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Effect of Tai Chi Exercises with Conventional Exercises on Pain Management and Joint Position Sense in Individuals with Unilateral Knee Osteoarthritis

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ABSTRACT

AIM: This study aims to find the effects of Tai Chi exercises with conventiona exercises on pain management and joint position sense in individuals with unilateral knee osteoarthritis.

MATERIALS AND METHODS: About 100 participants were selected by using NPRS and Electrogoniometer based on inclusion and exclusion criteria. Written informed consent was collected from all the subjects prior the commencement of the study. Experimental protocol and procedures were informed to all the subjects before giving their informed consent. These 100 participants were allocated into 2 groups. One is the Tai Chi exercise group and other is the conventional exercise group, each had 50 participants. The Tai chi exercise group and Conventional exercise group performed with IFT.

RESULTS: The Pre-test and Post-test values were analyzed , indicating that the Tai Chi group demonstrated significant improvement compared to the Conventional group, with “p-value” 0.0001 indicating superior outcomes for the Tai Chi group.

DISCUSSION: According to this study, the Tai Chi group had better results when compared to the Conventional group, Tai Chi exercises are more effective in reducing pain and improving joint position sense among unilateral knee osteoarthritis subjects.

KEYWORDS: Conventional exercises, IFT, Joint position sense, NPRS, Osteoarthritis of knee, Tai Chi.

ABBREVIATIONS: IFT - Interferential Therapy, NPRS - Numerical Pain Rating Scale, TC - Tai Chi.

INTRODUCTION:

One of the biggest issues in public health is knee osteoarthritis (OA), which mostly affects the medial tibiofemoral compartment. As the disease worsens, pain is a defining feature that usually necessitates expensive joint replacement surgery in addition to reducing physical function and quality of life. Proprioception is known to deteriorate with age, but this reduction is especially noticeable in those with knee OA.[1]

Osteoarthritis is the most common joint disease in the elderly and the main cause of functional disability; estimates place its radiological symptoms in 80% of persons over 65.[2] Osteoarthritis (OA) has a complicated pathophysiological base that includes a number of variables, including degeneration of the

articular structures, decreased muscular function, and psychological traits like persistent discomfort.[3] Structural abnormalities can also be seen in any of the tissues that comprise the joints, including the ligaments, cartilage, capsule, synovium, and subchondral bone. The main complaints of those with symptomatic osteoarthritis are related to pain and functional impairment. In particular, pain is thought to have an impact on one's quality of life; for this reason, pain management is crucial to clinical rehabilitation.[4] In the past year, almost 25% of persons over 55 will report having a substantial episode of knee discomfort. One of the most common chronic illnesses impacting older persons' ability to move physically is osteoarthritis. Osteoarthritis of the knee is a disorder associated with articular cartilage loss in addition to underlying bony alterations at the joint borders.[5]

A traditional Chinese form of exercise for health is tai chi. It incorporates deep breathing, slow, soft movements, meditation, and complete body relaxation. Tai chi is beneficial for patients' strength, balance, and mental and physical well-being. It can also help with depression and self-efficacy.[6]

Tai Chi activities can improve joint stability and musculoskeletal strength by progressively changing the elevation. Among the various health outcomes that mindfulness meditation and concentration training may promote and coordinate are the immunological and autonomic nervous systems, as well as mood.[7]

Tai Chi is one of the numerous exercises that can be good for older persons, especially for preventing falls. Tai Chi is a sort of psychophysiological exercise. This workout focuses on balance, weight shifting, steady rhythm, and breathing control.[8] KOA has a complicated pathophysiological foundation that includes the degeneration of collagen, intraarticular inflammation, reduced proprioceptive acuity, muscular function, and the psychological traits of chronic pain. Currently, there are no effective medical treatments or feasible preventive intervention methods for managing KOA. Tai Chi, therefore, has the potential to become a state-of-the-art, realistic way to provide structured workouts that support a mind-body approach to treating KOA.[9] Aerobic exercise is comparable to Tai Chi, an ancient Chinese mind-body practice.[10] There aren't any effective medication therapies or preventive intervention strategies available for the treatment of KOA at this time.

Osteoarthritis (OA) of the knee is a chronic musculoskeletal disease process that affects the cartilage and subchondral bone between the proximal tibia and distal femur1.[11] Our aim is to demonstrate Tai Chi's potential benefits over Physical Therapy in terms of pain management and elimination of functional limitations that severely impair the quality of life for millions of people suffering from osteoarthritis in the knee.[12] Tai Chi combines deep diaphragmatic breathing, relaxation, and a range of basic postures that flow to each other gently and slowly in a circular motion. There haven't been many patients who complain about TC training's bad side effects.[13] Tai chi has been found to benefit people with orthopedic, rheumatologic, neurological, and cardiac diseases as well as their psychological and physical well-being. It has also been

positively evaluated in terms of safety.[14] Tai chi training may shield the brain from age-related structural alterations. Reduced proprioception was considered a major risk factor for the start and course of the disease in KOA patients, as previously mentioned. There hasn't been much research done on how Tai Chi influences lower-limb proprioception, specifically how persons with KOA perceive their knee and ankle.[15] The benefits of Tai Chi are linked by several studies to enhanced quality of life, greater muscle flexibility, decreased joint discomfort, increased joint stability, and a synergy between mental and physical health.[16]

A patient's quality of life may be enhanced and disease development slowed by physiotherapy, which targets pain relief, function, mobility, and knee stabilization. It also encourages the adoption of certain daily activities, lowers joint strain, and prevents abnormalities.[17] Tai Chi's benefits would be transmitted through its impact on mental health, musculoskeletal flexibility, and muscle function. Tai Chi would exhibit a higher degree of improvement in knee pain, physical and psychological functioning, and overall health status as compared to those receiving treatment with an attention control intervention that included stretching and wellness education.[18]

In order to determine the prevalence of primary knee OA among the 1.252 billion people in the community, a cross-sectional study was conducted. It was discovered that 28.7% of people had knee OA overall.[19]

MATERIAL AND METHODS:

For this study, a cohort of 100 individuals diagnosed with Unilateral knee osteoarthritis was selected using convenient sampling from the Saveetha Institute of Medical and Technical Sciences. The study was approved by 01/022/2023/ISRB/SR /SCPT. The Study was conducted on 100 subjects with unilateral knee osteoarthritis for age 55 years and above and include both male and female with chronic knee pain more than 6 months, Each participant (both genders) met the American College Rheumatology criteria for OA knee and was aged above 55 years , Average pain rating from 1-5 on a Numerical Pain Rating Scale and subjects were excluded having metal implants in the affected lower limb, secondary osteoarthritis, past history of osteomyelitis, TB, or tumors in the knee joints, alone or in combination, peripheral vascular disease, subjects who had any neurological deficit (paresthesia, sensory loss, radiculopathy), other inflammatory conditions – rheumatoid arthritis, ankylosing spondylosis, recent stroke, psychiatric illness, active cancer, and acute or chronic organic illnesses of the hepatic, renal, cerebrovascular, and cardiovascular systems.

ETHICAL APPROVAL : Ethics approval was obtained by ethical committee

Institutional Scientific Review Board Number: XX/XXX/XXX/ISRB/SR /SCPT**.**

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PROCEDURE:

IFT was given for both the groups. Both groups underwent IFT for 10 minutes daily before engaging in exercises to manage pain. IFT Protocol: The patient was explained that a tingling sensation could be felt which should not be unpleasant. Patient lying in supine position with Frequency- 4000 Hz, Base- 90 Hz, Sweep- 40 Hz, Beat Frequency- 90-130 Hz, Quadripolar/2 channel. The treatment duration for both groups will be 3 alternative days a week over 4 weeks.

IN TAI CHI GROUP (n=50) subjects were selected and IFT is given for 10 minutes and Tai Chi exercise such as Starting posture, Part the wild horse's mane on both sides, Grasp the bird's tail on both sides, closing form were performed. It depends upon the physical capabilities and to improve confidence of the subjects to remain in each exercise and get benefits. Tai Chi was performed for 60 minutes for each session for 4 days per week. Each session of Tai Chi exercises was performed 3 sets and 10 repetitions with short period of rest in between. Tai Chi exercises are Starting Posture, Part the wild horse mane on both sides, Grasp the bird's tail on both sides, Closing form, Quadriceps strengthening, Hamstring strengthening.

CONVENTIONAL GROUP (n=50) participants were selected and IFT is given for 10 minutes and Conventional exercises are Quadriceps strengthening, Hamstring strengthening, Mini squat with support, Single limb squat with support were performed. Conventional exercises were formed for 60 minutes for each sessions for 4 days per week. Each session of Conventional exercise were performed 3 sets and 10 repetitions with short period of rest in between. Conventional exercises are Quadriceps strengthening, Hamstring strengthening, Mini squat with support, Single limb squat with support.

OUTCOME MEASURE:

NPRS SCALE:

NPRS – Numerical Pain Rating Scale

The NPRS is an 11 – point horizontal scale ranging from 0 to 10, with 0 indicating no pain and 10 representing the worst pain ever. It is a dependable and valid tool for evaluating musculoskeletal and arthritic pain.

ELECTROGONIOMETER:

A biometrics electrogoniometer with an ADU301 angle display unit was used to quantify knee joint proprioception. Each subject was assessed from three different test angles (30, 45, and 60 degrees); the sitting

posture occupied the neutral position (0 degrees) during this process. The participant was told to let their lower leg swing freely over the edge of an examination table while they sat on it. The electrogoniometer was then placed longitudinally so that it lined up with the subject's tibia and femur, and it was covered with medical tape on both sides. As the individual closed their eyes, the examiner moved their leg into a test angle. After holding that position for five seconds, the examiner released the subject's leg to hang freely. The individual was instructed to try to replicate the test angle while closing their eyes. Every one of the three test angles had its reproduced and practiced angle repeated. Each of the three test angles had its mean error (absolute angle error) determined by comparing the replicated and actual angles. Every one of the three test angles was measured by placing the electrogoniometer longitudinally in line with the tibia and femur using double-sided medical tape. After briefly observing one of the angles, the participants were instructed to close their eyes and try to duplicate the angle.

RESULTS

The results of the statistical analysis revealed that the differences between the values of the two groups were statistically significant. Using descriptive and inferential statistics, the acquired data was tabulated and evaluated. The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures of same group were analyzed by using Wilcoxon sign rank test. The Pre-test and Post-test values were analyzed , indicating that the Tai Chi group demonstrated significant improvement compared to the Conventional group, with “p-value” 0.0001 indicating superior outcomes for the Tai Chi group. This demonstrates that Tai Chi group received a higher score than Conventional group. Thus Tai Chi group is considerably effective than Conventional Group among unilateral knee osteoarthritis subjects.

TABLES:

Table 1: Pre-test and Post-test values of Tai Chi Group

OUTCOME	TAI CHI GROUP	MEAN	SD	T VALUE	Z VALUE	P VALUE
PAIN (NPRS)	Pre-Test	7.08	0.80	47.6235	-6.154	<0.0001
	Post-Test	3.48	0.91			
JPS (ELECTRO GONIOMET	Pre-Test	16.70	5.01	22.1074	-6.0927	<0.0001
	Post-Test	46.20	12.06			

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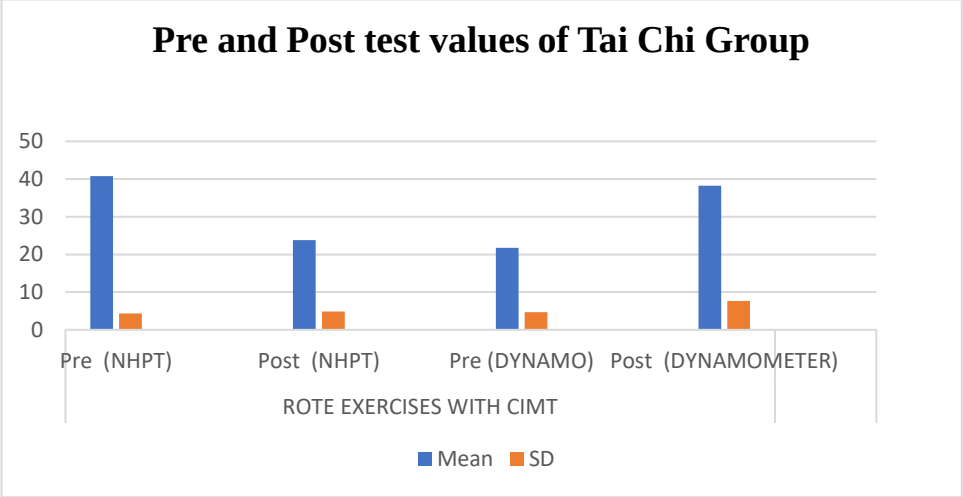
Table 2: Pre-test and Post-test values of Conventional Group

OUTCOME	CONVENTIONAL GROUP	MEAN	SD	T VALUE	Z VALUE	P VALUE
PAIN (NPRS)	Pre-Test	6.92	0.85	20.4400	-6.9662	<0.0001
	Post-Test	5.16	0.79			
JPS (ELECTRO GONIOMETER	Pre-Test	16	5.24	15.6525	-6.154	<0.0001
	Post-Test	23.50	5.17			

Table 3: Post-test values of Tai Chi Group and Conventional Group

OUTCOME	TAI CHI AND CONVENTIONAL GROUP	MEAN	SD	T VALUE	U VALUE	P VALUE
PAIN (NPRS)	Pe-Test	3.48	0.91	9.8549	239	<0.0001
	Post-Test	5.16	0.79			
JPS (ELECTRO GONIOMETER)	Pre-Test	46.2	12.06	12.2300	98	<0.0001
	Post-Test	23.50	5.17			

FIGURES:



Figures 1: Pre-test and Post-test values of Tai Chi Group

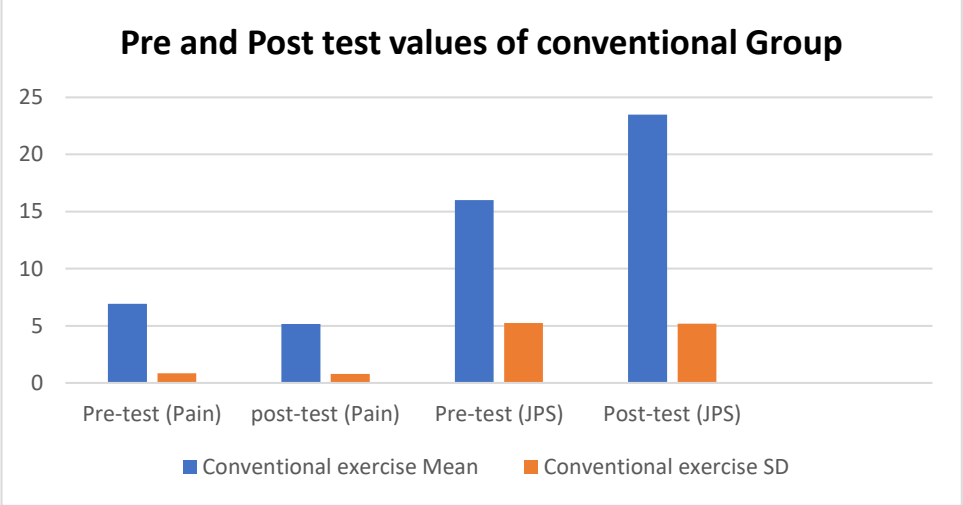


Figure 2: Pre-test and Post-test values of Conventional Group

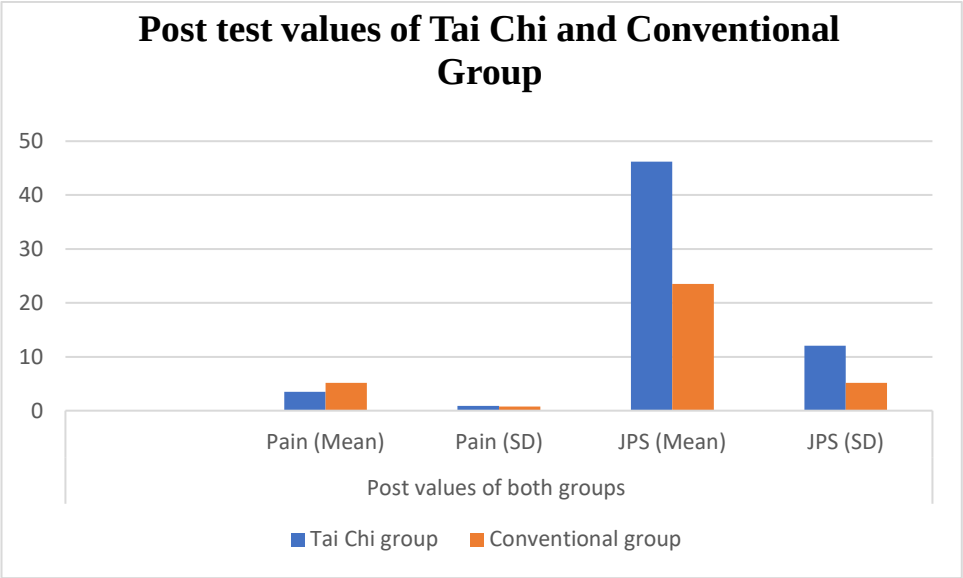


Figure 3: Post-test values of Tai Chi Group and Conventional Group

DISCUSSION

The purpose of the present study is to effect of Tai Chi exercise versus conventional exercise on pain and joint position sense in unilateral knee osteoarthritis subjects. This is demonstrated with a duration of four weeks. The results were measured using NPRS and Electrogoniometer before and after intervention.

Bedekar Nilima et al., 2015 suggested that IFT can be used to reduce pain which is caused due to musculoskeletal conditions.[20] CHENCHEN WANG et al., 2009 stated that Tai chi appears to improve function and reduce discomfort in those with osteoarthritis in their knees.[15] D Xu et al., 2003 stated that Tai chi exercise is made up of a series of beautiful movements that are performed continuously in a slow, circular pattern. The feet, ankles, and legs are where awareness of movement sequencing starts in tai chi practice. This study suggests that long-term tai chi practice may be more advantageous than other popular hobbies for maintaining knee and ankle proprioception, which may be crucial for maintaining balance in older adults.[21]

Hongyu Yue et al., 2023 stated that many symptoms commonly seen by KOA sufferers interfere with their regular activities. For people with KOA, tai chi is more beneficial than addressing knee discomfort, functional impairment, and muscular weakening.[22] Myeong Soo Lee et al., 2008 concluded that Tai chi is a form of physical exercise that, when practiced regularly, affects the cardiovascular and muscular systems, leading to muscular adaptation and, eventually, greater muscle strength.[23] Tressa Gamache et al., 2014 suggested that The development of innovative, cost-effective therapies to support individuals with knee OA in preserving their function and quality of life is a national priority.[24]

Xiaoyue Hu et al., 2019 stated that proprioception can be considered a subsystem of the somatosensory system, together with pain, touch, and temperature perception. Tai Chi exercise has a good effect on knee proprioception, according to numerous studies on the subject of knee proprioception.[25]

Similarly in our study Tai Chi Group is more beneficial than the Conventional Group. It is more effective in reducing pain and improving joint position sense in unilateral knee osteoarthritis subjects.

LIMITATION:

The duration of follow- up might be relatively short in the study. Osteoarthritis is a chronic condition, and longer- term follow-up would provide insights into sustainability of the interventions and their effects on pain and joint position sense outcomes over time.

RECOMMENDATIONS:

A longer-term follow up period would allow for the evaluation of the sustained effects of Tai Chi exercises and Conventional exercises on pain and joint position sense in osteoarthritis knee subjects. This would provide valuable information on long-term benefits of these intervention.

CONCLUSION

The study found that Tai Chi exercises were more effective in reducing pain and improving joint position sense among individuals with unilateral osteoarthritis of the knee compared to Conventional exercises. This suggests that incorporating Tai Chi into the treatment protocol may offer greater benefits for managing symptoms associated with unilateral knee osteoarthritis.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

ANIMAL AND HUMAN RIGHTS STATEMENT: For human research, an informed consent process is vital. This section answers how participants are provided with all necessary information, including potential

risks and benefits, and how their consent is documented. The study will follow esuring informed consent is obtained and participants' privacy is respected. All participants will have the right to withdraw at any time without consequence. The study will aim to minimize discomfort and will provide support services if needed.

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