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ORIGINAL ARTICLE

# Comparison of BRACE (balance, resistance, aerobic, cognitive exercises) and proprioceptive training on balance and mobility in knee osteoarthritis.

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**ABSTRACT… Objective:** The purpose of the study was to find the effect of Balance, Resistance, Aerobic, Cognitive Exercise (BRACE) and proprioceptive training on balance and mobility in knee osteoarthritis. **Study Design:** Randomized Controlled Trial. **Setting:** Independent University Hospital Faisalabad. **Period:** September 2020 to December 2020. **Material & Methods:** A sample of 18 participants were included. The participants were divided into 2 groups BRACE and proprioceptive training by lottery method. The participants got 3 training sessions per week for 8 weeks. The measurements were taken at baseline and after 8 weeks. Statistical Package for Social Sciences(SPSS 27) was used to analyzed the data. **Results:** The age of participants in both groups was (55.67±2.761) years. The gender distribution of participants was female (55%) and male (45%). Within group analysis shows statistically significant relat ion on BBS and TUG from baseline to 8 weeks in both groups ($p<0.05$), On CTSIB frim eyes closed and foam eyes closed show significant difference in both groups ($p<0.05$). Between group analysis shows that no statistically significant relation in both groups ($p>0.05$). **Conclusion:** Both groups shows comparable improvements in balance and mobility but BRACE protocol showed more improvement as compared with proprioceptive.

**Key words:** Berg Balance Scale, BRACE Protocol, Knee Osteoarthritis, Proprioceptive Training.

## INTRODUCTION

Osteoarthritis (OA) of knee is most public health problem referred by discomfort and decrease in functional activities. The incidence of symptomatic knee OA is 13% in female and 10% in male. The second most common cause of disability among older adults is OA.[1] Characteristic of OA is degenerative and progresses with age that can lead to muscle weakness, pain and functional limitations for example joint stiffness reduced activity duration of less than 30 minutes.[2] Physical therapy can contribute to decrease in pain, muscle strength, improved proprioception, postural stability, increased independence in activities of daily living and reduction of depression symptoms.[3] Balance is a important component of functions which allows persons to maintain their position and respond to perturbations. Dynamic balance comprises of balance control with movements and significant aspects of whole balance skills. A risk factors for fall in participants with knee osteoarthritis were reduced balance control.[4]

Proprioception can be defined as a conscious, unconscious and semiconscious awareness or sense about position, force, velocity and movement of an extremity, limb or joint in space. The Proprioception of knee joint declined with increasing age and with the presence of progression knee OA.[5] Proprioception responsible to provide primary information for balance and extent through skin, muscles, ligaments and tendons. Postural sway can also affect due to damage in lower limb proprioception. Proprioceptive recovery is an essential factor through out therapy for patients.[6] Regulation of balance depends on the proprioceptive, visual

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and vestibular stimuli. The reduction in balance control may lead to fall injuries that result in serious psychological, social and physical loss. In knee OA patients an effective assessment of balance control is necessary before management of condition.[7]

Aslihan in 2020 compared effect of performance of single versus dual task exercise on balance in elderly persons with knee osteoarthritis (KOA). They concluded that dual task exercises was not superior to single task exercises for improving balance in knee OA patients.[7] In 2019 Gulsen reported that greater numbers of falls in older people with knee osteoarthritis (KOA) has been experienced by participants with no OA. Balance tests were applied with Tetrax Interactive Balance System, Berg Balance Scale (BBS) was applied formeasured the balance of patients. He concluded that appropriate physiotherapy and rehabilitation programme for knee osteoarthritis patients helps to improv balance and reduces risks of falling[8] Ferraz et Al in 2018 assessed the influence of a low intensity exercises related with incomplete blood flow limitation in individuals with KOA. Blood flow ressitance training (all $p<0.05$). Significantly blood flow resistance training were also able for improved pain while encouraging less joint stress developed a effective therapeutic in KOA management.[9]

In literature many techniques was available like electrotherapy, manual therapy and some instrumental based techniques was reported which measured effects on balance and mobility in knee OA. I want to introduce performance based exercises for physiotherapist to improve balance and mobility which was performed at clinical setup as well as home base program. There was a lot of researche articles published specifically on balance training exercises, resistance exercises and aerobic exercises separately. Previously supervised BRACE protocol was used on mobility to reduce risk of fall. Now I used BRACE and Proprioceptive training for improve balance and mobility in elderly with knee OA. The Objective of this study was to compare the effect of BRACE and proprioceptive training on balance in knee osteoarthritis and to compare the effect of BRACE and proprioceptive training on mobility in knee osteoarthritis.

## MATERIAL & METHODS

The study design was Randomized Controlled Trial. The study was conducted in Physical Therapy Department of Independent University Hospital Faisalabad from September 2020 to December 2020. The study was completed in 6 months. A sample of 18 is calculated by Epitool.[10] A 20% attrition rate is added and sample is 22, 11 in each. Group A: BRACE protocol training and Conventional physical therapy, Group B: Proprioceptive training and Conventional physical therapy The convenient sampling technique was used to collect the data.

### Inclusion Criteria

1. Age 50-70 years.
2. Both Male and Female
3. Knee osteoarthritis unilateral and bilateral.[11]
4. American College of Rheumatology (ACR) criteria for identifying osteoarthritis of knee joint is occurrence of discomfort in knee joint and any three of six factors listed below.[12]

1. Age 50y or more
2. Occurrence of crepitus sound on active motion
3. Morning stiffness less than 30 min
4. Bony inflammation
5. Bone overgrowth
6. No palpable warmness of synovium
7. Mini-mental state examination (MMSE) 23 or higher.[13]
8. Berg Balance Scale (BBS) 30-45 points.[14]

### Exclusion Criteria

Patients were exclude because they exhibit;

1. History of stroke during the previous 12 months
2. History of cardiovascular or musculoskeletal diseases,
3. Previously used medication for the central nervous system.
4. Presence of lower limb lesion or fracture in the last six months.[15]

### Data Collection Tool

1. Berg Balance Scale (BBS) have shown high intrarater and interrater reliability (ICC 0.98) and Intra Class Coefficient (ICC=0.97-0.98)[14,16]
2. Time Up and Go test (TUG) show excellent reliability (ICC>.95).[17]
3. Modified Clinical Test of Sensory Interaction in Balance (CTSIB).[18]

### Interventional Protocol (Conventional Treatment)

Participants was received following treatment, heat treatment by infrared lamp which was positioned about 30cm from the knee surface for almost 15- 20 minutes, strengthening of selected muscles specially quads muscles (isometric and dynamic).[19]

### Brace Protocol[20]

| | |
|---|---|
| Balance training | Static balance:<br>1) Romberg with eye open and eye close [30 sec repeat 3 times]<br>2) Tandem standing with eye open then with eye closed. Right foot front first, then left foot front [10 Sec repeat 3 times]<br>3) Single leg stance 5 repetition with sec. |
| | Static/Dynamic/Anti-cipatory Postural Control:<br>1) Sit to stand: 5 repetition<br>2) Functional reach test: forward, sideways and cross reach, practice 1 min for each<br>3) TUG test: with distance of 10 feet and time 10 sec. practice 2 min |
| Resistance training Exercises | 1) Chair rise 30 sec without using hands: (8-15 repetition)<br>2) Stair climbing 10 stairs in 10-30 sec without using rails (8-12 repetitions) |
| Aerobic exercises | 1) 6 min walk test: 3-5 times<br>2) Cycling 5-10 minutes |
| Cognitiveexercises | 1) Count reverse from 50 Repeat with eyes open and close Reps of 30s for each<br>2) Push wall and reverse count from 20<br>3) Remember 5 words, Name 5 animals, Repeat 5 words |

| **Proprioceptive Training Phase[6]** | |
|---|---|
| 1st Phase - Steady phase<br>(1st set: Eyes Open, 2nd set: Eyes Close)<br>Preserve stand up position<br>Equally heels up and down<br>Preserve stand up on one leg by turns | For 4 minutes per set<br><br>For 10s (5times per set)<br>For 10s (5times per set)<br>For 10s (5times per set) |
| 2nd Phase - Dynamic phase<br>Standing training on unbalanced surface<br>(1st set with open eyes and 2nd set with closed eyes)<br>Preserve stand up position<br>Equally heels up and down<br>Preserve stand up on one leg by turns<br>Take step by turns | For 6 minutes per set<br><br><br>For 10s (5times per set)<br>For 10s (5times per set)<br>For 10s (5times per set)<br>For 10s (5times per set) |
| 3rd Phase - Functional phase<br>Walking on the equal place<br>Equally feet together, stand up with back and forward foot position<br>Siting down→ Squating position→ Standing up | For 10 minutes<br>For 6 minutes<br>For 10s (5times per set)<br>For 1 min |

Informed Consent was signed. Used Standardized Questionnaire to collect the data. 8 weeks of interventional was provided 3 sessions per week for 8 weeks. The data was collected at baseline and after 8 weeks. Randomization was done by lottery method without replacement. Odd numberwas allocated to Group A and even number was allocated to Group B. Data was analyzed through SPSS 27. Data was checked for its normality. Data was normally distributed parametric test applied, within groups comparison paired sample T-test, between groups independent sample T-test was applied. Ethical clearance certificate had taken from institutional research board committee (REC/RCRS/20/2036.

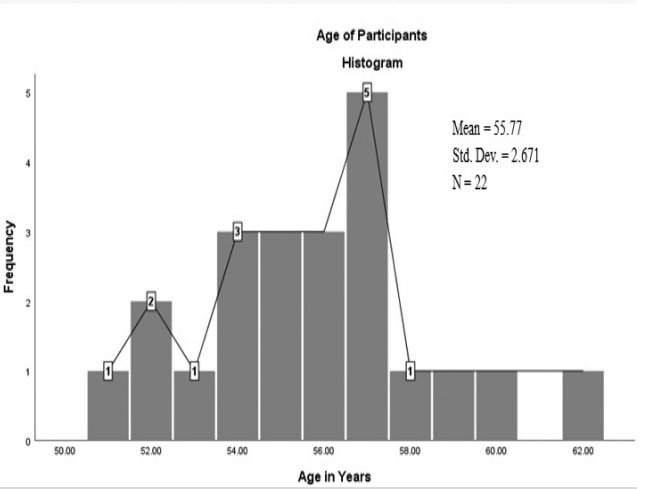


**Figure-1. Shows frequency distribution of age of the participants**

## RESULTS

On the basis of inclusion and exclusion criteria total 18 participants were recruited in this trial. Independent sample T-test was used to assess significance difference across the groups. Paired sample T test was used measure difference within the groups. For statistically significance p value (<0.05) or less and not significance p value (>0.05) or more selected. Age of the participants after Sequential Deletion total number of participants was (N = 18), mean of age (56.28) and standard deviations (SD) (2.585). Gender distribution in Group A 55% male and 45% female were participated. Gender distribution in Group B 36% male and 64% female were participated.

Within group analysis paired sample T test was applied and show statistically significant relation on BBS and TUG in both groups (p <0.05), On CTSIB frim eyes closed and foam eyes closed show significant difference in both groups (p <0.05). Between group analysis independent sample T Test was applied and show that no statistically significant relation in both groups (p >0.05).

Table-I was indicate descriptive statistics of BBS, TUG and CTSIB of Group A at baseline and after 8th weeks.

Table-II indicates descriptive statistics of BBS, TUG and CTSIB of Group B at baseline and after 8th weeks.

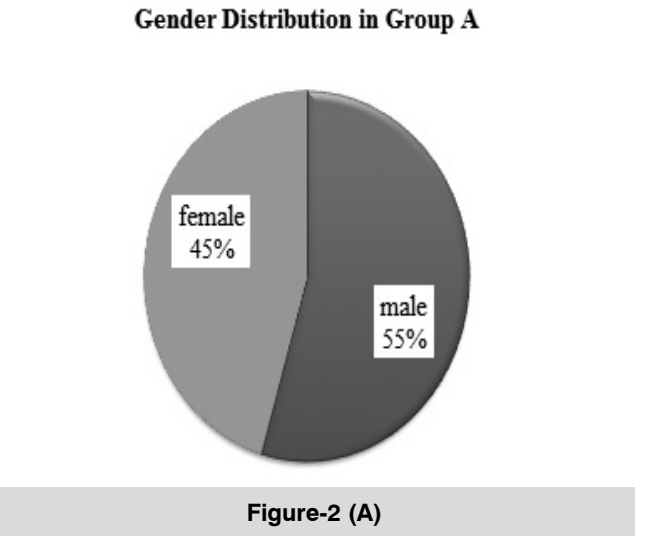


**Figure-2 (A)**

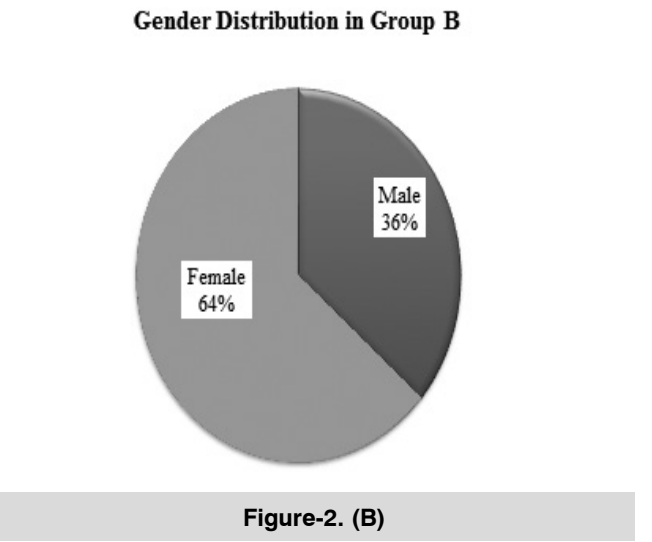


**Figure-2. (B)**

| | Pre Observations | Post Observations | |
|---|---|---|---|
| | Mean±Std. Deviation | Mean±Std. Deviation | P-Value |
| Berg Balance Score | 36.78 ±4.93 | 44.44 ±3.609 | .036 |
| Time Up &Go | 16.33 ±1.414 | 11.00 ±2.000 | .005 |
| Firm: Eyes Open | 27.11 ±4.484 | 29.67 ±1.000 | .499 |
| Firm: Eyes Closed | 16.67 ±4.500 | 22.67 ±4.607 | .000 |
| Firm: Dome | 15.78 ±2.779 | 19.00 ±4.358 | .043 |
| Foam: Eyes Open | 26.89 ±4.833 | 29.22 ±1.715 | .116 |
| Foam: Eyes Closed | 14.33 ±3.937 | 18.11 ±4.598 | .002 |
| Foam: Dome | 15.89 ±3.217 | 16.11 ±6.607 | .153 |

**Table-I. Pre & Post observations of Group A.**

| | Pre Observations | Post Observations | |
|---|---|---|---|
| | Mean±Std. Deviation | Mean±Std. Deviation | P-Value |
| Berg Balance Score | 39.20 ±5.157 | 45.70 ±3.093 | .000 |
| Time Up &Go | 17.70 ±2.869 | 11.40 ±2.756 | .001 |
| Firm: Eyes Open | 26.30 ±4.854 | 29.50 ±1.581 | .185 |
| Firm: Eyes Closed | 19.50 ±7.501 | 23.70 ±5.056 | .000 |
| Firm: Dome | 15.90 ±2.131 | 19.40 ±5.601 | .067 |
| Foam: Eyes Open | 25.10 ±6.436 | 29.70 ±0.948 | .099 |
| Foam: Eyes Closed | 19.10 ±7.823 | 21.40 ±7.381 | .002 |
| Foam: Dome | 15.50 ±3.566 | 16.40 ±4.477 | .056 |

**Table-I. Pre & Post Observations of Group B.**

## DISCUSSION

This study demonstrated that within groups comparison (Group A) mean and SD of berg balance scale (44.4±3.6) shows statistically significant progress in BRACE group (p=0.036) and (Group B) mean and of berg balance scale (45.7±3.0) show statistically significant progress in proprioceptive training group (p=0.000). Roig-Casasus et al. in 2018 studied that a 4 week training platform whose approaches comprised dynamo-metric stand resulted in significance progress of experimental groups measured with Berg Balance Scale (51.8±2.7), (p=0.03).[21]

Gulsen et al., in (2019) studied on older people aged 65 and over were given instrumental balance training with virtual reality practice. Result of the study was show an improvement in the balance in older people same as current study. Another study show that balance is impaired in knee osteoarthritis and the risk of falling is expected to increase. Falling occurs mostly during daily life activities situations that requiring dynamic postural control.[8] In current study both training programs resulted in significant improvements in balance measured with berg balance scale. Doma et al. in 2018 determine the benefits of balance training on balance performance. Meta analyses showed that balance-specific training improved walking capacity. However the current meta-analyses verified that persons who undertook approximately 6 weeks of balance training as an assistant showed significantly greater improvement in balance specific tasks.[22]

In current study results also showed that 8 weeks both training programs give significant improvements in mobility measured with time up and go test. Mean and SD of BRACE group (11.0±2.0) with significant value (p=0.005) and mean and SD of Proprioceptive group (11.4±2.7) with significant value (p=0.001).

This results supported by literatue of Bishoff HA et al. who suggested that TUG score <12 was required to decrease risk of fall and improve mobility. They also suggested that the TUG test is useful in detecting mobility impairments in elderly

persons.[23] Ng et al. in 2017 stated that TUG test is used to measure for perceiving change in mobility in older adults with high reliability. In exercise training goal the ankle was found to produce greater progress in postural stability. The intervention group also demonstrated a trend of an improvement in mobility and balance in single leg stance test.[24]

In this study CTSIB also shows significant improvement in two conditions frim eyes closed and foam eyes closed in both training groups. Other two conditions frim eyes open and foam eyes open proprioceptive training group is superior to BRACE group. Another condition of CTSIB frimdome BRACE group is superior to proprioceptive training group. Last condition of CTSIB foam dome proprioceptive training group is superior to BRACE group.

Hill et al., in 2013 verified high risk of falls in balance and mobility impairment in older women with OA showed most balance and mobility tasks in both groups of arthritis participants verified similar increased levels of across several CTSIB domains.[25] Ricci et al. in 2009 defined elderly individuals with different histories of falls presented differences regarding the influence of sensory interaction on balance.Under some conditions in which proprioception was in accurate that was performed on foam.[26]

But in current study only foam in dome was not statistically significant. Overall sum of mean difference in BRACE group was more effective than proprioceptive group.

## CONCLUSION

It is concluded that both groups revealed comparable improvements in balance and mobility but BRACE protocol showed more improvement as compared with proprioceptive.



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## AUTHORSHIP AND CONTRIBUTION DECLARATION

| No. | Author(s) Full Name | Contribution to the paper | Author(s) Signature |
|---|---|---|---|
| 1 | Ali Raza | Introduction, Literature review, Data collection & analysis. | |
| 2 | Khadija Liaquat | Supervision & Data analysis. | |
| 3 | Hafiz Salman Saeed | Discussion. | |