

# **CHANGES IN PLANTAR PRESSURE AND GAIT VARIABLES IN INDIVIDUALS WITH KNEE OSTEOARTHRITIS**

**Abstract ID: MRCHS139**

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# Introduction

- Knee Osteoarthritis (OA) is a degenerative joint disease characterized by pain and stiffness. These symptoms arise due to abrasion of the articular surface and directly affect the functional ability of the individual

**(Dillon et al., 2006; Nelson et al., 2017; Arik et al., 2019)**

- Globally, prevalent cases of OA have increased by 113.25%, from 247.51 million in 1990 to 527.81 million in 2019

**(Symmons et al., 2000; Silman & Hochberg, 2001; Long et al., 2022)**



# Introduction

- It is the most frequent joint disease with a prevalence of 22% to 39% in India

**(Muhammad et al., 2021)**

- Pain during gait is the most common and problematic symptom in individuals with knee OA
- Due to pain, movement dysfunction, and residual deformity, there is noticeable change in the gait pattern affecting daily activities

**(Boyer et al., 2012; Teichtahl et al., 2013; Saito et al., 2013)**



# Need and Objective

- Understanding the plantar pressure distribution and gait variables in individuals with knee OA is imperative for evaluating well-being, disease progression, and intervention efficacy
- Therefore, the objective is to determine the changes in plantar pressure, and spatio-temporal gait variables in individuals with knee OA

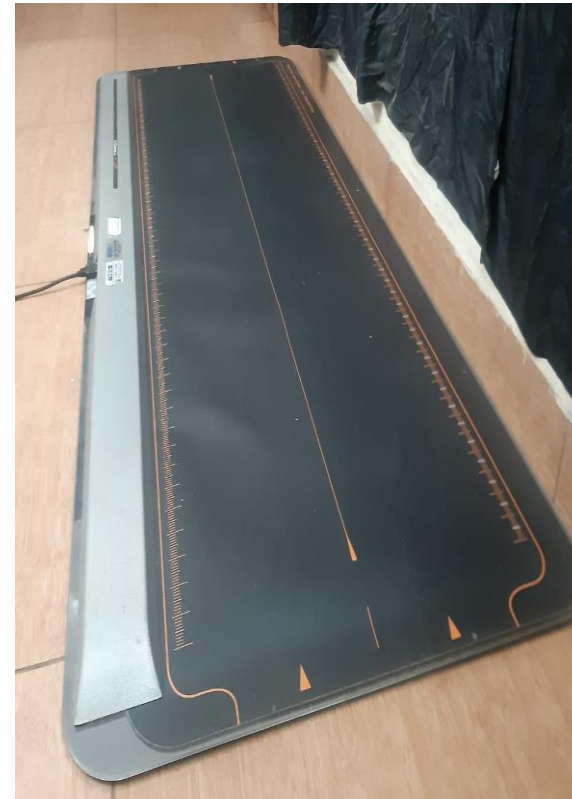
# Methods

- **Study design:** Cross-sectional study
- **Study setting:** Department of Physiotherapy and Department of Orthopaedics, Kasturba Hospital, Manipal
- **Participants:** Individuals with diagnosed knee osteoarthritis (knee OA group) and age, gender, and BMI matched individuals (control group)
- The plantar pressure assessment, and gait analysis was done using Win-Track (Medicapteurs Technology France) force platform

# Methods

- **Equipment/ materials used:**

- ❖ Win-Track Force Platform  
(Medicapteurs Technology France)
- ❖ Digital weighing scale
- ❖ Stadiometer
- ❖ Foot size measuring scale



# Methods

## Inclusion and Exclusion criteria

Inclusion criteria of knee OA group	Inclusion criteria of control group	Exclusion criteria
Patients with diagnosed primary knee osteoarthritis	Age, gender, and BMI matched healthy individuals who do not have any current lower extremity orthopaedic injuries or neurological, immunological, inflammatory, or cardiovascular diseases	Patients who had neurological deficits, inflammatory arthritis with multiple joint involvement and post traumatic arthritis
Age: Individuals aged 50 to 80 years  Gender: Both males and females	Age: Individuals aged 50 to 80 years  Gender: Both males and females	Who are not willing to participate in the study

# Results

**Table 1: Demographic & Anthropometric characteristics of knee OA and control group participants**

<b>Variables (Mean <math>\pm</math> SD)</b>	<b>Knee OA group (n= 35)</b>	<b>Control group (n= 35)</b>
Age (in years)	66.9 $\pm$ 7.1	62.78 $\pm$ 5.64
Gender (Female: Male)	23: 12	23: 12
Height (in cm)	155.8 $\pm$ 8.45	157.43 $\pm$ 6.12
Weight (in kg)	69.2 $\pm$ 14.1	65.8 $\pm$ 12.3
BMI (in kg/m <sup>2</sup> )	28.36 $\pm$ 11.3	28.28 $\pm$ 11.21



# Plantar Pressure Analysis

**Table 2: Plantar pressure analysis during 3 steps of knee OA and control group participants**

Plantar Pressure Analysis	Knee OA group	Control group
Area T1 (cm <sup>2</sup> )	50.8 ± 44.65	81.4 ± 22.09
Area T2 (cm <sup>2</sup> )	34.1 ± 44.03	77.2 ± 13.29
Area T3 (cm <sup>2</sup> )	34.9 ± 43.34	81.5 ± 23.72
Average Pressure T1 (kPa)	110.65 ± 25.44	139.12 ± 14.96
Average Pressure T2 (kPa)	42.73 ± 53.20	116.72 ± 15.57
Average Pressure T3 (kPa)	39.03 ± 48.09	115.68 ± 17.59
Maximal Pressure T1 (kPa)	291.59 ± 63.82	332.17 ± 49.11
Maximal Pressure T2 (kPa)	116.97 ± 145.58	332.17 ± 49.11
Maximal Pressure T3 (kPa)	111.25 ± 139.53	332.17 ± 49.11

# Gait Analysis

**Table 3: Spatio-temporal variables of gait analysis of knee OA and control group participants**

<b>Spatio-temporal Variables of Gait Analysis</b>	<b>Knee OA group Right</b>	<b>Knee OA group Left</b>	<b>Control group Right</b>	<b>Control group Left</b>
Step Duration (ms)	686.66 ± 522.46	613.75 ± 90.51	560.5 ± 83.07	567 ± 95.55
Gait Cycle Duration (Ms)	947 ± 776.75	1208.75 ± 487.72	1153.75 ± 103.55	1117.5 ± 152.23
Single Stance Duration (ms)	-	401.66 ± 259.78	-	465.83 ± 91.44
Double Stance Duration (ms)	1561.87 ± 897.65	1637.5 ± 1105.55	226.87 ± 66.09	243.12 ± 55.56
Swing Duration (ms)	1407 ± 395.64	1179.5 ± 284.10	1278.5 ± 156.22	1241.5 ± 151.93

# Gait Analysis

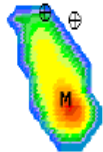
**Table 3 (continued): Spatio-temporal variables of gait analysis of knee OA and control group participants**

<b>Spatio-temporal Variables of Gait Analysis</b>	<b>Knee OA Group Right</b>	<b>Knee OA Group Left</b>	<b>Control group Right</b>	<b>Control group Left</b>
Stride Duration (ms)	1540 ± 634.01	2226.66 ± 795.48	1846.87 ± 158.72	1710 ± 458.16
Step Length (mm)	200.66 ± 228.77	273.4 ± 190.66	441.2 ± 81.44	470.2 ± 59.20
Gait Cycle Length (mm)	257.87 ± 321.07	531.2 ± 388.47	897.25 ± 132.15	881.8 ± 139.24
Angle (degrees)	13.87 ± 3.165	13.33 ± 7.099	7.04 ± 2.77	11.30 ± 5.57

### Static analysis

Area : 12 cm<sup>2</sup>  
Balance : 28 %  
Distribution : 40 %  
28 %

Area : 0 cm<sup>2</sup>  
Balance : 0 %  
Distribution : 0 %  
0 %



59 %  
87 %  
Area : 17 cm<sup>2</sup>  
Balance : 59 %  
Distribution : 60 %

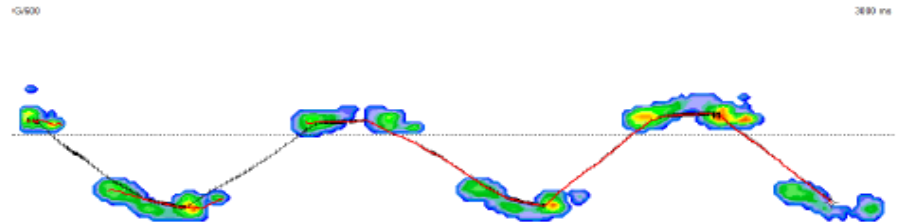
13 %  
13 %  
Area : 5 cm<sup>2</sup>  
Balance : 13 %  
Distribution : 100 %

#### Left foot results

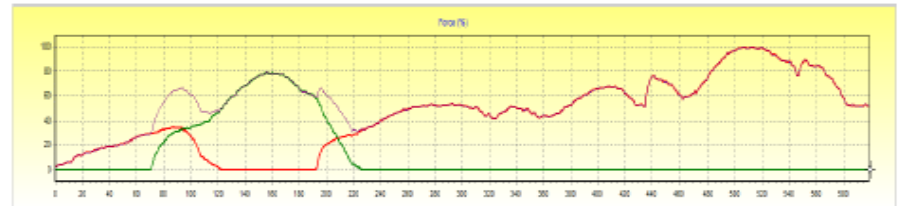
#### Right foot results

Area	Maximal P.	Average P.	Balance	Weight	Area	Maximal P.	Average P.	Balance	Weight
29 cm <sup>2</sup>	465.9 KPa	182.7 KPa	87 %	54 Kg	5 cm <sup>2</sup>	208.3 KPa	140.8 KPa	13 %	8 Kg

### Walk analysis



Left foot	615 ms	2030 ms
Right foot	755 ms	
Double Stand	250 ms	150 ms
Stance	355 ms	



#### Résultats Podométriques

	1	2	3
Area	27.0	88.0	311.0
Average P.	102.9	91.9	89.1
Maximal P.	265.4	265.4	265.4

#### Résultats Spatio-Temporels

Step Duration (ms)	365	605
Gait Cycle Duration (ms)	970	
Single Stance Duration (ms)		
Double Stance Duration (ms)	400	
Swing Duration (ms)	1120	2635
Stride Duration (ms)	3000	
Step length (mm)	125	336
Gait Cycle Length (mm)	461	
Angle (°)	11.31	10.49

— GaitLine — MaxLine

10% 29% 36% 44% 51% 59% 67% 77% 84% 94% +

# Results

- During static pressure analysis; knee OA group tend to put more weight on unaffected/ less affected side especially on the heel
- During dynamic analysis; average pressure, maximal pressure, gait cycle length, and step length was significantly higher in the control group than knee OA group ( $p < 0.05$ )
- Double stance duration, angle of toe out on right, and left step duration and stride duration was significantly higher in the knee OA group than control group ( $p < 0.05$ )

# Conclusion

- Overall, it is noted that individuals with knee OA lack the normal heel toe gait pattern and the average and maximal plantar pressure was comparatively less in these individuals
- These individuals tend to walk with gait deviations and compensations due to which significant changes were observed in the spatiotemporal gait variables when compared to the controls

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## Thank you