



TO COMPARE THE EFFECT OF FORWARD CYCLING VERSUS BACKWARD CYCLING ON PAIN FUNCTION AND RANGE OF MOTION IN SUBJECTS WITH KNEE OSTEOARTHRITIS – AN EXPERIMENTAL STUDY.

Medical Science

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ABSTRACT

Background: Osteoarthritis is a chronic degenerative disease. The major symptom of Knee Osteoarthritis Are Pain Decreased Range of Motion and Functional impairment.

The purpose of the study is to evaluate the effect of backward cycling and forward cycling in subject with Knee Osteoarthritis. The traditional protocol for treating knee osteoarthritis shows inability to treat the pain, function and range of motion at primary level of treatment. This can eradicate the drawback of generalized protocol.

Method: The subject assessed thoroughly would be divided in three group. Group A would be given Conventional Treatment and Forward Cycling. Group B would be given Conventional Treatment and Backward Cycling. Group C would be given only Conventional Treatment. Treatment Duration for all three groups would be for 4 weeks. Then improvement would be evaluated in pain, Function and ROM by taking Post data. Then Pre-and Post data would be compared for final Conclusion.

Conclusion: According to the present study the alternative hypothesis is accepted and null hypothesis is rejected. Which suggest that backward cycling proves to manage the symptoms efficiently than forward cycling and single handed conventional protocols.

KEYWORDS

Osteoarthritis, Pain, WOMAC, NPRS, Range of Motion (ROM), Forward Cycling, Backward Cycling.

INTRODUCTION

Arthritis is inflammation of joint. Where joint is inflamed and develop stiffness, warmth, swelling and pain. (1) It is the most common form of Arthritis. Due to age and its wear and tear it is seen in knee joint which causes degenerative changes. (1) This degenerative condition typically shows joint pain, tenderness, restricted movements, reduced muscle strength, joint effusion, inflammation, swelling, crepitus, muscle atrophy and deformity in progressive term of disease. It is commonly seen in large joints which bears maximum weight specially knee and hip. Also seen in spine, hands and feet. (4) The major symptom of Knee Osteoarthritis is pain, decreased range of motion, and functional impairment.

The quadriceps muscle is the most targeted muscle in patients suffering from knee osteoarthritis. The weakness of quadriceps muscle is the most evident issue of these patients. It is believed that its result of under used quadriceps because of pain. Whereas it can be suggested that the weakness of quadriceps is main etiology behind the development of knee osteoarthritis. (4)

Studies and researches has showed the positive effect of cycling on osteoarthritic knee. The cycling activity strengthen the muscle, works in favor of flexibility and pain free functional mobility. Kevin McCully et all in their study concluded that low and high intensity cycling activity decreases pain and improves functional activity. (13)

Cycling is used in clinical practice in routine for this purpose of strengthening and pain free motion. It adds motion to the stiff and painful joint so as to achieve pain free functions at the same time strengthen the weak muscles by work and relax concept of cycling. (13,14)

So, here arises the need to evaluate effect of backward cycling versus forward cycling on pain, function and Range of Motion. Through which the better cycling protocol can be used in clinical regime to enhance the prognosis in subjects with knee Osteoarthritis.

AIMS AND OBJECTIVES:

- To find out effect of forward as well as backward cycling on Pain, Function and Range of Motion in subjects with osteoarthritis
- To compare the effect of forward cycling versus backward cycling on Pain, function Range of motion in subjects with knee Osteoarthritis.

HYPOTHESIS:

Null Hypothesis: There is no significant difference between pain, function and range of motion in forward and backward cycling group.

Alternative Hypothesis: There is no significant difference between

pain, function and range of motion in forward and backward cycling group.

REVIEW OF LITERATURE:

Knee joint is a complex structure which comprises the two joints mainly tibiofemoral joint and Patellofemoral joint. The tibiofemoral joint is articulation between distal femur and proximal tibia. Whereas, the patellofemoral joint is articulation between posterior patella and femur. The tibiofemoral joint is a double condyloid joint with three degree of freedom. It mainly has two compartments medial and lateral compartments. The surfaces of the joint are covered with hyaline cartilage. The cartilage acts as the shock absorber and provides the surface which is smooth for facilitation of movement. (16)

Knee joint is the basic joint for human mobility. Which acts like a pillar for supporting the body weight and carry out functional activities and activity of daily living.

The basic angular motion of the tibiofemoral joint is flexion/extension. Whereas, the secondary motion of the joint that is medial /lateral rotation and varus/valgus motion also occurs but to a limited extent. The complexity of joint increases as the arrangement between the femoral condyles and tibial plateau keeps center of rotation changing. The medial-lateral and anterior posterior displacement in little amount cause incongruency of joint which in turn causes wear and tear. Osteoarthritis is classified as Primary and Secondary. Primary Osteoarthritis is due to unknown reason. Whereas, the Secondary Osteoarthritis is due to associated medical condition.

The diagnostic criteria for the osteoarthritis used in the study is KL Grading.

Outcome Measures used in study:

There are various outcome measures which can be used to quantify the osteoarthritis knee. The most used outcome measure for pain is Numeric Pain Rating Scale (NPRS) and for functional impairment Western Ontario Mac Master Osteoarthritis Index (WOMAC)

NPRS: It is the pain rating scale which records patients pain through number. It ranges from 0 to 10. Where 0 is absolute no pain and 10 is extreme level pain can be illustrated as pain during child birth or multiple fracture. It is patient self-reporting scale patient is asked to mark his level of pain felt at that point.

WOMAC: It consists of three main components pain, stiffness, functional limitation. The scale is available in various version out of which the one available for Indian population by CRD Pune is used. The questions are modified as per need of the Indian population. The

scoring is from 0 to 4 where 0 is None and 4 is extreme level. Higher the score the worst the condition.

Goniometry: The Goniometric measurement for measuring the available range is used clinically. The studies showed high reliability of using goniometric measurement for Range of motion.

Methodology: The study was approved by institutional ethical committee.

Sampling: Simple Random Sampling.

Sampling Method: Lottery Method

Study Duration: 6 months

Inclusion Criteria:

- Grade 1 and 2 (According to K L Classification and patient having their pre X-rays done.)
- 2) Age: 45 to 64 (Middle Aged according to Newman and Newman classification)
- 3) Gender: Both Male and Female
- 4) Subjects eligible to participate according to PARQ scale.
- 5) Subjects willing to participate.

Exclusion Criteria:

- 1) Any soft tissue injury around Knee Joint.
- 2) Any fracture in Lower Limb.
- 3) Any recent surgery.
- 4) Any systemic condition involving Knee Joint.
- 5) Any Malignancy.
- 6) Any lower limb neuromuscular dysfunction.

Subjects with prior X-ray done and having Grade 1,2,3 Osteoarthritis were included in study with their consent. Also before including in the study they were ask to fill the PARQ Form to rule out any lethal complication which may result due to know or unknown conditions present. Then through random allocation by lottery method were divided in three groups.

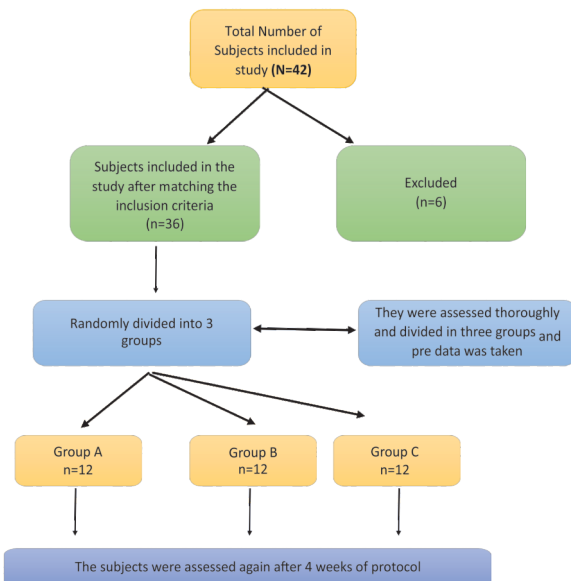
The three groups priorly made were Group A that is forward cycling group. Group B that is the Backward Cycling Group and Group C that is the Conventional Exercise Group.

All the subjects were treated for a time of 4 weeks, 4 days a week single session every day. The Pre data was collected in the beginning of the protocol then post data was collected at the end of four weeks.

The Conventional exercises included:

- Static Quadriceps sets, Hold each contraction for 6s with a 10s rest between repetition. Repeat 10 times.
- Terminal Knee Extension. Hold each contraction for 3s. Repeat 10 times.
- Active Knee ROM exercises. Repeat 10 time

The sample size calculated was 21 that is 7 in each group. The total subjects encountered were 50. The sample included in study were 42 out of which 6 got



RESULTS:

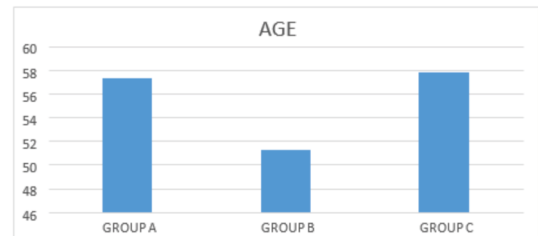
In the present study total 36 subjects were divided in to 3 groups; Group A (12 subjects), Group B (12 subjects) and Group C (12 subjects).

The outcome measures in the present study were NPRS for pain, WOMAC Modified CRD Version for functional activities, Goniometer for Range of Motion.

Data was analyzed using SPSS Version 20.

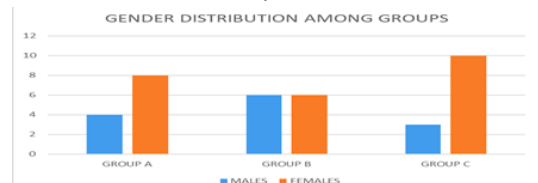
The data was thoroughly analyzed all the three outcomes were analyzed within the group statistically through Non Parametric Test that is Wilcoxon Test. At the same time the in between group analysis was done through Kruskal Wallis Test.

The graphical representation of the mean Age group for each group was depicted as:



Graph 1.2 Mean Age of all three groups

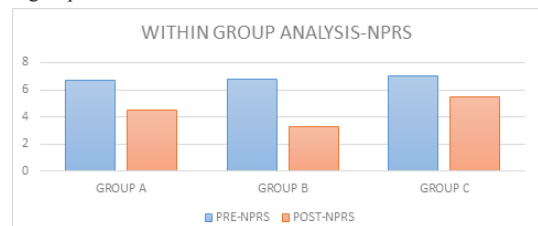
The Gender Distribution was analyzed as:



1.4 Gender distribution in each Group

Within Group Analysis for NPRS:

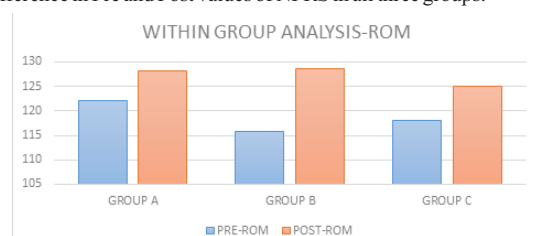
Then the within group analysis for each particular group was carried out. Using Wilcoxon Sign ranked Test. Which suggested that there is significant improvement in Pain, Function and Range of Motion in all three groups.



Graph 1.5 Within Group Analysis for NPRS

Within group analysis of NPRS showed significant improvement in pain rating in all the three groups. The P value for Group A was 0.001 for Group B was 0.002 and Group C was 0.001 which showed significant improvement in all three group due to the treatment protocol.

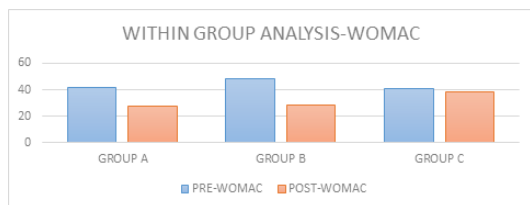
Then, the Graphical representation to depict the improvement in NPRS values in all the three groups was done which showed remarkable difference in Pre and Post values of NPRS in all three groups.



Graph 1.6 Within Group Analysis for Range of Motion (ROM)

The Within Group Analysis for Range of Motion showed that P value for all the three groups were 0.002 which showed significant improvement in Range of Motion in all the three groups due to the received treatment protocol.

Then within group analysis for Range of Motion (ROM) was graphically represented which showed that all three groups had significant improvement in Range of Motion and remarkable difference in Pre and Post data was evaluated.



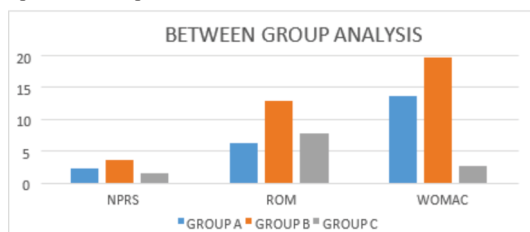
Graph 6.6 Within Group Analysis for WOMAC

The Within Group Analysis for WOMAC was done which showed P value of 0.002 in Group A and Group B and 0.001 in Group C which significant improvement in all three groups due to given treatment protocol.

Then the graphical representation for within group analysis of WOMAC showed improvement in all three groups. Marked difference was appreciated in all three groups in Pre and Post data.

For the Analysis of the improvement in between group for all three outcomes Kruskal Wallis Test was used. Then the detail analysis was done between all the three groups for evaluation of all three components improvement in the group.

The graphical representation for between group analysis showed that Group B showed significant improvement in all three components than Group A and Group C. Where Group A is better in improvement in Pain and Function then Group C. Whereas for Range of Motion is better in Group C than Group A.



DISCUSSION:

In the study presented here there is statistical difference in pain intensity which was measure through NPRS between Group A, B and C. In all the three groups the pre NPRS was taken before the intervention. Then after the four weeks of intervention the post data was collected. Then after the statistical significance the results depicted the significant improvement in the NPRS pain score.

The subjects having the osteoarthritis knee have pain in the knee joint due to pathophysiological changes specifically the degeneration of cartilage. The friction in the joint due to absence of lubrication cause the degeneration of bone. The primary and secondary and some etiological causes are considered as the causing factor. The two major muscle Quadriceps and Hamstrings which are responsible for the cofactor causing the adverse symptoms. This compilation in most of the patients becomes painful in the beginning. Due to which cycling is avoided or delayed in rehabilitation.

As per the studies the power phase which is marked phase for quadriceps activation is cut short. As the backward cycling provides equal opportunity for both hamstrings and quadriceps. At the same time reduces pressure on tibiofemoral joint. Which reduces pain and at the same time strength muscle and give opportunity for early rehabilitation.

According to study carried out by **R. R. Neptune, S. A. Kautz**, et al about knee joint loading in forward and backward cycling. They evaluated that as seen earlier that pedaling is effective for various knee disorders. At the same time their study evaluated that the backward

cycling reduced the tibiofemoral pressure. Which does eases the pain in subjects. At the same time the backward pedaling gives equal time of rest and activity to both muscle quadriceps and hamstrings. So, the overloading of muscle is avoided which in turn eases pain and functional ability.⁽³⁶⁾

The pain is the basic hindrance for performing the normal daily activities. The pain score was assessed before the treatment as well as reassessed after four week of treatment.

Now, considering Group A there was significance difference in pre and post scores. The in between Group showed significant improvement in pain with forward cycling and conventional treatment also.

One of the studies conducted by **Amanda J. Salacinski, et al in 2012** titled, The effects of group cycling on gait and pain-related disability in individuals with mild-to-moderate knee osteoarthritis: a randomized controlled trial. In this study the subjects were divided in two groups. One group were given group cycling activity and the other group was given conventional treatment. Bothe the groups were given 12 weeks' treatment. The study concluded that there was marked improvement in pain and gait parameters which suggested that cycling was well tolerated by the subjects.⁽³⁵⁾

Hence, forward cycling is normally used while rehabilitation of osteoarthritic knee patient.

When the result of the present study is thoroughly studied it reveals the higher effectiveness of backward cycling on pain, function and range of motion in patients with knee osteoarthritis.

Thus, when in between groups results were compared Group B was better than Group A and Group C. As the subjects were allocated randomly with lottery method so the subjects in group B were slightly younger in age than group A and C. This can be a factor for betterment of the result.

According to a study by **Ying Fang, et al in 2016** titled Effects of Workloads and Cadences on Frontal Plane Knee Biomechanics in Cycling the study thoroughly examined the increasing workload and increasing cadence due to cycling. The increase in workload caused increase in extension and abduction moment. Whereas, there is no increase in extension and abduction moment due to increase in cadence. The increase workload and increased extension and abduction moment increased the load on medial compartment. Hence, in subjects with knee osteoarthritis may avoid cycling in painful phases of the condition.⁽³⁷⁾

This load and increased moment of abduction and extension played a distinct factor in better result in Group B.

Considering the functional improvement in all three groups there is maximum improvement in Group B compared to Group A and Group C. As the functional activities of individual depends on the pain status and muscle strength and mobility of joint.

Here, if considering the three groups here the Group C is given conventional exercise only. Group A and Group B are focusing on land based exercise more then only conventional training.

In the present study the mobility of knee joint was improved more in Group B than Group A and Group C. The mobility is crucially dependent on the pain factor. When the pain is correlated with the joint mobility the direct relation is established between pain and mobility. Hence, decreased pain in Group B increases mobility in subjects.

In this present study when overall components of results were thoroughly assessed, it reveals that there was improvement in pain, function and range of motion in Group B than Group A and Group C. There is a probability that due to the random allocation of subjects in all the three groups the Group B subjects were having more young aged patients in the range of the age criteria priorly decided then Group A and Group C. Due to the less load over the joint in backward cycling the pain is managed efficiently due to which the acceptability towards the backward cycling by the patients was seen more clinically. Which ultimately showed more improvement in range, function and pain in the subjects receiving conventional treatment with backward cycling.

CONCLUSION:

From the present study it is stated that the Alternative Hypothesis is accepted and the Null Hypothesis is rejected. That is the backward cycling is more effective for pain function and Range of motion than Forward cycling and conventional treatment in subjects with osteoarthritis

Clinical Implication:

- The present study suggests that the backward cycling can be incorporated in the exercise regime of subjects with osteoarthritis knee rather than forward cycling as it can reduce the pain efficiently and can improve the functional activity. So, it can be well tolerated by the patients and should be used more clinically than the forward cycling.
- As Cycle is an easily available equipment and can be incorporated at home so in future it can be considered for home base programs.
- The level of exertion in cycling activity being minimal to moderate so it can be included as plan of care for the subjects with associated disorders.
- As the balance issues are totally omitted so can be the safer option for geriatrics

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