we planned some rehabilitation protocol to correct out faulty biomechanics at subtalar joint.

CONCLUSION

The present study revealed that the prevalence of navicular drop was high in age group of 18 to 25 years showed gender differences for navicular drop and influence of demographic characteristic (age, height, weight and BMI) on navicular drop showed no significant findings.

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