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COMPARATIVE STUDY BETWEEN NORMAL CANE AND SHOCK ABSORBING CANE ON ENERGY EXPENDITURE AND PAIN IN PERSONS WITH KNEE OSTEOARTHRITIS

Medical Science

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ABSTRACT

Purpose: The purpose of this study was to compare the efficacy between Normal Cane and Shock Absorbing Cane on energy expenditure and pain in persons with Knee Osteoarthritis.

Method: An Experimental study was carried out on 60 symptomatic persons with knee osteoarthritis. Two different canes were used. Resting and walking heart rate were measured with a portable pulse Oximeter. Pain was measured by using Visual Analogue Scale (VAS) with both the canes. Gait energy cost was estimated using the Physiological Cost Index (PCI) and results of PCI and VAS were compared.

Result: It was found that with the application of Shock absorbing cane, energy expenditure and pain both reduced significantly as compared with normal cane.

Conclusion: The subjects walked farther distance using Shock Absorbing Cane.

KEYWORDS

Knee Osteoarthritis, Cane, Energy Expenditure, Pain

INTRODUCTION:

Osteoarthritis (OA) is a chronic degenerative joint disease and also one of the very common form of arthritis. Its worldwide prevalence is estimated for symptomatic OA is 9.6% among men and 18% among women.[1] An estimation shows that persons aged between 45 to 64 years have 25% to 30% and more than 85% of people older than 65 years of age have radiographically detectable osteoarthritis.[2] The Epidemiological profile of OA in India is not clear. It is estimated that OA is the second most common rheumatological problem and the most frequent joint disease with prevalence of 22% to 39% and having a male: female ratio of 8.5%: 12.3% in India.[3,4]

Generally OA is characterized by the cartilage breakdown and eventual loss in one or more joints. Basically cartilage is a protein which is produced by chondrocytes that serves as a "cushion" in between the bones of the joints. Usually the joints are covered by a tough capsule that is filled with synovial fluid, which lubricates the joint and provide smooth movements. In OA, the cartilage gradually becomes brittle and degrades. Pieces of cartilage may even break away and starts floating around the synovial fluid, which can lead to inflammation. Gradually, the cartilage breaks down to the point that it no longer cushions the bones forming the joint.[5] Persons with knee osteoarthritis usually present with gait changes which results from muscle weakness, pain, joint deformity and joint instability, leading to unstable gait and increased energy expenditure for walking. This further increases fatigue and muscle weakness.9

There are 12 non-pharmacological modalities are often used for the management of knee osteoarthritis which includes; "education and self-management, regular telephone contacts, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, transcutaneous electrical nerve stimulation and acupuncture".[7]

Canes are most commonly prescribed for persons with knee osteoarthritis. [9,17] The main functions of these mobility aids are to increase the base of support, co-ordination,[16] improve balance,[10,12,19] and share the body weight load with the upper limbs, which is further achieved by directly applying force to the handle of the cane.[9,19] It also increase patient confidence, due to which the performance of daily activities increases and also it reduces the risk of falls which is an important issue in the elderly population.[6,9,11] Persons with knee OA frequently have to use canes[8,9,13,14,15,18] during walking to improve gait, reduce stress on the joints, and spare the contralateral side, which is normally overloaded.[9,10,13] There are many types of canes available, but wooden and adjustable aluminum canes are widely used.[9] The cane handle is very important and should be selected primarily as per the patient comfort and the capacity to provide an adequate surface for effective load transfer from the upper limbs to the ground.[9] The handle should permit the load to be conveyed to the center of the cane, thereby increasing the base of support and hence improving the patient's balance.[9]

Canes are used on the contralateral side,[8,9,13,14,15,18,20] and during walking, the affected lower limb is advanced together with the contralateral upper limb carrying the cane following the normal gait pattern.[9]

There are different types of canes are available and Shock Absorbing Walking Cane is one of them. Usually it doesn't bounce, but absorbs shock by providing compression through its inherent mechanism. It is designed for both long and short term users; the revolutionary quest shock-absorbing technology improves the users comfort and permits traveling farther distances.[21]

There are very few studies were conducted regarding the efficacy of cane, but there are no study has been reported to determine the efficacy between normal cane and Shock Absorbing Cane on Energy Expenditure and Pain in persons with knee osteoarthritis. The purpose of the study is to compare the efficacy between normal cane and shock absorbing cane on energy expenditure and pain in persons with Knee Osteoarthritis.

METHODS :

A total of 62 persons with knee osteoarthritis took part in this study and 60 subjects were selected as per inclusion and exclusion criteria and participated in the study. Detailed information was given to the persons about the procedure. Persons consenting to participate in the study and signed the consent form. Demographic data of the persons were collected in the demographic data form. Then the person randomly selected one intervention by lottery system. Person was initially allowed to sit at rest in a chair, located near the starting position, for at least 10 minutes before the test starts. Then Resting Heart Rate (RHR) was be taken by pulse Oximeter. Cane length was adjusted according to the height of the subject. Two point cane gait training was given to use cane. Then adaptation period of 10 minutes was given to the subjects. Then 10 minutes rest was given to allow the heart rate to return to normal. Then the subject was asked to walk in a walking course of 60 meter in length for six minutes with the 1st intervention i.e. Normal Cane or Shock Absorbing Cane. Then post-test measurements of Walking Heart Rate (WHR), Walking Distance (WD) and VAS score were taken. Then Walking Speed (WS) and Physiological Cost Index (PCI) were calculated. Then the same procedure was followed with the same subject using 2nd intervention i.e. Normal Cane or Shock Absorbing Cane and measurements were taken accordingly. During the total procedure a researcher was present along with the subjects to ensure safety.

RESULT:

A total 60 persons with knee osteoarthritis were participated in the study. Out of the 60 persons who participated in the study, 27 persons were males with mean age (years) of 56.926±5.076 while 33 females with 57.606±5.244. The mean height (cm) of male person was 167.815±8.901 and of female was 160.273±7.225. The mean weight (kg) of male person was 61.926±8.783 and of female was 54.242±5.220. The mean BMI of male persons was 21.817±1.651 and of female was 21.115±1.484.

A paired t-test was used to compare the difference between the Post test data of VAS and PCI to identify changes on Energy Expenditure and Pain with use of Normal Cane and Shock Absorbing Cane. There are significant difference shown on energy expenditure measured by PCI (t-value= 10.383, p=0.000) and Pain measured by VAS score for both the interventions shows significant difference (t-value= 23.618, p=0.000) (Table). Thus, it indicates that the person showed significant reduction in energy expenditure and significant reduction in pain using shock absorbing cane.

Energy Expenditure and Pain estimates of the subjects using normal cane and shock absorbing cane (Mean ± SD)

	Normal Cane (n = 60)	Shock Absorbing Cane (n = 60)	p-value
PCI	0.5565± 0.07061	0.5138 ± 0.05478	0.000
VAS	4.483± 0.8535	2.700 ± 0.6962	0.000

Note: p values were obtained from paired t test

Abbreviation: PCI = Physiological Cost Index; VAS = Visual Analogue Scale

DISCUSSION:

Persons with knee osteoarthritis have pain and they expend more energy during walking as compared with the normative value among the elderly population.[8,9,13] Cane aims to reduce pain, reduce energy expenditure, reduce load on the affected joint and improve balance by benefiting overall functional mobility.[8,9,13,24] It was very much surprising that, despite the fact that cane use goes back as far as ancient Egypt, a very few studies have been carried out on this topic. Most investigations have been cross-sectional studies and offer no comparisons of cane use with other interventions or with no intervention at all.[13]

This laid the foundation to the study hypothesis that "Is there any significant difference on Energy Expenditure and pain in persons with Knee Osteoarthritis using Normal Cane and Shock Absorbing Cane". The present study compares the effect of Normal Cane and Shock Absorbing Cane application on energy expenditure and pain in persons with knee Osteoarthritis.

Results processed that application of Shock Absorbing Cane is effective in reducing Pain and Energy Expenditure in persons with knee osteoarthritis than Normal Cane.

In the present study there was 4% mean percentage reduction was found to be in energy expenditure and pain was reduced by 24.8% in Shock Absorbing Cane use as compared with Normal Cane use.

In the earlier section, it was mentioned that among the study population the number of females were more than that of males; which marks up to about 55% and 45% respectively. The above mentioned data summarizes the mean reduction. When the results were being compared as per males and females, a noticeable conclusion overcame. The result obtained from the analysis revealed that there was 24.4% reduction of pain in females as compared to 25.2% in males, where as the overall reduction of pain was found to be 24.8% in both males and females with application of Shock Absorbing Cane as compared with Normal Cane use at the end of Six Minute Walk Test.

In present study Energy Expenditure was measured by Physiological Cost Index. Heart Rate, Walking Distance and Walking Speed were the major components for finding out the Energy Expenditure. Any fluctuation in these components has direct impact over the Energy Expenditure with the use of either Normal Cane or Shock Absorbing Cane. As it can be easily analyzed through the following observations, with the application of Normal Cane and Shock Absorbing Cane, the average enhancement of Heart Rate was found to be about 15.8% and 15.4% subsequently. This marks up about reduction of 0.4% in Shock Absorbing Cane. It was observed in the study after compilation of Six Minute Walk Test, the Walking Distance and Walking Speed increased by 2.4% with maneuvering Shock Absorbing Cane as compared to Normal Cane. It was mentioned in the preceding that these all are the components for measuring Energy Expenditure, which was calculated by following mathematical analysis.

$$PCI = \frac{WHR - RHR}{WS}$$

After computing the value, the result demonstrates that there was 4% reduction in Energy Expenditure with the application of Shock Absorbing Cane as compared with Normal Cane, with an average reduction of 3.6% in males and 4.4% in females comparatively.

The result obtained from the analysis in this study revealed that the persons with osteoarthritis of knee walked farther distances with less energy expenditure measured by PCI and pain measured by VAS using Shock Absorbing Cane as compared with Normal Cane after 6 Minute Walk Test.

The factor that might have contributed to reduce pain and energy expenditure via several proposed mechanisms like the inclusion of Shock absorbing technology in Cane, which did not bounced, but absorbed shock to relieve stress.[21]

Other factors that it expands the base of support to generate stabilizing reaction forces from the hand, reduce the load on lower limbs by shifting some of the body weight to the mobility aid, and assist with propulsion and braking by generating horizontal ground reaction forces.[22,23] Patients were advised to hold the cane in the hand opposite to the affected extremity because contralateral use usually leads to a normal reciprocal gait pattern and minimizes lateral lurching that is often observed with ipsilateral cane use. Contralateral cane use is associated with a lower peak knee abduction moment and lower peak knee flexion moment than ipsilateral cane use in subjects with knee OA.[22]

CONCLUSION:

The hypothesis that use of Shock Absorbing Cane will significantly reduce the Energy Expenditure and Pain in persons with knee osteoarthritis is supported by the study. Thus Shock Absorbing Cane shows significant reduction on PCI and VAS score and it can be concluded as Shock Absorbing Cane is a better prescription for the persons with knee osteoarthritis.

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