

EFFECTIVENESS OF RETROWALKING IN CHRONIC OSTEOARTHRITIS OF KNEE JOINT

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ABSTRACT

Background and need; Knee osteo arthritis (OA) is a metabolically active, dynamic disease that includes both destruction and repair mechanism that may be triggered by biomechanical and mechanical insults. Mechanical factor such as dynamic joint loading have been implicated in knee OA patho mechanics. Several Biomechanical studies shown OA knee patients walks with more secondary compensatory gait pattern of decreased knee excursion , increased adductor moment and joint stiffness to overcome greater ground joint reaction force. This prolonged usage of secondary compensatory gait ends with greater reduction in muscular endurance, strength, imbalance later ending up deformity. So it is important to overcome these physiological changes to avoid further degeneration in knee. Several author conducted study on Backward walking in normal subjects, their study shown backward waking has more advantageous effects compare to forward in reducing shear force, increasing extensor moment, and to gain flexibility around knee. Considering its advantageous effect, study was proposed to find the efficacy of retro walking in chronic osteoarthritis of knee patients.

Methods;30 subjects clinically diagnosed as OA and having grade 3 OA changes on radiological evaluation using Kellgren and Lawrence system and fulfilling inclusion criteria were selected in the study. All subjects underwent retro walking on 15 degree angle inclined motorized treadmill with (self tolerated) minimal pace and gradually increased depending on the patients comfort up to 10 minutes for 10 days. Parameter on VAS, WOMAC, EXTENSION Lag AND DYNAMIC BALANCE THROUGH STEP TEST taken prior and immediately after 10th day of intervention.

Result; result were statistically analyzed using T test, there was highly significant improvement in all parameters with $p < 0.0001$.

Conclusion; retro walking is highly effective in reducing symptom and overcome disability in patient suffering from chronic OA

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INTRODUCTION AND BACKGROUND

Knee Osteo arthritis (O.A.) is a metabolically active, dynamic disease that includes both destruction and repair mechanism that may be triggered by biomechanical and mechanical insults ^{1,2}. Mechanical factor such as dynamic joint loading have been implicated in knee O.A. patho mechanics. Biomechanical studies indicated individual with O.A. knee walk more slowly, with less knee excursion, increased adduction moment and with more joint stiffness. These secondary compensatory gait adaptation in O.A. knee patients helps in reducing pain by decreasing ground reaction loading on knee ^{1,3}. This prolonged usage of secondary gait compensation creates greater imbalances of muscle, progressively reduces muscle strength, endurance, flexibility and later ending to deformity ^{7,8}.

Bary bates university of Oregon started to investigate forward versus backward walking in mid 1980.

Result of there study and other author ^{4,5,6} shown Back ward walking has more advantageous effects compare to forward walking . this they have been described it as follows,

During forward walking knee joint flexes, extends and then flexes in support phase, where as in back ward walking knee initially extends, flexes and extends in support phase, prior to flexing and extending during swing . However Support swing ratio of backward walk is similar to forward walking with 60% support and 40% swing.

Back ward walking (B.W) increases stride rate, decreases stride length and increases support time. B.W. reduces overall range of motion of knee thereby increase active functional range. Muscular structure supporting ankle and knee reversed their role during B.W. [in B.W. knee provides the primary power producer and ankle plantar

flexors shock absorber] . Direction of knee joint shear force directed forward initially during backward walking [B.W] where as backward in forward walking[FW] . According Flynn et al.[1995] study show backward walking produces significantly lower patellar compressive force than forward walking. Flynn[1993] Retro walking helps to reduce maximal vertical force and impulsive force on knee compare to f.w because of Toe heel contact pattern.

Considering the advantageous effect of B.W. with respect to F.W. in decreasing the compressive load on knee, and improvising the muscular strength in functional range, study was hypothesized to find effectiveness of Back ward Walking or Retro Walking [R.W]training to overcome pain and physical dysfunction in patients suffering from chronic O.A knee.

The Objective of the study was to find 1] RetroWalking is effective in alleviating pain of O.A. knee patients 2] Retrowalking is effective in improving physical function of chronic O.A. knee 3] Retrowalking is effective in improving Balance in O.A. knee

MATERIAL AND METHOD;

30 Subjects both male and female of Mean age group of 50.23 years who clinically diagnosed as O.A. by Orthopedician and having grade 3 OA changes on radiological evaluation using Kellgren and Lawrence system and fulfilling inclusion criteria were selected in the study. Details of the study were explained to each subject and got signed in written informed consent form prior to enrollment in the trial. The study was approved by J.S.S. Research Ethics Committee. Subjects suffering from pain in the peripheral joints, Lumbar disc lesion, Neurological disorder [motor and sensory loss], cardio vascular disease and suffering from grade 4 or 5 OA were excluded from study.

INTERVENTION;

Prior to undergoing intervention each subjects base line measurement of parameter of the study such as Visual Analog scale, Western Ontario and McMaster universities (WOMAC) index, extension lag, dynamic balance through Step Test were taken for each subject prior to their intervention.

A motorized Tread Mill with 15 Degree inclination made from floor were used in this study.

Subjects initially underwent forward[F.W.] walking with minimal speed on a motorized treadmill with 15 degree inclination for duration one minute as a warm up and to get familiarized with equipment. Later speed was increased to their maximum tolerance and went Forward walking to extent of duration that stopped only when they report pain or discomfort. Time and distance covered in F.W. were recorded.

Same subject next day underwent retro walking [R.W] training on motorized treadmill to learn or to be familiar with R.W.. Patients were instructed to hold the Rails of Tread mill for support while doing R.W. After taking rest for 20 min and being familiarized with R.W. Subjects underwent retro walking on 15 degree angle inclined motorized treadmill with (self tolerated) minimal pace and gradually increased depending on the patients comfort up to 10 minutes.

Subjects underwent 10 minutes retro walking, one session per day for 10 days. On 10th day parameter of VAS, WOMAC, extension lag were taken. Dynamic balance through step test was also recorded.

On 10th day Subject under went forward walking on motorized treadmill with their tolerated speed , they were stopped immediately once they report pain or discomfort Time and distance covered on 10th day was noted.



Retro walking



Retro walking



step test

Findings ;Pre and post intervention Data were statistically analyzed using “paired T-test”

Table 1. Woman index pre and post retrowalking intervention

	MEAN	S.D.	S.E.	MEAN	S.D.	S.E.	MEAN DIFFERENCE	T- VALUE	P VALUE
Total score	91.16	164.5	30	8.9	5.6	1.03	82.2	2.7	0.001
pain	15.2	2.5	0.46	2.1	1.8	0.33	13.1	22.9	0.001
stiffness	4.3	2.29	0.41	0.53	0.73	0.13	3.8	9.51	0.001
Physical function	41.3	7.0	1.27	6.26	3.8	1.27	35.1	35.7	0.001

Table.2 Other parameter between pre and post Retro walking intervention

	PRE MEAN	S.D	S.E	POST MEAN	S.D	S.E	MEAN DIFFERENCE	T-VALUE	P-VALUE
Extension lag	13.6	9.5	1.7	2.23	2.7	0.50	11.3	6.44	0.001
vas	8.0	0.80	0.14	1.8	1.2	0.23	6.23	27.9	0.001
Step test	4.91	1.08	0.197	12.7	1.68	0.197	-7.8	31.0	0.001

Table 3 comparison of forwalking 1st vs 10th day.

	MEAN OF 1 ST DAY	S.D	S.E	MEAN OF 10 TH DAY	S.D	S.E	MEAN DIFFERENCE	T-VALUE	P-VALUE
time	4.6	2.1	0.39	11.4	1.50	0.27	-6.7	16.5	0.001
speed	1.14	0.26	0.04	1.4	0.15	0.18	-2.7	5.4	0.001
distance	84.2	68	12.5	236.3	40.46	7.38	-152	16.8	0.001

The result of the study had shown highly significant improvement in all parameters of WOMAC index, and also on other parameter Extension lag, VAS and Dynamic Balance. Result also showed significant improvement on time, speed, and distance of forward walking following 10 days of B.W. Intervention.

DISCUSSION

Knee O.A. is a prevalent condition contributing significantly to functional limitation and disability. Numerous studies show secondary gait change pattern of O.A. is due to pain, decreased muscle strength, instability and stiffness. Numerous studies revealed pain in O.A. KNEE is due to increased abnormal ground reaction force loading on joint and decreased extensor moment. According to Mundermann et al [2005] decreased knee extension momentum is due to compensatory strategy to unload knee joint. Kinetic and kinematic variable in knee joint of O.A. include, decreased knee flexion angle, decreased knee extension moment, increased hip extension moment at the beginning of single leg stance and decreased flexion momentum at the end of single leg stance. There will be increased in leg stiffness adaption at the end of single leg stance to gain stability while accepting body weight. This adaptation gradually increases stiffness of knee joint, increases extension lag and reduces their balance. The results showed significant improvement in all parameter following Retro walking intervention, shows normalizing kinetic and kinematic variable.

According to Arata[1999], Batta[1980] from research work stated numerous performance differences between B.W. against F.W, they are as follows.

Increased stride rate and support time with decreased stride length is the hall mark of B.W. In B.W. Toe heel contact pattern is seen. In B.W. knee act as primary power producer and an ankle shock absorber. According Grano etal; Shear force is directed forward during backward walking [b.w.], where as backward in forward walking [fw] during the initial support phase there by decreases external compression load. His study also shown significant increase in hamstring stretch during each stride, E.M.G. activity shown greater in lower limb muscles in backward compared to forward walk. This study correlate the result where Extension Lag, VAS, could have improved because of retro walking effect in improving extensor muscle activation, gaining flexibility with reduce reaction and shear force directing on joint.

According Yoshimot et al [] backward walking on treadmill of 15 degree slope increases higher firing rate of hamstring and quadriceps, where vast us medialis of quadriceps shown higher activation. According Finland etal B.W. increases vo2max. these above changes correlate with result of present study where there was improvement in WOMAC INDEX, Extension lag, Dynamic balance occurred due to its greater impact in increasing extension moment,

improvising strength in functional range with decline compression force assist in improving physical function. In our study most of subjects were around 50 year age group. Future study required to know its effect on higher age group and above grade 3 osteoarthritis.

CONCLUSION

The study concludes retro walking is effective in reducing symptom and overcoming physical dysfunction in Osteo Arthritis of knee.

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