

Effectiveness of Progressive Resistance Drills and Dynamic Balance Training on Functional Performance among the Patients with Osteoarthritis of Knee

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Abstract

Osteoarthritis, degenerative joint disease in which the wearing down of the protective tissue at the ends of bones (cartilage) occurs gradually and worsens over time. The majority of people aged 40 years have radiographic evidence of knee osteoarthritis, is more common in women than in men.⁽¹⁾ Exercise has a wide range of health benefits in every individual. Mostly for middle aged population there is a clear evidence to support exercise in improving health and functional performance with well evidenced exercise programs.^(2, 3) These programs have shown to improve the mobility of joints and strength of muscles around the joints by performing specific exercises for the specific muscles. This population people are often unable to undertake high intensity exercise programs. Therefore progressive resistance exercises are been used as an alternative. Many research studies have reported the benefits of resistance exercises as a physical activity for middle aged adults and individuals with limited movement.

Method: The subjects in the KIMSDU campus were screened and 41 subjects fulfilling the criteria were involved. Prior consent was taken. Treatment protocol consists of progressive resistance exercises for 4 days per week for 6 weeks The interpretation of the study was done on the basis of comparing pre-test and post-test assessment of Western Ontario and McMaster Universities Osteoarthritis Index(WOMAC) and BERG BALANCE TEST.

Result: Intra group comparison results showed that progressive resistance exercises are effective and WOMAC and Berg Balance Test were statistically extremely significant ($p < 0.0001$) and ($p < 0.0001$) respectively.

Conclusion: Progressive resistance exercises were significantly effective in improving the mobility and function and reducing the pain among the patients with osteoarthritis of knee.

Keywords: *Osteoarthritis (OA), progressive resistance exercises, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Berg balance Test.*

Abbreviations: Western Ontario and McMaster Universities osteoarthritis index (WOMAC), Osteoarthritis (OA).

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Introduction

Osteoarthritis is the most common type of arthritis which is usually found in elderly individual. It is degenerative, non-inflammatory disorder of synovial joint characterized by loss of hyaline cartilage, remodeling of surrounding bone and narrowing of joint space.⁽⁴⁾ Osteoarthritis of knee is the most common type

of osteoarthritis and the prevalence is more in women than men.⁽⁵⁾ Due to the degenerative changes occurs in knee joint it mainly affect the cartilage of the knee joint and is one of the most common cause of functional limitation and dependency.^(6, 7)

OA of knee is mainly diagnosed by symptoms such as:^(1, 4, 8)

1. Pain
2. Stiffness
3. Paresis
4. Tenderness
5. Effusion
6. Decrease in range of motion (ROM) secondary to pain
7. Muscle weakness.

In OA of knee, day to day physical activities like walking, squatting, stair climbing, cross leg sitting are mainly affected. OA of knee is a degenerative disorder so the line of treatment should be focus on reducing physical and psychological disability which includes patient education, physical activity, weight reduction and the use of assistive or orthotic devices. Muscle strength around the knee joint is significantly reduced in subject with OA of knee. Mostly the muscle which is get affected by OA of knee is quadriceps group of muscle.⁽²⁾ It acts as a shock absorber in the knee joint that is why the weakness in quadriceps muscle causes the reduction in functional performance at knee joint.^(3,9)

In OA of knee individual balance is also affected which may leads to injury to the knee joint.⁽¹⁰⁾ Muscle strengthening through resistance increases physical function, decrease pain and increase stability at the knee joint which is causes by OA and it also helps to reduce self-reported disability due to the OA.

The progressive resistance exercises are as follows:

1. Seated hip march
2. Heel raise
3. Step up
4. Walking
5. Squatting

6. Stair climbing

It is found in earlier studies that physical activities improve the metabolism and blood circulation. Resistance can be applied by various methods with progressively increasing manner like weight cuff, resistance band, body weight exercises, etc. Regular exercise including stretching and strengthening is an important component in managing OA irrespective of severity which is the standard care for individual with knee OA because it helps to reduce pain and improve function and stability at the knee joint. That is why it is important to evaluate the effect of progressive resistance drills and dynamic balance training on functional performance among the patients with OA of knee. However there is less number of articles available on effect of progressive resistance exercises on functional performance among the patients with osteoarthritis of knee.

Material and Methodology

Ethical clearance was obtained from the institutional ethical committee, KIMSUDU, karad. This study included the 41 osteoarthritis of knee individuals according to inclusion and exclusion criteria. The study protocol was approved by the regional ethical committee. Individuals were selected according to inclusion criteria age between 40-70 years, men and female and exclusion criteria was individuals taking medication which influence the variable measured, any orthopedic condition that limit the exercise, unstable angina, uncontrolled hypertension – SBP \geq 200 mmHg and DBP \geq 110 mmHg. And they were perform progressive resistance exercises including warm up and cool down period of 10 min.

Progressive Resistance Exercise Protocol: (30 minutes)

1. WARM UP (6 minutes)

- Seated hip march
- Heel raise
- Step up

Each move will have 20 repetitions.

2. WORKOUT (18 minutes)

(Walking)

- Slow walking

- Fast walking
- Toe walking
- Heel walking
- With weight cuff walking

(Squatting)

- With support
- Without support
- With progressive increase in weights

(Stair climbing)

- With support
- Without support
- With weight cuffs

Each exercise will have 6 minutes.

3. COOL DOWN (6 minutes)

- Hamstring stretch
- Adductor stretch
- Trunk side flexor stretch
- Quadriceps stretch
- Calves stretch

Each stretch will be held for 20 seconds.

This protocol will be conducted for 4 days in a week for 6 weeks.

OUTCOME MEASURES

1. Western Ontario and McMaster Universities Osteoarthritis index (WOMAC). ⁽¹¹⁾
2. BERG BALANCE TEST.

STATISTICAL ANALYSIS

Statistical analysis of the recorded data was done by using the software INSTAT. 41 subjects were successfully completed assessment and were perform progressive resistance exercises for 12 weeks.

Result

Age Distribution

Table 1: Age distribution

Age Group	No. of Individuals
40-49 yrs.	12
50-59 yrs.	19
60-70 yrs.	10

Gender Distribution

Table 2: Gender distribution

Gender	No. of Individuals
Male	17
Female	24

Outcome Measures

(WOMAC AND BERG BALANCE TEST)

Table 3: Comparison of pre and post WOMAC and BERG BALANCE TEST within the group

Outcome Measures	Pre-test	Post-test	P value	t value	Inference
WOMAC	75.682±12.084	62.170±10.370	0.0001	13.193	Extremely Significant
Berg Balance Test	61.365±10.495	77.682±14.138	0.0001	8.157	Extremely Significant

In present study the pre-test mean of WOMAC was 75.682 ± 12.084 , whereas post-test mean was 62.170 ± 10.370 . The pre-test mean of BERG BALANCE TEST was 61.365 ± 10.495 , whereas post-test mean was 77.682 ± 14.138 . Intra group analysis of WOMAC and BERG BALANCE TEST revealed statistically increase in post-test WOMAC and BERG BALANCE TEST scores. This was done by using paired t test. WOMAC ($P < 0.0001$), BERG BALANCE TEST ($P < 0.0001$).

In group statistical analysis for WOMAC and Berg balance test shows extremely significant in post intervention. There is improvement in strength in muscle around the knee which helps to reduce the pain due to osteoarthritis of knee in subjects. This patients performs the specified progressive resistance strength training show the significantly improvement in decreasing level of pain due to osteoarthritis of knee during activity daily living.

Discussion

Walking is the aerobic activity which can be used as the warm up which leads to pump up the body for the further training effect. The walking with progressive resistance use to train the lower extremities and it is largely used by the sports players as a part of exercise training. So, it is very effective to do exercise in middle aged individuals which helps in the weight reduction as well as improves the strength all over the body. This specified progressive resistance training are used to improve stamina, aerobic capacity and strength in the individual with osteoarthritic of knee. This exercise helps to improve strength muscles around the hip and knee which reduce the level of pain and increase the mobility of knee in the patient with osteoarthritic of knee. It also improves the balance of individual.⁽¹⁰⁾

Conclusion

From this study, we can conclude that there is significant effect of progressive resistance drills and dynamic balance training on functional performance among the patients with osteoarthritis of knee.

Conflict of Interest: There is no conflict of interest concerning the content of the study.

Source of Funding: This study was self-funded

Ethical Clearance: The study was undertaken after obtaining the approval of Protocol committee and Institutional Ethical committee of KIMSDU.

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