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EFFECT OF LOW INTENSITY CLOSED KINEMATIC CHAIN EXERCISE WITH PULMONARY REHABILITATION IN COPD

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ABSTRACT:

Introduction:

COPD is preventable and treatable disease with progressive airway restriction. There is reduced physical activity in COPD and also it is associated with reduced peripheral and respiratory muscle weakness hence the present study is conducted with the aim to determine the effect of low intensity closed kinematic chain exercise along with pulmonary rehabilitation in COPD.

Materials and Methods: *A Randomised control trial was carried out on 22 samples with COPD. The individuals were selected based on inclusion and exclusion criteria and were divided into 2 groups. Group A was treated with low intensity CKC exercise along with pulmonary rehabilitation and Group B was treated with only pulmonary rehabilitation program. Study place was OPD Krishna college of Physiotherapy, Karad. The protocol was given for 6 weeks (3 times per week.). The outcome measures were 6 minute walk test, time up and go test for balance and maximal voluntary contraction.*

Result: *There was statistically significant improvement in group A as compared to Group B. The six minute walk test distance was significantly improved in group A as compared to group B (p=0.0256). The balance was improved in group A as compared to Group B (p=0.0069).*

Conclusion: *The study concluded that the Low intensity closed kinetic exercises should also be implemented in routine pulmonary rehabilitation for better functional outcome in individuals with COPD*

Keywords: *chronic obstructive pulmonary disease, six minute walk test, pulmonary rehabilitation.*

I. Introduction:

The individuals with COPD suffer from one of the most serious extrapulmonary manifestations which include skeletal muscle dysfunction.[1]

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The patients with COPD have limited physical ability to perform usual daily activities like work activities, recreational exercises and hobbies. They develop exercise intolerance.[2]

The exrcise intolerance develops due to airway resitance, increased elastic losd to breathing, gas excgange abnormalities, and mechanical disadvantage of respiratory muscle[3,4]

The evidences suggest that there is decline in physical activity in individuals with COPD.[5]

The exercise interventions given to COPD individuals consist of pulmonary rehabilitation which is incorporated as long term disease management.[6]

The studies have shown that high intensity interval training gives benefits related to dyspnea, health realted quality of life and exercise capacity, but the syatematic analysis shows lack of evidences when high intensity exercises are compared to low intensity exercises.

It is suggested that low intensity exercise programs are seay to implement and can be used as standarad exercise program in rehabilitation of COPD individuals but there is lack of evidence. This exercises can be well tolerated by COPD patients without any complications.[7-9]

So the present study is conducted with the aim to find out effect of low intensity closed chain exercises along with pulomonary rehabilitation in patients with COPD.

II. Methodology and procedure:

Ethical clearance was taken from institutional ethical committee of KIMSDU, Karad. A randomised control trial was conducted among 30 individuals with COPD selected as per the inclusion and exclusion criteria. The inclusion criteria of the study was age between 50-80 years , COPD stage II-IV, smoking history of >20 pack in a year, pharmacological therapy according to current guidelines, individuals willing to participate. The individuals with respiratory insufficiency, cardiac insufficiency, uncontrolled arterial hypertension, malignant disease, limited physical capabilities due to musculoskeletal disorders, unwillingness to participate were excluded from the study.

The participants were divided into 2 groups by simple random sampling method. Group A was treated with low intensity closed kinetic chain exercises and pulmonary rehabilitation. Group B was treated with pulmonary rehabilitation only. Each group consisted of 15 participants. The place of study was Krishna hospital and physiotherapy OPD Karad. The treatment was given for 12 weeks, 3times/week, each session of 80 minutes with adequate rest time in between the exercises to avoid exertional dyspnoea.

Low intensity closed chain exercises consisted of leg press, stair climbing activity(first without resistance and then the resistance was increased), squatting.

The outcome measures were taken on first day pre interventional and post intervention was taken after 12 weeks.

The outcome measures taken were:

1. 6 minute walk test.

2. Time up and go test for balance.
3. Borg's scale for rate of perceived exertion

Statistical analysis:

Statistical analysis for present study was done manually as well as using the statistics software INSTAT so as to verify the results obtained. Various statistical measures such as mean, standard deviation (SD) and paired and unpaired test of significance were utilized for this purpose. Probability values less than 0.05 were considered statistically significant and probability values less than 0.0001 were considered statistically extremely significant.

III. Results:

DEMOGRAPHIC DATA:

1. MEAN AGE:

	GROUP A	GROUP B	T VALUE	P VALUE
MEAN AGE	61±7.00	59±6.2	0.8284	0.4145

Table 1: mean age in Group A and Group B.

The total mean age in group A was 61±7.00 years and group B was 59±6.2 years. The p value was 0.4145 which is statistically not significant indicating no difference in age in both the groups.

2. GENDER DISTRIBUTION:

	GROUP A	GROUP B	TOTAL
MALES	9	10	19
FEMALES	6	5	11
TOTAL	15	15	30

Table 2: Gender distribution in Group A and Group B

The gender distribution shows that their were 9 males and 6 females in group A and 10 males and 5 females in group B. Their were total 19 males and 11 females in the study.

OUTCOME MEASURES:

1. 6 minute walk test:

	PRE TREATMENT	**POST TREATMENT**	**'P' VALUE**	**'T' VALUE**	**LEVEL OF SIGNIFICANCE**
GROUP A (ckc + PR)	496.5±11.38	581.12±34.8	<0.0001	9.962	EXTREMELY SIGNIFICANT
GROUP B (PR)	504.18±17.08	552.66±31.67	<0.0001	7.332	EXTREMELY SIGNIFICANT
'P'VALUE	0.1832	0.0256	BETWEEN GROUP ANALYSIS – GROUP A SHOWS STATISTICALLY SIGNIFICANT VALUES AS COMPARED TO GROUP B POST TREATMENT		
LEVEL OF SIGNIFICANCE	NOT SIGNIFICANT	SIGNIFICANT			

More the distance covered more is the improvement

The within group analysis shows that in group A the pre intervention six minute walk test score was 496.5±11.38 and post intervention was 581.12±34.8 which was statistically extremely significant ($p<0.0001$). Group B analysis showed that pre intervention score was 504.18±17.08 and post intervention was 552.66±31.67 which is statistically extremely significant ($p<0.0001$). This was done using paired t test.

The between group analysis showed that pre interventional there was no significant difference statistically ($p=0.1832$) but post interventional there was significant difference in group A as compared to Group B ($p=0.0256$) indicating that six minute walk test distance was improved in group A(CKC + PR) as compared to Group B (PR). This was done using unpaired t test.

2. Time up and go test:

	PRE TREATMENT	**POST TREATMENT**	**'P' VALUE**	**'T' VALUE**	**LEVEL OF SIGNIFICANCE**
GROUP A (ckc + PR)	14.22±1.08	9.86±1.12	<0.0001	10.933	EXTREMELY SIGNIFICANT

GROUP B (PR)	14.13±1.45	11.05±1.102	<0.0001	20.938	EXTREMELY SIGNIFICANT
'P'VALUE	0.8435	0.0069	BETWEEN GROUP ANALYSIS – GROUP A SHOWS STATISTICALLY very SIGNIFICANT VALUES AS COMPARED TO GROUP B POST TREATMENT		
LEVEL OF SIGNIFICANCE	NOT SIGNIFICANT	Very SIGNIFICANT			

Less the score post intervention more is the improvement:

The within group analysis shows that in group A the pre intervention time up and go test score was 14.22±1.08 and post intervention was 9.86±1.12 which was statistically extremely significant ($p<0.0001$). Group B analysis showed that pre intervention score was 14.13±1.45 and post intervention was 11.05±1.102 which is statistically extremely significant ($p<0.0001$). This was done using paired t test.

The between group analysis showed that pre interventional there was no significant difference statistically ($p=0.8435$) but post interventional there was very significant difference in group A as compared to Group B ($p= 0.0069$) indicating that time up and go test score was improved in group A(CKC + PR) as compared to Group B (PR). This was done using unpaired t test.

3. Borg scale (rate of perceived exertion scale):

	PRE TREATMENT	**POST TREATMENT**	**'P' VALUE**	**'T' VALUE**	**LEVEL OF SIGNIFICANCE**
GROUP A (ckc + PR)	4.6±1.05	2.4±0.63	<0.0001	6.45	EXTREMELY SIGNIFICANT
GROUP B (PR)	4.46±0.6	3.06±0.7	<0.0001	10.69	EXTREMELY SIGNIFICANT
'P'VALUE	0.678	0.0109	BETWEEN GROUP ANALYSIS – GROUP A SHOWS STATISTICALLY SIGNIFICANT VALUES AS COMPARED TO GROUP B POST TREATMENT		
LEVEL OF SIGNIFICANCE	NOT SIGNIFICANT	SIGNIFICANT			

Less the score more is the improvement

The within group analysis shows that in group A the pre intervention rate of perceived exertion score was 4.6±1.05 and post intervention was 2.4±0.63 which was statistically extremely significant ($p<0.0001$). Group B analysis showed that pre intervention score was 4.46±0.6 and post intervention was 3.06±0.7 which is statistically extremely significant ($p<0.0001$). This was done using paired t test.

The between group analysis showed that pre interventional there was no significant difference statistically ($p=0.678$) but post interventional there was significant difference in group A as compared to Group B ($p= 0.0109$) indicating that rate of perceived exertion score was improved in group A(CKC + PR) as compared to Group B (PR). This was done using unpaired t test.

4. One repetition maximum in kilograms:

	PRE TREATMENT	**POST TREATMENT**	**'P' VALUE**	**'T' VALUE**	**LEVEL OF SIGNIFICANCE**
GROUP A (ckc + PR)	18.7±4.2	22.8±3.2	0.0055	3.007	VERY SIGNIFICANT
GROUP B (PR)	17.6±6.7	19.82±1.2	<0.2169	1.263	NOT SIGNIFICANT
'P'VALUE	0.5943	0.0022	BETWEEN GROUP ANALYSIS – GROUP A SHOWS VERY STATISTICALLY SIGNIFICANT VALUES AS COMPARED TO GROUP B POST TREATMENT		
LEVEL OF SIGNIFICANCE	NOT SIGNIFICANT	VERY SIGNIFICANT			

More score indicates more improvement

The within group analysis shows that in group A the pre intervention one repetition maximim score was 18.7±4.2 and post intervention was 22.8±3.2 which was statistically very significant ($p=0.0055$). Group B analysis showed that pre intervention score was 17.6±6.7 and post intervention was 19.82±1.2 which is statistically not significant ($p<0.2169$). This was done using paired t test.

The between group analysis showed that pre interventional there was no significant difference statistically ($p=0.5943$) but post interventional there was very significant difference in group A as compared to Group B ($p= 0.0022$) indicating that one repetition maximum score was improved in group A(CKC + PR) as compared to Group B (PR). This was done using unpaired t test.

IV. Discussion:

A randomised control trial was conducted among 30 individuals with COPD divided into 2 groups (15 in each group) by simple random sampling technique. Group A was treated with low intensity closed kinetic chain exercises and pulmonary rehabilitation. Group B was treated with only pulmonary

rehabilitation protocol. The treatment was given for 12 weeks, 3times/week, and each session of 80 minutes.(adequate rest was given between each exercise.)

The outcome measures were taken pre interventionally and post interventionally. The outcome measures taken were 6 minute walk test, time up and go test, Borgs scale and one repetition maximum for strength.

The statistical analysis was done by using paired‘t’ test for within group analysis and unpaired‘t’ test for between group analysis.

Among the individuals participated in the study the mean age for group A was 61±7.00 years and group B was 59±6.2 years.

The 6 minute walk test results shows increase in distance in group A from 496.5±11.38 to 581.12±34.8 and in group B from 504.18±17.08 to 552.66±31.67. The distance was calculated in meters. This shows that there was more improvement in group A individuals who were treated with low intensity closed chain exercises and pulmonary rehabilitation program.

This result agrees with previous studies on the effect of functional exercise on physical capacity in older subjects and COPD patients.[10-11]

The time up and go test results also showed that their was improvement in Group A individuals than Group B, showing that low intensity ecercises have helped individual sto deal with their balance problems. The training session conducted also improvement the daily activity level of the individuals. The relationship between the old age and postural stability is already been proved. The small improvement in balance observed in Group A is attributed to thr strength training program which is added along with pulmonary rehabilitation.[12-14]

The rate of perceived exertion also showed improvement in both the groups, but statistically significant improvement was seen in group A than in Group B. This matches with the results of study conduted by T Hitomi et al[15], which shows improvement in rate of perceived exertion in individual on low intensity exercise program in COPD. This is attributed to adequate rest periods during exercise program.

The study shows that strength of quadriceps muscle was improved in group A undergoing low intensity closed chain training program along with pulmonary rehabilitation.

The studies have shown that individuals with COPD have lower muscle strength in ower extremity as compared to normal individuals.[16,17]

The results of the studies matches with previous studies which indicteas that strength training program increases mucle strength in COPD which ultimately results in improved walking distance and balance in individuals with COPD.[18]

Thus the study shows that there was additional benefit of adding low intensity closed chain exercises with pulmonary rehabilitation in COPD individuals.

V. Conclusion:

Low intensity closed chain exercises are tolerated and benefitted by the COPD patients and can be used along with pulmonary rehabilitation.

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