International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979
Impact Factor: RJIF 5.72
Received: 11-12-2017; Accepted: 19-01-2018
www.allsubjectjournal.com
Volume 5; Issue 1; January 2018; Page No. 173-177

Effectiveness of normal walking and Nordic walking on knee osteoarthritis

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Abstract
Background: Walking with Nordic poles was used for skiing and later evolved for the use of support and balance. It had two specific styles like Japanese style Nordic walking and European style Nordic walking. So the study is carried out using the European style Nordic walking to know its effects on patients having knee osteoarthritis.
Materials and Methods: The study included 30 participants, which were divided into two groups with 15 participants in each group. They were asked to walk with Nordic poles and without poles and their distance, pain, and manual muscle testing of upper and lower extremity was assessed and compared before and after.
Result. As compared to normal walking, walking with Nordic poles has been proved to be highly significant on pain and MMT and there no significant difference on distance
Conclusion: As compared to normal walking, walking with Nordic poles has significant effects in knee osteoarthritis individuals in terms of pain threshold, increase in walking distance and also increase in muscle strength of upper and lower extremity.

Keywords: nordic poles, distance, pain, manual muscle testing

Introduction

One of the most disabling chronic degenerative diseases affecting the elderly is osteoarthritis (OA) [1]. Osteoarthritis, commonly known as wear-and-tear arthritis, is a condition in which the natural cushioning between joint-cartilage wears away [2]. When this happens, the bones of joint rub more closely against one another with less of the shock-absorbing benefits of cartilage. The rubbing result in pain, stiffness, swelling, decreased range of motion and sometimes the formation of bone spur. It also involves progressive loss of cartilage. The cartilage tries to repair itself and the bone remodels, the underlying (subchondral) bone hardens, and bone cysts form. The individual with OA walks slower than the normal subjects. According to the Arthritis foundation, more than 27 million people in the U.S. have knee Osteoarthritis. And also the osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India. Women's are more likely to have osteoarthritis then men. It occurs even in young people [3]. The chance of developing Osteoarthritis rises after age 45. The knee is a modified hinge joint, a type of synovial joint [4]. The knee joint is not only one of the largest joint in body but also the most complex. The knee complex is composed of two distinct articulations located within a single joint capsules; the tibiofemoral joint and the patellofemoral joint. The tibiofemoral joint is the articulation between the distal femur and proximal tibia. The patellofemoral joint is the articulation between the patella and femur [5]. The most common cause of osteoarthritis of the knee is the age of person; other causes are heredity, gender, repetitive stress injuries, athletics, and other illness. The symptoms which are seen in osteoarthritis are pain, swelling, muscle spasm, crepitus, feeling of warmth in period of time; this decreases the mobility of knee [6]. Walking is the best aerobic physical activity which has been highly recommended in recent decades for its numerous benefits to the cardiovascular and musculo-skeletal system [7]. Gait is normal human locomotion. The alternating movements of the lower extremities essentially support the human body and along with it there is movement of head, arms and trunk. Gait cycle has two successive events of the same limb, initial contact of the lower extremity with the supporting surface. During one gait cycle, each extremity performs two phases. A stance phase, where some part of the foot is in contact with the floor, which is about 60% of gait cycle, and a swing phase when foot is not in contact with the floor, which is about 40% of gait cycle [8].

Now-a-days, an innovative walking aid called 'NORDIC POLES' [NP] are being used widely. Nordic walking is performed with Nordic poles to aid traction. The use of walking poles makes Nordic walking technique different from that of normal human gait Nordic walking was divided into Japanese-style Nordic walking (JS NW) and European-style Nordic walking (ES NW) by the Japan Nordic walking League. The difference between JS NW and ES NW involves the use of the poles: in JS NW, the walker plants the pole vertically on the ground, like a cane and in ES NW, the walker thrusts each pole at a diagonal angle, creating driving force for a more active walking style [9]. During walking the individual moves with body slightly leaned forward, with contra-lateral hand and foot coordination, such that the swing phase is

always double with one lower extremity and opposite hand [10]. There are phases with two and four contact moments which also gives walking style great stability [11]. Compared to Normal walking the Nordic walking involves applying force to the poles with each stride. Nordic walkers use their entire body and receive fitness building stimulation which is not present in normal walking [12]. It does offloading of lower extremities and loading of the upper extremities [13].

Material and Methodology

Research Design

The research design used for the study was prospective Comparative Study

Source of Data

The source of data will be collected from patients with unilateral knee OA (sub acute) from Dr. A.P.J. Abdul Kalam, College of Physiotherapy, Loni, Taluka- Rahata, District-Ahemdnagar-413736, Maharashtra

Type of Data

The data was collected by the primary investigator

Place of Study

The study was conducted in Dr. A.P.J. Abdul Kalam college of Physiotherapy, Pravara Institute of Medical Sciences

Duration of Study

The study was conducted from August 2017 to November 2017

Intervention Period: 2 weeks, 15 minutes per day

Participants

Both Males and Females were included for the study

Sample

The sample included participants who fulfilled the inclusion and the exclusion criteria and were willing to participate

Sample Size: The sample size was 30

Sampling Design: Convenient Sampling

Equipment: Nordic Poles, Stopwatch, Chair, Cones

Selection Criteria

1. Both males and females up to the age group of 40 to 60 having sub acute unilateral osteoarthritis of knee and the subjects who were willing to participate were included in the study
2. Individuals with past history of neuro-muscular, cardio-respiratory, cognitive disorders, balance impairments, any recent infections, or operative wounds were excluded from the study

Procedure

The study received ethical approval from Institutional Ethical Committee of Dr A. P. J. Abdul Kalam College of Physiotherapy, Loni.

The participants were screened and after finding suitability according to the inclusion and exclusion criteria, they were requested to participate in the study. They were explained about the study and the intervention. The participants were briefed about the nature of the study, duration of intervention and the intervention being used was explained in the language best understood by the participants. They were encouraged to clarify the queries regarding the study if any. An informed written consent form, approved by ethical committee was given to the participants. The demographic data was obtained and the detailed assessment was done. The sample size of the study was 30 participants. There were two groups namely A and B and each group was having 15 participants each. The participants were assessed on the first day for the severity of pain, duration of walking covered and strength of the upper and lower extremity muscles using VAS, 6MWT and MMT respectively.

Group A: Walking without poles i.e. Normal walking

Group B: Walking using Nordic poles i.e. Nordic walking

The pain was assessed by VISUAL ANALOGUE SCALE (VAS) [14]. The patient marks on the line the point that they feel represents their perception of their current state of pain. The VAS score was determined by measuring from the left hand end of the line to the point that the patient marks.

SET-UP:6 Minute Walk Test (6 MWT)

This test requires a pathway of 30 meters.

Cones were placed on the either end of the pathway along with chairs. 6 min of time was set and then the participants were asked to walk with their normal pace and ability. While they walk, they were encouraged to walk faster and while walking if they were feeling fatigue they were asked to take rest for some time and again continue walking. After 6 mins participants were asked to sit and distance was calculated in given period of time. Then the data was kept to check for progression. The strength of the patient's upper extremity and lower extremity will be checked. The strength will be measured in terms of grades using the manual muscle testing technique [15].

Both the groups were asked to perform their respective tasks i.e. group A Normal walking and group B Nordic walking. The duration was 15 mins ever day up-to 3 weeks. they were re-assessed using the (6 MWT) after 3 weeks. The strength of the patient's upper extremity and lower extremity was checked and measured using manual muscle testing (MMT). The data analysis was done. The information was recorded and compared respectively for each group.

Fig 1: measuring MMT of upper extremity

Fig 2: Participants walking with nordic poles

Fig 3: Participants performing 6MWT

Fig 4: Participants walking without poles

Data Analysis, Interpretation and Result

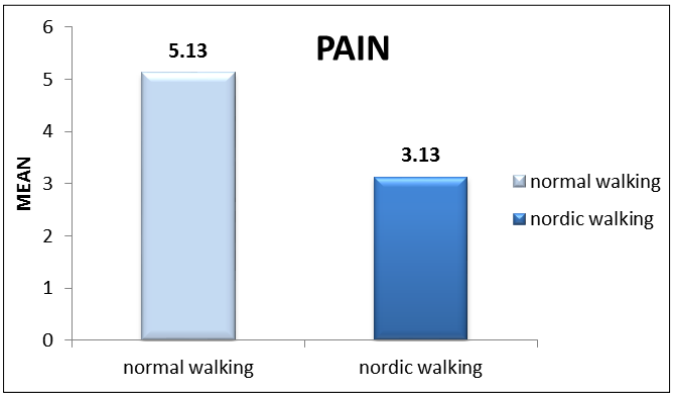

Fig 5: Pain Post Readings in Normal Walking and Nordic walking

Table 1: Data Presentation of pain In Normal Walking and Nordic walking

Parameter	Post (mean ± SD)of Normal walking	Post (mean ±SD) of Nordic walking	Unpaired 't'test value	p value
PAIN	5.13±0.63	3.13±0.74	7.89	<0.0001, highly significant

Result 1: The above figure shows the comparison of mean value of post pain on Normal walking and Nordic walking, t

value was 7.89 and p<0.001 using student paired 't' test within the groups which shows highly significant difference

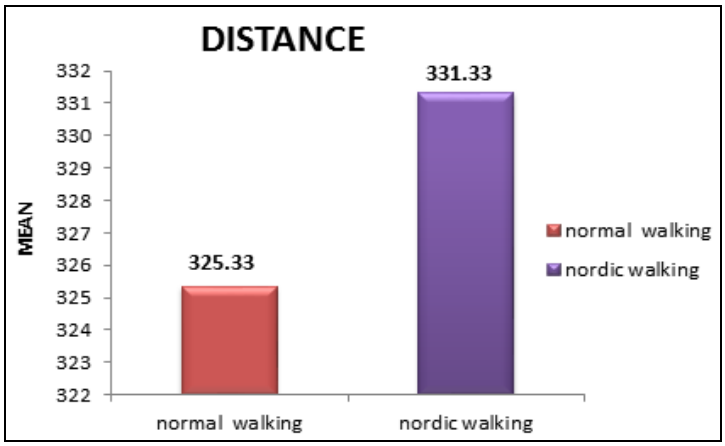

Fig 6: Distance Post Readings in Normal Walking and normal walking

Table 2: Data Presentation of Distance in Normal Walking and Nordic walking

Parameters	Post distance (mean± SD)of normal walking	Post distance (mean± SD) of Nordic walking	Unpaired 't' test value	'p value and significance
Distance	325.33±26.82	331.33±22.07	0.668	0.509, not significant

Result 2: The above figure shows the comparison of mean value of post distance on Normal walking and Nordic walking, t value was 0.668 and p=0.509 using student paired't' test within the groups which shows not significant difference.

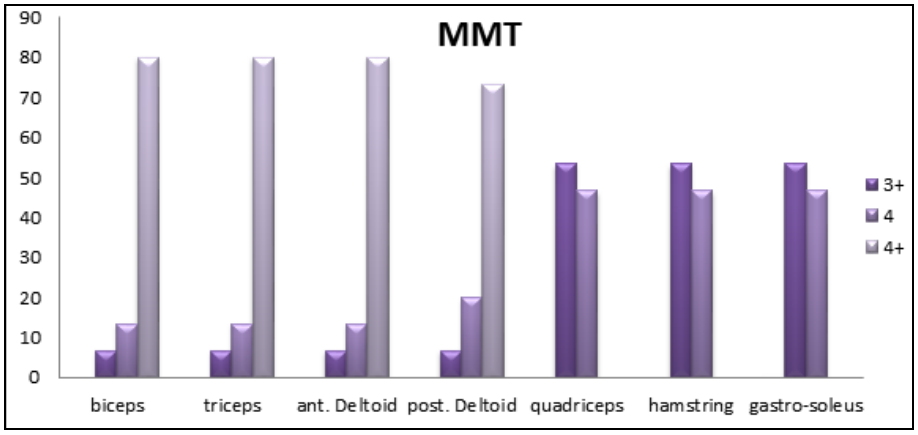

Fig 7: MMT Post readings in normal walking

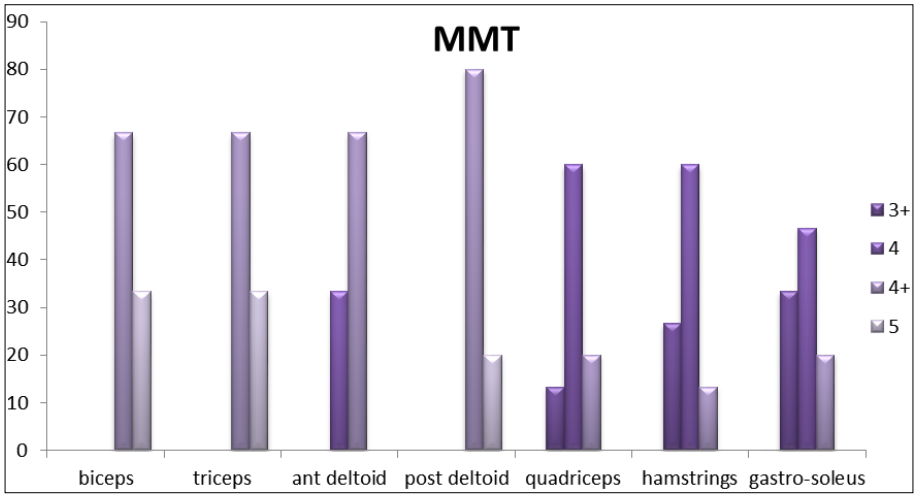

Fig 8: MMT Post readings in Nordic walking

Table 3/4: Post readings of MMT in Normal and Nordic walking

Parameter	Normal walking				Nordic walking				
	3	3+	4	4+	3	3+	4	4+	5
Biceps		6.66	13.33	80				66.66	33.33
Triceps		6.66	13.33	80				66.66	33.33
Ant deltoid		6.66	13.33	80			33.33	66.66	
Post deltoid		6.66	20	73.33				80	20
Quadriceps		53.33	46.66			13.33	60	20	
Hamstrings		53.33	46.66			26.66	60	13.33	
Gastro-soleus		53.33	46.66			33.33	46.66	20	

Result No. 03and 04

The above figure shows comparison post values of Manual Muscle Testing using of upper and lower extremity using percentage method in Normal walking, in post values, for grade 3+ values were 6.66% for biceps, triceps, anterior deltoid, posterior deltoid,53.33% for quadriceps, hamstring, gastrosoleous, for grade 4 values were 13.33% for biceps, triceps, anterior deltoid,20% for posterior deltoid,46.66% for quadriceps, hamstring, and gastrosoleous, for grade 4+ values were 80% for biceps, triceps, anterior deltoid,73.33% for posterior deltoid and in Nordic Walking post values for grade 3+ were 13.33% for quadriceps,26.66% for hamstring,33.for grade 4+ values were 66.66% for biceps, triceps, anterior deltoid, 80% for posterior deltoid,20% for quadriceps,13.33%for hamstrings,20% for gastrosoleous, for grade 5 values were 33.33% for biceps,triceps,20% for posterior deltoid.

Discussion

The study evaluated the effectiveness of Normal walking and Nordic walking in the knee OA individuals**.** The result of this study showed that there were significant changes in the strength of upper and lower extremity, pain, distance of both the groups. However, when both the groups were compared, Group B (NORDIC WALKING) showed highly significant changes than Group A (NORMALWALKING).The strength of lower extremity increased because Nordic poles reduce the loads on knee joint. And Nordic walking exercises induces the mobilization of all upper and lower extremity muscles compared to Normal walking. The strength of upper extremity increased in Nordic walking because Compared to normal walking, Nordic walking involves apply force to the poles with each stride. Nordic walkers use their entire body and receive fitness building stimulation not present in normal walking for the chest, latissimus dorsi, triceps, biceps, abdominals, spinal and core muscles.

Daisuke Homma has a study on effects of Nordic walking on pelvis motion and muscle activities around the hip joints of adults with hip osteoarthritis, found results that the pelvic rotation angle was significantly larger in European style Nordic walking than in Japanese style Nordic walking. In the stance phase, hip abductor muscle activity was significantly decreased in Japanese style Nordic walking compared to both ordinary walking and European style Nordic walking. In the swing phase, rectus abdominis muscle activity was significantly increased in both Japanese style Nordic walking and European style Nordic walking compared to ordinary walking and lumbar erector spine activity was significantly lower in Japanese style Nordic walking than in ordinary walking. Japanese style Nordic walking style may reduce the compensatory pelvic rotation in patients with hip Osteoarthritis. Japanese style Nordic walking might be better for joint protection and prevention of secondary disorders of the hip in Osteoarthritis patients[9].

So, according to the study performed to know the effect of Normal walking and Nordic walking in knee osteoarthritis showed that after walking with Nordic poles on knee osteoarthritis individual it reduces the load of knee joint and induces the mobilization to upper and lower extremity muscles.

Conclusion

Compared to normal walking, walking with Nordic poles has significant effects in knee osteoarthritis individuals in terms of pain threshold, increase in walking distance and also increase in muscle strength of upper and lower extremity

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