Effects of modified gait pattern with isometric exercises on pain and morning stiffness in knee osteoarthritis patients

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Abstract: *The objective of this study is the effects of modified gait pattern with isometric exercises on pain and morning stiffness in knee OA patients. A comparative study was conducted after approval from ethical committee. Sample sizes of 30 patients were included in the study. Simple random sampling technique was used to collect sample. The subjects were knee osteoarthritis patients with grade 3 & 4 of kellgren Lawrence scale who were at greater risk of falling due to osteoarthritis. The half of patients received modified gait pattern along with isometric exercises and other half received isometric exercises. A Kellgren Lawrence scale was used to identify the grades of osteoarthritis in patients and also to collect data. For group A Isometric exercises with knee dorsiflexion, Resisted knee extension in sitting, knee isometric in long sitting (Towel press). For group B Increase toe out angle, lateral trunk lean, medial insoles and wedges were used. 2-5 minutes baseline walk for group B and ultrasonic waves for 10 minutes was applied on each knee joint before each treatment session. This non-parametric test was used to compare two populations at different intervals. Repeated Measure ANOVA was used to check the effects within groups. The descriptive and inferential statistics of the pain of participants of group A from the initiation of intervention till the end of the last follow-up. It is evident from the table that mean pain level is reducing by each session ranging from 7.87 ±0.990 at baseline to 6.80±0.862 after the 3rd week of treatment then to 5.67±0.617 after 6 weeks among the subjects of group A. The p value of the test within the subject effect was (0.000) which is less than selected alpha (0.05). This shows that there is significant improvement in Group A participants. There is more decrease in the level of pain from baseline to post-treatment follow-up in group B as compare to decrease in pain in group A subjects.*

Key Word: *Modified gait pattern, Isometric Workouts, Knee Osteoarthritis, physiotherapy methods.*

1. INTRODUCTION:

Inflammation of the joint which should involve infiltration of monocytes, synovial hyperplasia, new bone formation and bone erosion and narrowing of spaces of joint is called arthritis [1]. It is that disease of the joints which leads to the quality of life reduced. It has been introduced as a risk factor contributing to increased chances of fall and deteriorate standard of life and balance in the elderly people. The study explained the effectiveness of physical therapies in increasing balance and decreasing chances of patients diagnosed with knee OA falling [2]. Osteoarthritis pain mostly occurs when we bear the weight on the affected joint and when we perform the movement [3]. Stiffness is highly common in the knee joint and is most commonly felt when the patient has been sitting for a long time or especially in the morning. The knee joint mobility is decreased which makes using the stairs, walking and moving in and out of chairs and cars tough. Crackle sound may also be audible when the patients move their affected knee [4].

In elderly patients the most common joint disease is knee osteoarthritis which results in increased sway of posture and impairment of balance which leads to increased risk of fall in knee osteoarthritis patients. Exercises in older patients which have knee osteoarthritis can increase balance improvement and postural sway decrease [5]. The older adults of age 65 mostly face the condition of osteoarthritis. Knee osteoarthritis is mostly associated with disability and increases social cost in comparison with any other joint osteoarthritis. Obesity is a high risk of osteoarthritis. Mostly risk in women which shows symptoms reduction of weight loss may be indicated [6,7].

The initial changes occur in the articular cartilage with osteoarthritis, which then leads to changes in the sub chondral bone that can be associated with the initial change so treatment that prevent it altogether could be started to reverse the disease from progressing further [8]. Disorders in balance and gait are more commonly found in elderly people and are one of the main causes of falls in this population. They are described by higher morbidity and death rates, as well as decreased level of function. The most usual causes include orthostatic hypotension and arthritis; however, most of the gait disorders involve multiple factors contributing to it. Many changes in gait are associated with underlying medical conditions [9].

Higher active load in the medial part of the knee is the factor in developing or progressing knee OA. Provided frequently influence the medial part and some studies described the active load on the joint of knee uses the knee adduction moment responds to higher loads in medial part rather than lateral part. Individuals affected by knee OA with joint space narrow on medial side are shown to show higher movements as compared to usually highest adduction movements of knee [10]. The outward knee adduction movement in standing phase is discrete in knee movements while walking, for patients of knee OA and healthy people. Extreme movement in adduction strongly predicts medial knee OA severity, presence and progress [11]. A noninvasive option for offloading the medial compartment of the knee in people diagnosed with knee OA is provided by gait modification. Although the proposition of gait modifications has been based on their ability to reduce the external knee adduction movement, no gait pattern has been shown to decrease medial compartment contact force directly [12].

Gait modification is an alternative of high osteotomy of tibia and it is a noninvasive treatment. In Knee osteoarthritis gait modification is an effective technique which affects speed of walk, position of foot (toe-in and out) trunk sway mediolateral direction which affect the kinetics of knee joint. In KAM the main effect is observed [13]. Programmers involved in exercise planning included both specific and general physical activities like aerobics, walking etc. Particular activities including focused exercises for strength, balance and gait [14].

The aim of this study is to identify the effects of modified gait pattern with isometric exercises on pain and morning stiffness in knee osteoarthritis patients.

2. MATERIALS:

A comparative study was conducted after approval from ethical committee. Sample sizes of 30 patients were included in the study. This study was conducted on Allied Hospital, Faisalabad. Private setting was Irfan medical city, Faisalabad with study duration of 6 months. Simple random sampling technique was used to collect sample. Simple random sampling technique was used to collect sample. The subjects were knee osteoarthritis patients with grade 3 & 4 of kellgren Lawrence scale who were at greater risk of falling due to osteoarthritis. The half of patients received modified gait pattern along with isometric exercises and other half received isometric exercises. A Kellgren Lawrence scale was used to identify the grades of osteoarthritis in patients and also to collect data [15]. For group A Isometric exercises with knee dorsiflexion, Resisted knee extension in sitting, knee isometric in long sitting (Towel press). For group B Increase toe out angle, lateral trunk lean, medial insoles and wedges were used. 2-5 minutes baseline walk for group B and ultrasonic waves for 10 minutes was applied on each knee joint before each treatment session.

Inclusion criteria
1. Age between 45-65 years.
2. Knee OA patients with risk of fall.
3. Patients whose activity level was limited due to pain.
4. Bilaterall involvement of knees.
5. The participants who were fallen in Grade 3 & 4 of kellgren Lawrence scale were also included.
6. Radiography x-rays of knee.

Exclusion criteria
1. Lower limb neurological warning sign and /or signals.
2. Any surgical procedure involving knee replacement.
3. Patients diagnosed with psoriatic arthritis.
4. Patient with any systemic disease.
5. Any medication in which exercise was contraindicated.

Data collection method:
The informed consent was taken from the patients of knee OA . Before the informed consent given to the PTs, they were fully educated about the purpose of study, method and measures and only then they were asked to join the study if they are willing .Then we were given the Desmond risk of fall questionnaire by Blue Ridge et al and ask them to fill the questionnaire.

Data analysis:
The collected data was analyzed by using the following statistical tool SPSS version 23.Statistical significance was set at $P = 0.05$ .Following tests was used frequency tables, pie charts, bar charts, was used to show summary of the results and independent sample t-test was used. This non-parametric test was used to compare two populations at different intervals. Repeated Measure ANOVA was used to check the effects within groups.

3. DISCUSSION:

Current studies shows that mean pain level is reducing by each session ranging from 7.87 ±0.990 at baseline to 6.80±0.862 after the 3rd week of treatment then to 5.67±0.617 after 6 weeks among the subjects of group A. The p value of the test within the subject effect was (0.000) which is less than selected alpha (0.05). This shows that there is significant improvement in Group A participants. In group B mean pain level is reducing rapidly by each session ranging from 7.47 ±0.834 at baseline to 5.20±0.884 after the 3rd week of treatment then to 2.53±0.834 after 6 weeks among the subjects of group B. The p value of the test within the subject effect was (0.000) which is less than selected alpha (0.05). This shows that there is significant improvement in Group B participants. In 2014 gale conducted a study in which osteoarthritis rate of prevalence is depends the joint involved. The knee Osteoarthritis Prevalence In adults above the age of 45 is 19.2% Age was the common risk factor of prevalence of the osteoarthritis. The prevalence of OA in older adults is due to several biological changes and various risk factors such as weak muscle strength, cartilage thinning. Women were more prone to OA then men. Gender and hormones are also involved in the arthritis of the knee joint. On the onset of time of menopause and in the hormonal changes in women lead to knee OA [16, 17]. In 2015 Silver wood V, et al., conducted a investigate on bearing and on the patients which are suffering from arthritis of the knee- On the inspection of the joint of knee pain notice out that in well subjects, which gives better results in knee osteoarthritis patients. The Study Experiment was be old to revise progress of arthritis of the knee [18, 19]. In our studies the subjects which we include are between the age 45-65 both male and female. The patient with knee Osteoarthritis have minimum age of 45 and maximum age of 65 we include. The knee Osteoarthritis Prevalence In adults above the age of 45 is 19.2% Age was the common risk factor of prevalence of the osteoarthritis. The prevalence of OA in older adults is due to several biological changes and various risk factors such as weak muscle strength, cartilage thinning [20, 21]. According to Celgene Lawrence score we include the patients of grade 4 [22]. From out of 17 patient total 15 patients received treatment 2 have lost of follow-up from out of 30 patients there are 15 patients who received modified gait pattern showing that there is a clear decrease in the morning stiffness of participants in group B receiving isometrics along with gait modification [23,24]. Difference of changes in the activity limitations of both groups. As group A receiving isometrics exercises show a less decline in the activity limitation level while on the other hand group B receiving isometrics along with gait modification show a more decline in activity limitation level before and after the treatment sessions [25, 26].

4. RESULTS:

In our current studies the particpants which fulfilled the requirement of inclusion criteria are 37% male and females which fullfilled the inclusion criteria are 63% the ratio of knee osteoarthritis is as compared to males is higher in women above age of 40. There was a clear decrease in the morning stiffness of participants in group B (receiving isometrics along with gait modification) from Mean=1.47 to 0.13 as compare to the group A (receiving isometrics exercises) from Mean=1.53 to 0.73 (fig:-1). A significant difference of changes in the activity limitations of both groups. As group A receiving isometrics exercises show a less decline in the activity limitation level while on the other hand group B receiving isometrics along with gait modification show a more decline in activity limitation level before and after the treatment sessions (fig:-2). The descriptive and Inferential statistics of the pain of participants of group A from the initiation of intervention till the end of the last follow-up. It is evident from the table that mean pain level is reducing by each session ranging from 7.87 ±0.990 at baseline to 6.80±0.862 after the 3rd week of treatment then to 5.67±0.617 after 6 weeks among the subjects of group A. The p value of the test within the subject effect was (0.000) which is less than selected alpha (0.05). This shows that there is significant improvement in Group A participants (Table-1). This graph of pain as there is mild decrease in pain from baseline to the end of treatment in participants of group A (fig:-3). Table above shows the descriptive and Inferential statistics of the pain of participants of group B from the initiation of intervention till the end of the last follow-up. It is evident from the table that mean pain level is reducing rapidly by each session ranging from 7.47 ±0.834 at baseline to 5.20±0.884 after the 3rd week of treatment then to 2.53±0.834 after 6 weeks among the subjects of group B. The p value of the test within the subject effect was (0.000) which is less than selected alpha (0.05). This shows that there is significant improvement in Group B participants (Table-2). This graph of pain as there is huge decline in pain from baseline to the end of treatment in participants of group B (fig:-4). There were 30 subjects taken totally into the study (Group A=15 and Group B=15) there pain was taken and statistically compared between both groups at baseline, after 3rd week and at 6th week (Post-treatment). Table of group statistics is showing the comparison of mean values of pain between both groups. Independent sample t-test shows there was no significant difference of pain at baseline between both groups as the (p-value > 0.05) but at the last of treatment the results became statistically significant (table-3). This graph shows that there is more decrease in the level of pain from baseline to post-treatment follow-up in group B as compare to decrease in pain in group A subjects (fig:-5).
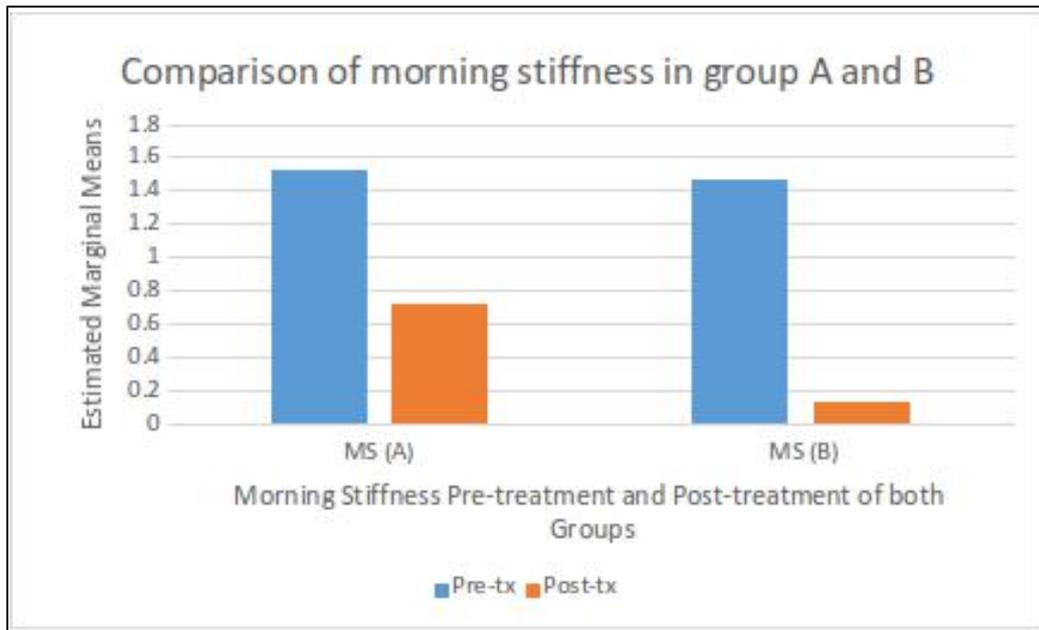
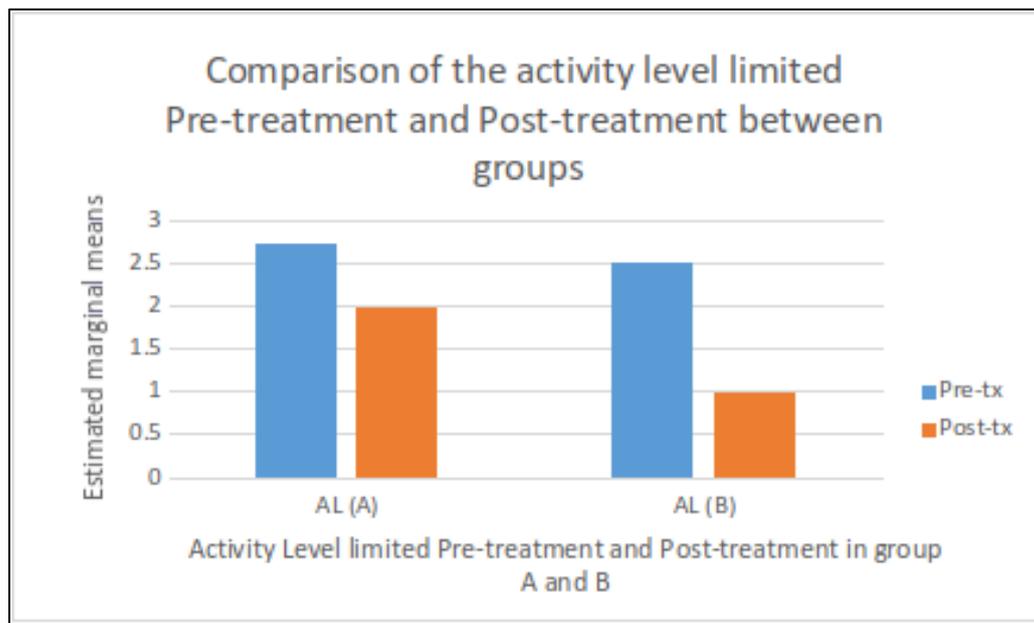**Fig:-1 Comparison of Morning stiffness Pre-treatment and Post-treatment in the study between groups**

Fig:-2 Comparison of activity level limited Pre-treatment and Post-treatment in the study between groups

Table:-1 Analysis of pain through the duration of 6 weeks in Group A : Repeated Measure ANOVA

Table 4.5.1a Descriptive and Inferential statistics				
Parameter	Mean	Std. Deviation	N	Significance
Numeric Pain Rating Scale at baseline before treatment	7.87	.990	15	
Numeric Pain Rating Scale after 3 weeks	6.80	.862	15	
Numeric Pain Rating Scale at 6th week after treatment	5.67	.617	15	.000

Fig:-3 Estimated marginal means of Pain in Group A

**Table:-2 Analysis of pain through the duration of 6 weeks in Group B : Repeated Measure ANOVA**

Table 4.5.2a Descriptive and Inferential statistics				
Parameter	Mean	Std. Deviation	N	Significance
Numeric Pain Rating Scale at baseline before treatment	7.47	.834	15	
Numeric Pain Rating Scale after 3 weeks	5.20	.884	15	
Numeric Pain Rating Scale at 6th week after treatment	2.53	.834	15	.000

Fig 4:- Estimated marginal means of Pain in Group B

Table:-3 Analysis of pain through the duration of 6 weeks between groups A and B : Independent Sample t-test.

Table 4.5.3a Group Statistics					
	Patients group based on intervention	N	Mean	Std. Deviation	Sig.(2-tailed)
Numeric Pain Rating Scale at baseline before treatment	Isometric exercises group	15	7.87	.990	.242
	Modified gait training along with isometrics	15	7.47	.834	.242
Numeric Pain Rating Scale after 3 weeks	Isometric exercises group	15	6.80	.862	.000
	Modified gait training along with isometrics	15	5.27	.884	.000
Numeric Pain Rating Scale at 6th week after treatment	Isometric exercises group	15	5.67	.617	.000
	Modified gait training along with isometrics	15	2.53	.834	.000
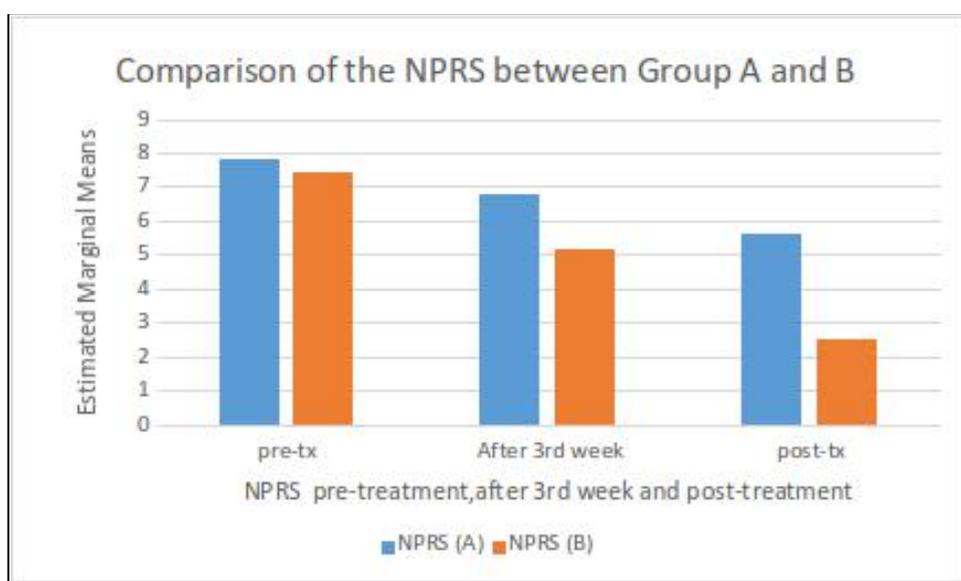
Fig-5:- Comparison of NPRS between groups A and B

5. CONCLUSION:

In our study we modify the gait pattern of knee osteoarthritis patients and reduce the adduction movement of the knee OA patient we guide the particpants of our research about the proper usage of insoles and after 4 weeks the results of our study is beneficial for our patients. the group which received the insoles and isometrics both have better reslt then only isometric exercise the result and outcomes of Group B is better than Group A. Gait modification along with isometrics is effective for treatment of risk of fall in knee osteoarthritis patients.It is concluded that gait modification along with isometrics is more effective as compared to group receiving only isometrics. Group A receiving isometrics only has shown less decline in pain, risk of fall as compare to the group B who were receiving both the isometrics and the gait modification. There were 30 subjects taken totally into the study (Group A=15 and Group B=15) there pain was taken and statistically compared between both groups at baseline, after 3rd week and at 6th week (Post-treatment). Table of group statistics is showing the comparison of mean values of pain between both groups. Independent sample t-test shows there was no significant difference of pain at baseline between both groups as the (p-value > 0.05) but at the last of treatment the results became statistically significant. There is more decrease in the level of pain from baseline to post-treatment follow-up in group B as compare to decrease in pain in group A subjects.

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