Original Article

GAIT VARIATION IN PATIENTS WITH KNEE OSTEOARTHRITIS: A CONTROLLED STUDY

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ABSTRACT

Osteoarthritis is one of the most common chronic diseases which increase the individual's disability and affects the patients gait as the disease progress. Thus identifying the changes in gait variables in knee osteoarthritis patients is important.

Objectives: To compare the gait variables such as walking velocity, cadence, step length, walking base, and single support time, in both control group of people and in the disease group.

Method: This descriptive cross sectional study conducted at physical therapy department National Hospital Sri Lanka. 120 participants were included for the study if they fulfill the inclusion criteria. The participants were divided in to Osteoarthritis and a control group. A walk way was used to collect data from the subjects. Participants were asked to walk once in a single direction in the walkway in their normal speed.

Results: The group of females with knee osteoarthritis had significant levels between means of single support time, step length, walking velocity and cadence. Males with osteoarthritis showed significance in walking velocity. Healthy males and females showed a significant gait variation in step length and walking velocity. Osteoarthritis has an effect on the group of patients compared to healthy females. The single support time (15.62%), step length (8.5%), walking velocity (15.19%) and cadence (9.25%) showed reductions in gait parameters. Males with osteoarthritis showed a significant reduction in walking velocity (10.91%). Females with osteoarthritis has reduce single support time, step length, walking velocity and cadence and increase walking base compared to healthy control group of females. In the comparison among males, males with osteoarthritis have reduced step length, walking velocity, cadence and walking base but have same single support time, compared to healthy control group of males

Conclusion: Osteoarthritis shows different patterns of affection in gait between genders.

KEYWORDS: Gait Analysis, Gait Parameters, Knee Osteoarthritis.

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INTRODUCTION

Hundreds of millions of patients suffer from joint diseases around the world.[1] Osteoarthritis is one of the most common chronic diseases which affects patients and has a great reduction in the individual's quality of life.[2]

Degenerative conditions around the world will rise in the future years and the burden to the family, society as well to the world will increase dramatically.[1] In Sri Lanka, at present the impact increases day by day.

Osteoarthritis is a non-curable disease[3] which can be controlled by medical and physiotherapy treatments. Effect of osteoarthritis has a great impact on the individual's quality of life because lower limb joints hip, knee, ankle can be involved.[4]

As the disease progresses it effect on the patients gait. Patients with knee Osteoarthritis seems to develop their own gait pattern and try to unload the affected structures during gait. More over patients with less severe knee osteoarthritis develop a gait pattern that differs from patients with severe osteoarthritis and control group of patients.[4]

Gait of a person has a major influence on their independence which will in turn be a great relief for patient's family in the day to day life.

When a person is walking the body should bear weight, provide support for locomotion and maintain equilibrium to achieve that gait and the body alignment should set accordingly.[5] As the mobility is important to the independence of the patient they strive to retain this ability even in the presence of severe impairment.

There is a clear link between human gait characteristics and osteoarthritis.[6] There are other medical conditions which also influence the human gait. Some of them are diabetes mellitus, Parkinson, hydrocephalus etc.[6] Early monitoring of the gait abnormality is very important because the patient can then put on to educational programme to minimize the affection on the gait by the disease and maintain functional mobility for a longer period

Gait variation in patients with knee Osteoarthritis, A controlled study will address difference of gait due to Osteoarthritis in a gender basis.

Primary objective was to compare the gait variables in a control group of people and in patients with knee Osteoarthritis. Secondary objective of the study was to assess how Osteoarthritis affects in different genders.

METHODS

This simple cross sectional study was carried out on patients who attended National Hospital Sri Lanka for physical therapy at Department Of Rheumatology and Rehabilitation (General). Sample size was hundred and twenty patients consisting of two comparative groups each group 30 consecutive male and female subjects fulfilling the inclusion criteria were enrolled. All the subjects were between age of 40 to 65. **Inclusion criteria:** patients diagnosed as

osteoarthritis of the uni/ bilateral knee joints over three years. Exclusion criteria: any gait pathologies, had any arthroplasty in lower limbs, had any intraarticular injections within past two months of the measurement taking date and if any respiratory diseases which would had affects the gait. A walkway of 8m[5,8] long (Whittle MW,2006 pp150; Framen M et al 1997) and 0.61m (2 feet) wide was used with sand was filled up to 2inch.

Participants were asked to walk in their normal speed in single direction in the walkway in their normal speed and not to return back in the walkway. Measurements of single support time and total time were taken. After the participant has walked step length and walking base was measured using the foot prints. A mean value was obtained from three measurements of each step length and walking base. And the number of steps were counted and recorded

Ethical clearance was obtained from Ethical Review Committee of the Faculty of Medicine, University of Colombo and National Hospital Sri Lanka. Permission was obtained from Director of the NHSL, Consultant and the Senior Physiotherapist of DRR General before the commencement of the study.

Each participant was informed about the study and that their participation was not obligatory. Participants were informed about their right to not participate and that they were not penalized to do so. Written consent was obtained and data gathered was kept confidential and that it would not be released unless taking their permission.

Statistical Analysis: The data was analyzed using computer software, SPSS (statistical package for social sciences Version 17). Descriptive statistics and independent sample T test was used to analyze data.

RESULTS

The female category mean age value was 54.46 and male category it was 56.78. The minimum years of having Osteoarthritis was 3 years and maximum was 18 years and mean value within the group was 6.76 years.

Comparison of gait variables among female osteoarthritis group and control the diseased group has a reduced single support time, step

length, walking velocity and cadence compared to the healthy females and has an increased walking base (Table 1).

Single support time showed a satisfactory significant level of 0.003 when comparing the means of the two groups. (Mean ± SD value was 0.63±0.16 seconds for females with osteoarthritis and 0.7467±0.13 seconds for female with out osteoarthritis). Step length showed a significance level of 0.028 (Mean ± SD value for osteoarthritis group was 46.4344± 7.98cm and 50.7522± 6.8cm for females with out osteoarthritis), Confidence interval of walking base was 0.173(Mean ± SD value for disease group was 8.5022± 3.09cm and in the healthy group was 7.5011± 2.48cm. There was no satisfactory significance shown in walking base.

Walking velocity and cadence both showed significance below 0.05. Both parameters the level of significance was 0.014. (Mean ± SD value walking velocity of osteoarthritis group was 0.6192± 0.17m/s and non osteoarthritis group was 0.7301± 0.16m/s). Cadence (Mean ± SD value of osteoarthritis group were 81.005± 1.28steps/min and the healthy group 89.2661± 1.25steps/min).

When comparing the male category (Table 2) a satisfactory significance was shown in walking velocity the level of significance was 0.017 (Mean ± SD value 0.7514± 0.16m/s and the control group and 0.8435± 0.12m/s). Single support time did not showed a marked significance between the two means, significance level was one (Mean ± SD value for both osteoarthritis and control groups in order was 0.7467± 0.11s and 0.7467± 0.08s) Step length showed a significance level of 0.394 (Mean ± SD 55.6999± 8.92cm for OA group and 57.5144± 7.36cm non OA group)

Walking base showed a level of significance was 0.619 (Mean ± SD value: 7.7744± 2.8cm,OA group 8.0977± 2.16cm non OA group). Cadence in the two comparative groups did not showed a satisfactory significance and the value was. 0.150 (Mean ± SD value were 86.75± 1.53steps/min in OA group and 91.6343± 1.0steps/min in the control group).

When comparing the parameters of gait in a female, there is a reduction in the walking velocity. The osteoarthritis group walks

15.1906% slower that the controlled normal group of women. Also single support time is reduced from 15.6288% than normal women who bear weight from one limb during walking. When considering the parameters further, it can be identified a reduction in the step length and cadence. The length of a step of the knee osteoarthritis women's group has reduced from 8.5076% compared to healthy women. Number of steps kept within one minute (cadence) is reduced from 9.2544% compared with control group of women.

Table 1: Comparison of spatiotemporal parameters of female osteoarthritis and non osteoarthritis group.

	Diagnose	n	Mean	Std deviation	T value	Degree of freedom	Significance
Single support time	Osteoarthritis (OA)	30	0.63	0.16	-3.068	58	0.003
	Non Osteoarthritis (no OA)	30	0.7467	0.1332			
Step length average	OA	30	46.4344	7.9823	-2.254	58	0.028
	No OA	30	50.7522	6.8077			
Walking base	OA	30	8.5022	3.0941	1.381	58	0.173
	No OA	30	7.5011	2.4893			
Walking velocity	OA	30	0.6192	0.1725	-2.527	58	0.014
	No OA	30	0.7301	0.1674			
Cadence	OA	30	81.005	1.2843	2.522	58	0.014
	No OA	30	89.2661	1.2531			

Table 2: Comparison of spatiotemporal parameters of male osteoarthritis and non osteoarthritis group.

	Diagnose	n	Mean	Std deviation	T value	Degree of freedom	Significance
Single support time	Osteoarthritis (OA)	30	0.7467	0.1105	0	58	1
	Non Osteoarthritis (no OA)	30	0.7467	0.0899			
Step length average	OA	30	55.6999	8.9222	-0.859	58	0.394
	No OA	30	57.5144	7.3612			
Walking base	OA	30	7.7744	2.8076	-0.5	58	0.619
	No OA	30	8.0977	2.164			
Walking velocity	OA	30	0.7514	0.1652	-2.46	58	0.017
	No OA	30	0.8435	0.1212			
Cadence	OA	30	86.75	1.5377	-1.458	58	0.15
	No OA	30	91.6343	1.0004			

All these parameters had significance in there means during SPSS analysis. Comparing the effect of osteoarthritis to the male gait cycle, there was only one parameter which had a significant value and it was walking velocity. Considering the walking velocity there is a reduction in osteoarthritis group up to 10.9129%

compared to healthy male participants who haven't osteoarthritis.

DISCUSSION

In the study all the subjects were asked to walk in the walkway and the gait parameters were recorded. The osteoarthritis females were compared with age matched healthy females and osteoarthritis males were compared with age matched healthy males.

This study found that diseased females had reduced single support time, step length, walking velocity and cadence. There was an increase in the walking base. These results came in agreement with other authors who reported the same findings in their studies.[9,10]

During the pathological process of osteoarthritis, degenerative changes occur in the knee joint, causing knee joint laxity, reduced muscle activation. It becomes difficult to compensate body weight during the gait cycle, Body tends to keep the next step to overcome the difficulty as a result reducing the step length. Reduce step length cause reduction in walking velocity and cadence.

In the comparison among males Osteoarthritis males had equal single support time and reduced step length, walking base walking velocity and cadence. Changes in the walking velocity comes to an agreement with Chen,[9] with a significance in the value, The other changes may be indicative of gait adaptations selected by the male individuals rather than the results of disease specific impairments.

It shows that knee osteoarthritis affects in different patterns in males and females. Study revealed that disease females has a 15.1906% reduction in the walking velocity, 15.6288% in single support time, 8.5076% in step length and 9.2544% in cadence In the disease male group walking velocity had a reduction in 10.9129% compared to healthy male participants.

CONCLUSION

Osteoarthritis shows different patterns of affection in gait between genders.

Limitations and Relevance of findings

Sample size was limited and method to generalize their walking speed seemed impracticable.

Conflicts of interest: None

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