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Normal plantar weight distribution pattern and its variations with change of functional position and its comparison with patients of knee osteoarthritis

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ABSTRACT: Early osteoarthritic changes at the knee result in altered plantar weight distribution pattern during stand, minisquat, squat and one leg stand positions. To study and quantify these plantar weight distribution variations with changes in static functional position, a cross-sectional study was conducted. A total of 202 subjects, 92 healthy people (control group) and 110 with early knee osteoarthritis, participated in the study. The plantar weight distribution and its variations with change in functional position were assessed using footplate, while the functional disability status was assessed using WOMAC (Western Ontario and McMaster Universities Arthritis Index) & CIFKAS (Composite Indian Functional Knee Assessment Scale). The participants were allocated into two groups i.e. group-1 and group-2. The participants in group-1 had no knee complaint and those in group-2 had diagnosis of early knee osteoarthritis. Independent t test was used for the statistical analysis. Significant difference between the groups was observed for the percentage plantar weight (load) distribution during stand (p value <.001 to .005), minisquat (p value <.001 to .022), left leg stand (p value <.001 to .003) and right leg stand (p value <.001 to .008) and Pain &functional disability status on WOMAC & CIFKAS (p value <.001). It was concluded that the knowledge of this altered plantar weight distribution and its variation with change in functional position can serve as a guiding tool for formulating an effective context-specific intervention strategy for managing pain and functional disability in knee osteoarthritis.

KEY WORDS: ***Knee osteoarthritis; Footplate; Functional position; Functional Disability; Plantar weight distribution***

INTRODUCTION

The knee transmits load to the foot, participates in motion, aids in conservation of momentum and provides a force couple for activities involving the leg. With the onset of osteoarthritic changes at the knee, plantar weight (load) distribution pattern over different regions of the foot gets altered[1-5]. This has been investigated by various researchers using different techniques such as pedobarograph, foot plate etc.[5-8]. A number of authors and researchers have estimated the mean percentage plantar weight distribution of body weight in the standing position as 57 percent on the heel and 43 percent on the forefoot and arch[6]. In a recent study, it has been estimated as 60 percent of body weight on the rear

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foot, 8 percent on the mid foot, 28 percent on the forefoot and 4 percent on the toes, but most of these studies have been done for the standing position alone[7,9].

Transitions between standing, squatting and one leg stand are fundamental for day to day functional activities and difficulties in their performance can be identified as a major problem for people with early knee osteoarthritis (OA)[10]. Till date, no direct comparison of altered plantar weight distribution in different functional positions and its impact on pain and functional disability status has been made between healthy persons and those with knee osteoarthritis. Identification of an association between plantar weight distribution and impairments related to progression of knee OA (i.e. pain and limited functional performance abilities) is necessary in order to develop effective interventions that minimize symptoms and maximize function. Based on these considerations plantar weight distribution pattern (in functional positions) and pain and functional disability status were chosen as the functional measure in the current investigation.

There were three purposes of this study. The first purpose was to determine static plantar weight distribution pattern and its variation with change in functional position from stand to minisquat to squat to one leg stand in normal people. The second purpose was to compare static plantar weight distribution patterns of normal people with those of a population with early knee osteoarthritis in different functional position. The third purpose was to compare the impact of altered plantar weight distribution pattern on functional disability status of people with early knee osteoarthritis. The hypotheses were *patients with OA would demonstrate altered plantar weight distribution during transitions between stand to squat and one leg stand from that in healthy persons* and *altered plantar weight distribution results in functional disability*.

METHODOLOGY

Study sample

This is a cross-sectional observational study. Participants (N = 202) including the healthy group (group 1, n=92) and knee OA (group 2, n= 110) within the age range of 40 to 60 years were recruited from outdoor patient departments of physical medicine and rehabilitation, and orthopedics and from camps organized in various geographical locations of the country. Mean age in the healthy group (group 1) and the knee OA (group 2) was 48.2±7.2 and 49.5±6.6 respectively. The participants were filtered one by one by the experienced physical medicine and rehabilitation, and orthopedic specialist, based on clinical presentation and radiological findings (*Kellgren and Lawrence grade 1 and 2*)[11]. The participants who met the inclusion criteria and gave their consent were included in the study (*Inverse Sampling method*)[12]. Volunteers who had uncontrolled hypertension, uncontrolled diabetes, body mass index greater than 30kg/m2, limitation of knee Range of Motion (ROM), psychiatric, neurological or cardiac illness or other lower-extremity orthopedic problems, were excluded from the study. The Human Institutional Ethical Research Committee of the institute approved the study and written informed consent was obtained from all participants at the time of enrollment.

Method

Plantar weight distribution measurer

Measurement of plantar weight distribution pattern in different functional positions was achieved with ground reaction force (GRF) data obtained from multidisciplinary weight distribution analysis system (foot plate) located under each foot of the participant during a timed testing[10]. The instrument comprised of three units, namely, the load cells (transducers), the interface and digital display unit. There were sixteen load cells (eight for each foot) with separate digital display for each cell. The load cells were used as the transducers and incorporated as its integrated portion, the arrangement for initial balancing (i.e. obtaining 'zero' output at 'zero' load on the load cells). The force platform offsets were reset (i.e., zeroed) prior to each testing session. The digital display unit was graduated directly in terms of kilograms and divided into two sections i.e. left and right for each foot separately. The foot was divided into seven compartments. The first compartment *(load cell*) corresponds to the great toe and 2nd toe region, second to the lateral three toes, third to anterior half of medial arch, fourth to anterior half of lateral border, fifth to posterior half of medial arch, sixth compartment to posterior half of lateral border and seventh (*seventh and eighth loads cells*) to the heel region[10]. Averages of three reading were taken for each of the seven compartments. To describe plantar weight distribution pattern in both the healthy people group and the early knee OA group, average percentage plantar load for each compartment of the foot was calculated. All the participants were made to acquire different functional test positions (*i.e. stand, minisquat, squat, left leg stand and right leg stand*)[13]. Initially each subject was allowed to relax for 5 minutes in the research room, then he/she was made to acquire anatomical standing position over the foot plate so that each compartment of the foot corresponded to respective load cells of foot plate. From the anatomical stand position, the subjects were made to acquire minisquat position with knee flexed at 70 degrees and back straight. After minisquat position, the subjects were asked to acquire squat position over the foot plate. Similarly they were asked to acquire one leg stand position without support (*i. e. left leg stand and right leg stand position*) with the trunk in neutral alignment. For each test position, the average of three readings at 5 second intervals was recorded. The percentage plantar weight distribution was calculated for each compartment with respect to individual's body weight *[% C1 = (C1/ Body weight) X 100]* [9,12,13].

Functional disability status measurer

Two measurers for pain and functional disability status were used in this study: *self-reported questionnaire WOMAC* and *therapist administered CIFKAS* (Composite Indian Functional Knee Assessment Scale). The scoring criteria for WOMAC are ranged from 0 to 4, with 0 representing no impairment/pain/functional disability and 4 being the worst possible (maximal disability). The scoring criteria for CIFKAS are ranged from 0 to 5, with 0 representing no functional disability and 5 being the worst possible (maximal functional disability).

Statistical Analysis

A sample size estimate for determining differences in plantar weight distribution for each compartment of both the feet during bilateral limb loading (i.e. stand, minisquat and squat) and each foot during unilateral limb loading (i.e. left leg stand and right leg stand) between the control group and the early knee OA group was calculated on the basis of means and SD values available for the first 20 participants in the early knee OA and control (healthy population) groups. We determined the sample size for the early knee OA group to be 50 based on the known number of 17 participants in the control (healthy population) group, a power level of .90, an alpha level of .05, and a 2-tailed Independent t test of difference between the group means. Comparison of the early knee OA group and the control (healthy population) group for percentage plantar weight distribution, pain and functional disability status was done using independent t tests. Group values are reported as mean±SD and t value. The level of significance for the t-test comparison between groups was set at 95% confidence interval ($p < .05$).

RESULT

Normal percentage plantar weight distribution

Normal percentage plantar weight distribution for each of the seven compartments of the foot for its variation with change in static functional position was calculated. The percentage weight (load) distribution in standing position over the great and 2nd toes, the lateral three toes, anterior half of the medial arch, anterior half of the lateral border, posterior half of the medial arch, posterior half of the lateral border, and the heel region of the left foot were 4.8%, 4.1%, 2.1%, 7.4%, 1.6%, 5.8%, and 24.0% and for right foot 4.9%, 4.1%, 2.2%, 7.5%, 1.6%, 5.7%, and 24.2% respectively. With change of position from stand to minisquat, the load shifted anteriorly and the percentage weight (load) distribution for the left foot was 8.2%, 5.9%, 3.4%, 8.7%, 1.8%, 4.6%, and 17.1% and for the right foot was 8.2%, 6.0%, 3.5%, 8.8%, 1.8%, 4.8%, and 17.3% respectively. During shift from minisquat to squat, the weight (load) shifted posteriorly with percentage weight (load) distribution for the left foot 4.0%, 3.4%, 1.6%, 7.6%, 2.5%, 5.1%, and 25.0% and for the right foot 4.2%, 3.4%, 1.6%, 8.1%, 2.6%, 5.0% and 25.9% respectively.

In the left leg stand position, the percentage weight (load) distribution was 19.1%, 11.1%, 5.8%, 18.6%, 3.6%, 12.6 %, and 29.3%, whereas in the right leg stand, it was 19.3%, 11.1%, 6.2%, 18.3%, 3.5%, 12.3%, and 29.2% respectively. There was minimal difference in percentage weight (load) distribution between left leg stand and right leg stand positions.

Comparison of percentage plantar weight distribution among the healthy group (group 1) and the knee OA group (group 2)

The percentage weight (load) distribution of participants from the normal population having no knee complaints was compared with those having knee osteoarthritis. Student t test was used to compare percentage plantar weight distribution and p value (95% confidence interval) was calculated for each of the seven compartments (**Table 1**). In the standing position, there was significant difference in percentage weight (load) distribution over the great and 2nd toes, the lateral toes, posterior half of the medial arch, posterior half of the lateral border, and the heel region of both the left and right foot (p value ranging from <.001 to .005). In minisquat position there was significant difference in percentage load distribution over the great toe and 2nd toe, lateral anterior half of the medial arch, anterior half of the lateral border, posterior half of the medial arch, and the heel region (p value ranging from <.001 to .022). In left leg standing position, the p value was significant for the great toe and 2nd toe, the lateral three toes, posterior half of the medial arch, and the heel region (p value ranging from<.001 to .003). In the right leg stand position, there was significant difference for the lateral three toes, anterior half of the lateral border, and posterior half of the medial arch (p value ranging from <.001 to .008). The p value calculated was found to be significant (p <.05) at 95% confidence interval, for most of the compartments which indicates the difference between the groups for the percentage plantar weight distribution.

Table 1: Percentage Plantar Weight Distribution pattern Group 1 (Healthy population) and Group 2 (Knee OA) group in Right Foot

Test Position	Comp	Right Foot					
		Group 1*		Group 2**		t	p value
		Mean ± SD	95% CI	Mean ± SD	95% CI		
Stand	C1	4.9 ± 1.5	4.6 to 5.2	4.7 ± 2.3	4.3 to 5.2	0.6	0.545
	C2	4.1 ± 1.4	3.8 to 4.4	3.7 ± 1.9	3.4 to 4.1	1.6	0.106
	C3	2.2 ± 1.1	1.9 to 2.4	3.9 ± 1.9	3.6 to 4.3	-7.7	<.001
	C4	7.5 ± 2.2	7.0 to 7.9	7.8 ± 3.3	7.1 to 8.4	-0.7	0.484
	C5	1.6 ± 1.3	1.3 to 1.9	3.7 ± 3.6	3.0 to 4.4	-5.3	<.001
	C6	5.7 ± 2.6	5.2 to 6.3	7.3 ± 4.7	6.4 to 8.2	-2.8	0.005
	C7	24.2 ± 4.2	23.3 to 25.0	21.5 ± 7.9	20.0 to 23.0	2.9	0.004
Minisquat	C1	8.2 ± 2.1	7.8 to 8.6	10.3 ± 6.0	9.2 to 11.5	-3.2	0.002
	C2	6.0 ± 1.9	5.6 to 6.4	6.2 ± 3.4	5.5 to 6.8	-0.4	0.703
	C3	3.5 ± 1.6	3.2 to 3.8	5.8 ± 3.0	5.2 to 6.4	-6.6	<.001
	C4	8.8 ± 2.4	8.3 to 9.3	8.8 ± 4.0	8.1 to 9.6	0.0	0.994
	C5	1.8 ± 1.3	1.5 to 2.0	3.1 ± 3.0	2.5 to 3.6	-3.8	<.001
	C6	4.8 ± 1.9	4.5 to 5.2	5.1 ± 3.6	4.4 to 5.8	-0.6	0.536
	C7	17.3 ± 4.5	16.3 to 18.2	11.3 ± 6.4	10.0 to 12.5	7.5	<.001
Squat	C1	4.2 ± 2.5	3.7 to 4.7	4.2 ± 3.3	3.5 to 4.8	0.2	0.869
	C2	3.4 ± 1.6	3.1 to 3.7	3.5 ± 2.5	3.0 to 4.0	-0.3	0.727
	C3	1.5 ± 1.2	1.3 to 1.8	1.6 ± 1.5	1.3 to 1.9	-0.2	0.852
	C4	8.1 ± 3.3	7.4 to 8.8	8.3 ± 3.5	7.6 to 8.9	-0.3	0.736
	C5	2.6 ± 2.0	2.2 to 3.0	2.6 ± 2.1	2.2 to 3.0	0.1	0.915
	C6	5.0 ± 2.7	4.5 to 5.6	5.1 ± 3.0	4.5 to 5.6	-0.1	0.942
	C7	25.9 ± 6.5	24.5 to 27.2	25.9 ± 6.9	24.5 to 27.2	0.0	0.994
One Leg Stand	C1	19.3 ± 4.3	18.4 to 20.2	9.1 ± 4.9	8.2 to 10.1	15.5	<.001
	C2	11.1 ± 3.2	10.4 to 11.8	7.2 ± 4.0	6.5 to 8.0	7.6	<.001
	C3	6.2 ± 3.3	5.6 to 6.9	7.5 ± 3.5	6.8 to 8.2	-2.7	0.008
	C4	18.3 ± 5.5	17.1 to 19.4	14.5 ± 5.6	13.5 to 15.6	4.8	<.001
	C5	3.5 ± 2.3	3.0 to 3.9	7.2 ± 6.9	5.9 to 8.5	-5.0	<.001
	C6	12.3 ± 4.1	11.5 to 13.2	14.0 ± 9.0	12.3 to 15.7	-1.6	0.104
	C7	29.2 ± 5.6	28.1 to 30.4	40.5 ± 13.2	38.0 to 43.0	-7.6	<.001

** Group 1 = Healthy (normal) people group; **Group 2 = Early knee osteoarthritic group*
Compartments (C): C 1 = Greater and 2nd toes; C 2 = Lateral three Toes; C 3 = Proximal (anterior) half of medial arch; C 4 = Proximal (Anterior) half of lateral border; C 5 = Distal (Posterior) half of medial arch; C 6 = Distal (Posterior) half of lateral border; C 7 = Heel region

Table 2: Percentage Plantar Weight Distribution pattern Group 1 (Healthy population) and Group 2 (Knee OA) group in Left Foot

Test Position	Comp	Left Foot							
		Group 1*		Group 2**				t	p value
		Mean ± SD	95% CI	Mean ± SD	95% CI				
Stand	C1	4.8 ± 1.4	4.5 to 5.1	4.6 ± 2.4	4.1 to 5.0			0.9	0.377
	C2	4.1 ± 1.2	3.8 to 4.3	3.3 ± 1.9	3.0 to 3.7			3.3	0.001
	C3	2.1 ± 1.2	1.9 to 2.4	3.5 ± 2.3	3.1 to 3.9			-5.0	<.001
	C4	7.4 ± 2.2	7.0 to 7.9	6.4 ± 2.3	5.9 to 6.8			3.3	0.001
	C5	1.6 ± 1.4	1.3 to 1.9	4.6 ± 3.5	3.9 to 5.2			-7.6	<.001
	C6	5.8 ± 2.5	5.3 to 6.3	6.1 ± 3.7	5.4 to 6.8			-0.8	0.438
	C7	24.0 ± 4.3	23.1 to 24.8	18.8 ± 7.8	17.4 to 20.3			5.6	<.001
Minisquat	C1	8.2 ± 2.0	7.7 to 8.6	10.0 ± 4.3	9.2 to 10.8			-3.7	<.001
	C2	5.9 ± 2.0	5.5 to 6.3	5.4 ± 3.1	4.8 to 6.0			1.4	0.158
	C3	3.4 ± 1.4	3.1 to 3.7	5.1 ± 3.3	4.5 to 5.8			-4.7	<.001
	C4	8.7 ± 2.1	8.2 to 9.1	7.7 ± 3.5	7.0 to 8.4			2.3	0.022
	C5	1.8 ± 1.3	1.5 to 2.0	4.6 ± 3.4	4.0 to 5.3			-7.6	<.001
	C6	4.6 ± 1.9	4.2 to 5.0	4.8 ± 3.2	4.2 to 5.4			-0.6	0.540
	C7	17.1 ± 3.7	16.3 to 17.9	11.9 ± 8.2	10.3 to 13.4			5.6	<.001
Squat	C1	4.0 ± 2.3	3.6 to 4.5	3.9 ± 2.5	3.4 to 4.3			0.5	0.613
	C2	3.4 ± 2.1	3.0 to 3.9	3.4 ± 2.4	2.9 to 3.9			0.1	0.904
	C3	1.6 ± 1.3	1.3 to 1.9	1.6 ± 1.5	1.3 to 1.9			0.0	0.997
	C4	7.6 ± 2.6	7.0 to 8.1	7.6 ± 2.8	7.1 to 8.1			-0.1	0.929
	C5	2.5 ± 1.9	2.1 to 2.9	2.6 ± 2.1	2.1 to 3.0			-0.2	0.877
	C6	5.1 ± 2.7	4.5 to 5.6	5.0 ± 2.9	4.4 to 5.5			0.2	0.835
	C7	25.0 ± 6.5	23.7 to 26.3	25.0 ± 7.4	23.5 to 26.4			0.0	0.985
One Leg Stand	C1	19.1 ± 4.0	18.3 to 19.9	9.7 ± 4.9	8.8 to 10.7			14.7	<.001
	C2	11.1 ± 3.0	10.5 to 11.7	7.0 ± 3.9	6.3 to 7.8			8.1	<.001
	C3	5.8 ± 2.9	5.2 to 6.4	7.6 ± 5.0	6.6 to 8.5			-3.0	0.003
	C4	18.6 ± 5.1	17.6 to 19.7	13.8 ± 5.2	12.8 to 14.7			6.7	<.001
	C5	3.6 ± 2.2	3.1 to 4.0	9.6 ± 7.3	8.2 to 11.0			-7.6	<.001
	C6	12.6 ± 3.7	11.8 to 13.3	12.8 ± 7.3	11.4 to 14.2			-0.2	0.805
	C7	29.3 ± 4.6	28.4 to 30.3	39.5 ± 14.5	36.8 to 42.3			-6.5	<.001

**Group 1 = Healthy (normal) people group; **Group 2 = Early knee osteoarthritic group*
Compartments (C): C 1 = Greater and 2nd toes; C 2 = Lateral three Toes; C 3 = Proximal (anterior) half of medial arch; C 4 = Proximal (Anterior) half of lateral border; C 5 = Distal (Posterior) half of medial arch; C 6 = Distal (posterior) half of lateral border; C 7 = Heel region

Comparison of pain and functional disability score among healthy group (group 1) and knee OA (group 2)

The mean pain and functional disability score of participants from the healthy (normal) population having no knee complaints was compared with those having knee osteoarthritis. Student t test was used to compare pain and functional status on WOMAC and CIFKAS and p value (95% confidence interval) was calculated. The mean scores for pain and functional disability status were 4.2±3, 120.5±72.6; 18.4±10.3, 208.6±107 and 0.5±0.1, 14.4±5.0; 2.1±0.8, 23.7±12.7, for the knee osteoarthritic and the healthy population group on WOMAC and CIFKAS respectively. The p value calculated was found to be significant (p <.001) at 95% CI for pain and functional disability status on WOMAC and CIFKAS, which indicates that there is a significant difference among the groups. (**Table 2**)

The results obtained indicate that with the onset of osteoarthritic changes at the knee the percentage plantar weight distribution patterns gets altered during functional positions resulting in pain and functional disability. Also, pain and functional disability measures (WOMAC and CIFKAS) can be used as clinical markers of percentage plantar weight (load) distribution.

Table 3: Pain and functional status on WOMAC and CIFKAS in Group 1 (healthy population) group and Group 2 (knee OA group)

Scale	Variable	Group 1 Mean±SD	Group 2 Mean±SD	t value	p Value	Mean Difference	95 % CI of Difference
WOMAC	Pain	0.5±0.1	4.2±3	12.9	<.001	4.086	3.5 to 4.7
	Total Score	2.1±0.8	18.4±11.3	14.7	<.001	17.491	15.1 to 19.8
CIFKAS	Pain	14.4±5.0	120.5±72.6	15.0	<.001	115.484	100.3 to 130.7
	Total Score	23.7±12.7	208.6±107	17.2	<.001	195.852	173.4 to 218.3

**Group 1 = Healthy (normal) people group; **Group 2 = knee osteoarthritic group*

DISCUSSION

The study of plantar weight (load) distribution in different functional positions like stand, minisquat, squat and one leg stand can be a vital biomechanical parameter to evaluate knee joint changes and its functional correlates in knee OA[4,10]. It was observed that, with the change in functional position, the center of gravity and percentage plantar weight distribution pattern over different compartments of the foot changes. In the upright (i.e. standing) position, maximum weight (load) is borne by the heel. During minisquat, the load shifts anteriorly whereas in squat it shifts back posteriorly with maximal load over the heel region. The results could be explained by the fact that during standing, the knee is in closed packed position with the femur in internal rotation along with external rotation of the tibia. The center of gravity is located posteriorly thereby increasing the flexor torque and activity of gluteus maximus.

With the change in position from stand to minisquat, tibia on femoral rotation occurs and the femoral condyle rolls posteriorly along with anterior translation. The center of gravity lowers and the load shifts anteriorly, increasing the extensor torque and activity of the flexor group in order to prevent the body from falling backwards.

During squatting, the center of gravity further lowers, shifting the load again in posterior direction increasing the flexor torque and activity of gluteus maximus in order to prevent the body from falling anteriorly[3,4].

The percentage plantar weight distribution of the normal population was also compared with patients having knee osteoarthritis. Also, the percentage mean deviation (left vs right) of normal versus knee osteoarthritic population was found to be significant. From the analysis of these results null hypothesis stating that plantar weight (load) distribution pattern does not gets altered in patients with knee osteoarthritis can be rejected.

During standing, maximal load is borne by the heel. With the movement transition from stand to squat, the tibia generates an external rotation torque against the ground during knee flexion and an internal rotation torque during knee extension from squat to stand. With the onset of osteoarthritic changes at the knee, the normal artho-kinematics get altered and tibial rotation gets altered during minisquat. In order to compensate for this altered tibial rotation and shortened adductor lever arm at knee, subjects with early knee OA acquire secondary compensatory strategies such as external rotation of the hip along with increased toe out angle. As a result, the load shifts anteriorly in the medial arch region. With a further transition from minisquat to squat as a result of decreased external rotation of tibial rotation along with muscle dysfunction, hyper-pronation of feet results along with increase in load in the antero-medial and heel region during squat.

Moreover knee osteoarthritis is bilateral most of the time and with the onset of osteoarthritis changes at the knee patients develop a similar set of compensatory strategies in both knees simultaneously. So, measurement of percentage mean deviation of plantar weight distribution (left vs right) alone may not identify this alteration. Hence the percentage plantar weight distribution for each compartment along with the percentage mean deviation should be assessed. The results so obtained can also be explained on neuro-pathophysiological basis of knee osteoarthritis[15].

The knee joint complex is richly innervated with mechanoreceptors such as joint receptors, skin receptors and muscle receptors[16,17] having different adaptive properties and threshold which when impaired (as in knee OA) leads to pain, muscle weakness, impaired joint position sense, impaired ability to generate force quickly during voluntary muscle contraction, and joint malalignment. This contributes to abnormal sensorimotor performance[4,17,18] which leads to decreased central activation resulting in muscle dysfunction[15,18,20], proprioceptive impairments[14], neuromuscular incoordination[18], abnormal joint loading[15,16]. With the onset of knee joint changes there is a shift in the center of gravity resulting in an altered plantar weight distribution pattern over different compartments of foot. As the foot is the direct contact between the body and the external environment, the central nervous system relies on sensory input from the muscles and cutaneous receptors in the lower extremity to generate effective motor patterns for human posture and locomotion. Feedback that originates from these receptors provides a constant source of information on loading, joint kinematics, plantar pressure distribution[3-5].

The abnormal loading and unloading pattern produces an undue stress over the knee resulting in a vicious cycle of pain, altered plantar weight distribution and functional disability[18]. This may further aggravate the degenerative process at the knee and surrounding structures thereby affecting neuromusculoskeletal integrity[4,18].

Strengths and Limitations

The current study has several strengths including the high consent rate, fairly good sample size and context specific functional test positions in which most daily activities/tasks are performed. The data generated from the current study could serve as a reference frame to identify and compare the load distribution at different regions of the foot in different functional positions in knee OA which could help in early identification of the disease process and guide the treatment strategy.

CONCLUSION

In knee OA percentage plantar weight (load) distribution pattern gets altered resulting in pain and functional disability. The knowledge of this altered plantar weight distribution and its variation with change in functional position may serve as a therapeutic tool for formulating an effective context-specific intervention strategy for improving pain and functional status in patients with early knee osteoarthritis.

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