**ORIGINAL RESEARCH ARTICLE**

# COMPARATIVE STUDY OF BIO FEEDBACK TRAINING WITH STRENG THENING EXERCISES VS STRENGTHENING EXERCISES IN OSTEOAR THRITIS KNEE CASES.


## ABSTRACT-

**Introduction-** Osteoarthritis is a non inflammatory degenerative disorder of joints causing disability in millions of people all over the world. WHO estimates that 10% of world's population over 60 years of age suffers from osteoarthritis and 80% of people with osteoarthritis have limitation of movement and 25% are unable to do daily activities. Thus, making it a major cause of impairment & disability in elderly and economic burden in community.

The purpose of the study is to compare the effects of biofeedback training along with strengthening exercises vs strengthening exercises in knee osteoarthritis subjects to reduce the symptoms of pain, loss of ROM and functional activity. **Methods-** 50 subjects diagnosed of grade-I to early grade-II osteoarthritis recruited for the study after obtaining a informed consent. Each group will comprise of 25 subjects with age group ranging 40-70 years. Group A will be given biofeedback training along with the strengthening exercises of knee, Group B will be given strengthening exercises exclusively. Both the groups will undergo training for 3 days per week for 6 weeks. Each session will be of 20-30 minutes. **Results-** Parameters include WOMAC score and joint ROM, both pre-test and post-test measures will be analyzed statistically using t-test to check the effectiveness of each technique. P value WOMAC Score showed p >0.0001 and shows significance in the biofeedback training subjects. **Conclusion-**In this study bio feedback training with the strengthening exercises shows significant improvement in symptoms of OA knee cases.


**Key words**: biofeedback, Knee osteoarthridites, Neurofeedback, Osteoarthritis; Training exercise.




## 1. INTRODUCTION:

Osteoarthritis is a degenerative and non-inflammatory disorder of joints in adults causing disability all over the world among million of people [1]. It is characterized by progressive articular cartilage deterioration and new bone formation (osteophytes) at joint surfaces[2]. Women are more affected than men, associated with varus deformity (more than 90%, in contrast genu valgum present in 90% in RA.

10% of world's population aged over 60 years according to WHO estimates that they suffer from osteoarthritis and 80% of osteoarthritic cases have limitation of movement and 25% are having difficulty to do daily activities, making it a major cause of impairment and disability in elderly and causing economic burden in community. One in five women over aged 60 is affected [2]. A US based study in 1995 suggested that by the year 2020, 66% increase will be seen in number of osteoarthritis related disability [2].

Management: *1. Conservative* :Anti-inflammatory drugs, electrotherapy for pain relief and quadriceps strengthening exercises and full mobility maintenance, lifestyle modifications[3],weight loss, isometric quadriceps exercises, offloading braces [1], shifting weight from one compartment of knee to other thereby relieving pain [1]. *2. Surgical options*: Osteotomy in uni-compartmental disease, Open wedge with internal fixation, arthrodesis, replacement arthroplasty , Arthroscopic lavage and debridement, Joint surface allo-grafting and osteochondral grafting drilling and debridement, knee arthrodesis[2].

Following a proper diagnosis of OA knee, treatment procedure is prescribed in favor of the treatment of symptoms. Biofeedback training is used to help prevent or treat conditions including migraine headache, chronic pain, urinary incontinence and hypertension[12].

The intention of giving biofeedback training is thought that by channeling the power of one's mind and becoming aware of what's going on inside the body, subject would gain more control over the health. Since it is non-invasive technique and does not involve drugs, there is a low risk of undesirable side effects.

Biofeedback therapy is an emerging treatment maneuver that is instrument-based learning process based on "operant conditioning" techniques. In physical therapy, biofeedback training requires active participation by patients and regular practice between the training sessions. Clinical biofeedback is used to manage disease symptoms and to improve overall health and wellness through stress

management training [14]. This training requires a particular instrument to convert physiological signals into significant visual and auditory cues and a trained biofeedback practitioner to guide the therapy. Signals from the instrument will be shown in a monitor. The patient get feedback that helping them to control their body's physiology. Biofeedback allows patients to assess their bodies, with help of trained practitioner, as a guide to use the feedback in amending body physiology to a healthier form.

Research shows that biofeedback intervention is effective in treating a variety of medical conditions. There are rates on the principle of refining a movement sequence or pattern by visual, physical and/or auditory feedback for assisting the patient to optimally perform. The patient knows his own body signs and he/she has the ability to control them consciously using biofeedback instrument which helps in achieving the desired goal along with encouraging the patient. However there are limitations to biofeedback application with the therapist, there should be a solid understanding of the basic principles of the therapy in combination with a clinical understanding of the patient's problems and numerous applications for the therapy. EMG Biofeedback is widely in use and studied upon.

## 2. Methods and Materials

*Study Design:*

Quasi-experimental study design

*Sampling Method and Set-up:*

Study was conducted in Department of Physiotherapy, Chettinad Hospital and Research Institute, Chennai. Diagnosis of osteoarthritis was made by the orthopedician with relevant examination and radio graphical comparisons. Chief purpose, outcomes and benefits for the patients were explained in their vernacular language along with the informed consent.. Convenient sampling was done based on the inclusion and exclusion criteria patients were selected and they were randomly segregated into two groups with 25 patients in each group.

*Sample Size:*

50 subjects were taken from the osteoarthritic group based on the inclusion and exclusion criteria and were grouped into group A and group B.

Group A and B comprised of 25 subjects in each group having diagnosed as Grade I to early Grade II Osteoarthritis of knee as per the Kellgren-Lawrence grading of osteoarthritis. The subject around 40 to 70 years of aged both the gender with the Unilateral Evidence of Grade I and Grade II Osteoarthritis by examination, radio graphical comparisons are included. Evidence of any previous knee surgery undergone for the same condition, Presence of any Knee deformities, Any steroids or intra articular injections administered within the past 3 months, Other associated musculoskeletal conditions involving the knee joint (Tendon or Ligament tears) are excluded from the study.

## 3. Procedure

Two groups of patients were taken with 25 in each group for the study .

Group A was treated with the biofeedback training along with strengthening exercise protocol and Group B was treated exclusively by strengthening exercises. Pre-intervention WOMAC scores and ROM values of affected knee were taken for both the groups. Intervention was given to both the groups in form of designed strengthening exercises as in the table.1. for 3 days in a week for 6 weeks. Subsequently readings were taken on the completion of sixth week and assessment was done thereafter.
Biofeedback training using dial-type sphygmomanometer was given along with the strengthening exercises to let the subject have audio and visual feedbacks and improve the strength in exercise production. In the other group the same group of exercise was given post-intervention for 6 weeks, WOMAC scores and ROM scores were evaluated to find the efficacy between the two groups.
Finally results of both the groups were compared on the basis of outcome measures of WOMAC Index to find efficacy of Biofeedback training for the Osteoarthritis Knee condition.

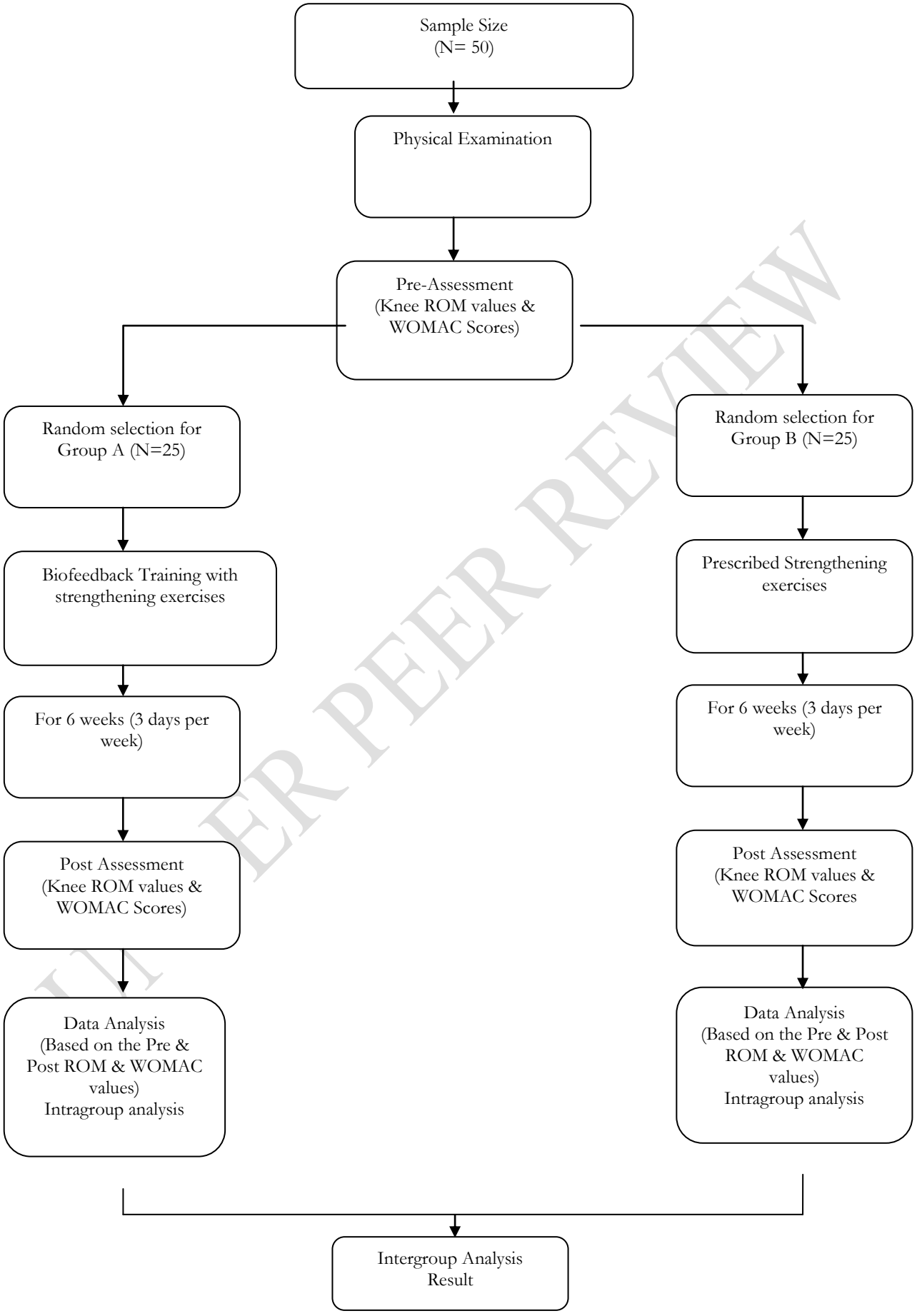
Materials : Dial- type Sphygmomanometer, A observational table or couch, Patient's consent form, Pillows or towel roll for comfort, Outcome measures forms (WOMAC Index), Patient with osteoarthritis relevant diagnosis.

*Table 1: Exercises Intervention for both the groups*

| S.No. | Exercises | Duration(Hold Time) | Frequency | Repetition |
|---|---|---|---|---|
| 1. | Single leg raises | 5 Second hold | 1set-4times | 3sets |
| 2. | Hamstring stretch | 30-60 Second hold | 1-2times | 3sets |
| 3. | Half squats | - | 1set-10 times | 2sets |

| | | | | |
|---|---|---|---|---|
| 4. | Leg stretch | 5 Second hold | 1set-10 times | 3sets |
| 5. | Posterior Capsular Stretch | 10 Second hold | 1set-10times | 3sets |

***Flow Chart 1**: Data Collection & Analysis Procedure*



**Data Analysis and statistics:**
Statistical analysis was conducted using SPSS software version 16.0, Pre-test and post-test values of WOMAC scale and Knee flexion ROM were collected for both experimental and control group. Mean and SD were calculated for the pre and post test measurement, later the mean difference was calculated to find the change in the observed variables. A paired t test is done compare the mean and standard deviation of two group, taking the t value under 48 degree of freedom, under 0.05 significnce level. P value is < 0.0001 which indicates the change is highly significant.

*Table 2: Pre and Post- test mean ± SD analysis of WOMAC scale scoring within the experimental and control groups:*

| **Groups** | **Mean ± SD** | | **t-value** | **Degrees of freedom** | **P value** |
|---|---|---|---|---|---|
| | **Pre-test value** | **Post-test value** | | | |
| **Experimental Group (Group A)** | 78.08±4.79 | 55.96±6.13 | 14.216 | 48 | < 0.0001** |
| **Control Group (Group B)** | 77.08±8.79 | 67.96±5.13 | 4.480 | 48 | < 0.0001** |

**** P value indicates highly significant**

*Table 3: Pre and Post- test mean ± SD analysis of Knee Flexion range within the experimental and control groups:*

| **Groups** | **Mean ± SD** | | **t-value** | **Degrees of freedom** | **P value** |
|---|---|---|---|---|---|
| | **Pre-test value** | **Post-test value** | | | |
| **Experimental Group (Group A)** | 110±3.19 | 130±4.13 | 19.162 | 48 | > 0.0001** |
| **Control Group (Group B)** | 105±4.29 | 120±3.13 | 14.123 | 48 | > 0.0001** |

**** P value indicates highly significant**

## 4. Results:

The study was conducted with a sample size 50 among the people who were 40 – 70 years old having OA changes in knee including both male and female. The outcome measures used to analyze the result of the study were WOMAC scale and ROM examination using WOMAC index and Goniometer. It is evident that group A is effective in reducing pain, stiffness and improving physical function in these cases. Group B, the control group also shows reduction in pain, stiffness and improvement in physical function. When group-A is compared to group-B, significant results obtained suggests effectiveness in group-A as compared to group-B in reduction of pain, stiffness and improving the physical function. In terms of range of motion, significant changes was seen in group-A in both flexion and extension of knee. In group-B, improvement in flexion and extension ranges of motion was also marked.

Thus, more effectiveness was marked in group-A subjects treated with biofeedback training along with strengthening exercises in comparison to group-B that was treated with strengthening exercises exclusively, suggesting that biofeedback training along with strengthening exercises is more effective in reduction of pain, stiffness and improving physical function as compared to strengthening exercises only.

## 5. Discussion

The aim of the study was to compare the effectiveness of biofeedback training along with strengthening exercises compared to strengthening exercises only in OA knee subjects.

A sample of 50 subjects according to the inclusion and exclusion criteria were grouped into two groups of 25 each. All participants were clearly explained about the treatment procedure.

The informed consent was obtained from all the participants and they underwent treatment for 6 consecutive weeks. The outcome measures were recorded on before and after the treatment using WOMAC and ROM scores on the last day of treatment.

According to table-2 we compare the pre an post-test means of WOMAC score and there is significant difference between two treatments (A and B) in terms of average reduction in value of WOMAC score (t=12.42,p=0.000<o.o5).In addition, the mean reduction in WOMAC score by treatment A(17.12) is greater than that of treatment B(5.72).Hence, we conclude that treatment A is effective than treatment B in terms of average reduction in WOMAC scores.

**Yun Lak Choi et al (2015)**[30]did a study to investigate the effects of isometric exercises using EMGBF (EMG biofeedback) and USBF(ultrasound biofeedback) on maximum voluntary isometric contraction(MVIC),pain was assessed by the VAS and VMO thickness in Knee OA cases. The maximal voluntary isometric contraction was improved significantly and VAS scores was reduced in the experimental group in comparison to the control group. Significant increase in VMO thickness was seen in comparison to the pre intervention status. They concluded that both EMGBF and USBF were effective in treating knee OA cases.

According to table 3 comparing the pre and post means of treatment A and B in increasing flexion values and there is sufficient evidence to conclude that there is a significant effect of treatment A in increasing the value of FLEXION score ($t = –8.70$, $p = 0.000 < 0.05$). In addition, the mean value of FLEXION Score has increased from 114.60 to 124.80, which confirms that Treatment A is significantly effective in increasing the value of FLEXION score.

**Rosie E. Richards et al (2017)**[31]studied the effect of real-time biofeedback on peak knee adduction moment in patients with medial knee osteoarthritis:effectiveness of direct feedback and found significant reduction in knee adduction moment with direct feedback. Significant reductions in adduction with specific instructions and direct feedback was seen whereas on removal of feedback reductions in knee adduction was seen.

In addition, the mean improvement in FLEXION score by Treatment A (10.2) is greater than that of Treatment B (8.0). Hence, we conclude that Treatment A is significantly effective than Treatment B in terms of average improvement in FLEXION score at 10% level of significance.

In addition, the mean improvement in EXTENSION score by Treatment A (10.2) is greater than that of Treatment B (8.0). Hence, we conclude that Treatment A is significantly effective than Treatment B in terms of average improvement in EXTENSION score at 10% level of significance.

**Limitations & Future Recommendations**

- Small Sample Size
- Future researches can be conducted out to create more evidence based practice.
- Reach to greater number of population.
- Can be implemented on other musculoskeletal conditions to find biofeedback efficacy.

## 6. Conclusion

The intra-group analysis showed that both the treatments in the Experimental group treated by biofeedback with strengthening exercises and Control group treated by strengthening exercises. It shows effective in terms of reduction in the values of WOMAC and improvement in the values of FLEXION and EXTENSION. However, the inter-group analysis showed that Experimental Group is effective than Control Group in terms of average change in all the three measures (at 10% level of significance). Hence, we conclude that Biofeedback training along with strengthening exercises is effective than Strengthening Exercises in knee osteoarthritis cases to reduce the symptoms of pain, stiffness and physical function.

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