Original Article

Compare the Effectiveness of Weight Bearing Exercises and Plyometric Training Improve Joint Position Sense in Osteoarthritis Knee Subjects

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Abstract

Background: This study was designed to compare the effectiveness of weight bearing exercises and plyometric training to improve joint position sense in osteoarthritis knee subjects.

Purpose: To compare the effectiveness of weight bearing exercises and plyometric training improve joint position sense in osteoarthritis knee subjects.

Materials and Methods: A total 196 subjects with OA knee were taken from the sri murugan physiotherapy pain and rehabilitation centre-kanchipuram.The subjects are selected based on the inclusion and exclusion criteria.196 subjects were divided into 2 groups. Group A contains 98 subjects received weight bearing exercises and group B contains 98 subjects received plyometric exercises. Both the groups commonly received the IFT. All subjects underwent pre-test measurement with (KOOS) and the same repeated for post-test at the end of 4 weeks**.**The intervention was given for 4 weeks. The entire study process was conducted from November 2022 to April 2023.

Results: The pre-test and post-test were analysed, according to statistical analysis weight bearing exercise group were effective in decreasing the pain score and improved functional outcome with p value <0.0001.

Conclusion: This study concluded that weight bearing exercises has high impact in improving the joint position sense and functional outcome in OA knee subjects.

Key Word: weight bearing exercises, plyometric training, Osteoarthritis knee, IFT.

Introduction

Osteoarthritis (OA), also known as degenerative joint disorder, primary OA wear and tear arthritis, or age associated arthritis, is one of the leading causes of disability. The word "arthritis" is used by docters to characterize joint inflammation.[1]

Knee OA affects the medial, lateral, and patellofemoral joints, and it normally develops slowly over a period of 10 to 15 years. Osteoarthritis develops over time as the cartilage that protects the ends of your bones in your joints slowly wears away.[1]

Plyometric workouts were first used in sports training to improve jump ability, agility, muscular power, and quick force output older persons can benefit from their benefits as well. For instance, high speed training, which is associated with increases in

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muscle power, has been shown to enhance functional performance and health-related quality of life in older women[5]. Exercises that involve plyometrics are frequently used to evaluate sports performance, increase muscle power, and lower the risk of injury. Given the correlation between plyometric landings and a variety of knee problems, such as tendinosis, anterior cruciate ligament (ACL) damage, and osteoarthritis, the impact from plyometric landings has attracted particular attention.[2]

Weight-bearing exercises can be beneficial for osteoarthritis (OA) of the knee, as they help improve joint stability, maintain bone density, and strengthen the surrounding muscles. However, it's essential to choose the right exercises and perform them with proper form to avoid exacerbating the condition.

A questionnaire called the KOOS is used to evaluate symptoms as reported by patients. Symptoms (7 items), Pain (9 items), Function in Daily Living (16 items), Function in Sports and Recreation (5 items), and Knee-Related Quality of Life (QOL) (4 items) are the 5 subscales that make up the KOOS. Each question receives a score between 0 and 4, and responses are provided via Likert boxes. Each subscale receives a normalized score that ranges from 0 (severe symptoms) to 100 (no symptoms). According to reports, KOOS reliability in an OA population is adequate. The KOOS questionnaire was used both at the beginning and end of the treatment. [6]

Aim

To compare the effectiveness of weight bearing exercises and plyometric training improve joint position sense in osteoarthritis knee subjects.

Material and Method

It was an experimental study conducted on 196 subjects. convenient sampling with random allocation method was used in this study. The entire study process was conducted from November 2022 to April 2023.

Inclusion criteria:

1. Subject's age 40 years and above.
2. Had chronic knee pain for six months.
3. By using the clinical history and physical examination, OA knee was identified.
4. Subjects diagnosed with Knee Osteoarthritis grade I & II based on American College of Rheumatology criteria.

Exclusion criteria:

1. Knee surgery/joint injection in past 6 months or planned surgery in the next 9 months;
2. Past knee fracture or malignancy.
3. Past hip/knee joint replacement/tibial osteotomy.

Outcome measures:

Knee injury and osteoarthritis outcome score KOOS scale was used to examine pain, symptoms, activity of daily living, sports and recreation, and quality of life.

Procedure

In the comparative study which carry 196 subjects with OA knee were selected based on the inclusion and exclusion criteria. The detailed procedure for performing the test was explained to the subjects. The subjects were made to feel comfortable with the procedure after the explanation. 196 subjects are divided into 2 groups. Group A experimental group contained 98 subjects who received weight bearing exercises and group B control group contained 98 subjects who received plyometric exercises. Both the groups commonly received the IFT. All subjects underwent pre-test measurement knee injury and osteoarthritis outcome score (KOOS) and the same repeated for post-test at the end of 4 weeks.

- IFT PROTOCOL: The patients were explained that a tingling sensation could be felt which should not be unpleasant.
- PATIENT POSITION: Supine lying
- FREQUENCY: 4000HZ
- BASE:90HZ
- BEAT FREQUENCY: 90-130HZ
- CHANNEL: Quadripolar/2 channel
- DURATION:10 minutes.

IN **WEIGHT BEARING EXERCISE GROUP** (n=98) participants were selected and IFT is given for 10 minutes and weight bearing exercise practice such as weight shifting, leg curl, mini squat, single leg standing. Exercises were performed for 30 minutes for each session for 5 days per week. Each exercise performed for 3 sets and 10 repetitions.

1. WEIGHT SHIFTING

POSITION: Stand

Stand next to the chair with your feet hip-width apart and your toes pointing forward. Placing one finger on the chair's backrest can help maintain balance.

MOVEMENT & FORM

Maintain keeping the chin tucked, the blades set, and the core set. Exhale, shift weight on one leg and hold. Breath in, shift the weight to another leg. Repeat.

2. MINI SQUAT

POSITION: Stand

Stand with feet hip-width apart against the wall, rest the back on the wall, arms crossed over your chest.

FORM & MOVEMENT

Maintain a tucked chin, set blades, and core set. Exhale, bend the knees, lower down towards the floor by 30 degrees, such as sitting on a chair, back in contact with the wall. Inhale, tighten the buttocks, and stand up to starting position. Repeat.

3. LEG CURL

POSITION: Stand

FORM & MOVEMENT

Stand facing back of a chair. Slowly bend one leg up toward your buttock, about 90 degree, then straighten it again. Repeat.

IN PLYOMETRIC TRAINING GROUP

(n=98) participants were selected and IFT is given for 10 minutes. Plyometric was done for 30 minutes each session 5 days per week. The program includes Towel calf stretch, hamstring stretch, gastrocnemius stretch each exercise were performed for 3 sets and 10 repetitions.

1. TOWEL CALF STRETCH

POSITION**:** Long sitting

FORM & MOVEMENT

Keep your back straight and your shoulders down and away from your ears as you gently pull the towel towards you.

2. HAMSTRING STRETCH

POSITION: Long sitting

FORM & MOVEMENT

Bend forward from your waist as far as possible while keeping your legs straight.

3. GASTROCNEMIUS STRETCH

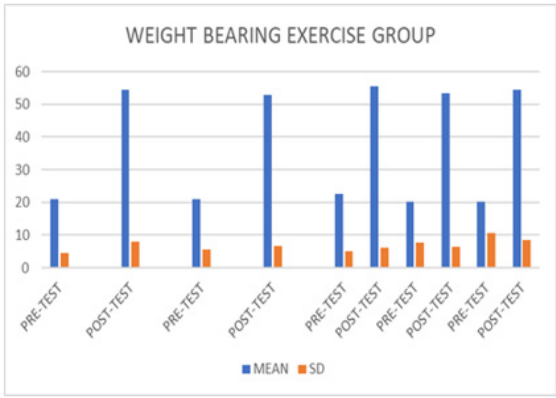
POSITION: stand

FORM & MOVEMENT

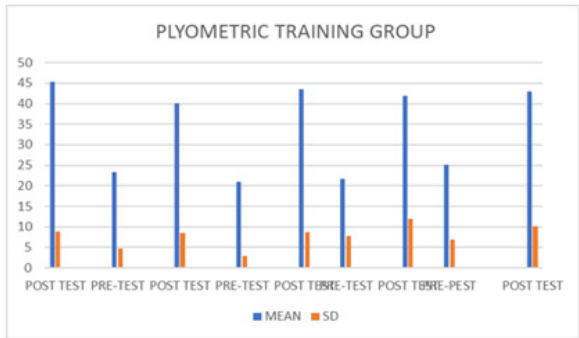
Place yourself approximately an arm's length away from the wall. Lean forward and position your hands roughly shoulder-width apart on the wall.

Extend one foot (the stretched side) behind you, one heel on the ground and the other closer to the wall. Lean your hips into the wall until you feel a stretch in the calf of the extended leg. Hold this stretch for about 30 seconds before switching sides. Move your foot further back for a deeper stretch.

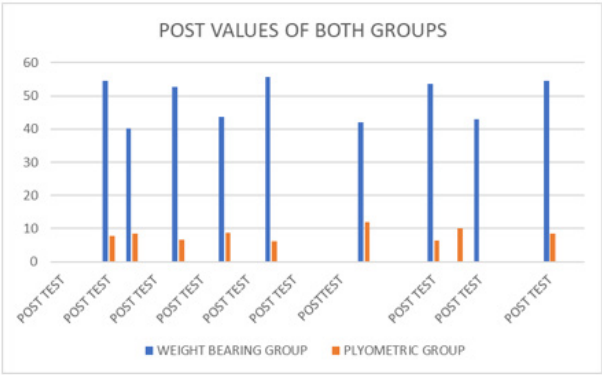
Data Analysis



Graph-1: Comparison of pre-test and post-test values of weight bearing exercise group using KOOS Scale.



Graph-2: Comparison of pre-test and post-test values of plyometric training group using KOOS Scale.



Graph-3: Comparison of post values of both the groups using KOOS Scale.

Result

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 analysed by paired t-test. The significance difference between the post- test values of both the group were analysed by unpaired t-test to examine significant changes between two groups.

The KOOS pre -test and post-test mean value for pain in bearing group was 20.86 (+4.46) and 54.46 (+7.85), whereas it was 21.00 (+3.20) and 45.27 (+8.86) in the plyometric training group. The KOOS pre- test and post-test mean value for symptom in the weight bearing exercise group was 21.09 (+5.45) and 52.76 (+6.54), where as it was 23.37 (+4.62) and 40.18 (+8.44) in the plyometric training group. The KOOS pre-test and post-test mean value for ADL in the weight bearing exercise group was 22.63 (+5.06) and 55.61(6.06), where it was 20.88 (+2.81) and 43.60 (+8.69) in the plyometric training group. The KOOS pre-test and post-test mean value for SR in the weight bearing exercise group was 20.10 (+7.67) and 53.32 (+6.43), where it was 21.73 (+7.74) and 41.99 (+11.97) in the plyometric training group. The KOOS pre -test and post-test mean value for QOL in the weight bearing exercise group was 20.06 (+10.06) and 54.59 (+8.36), where it was 25.09 (+6.90) and 43.08 (+10.17) in the plyometric training group. The results suggest that findings are considered to be statistically significant with p-value<0.0001.

The KOOS post-test mean value for pain in the weight bearing exercise group was 42.83 (+11.5), where it was 54.45 (+7.85) in the plyometric training group. The KOOS post-test mean value for symptoms in the weight bearing exercise group was 40.18 (+8.44), where it was 52.76 (+6.54) in the plyometric training group. The KOOS post-test mean value for ADL in the weight bearing exercise group was 43.60 (+8.69), where it was 55.61(+6.06) in the plyometric training group. The KOOS post-test mean value for SR in the weight bearing exercise group was 41.99 (+11.97), where it was 53.52 (+6.43) in the plyometric training group. The KOOS post-test mean value for QOL in the weight bearing exercise group was 43.04 (+10.15), where it was 54.59 (+8.38) in the plyometric training group. The results suggest that findings are considered to be statistically significant with p-value<0.0001.

Discussion

The purpose of the present study is to compare weight bearing exercise and plyometric training in pain and functional outcome in osteoarthritis knee subjects. The comparison is demonstrated with a duration of four weeks. The results were measured using KOOS before and after intervention. Beneficial effects were significantly greater in the weight bearing exercise group than the plyometric training group.

According to Christiansen & Stevens-Lapsley et al., (2010) weight-bearing asymmetry during standing-from-sitting transitions can be a clinically meaningful marker of both knee impairment and functional mobility for those with unilateral knee OA.[3]

NJ Chimera et al., (2004) found that pre-programmed motor strategies that were learned during plyometric training include adductor-to-adductor coactivation and stronger anticipatory adductor activity. These results offer strong support for the use of hip-muscle activation strategies to dynamically control and constrain lower extremity posture when making contact with the ground. Female athletes' training regimens should incorporate plyometric exercises since they increase the functional joint stability in the lower extremity, which may reduce the risk of injury.[4]

Mahalle et al., (2022) has stated that Short-term IFT therapy may significantly lessen pain and improve physical function in people with knee OA. These results imply that physical methods can be used to treat knee OA pain as an adjunct to medicine or as an alternative to it.[5]

Ewa M Roos et al., (2003) has concluded that The KOOS is a relatively new instrument that was originally released in 1998. The literature that is currently available supports its use in a variety of patient populations. However, continued usage of the tool will add to our knowledge and point out areas that need more research and development.[6]

Fernando Ribeiro et al., (2009) has concluded that Regular exercise has a good influence on knee joint position sensibility in both younger and older subjects and it can slow the decline in knee position sense that comes with getting older.[7]

Przemyslaw T Paradowski et al., (2006) has concluded that they discovered that pain, physical function, and quality of life associated with the knee varied with age and gender, suggesting the use of age- and gender-matched reference values for greater comprehension of the result by employing koos following therapies linked to knee injury and knee OA.[8]

Andrea E. Richter et al., (2001) has stated that Sports acceleration training regimens be used by many sportsmen to outperform their opponents. Increasing the balance and reaction time is one approach to obtain this advantage. These two elements are crucial for any athlete but are frequently disregarded. The athlete's skill level can be raised and injury risk decreased with the aid of balance and response time. Therefore, it is crucial to understand what kind of training can be employed to enhance them in order to help reduce the athlete's risk of injury and raise his or her degree of proficiency. This study examined whether plyometric and treadmill exercise enhanced balance and response time in high school players who took part in the Sports Acceleration program at the Altru Health Institute in the summer of 2000. The NBM was used to evaluate 19 patients utilizing the forward lunge and stability limit tests.

The outcomes showed that after plyometric and treadmill exercise, balance and response speed did dramatically improve. There were, however, a number of restrictions on this investigation. To help this area of analysis even further, it is advised that additional research combine the aforementioned suggestions.[9]

Conclusion

According to this study, WEIGHT BEARING EXERCISE had better results when compared to the PLYOMETRIC TRAINING GROUP, weight bearing exercise is more effective in reducing the pain and improving the functional outcome among osteoarthritis knee subjects.

Ethical Clearance: The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations- 03/033/2022/ISRB/SR/SCPT.

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Conflict of Interest: The authors state that there is no conflict of interest.

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