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ORIGINAL ARTICLE

Comparison of intermittent compression-decompression with glides and conventional physical therapy protocol for knee osteoarthritis

Jamal Tariq[1], Ateeqa Younis[2]*, Muhammad Affan Iqbal[3], Nimra Malik[4], Bakhtawar Tariq[5], Abdul Basit Khan[6]

[1] Head of Department, Chaudhary Physical Therapy and Rehabilitation Center, Haripur, Pakistan

[2] Lecturer, Foundation University College of Physical Therapy, Foundation University, Islamabad, Pakistan

[3] Assistant Professor, Department of Physical Therapy, Riphah International University, Islamabad, Pakistan

[4] Clinical Physical Therapist, Chaudhary Medical Center, Haripur, Pakistan

[5] Clinical Physical Therapist, Helping Hand Comprehensive Physical Rehabilitation Program, Mansehra, Pakistan

[6] Clinical Physical Therapist, Chaudhary Physical Therapy and Rehabilitation Center, Haripur, Pakistan

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Correspondence

Ateeqa Younis

ateeqayounis06@gmail.com

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A B S T R A C T

Introduction: Osteoarthritis (OA) is among the most prevalent types of arthritis and a fundamental cause of disability in people around the globe. Elderly population particularly females over the age of 65 years, patients with uncontrolled obesity have the highest risk of developing OA. To compare the effects of intermittent compression-decompression with glides and conventional physical therapy on pain, range of motion, and functional status in knee osteoarthritis.

Methodology: A randomized controlled trial was conducted with 60 participants having knee Osteoarthritis. The subjects were randomly allocated to Group A (intermittent compression-decompression with glides), Group B (conventional physical therapy), and Group C (intermittent compression-decompression with glides and conventional physical therapy) using a lottery method. The treatment was provided for 3 days per week alternatively and continued for 4 weeks. The assessment was done at the baseline and post-12th treatment day using NPRS, range of motion, WOMAC scale, and KOOS scale as outcome measures.

Results: Based on the results attained through the Kruskal Wallis test, there was a statistically significant effect ($p<0.05$) on scores of NPRS, Flexion, WOMAC, and KOOS, while extension showed no superlative effects after the application of the novel technique. More significant results were obtained in Group C ($p<0.05$) as compared to Groups A and B respectively.

Conclusion The application of compression and decompression with glides supplemented with conventional treatment protocol resulted in a massive reduction in pain and related symptoms, and improvement in range of motion with enhanced functional proficiency of patients affected with knee osteoarthritis.

Keywords: *Flexibility, Knee Osteoarthritis, Knee joint, Quadriceps muscle, Range of motion.*

Introduction

Osteoarthritis (OA) is among the most prevalent types of arthritis and one of the fundamental causes of disability in people around the globe. The term arthritis usually refers to more than over 100 joint-related diseases affecting joint surfaces, surrounding soft tissues, and connective tissue as well. According to the World Health Organization's recently available data, osteoarthritis has a higher worldwide incidence which is drastically affecting the economy and is now considered the fourth biggest cause of death and disability by 2020.[1] It is considered a degenerative joint disorder, is gradually progressive which impacts almost around 250 million humans throughout the

world.[2] The elderly population particularly females over the age of 65 years, patients affected with uncontrolled obesity highest risk of developing OA. This is about the inefficiency and disability associated with this condition and its deleterious impression on the social and economic aspects of society. People usually experience reduced movement at the knee joint, recurrent and progressive pain along with deterioration in strength and balance with compromising and facing restrictions in daily routine activities of life.[3]

OA was often thought to be solely a degenerative illness, but novel data shows that it is a complex disease involving various causal elements such as traumatic events, imbalanced mechanical forces, joint and soft tissue inflammation, biochemical, and inflammatory reactions, and various metabolic abnormalities. It is similarly worth noting that cartilaginous tissue isn't the only one affected. The cartilage, due to its lack of vascular supply and corresponding innervation, is unable to cause inflammation or discomfort on its own, particularly in the early onset of the disease.

Changes to the non-cartilaginous elements, such as the joint capsule, surrounding joint lining, underlying bone, adjoining ligaments, and connecting muscles, are the principal source of pain. These tissues are impacted as the condition worsens, and alterations such as bone remodeling, osteophyte growth, atrophy of surrounding muscles, ligament flexibility, and synovial effusion can be seen.[4] Mobilization with Movement is premised on the theory that slight positional faults in the joint emerge as a result of some trauma or stress. These faults produce mobility limitation, discomfort, and pain that is aggravated by active muscular contractions inside the faulty joint segments.

This includes the application of glides at right angles to the joint plane by the practitioner for correcting the fault within the joint, as well as the defaulting movement which is repeatedly performed by the patient and maintained for several repetitions. It produces hypoalgesia that improves ROM, improves muscular activation, and function, and addresses particular disorders. It shows beneficial results in treating tennis elbow, sprains at the ankle joint, impingement at the level of the shoulder joint, and hip along with knee OA are all treated effectively. In individuals with knee OA, other mobilizations such as anterior and posterior tibial glides at the knee joint generate both regional and global benefits.[5]

Mobilizations performed at the knee joint comprise the mobilization of the tibio-femoral joint specifically. This consists of anterior and posterior glides applied along with compression and decompression at the knee joint. Mobilization is a technique that is implemented to improve the intensity of unremitting discomfort and related pain, escalation in joint range of motion, and upturns functional outcome or independence of the patient because optimum provocation or signal for the regeneration of the damaged cartilage is the application of intermittent compression and decompression along with gliding.[1]

Intermittent compression-decompression with glides aids in the activation of osteoplastic action within the joint and helps to improve osteoarthritis complaints, hence prolonging the degradation process. Owing to its poor metabolic rate and insufficient blood flow, cartilage seems to have a lower healing ability, allowing for a slower reaction to injury. This damaging cartilage injury can be extremely progressive at times. As a result of this massive damage, early management aims to reduce this gradual damage to articular cartilage, which could be important in reducing the impairments and persistent discomfort causing disability. Compressive pressure performed on the knee joint helps in washing the fluid and minerals out of the surface of the cartilage, which is then reabsorbed back into the cartilage during performing decompression.

This occurrence aids cartilage repair by giving essential nutrients and minerals along with the supply of oxygen as well.[6] The main purpose of the study was to investigate the effects of accessory knee joint mobilization or compression and decompression with glide on outcomes of pain intensity and functional independence in individuals with knee osteoarthritis. The application of this innovative technique could help in better, improved, and innovative non-invasive management of knee osteoarthritis. The recent technique is highly cost-effective as compared to surgical interventions and intra-articular injections. This study also helped to set the foundation for further studies designing magnificent protocols of treatment for the affected population.

Methodology

The randomized clinical trial was conducted at the Physiotherapy Department of Yahya Welfare Complex Hospital, Chaudhary Medical Center, DHQ Haripur, and Akhter Jahan Medical Centre, Wah Cantt. The RCT was registered with the International Standard Randomized Controlled Trial Number NCT05262049. The approval was acquired from the ethics review committee of Riphah College of Rehabilitation Sciences, Riphah International University, Islamabad, Pakistan with the reference number mentioned as RIPHAH/RCRS/REC/Letter-00862.

The sample size determined using the OpenEpi sample size calculator was 60 with confidence level (95%) and each group was allocated with 20 participants. The outcome used for the sample size calculation was Range of motion.[2] Non-probability purposive sampling technique was used. The subjects diagnosed with bilateral knee OA (stage 3), ranging from 40 to 70 years of age and able to comprehend certain commands were included in the study. Moreover, the subjects who had undergone any surgery of the lower limb had inflammatory joint disease or neurological disorder of the lower limb, or had received intra-articular injections of corticosteroids in the past 6 months were excluded from the study.

Patients who met the specific criteria were placed into three groups (i.e. Group A, Group B, and Group C) randomly using the lottery method. Data from baseline and after the intervention was then compared after 4 weeks. The information was gathered using questionnaires and forms. Information about osteoarthritis, such as knee ROM, pain, and functional activity score, was requested from the patient.

Group A: Intermittent compression-decompression with glides: Knee decompression (traction) was applied for 10 seconds with 30 repetitions of anterior-posterior oscillatory glide followed by compression for 10 seconds for 5 minutes. This treatment plan was continued for 4 weeks (3 days a week, alternate days).

Group B: Conventional physical therapy: Hot pack for 10 minutes, Low-frequency TENS for 10 minutes, Stretching of Hamstring (10reps*3set) and calf (10reps*3set), Strengthening of peri-articular muscles especially the quadriceps through straight leg raising, pillow squeeze and knee isometrics (10reps*3set). In this group, conventional therapy was given for 4 weeks (3 days a week, alternate days).

Group C: Conventional physical therapy and intermittent compression and decompression with glides: Patients in this group received the combination of conventional physical therapy and intermittent compression and decompression with glides for 4 weeks (3 days a week, alternate days).

Data Collection Tools

Numeric Pain Rating Scale (NPRS): This outcome was used to evaluate the intensity of pain. The score 0 represents “Having no pain at all” whereas a score of 10 means “The most terrible pain ever felt”. The participants were instructed to select one number from the scale that reflects their actual state of knee pain.[7] The interclass correlation was 0.95 represented by a study in patients with knee OA respectively.[8]

Knee Injury and Osteoarthritis Outcome Score (KOOS): It is a detailed questionnaire that is used to evaluate brief and long-term outcomes related to a patient's condition after a knee injury. This evaluates five objectives: pain during certain difficult activities like walking and using stairs, related symptoms, everyday activities of life like rising from a chair and using a car, sports participation, knee-related life quality, as well as recreational performance. This takes about 10 minutes to complete. The internal reliability of this questionnaire was above 0.70 respectively.[9]

Western Ontario and McMaster Osteoarthritis Index (WOMAC): It is widely utilized to evaluate pain, its related stiffness, and the functional status of the lower extremities. It comprises 24 questions: from which 17 questions are based on physical status, 5 questions are based on status of pain, and 2 questions are related to stiffness. Each question has five options starting from 0 which means no symptom or difficulty at all to 4 which represents extreme difficulty in performing activities with severe symptoms. Subscale scores are present for pain, stiffness, and functional status. Total scores were defined as the sum of all mentioned 24 items ranging from 0 to 96 scores respectively. The intraclass correlation coefficient values were 0.86 in patients with knee OA.10.

The data was entered and evaluated by using SPSS-21 software and expressed in a structure of tables and figures. All the individuals were analyzed at baseline and then after the completion of 4 weeks. Kolmogorov Smirnov test was used to evaluate the normality of data. The score of the normality test revealed that the data was non-normally distributed ($p<0.05$). Kruskal-Wallis test and Friedman tests were applied for the statistical analysis.

Results

The mean age of individuals in Group A was 58.60±8.34, the individuals in Group B were depicted mean age of 59.30±7.46 and Group C showed a mean age of 59.60±7.42 respectively. The frequency of females was 32 (53%) and that of males was 28 (47%). Kolmogorov Smirnov test was used to evaluate the normality of data. The score of the normality test revealed that the data was non-normally distributed ($p<0.05$). Furthermore, for the analysis of significance between groups, the Kruskal Wallis test was applied for all the outcomes as the data was non-parametric. All variables depicted significant differences ($p<0.05$) among all groups except Extension ($p=0.1$). (**Error! Reference source not found.**).

Table 1: Results of the Kruskal Wallis Test

Variables	Intervention	Median (IQR)	Sig.
NPRS	Pre	8.00(2.00)	0.22
	Post	3.00(3.00)	0.00
Flexion (Degrees)	Pre	110(13.00)	0.28
	Post	127(10.00)	0.00
Extension (Degrees)	Pre	5.00(10.00)	0.95
	Post	0.00(5.00)	0.10
WOMAC Scale	Pre	50.00(15.75)	0.07
	Post	22.00(21.00)	0.00
KOOS Scale	Pre	44.90(19.00)	0.10
	Post	71.70(25.00)	0.00

Similarly, the Friedman Test was applied for within-group analysis. For NPRS, flexion ROM, extension ROM, WOMAC, and KOOS, Group C depicted superlative improvement in range of motion and activities of daily living as compared to Group A and Group B (**Error! Reference source not found.**).

Table 1: Results of the Friedman Test

Variables	Groups	Time	Median	Outcome
NPRS	Group A	Pre	3.55	8.0 (2.00)
	Group B		3.65	8.0 (1.75)
	Group C		3.93	7.0 (1.00)
	Group A	Post	2.35	5.0 (3.00)
	Group B		2.23	3.5 (1.75)
	Group C		2.23	1.0 (1.00)
Flexion (Degrees)	Group A	Pre	9.10	110 (15.00)
	Group B		9.00	110 (19.00)
	Group C		9.03	112.5 (10.0)
	Group A	Post	9.90	125 (14.00)
	Group B		9.95	125 (15.00)
	Group C		9.98	130 (5.00)
Extension (Degrees)	Group A	Pre	2.75	5.0 (10.00)
	Group B		2.68	5.0 (10.00)
	Group C		2.88	5.0 (10.00)
	Group A	Post	1.45	0.0 (5.00)
	Group B		1.50	0.0 (5.00)
	Group C		1.40	0.0 (0.00)
WOMAC Scale	Group A	Pre	6.80	49.5 (14.25)
	Group B		6.85	52.0 (15.00)
	Group C		6.45	41.0 (20.50)
	Group A	Post	5.10	32.0 (17.25)
	Group B		5.10	30.0 (13.00)
	Group C		4.63	11.0 (7.75)
KOOS Scale	Group A	Pre	6.10	44.9 (11.75)
	Group B		6.15	40.8 (17.82)
	Group C		6.50	50.30 (21.2)
	Group A	Post	7.90	60.85 (18.8)
	Group B		7.90	66.70 (16.8)
	Group C		8.00	84.20 (6.23)

The statistics of the Friedman test showed statistically significant differences in Group A ($X2=170.91$, $p=0.00$), Group B ($X2=171.71$, $p=00$), and Group C ($X2=171.72$, $p=0.00$). Moreover, Group C showed more exceptional progress as compared to Group A and Group B (**Error! Reference source not found.**).

Table 2: Statistics of Friedman Test

Groups	Chi-Square (X2)	Significance
A	170.91	0.00
B	171.71	0.00
C	171.72	0.00

Discussion

The study was performed to compare the effects of intermittent compression-decompression with glides and conventional physical therapy on pain, ROM, and functional status. The interventions were applied for 4 weeks with 3 sessions per week alternatively to investigate which one was proved to be more efficacious. The outcomes of the study showed that Maitland Mobilization along with conventional therapy was more effective in knee osteoarthritis as the combination showed improvement in NPRS, increased range of motion, WOMAC, and KOOS scale representing functional independence respectively. Demographic data of the subjects was thoroughly collected in terms of age, gender, occupation, and education respectively.

A great number of processes are explained about the hypoalgesic effects of mobilization. The mobilizations or glides when applied at the joint trigger pain-inhibitory signals from the spinal cord through the brainstem. Moreover, it is also postulated that mechanical stimulation at joints helps in the modification of the surrounding chemical atmosphere and changes the amount and activity of inflammatory mediators, this again leads to decreasing the stimulus or experience of pain and discomfort.[11] In the recent study, the pain was significantly reduced after the application of glides on the knee joint, and the motion of the joint was also enhanced and the patient felt much independent in performing daily life tasks.

The reduction of pain and improvement in functional status following the application of Maitland's mobilization with conservative treatment was observed in a study. In addition to this, the 6-meter walk test depicted significance of <0.001 between the groups. It was concluded that the combination of both produces greater hypoalgesic effects, thus Maitland's mobilizations along with the conservative treatment caused an effective reduction in pain and improvement of functional status than conservative therapy alone.[12] This observation is similar to the findings of the present study. The intensity of pain showed a significance of $p<0.05$, the range of flexion of the knee joint was drastically improved and the functional status of patients represented by WOMAC and KOOS scale was also enhanced respectively.

The evidence suggested that physical therapy assists in the reduction of pain, discomfort, and swelling. In addition to this, it also elevates the level of physical functioning in patients by decreasing the joint locking or stiffness within the joint. Moreover, daily routine exercises are beneficial as well as cause enhancement in the condition of the patient. Also, the combined treatment of Mobilization with other exercises and modalities has proved to give better results as well.[13] The present study also included a couple of exercises and the application of modalities with the most superlative results. The patient's physical function was highly enhanced. The patient faced less difficulty in using stairs, sitting and standing, using the toilet, walking over even and uneven grounds, and domestic chores, assessed through the WOMAC scale which depicted exemplary significance. There were fewer complaints of stiffness or catching, locking, grinding, and swelling assessed through the KOOS scale respectively.

Implementation of Compression-decompression can assist in avoiding surgical intervention, as this appears to be very expensive and chances of healing and regaining mobility are not that much satisfactory. The recent technique is cost-effective and highly significant in the reduction of symptoms of OA as compared to surgical interventions and intra-articular injections. The movements are performed to assist in increasing the thickening and resilience of the cartilage. The mainstream geriatric population of Pakistan is suffering from knee OA, particularly females above 40 years because of the post-menopausal effect. The decline in the amount of estrogen hormone leads to the weakness and fragility of bones and prompt degeneration of the cartilage. The emergence of osteoarthritis has the worst impact and causes the emergence of physical, psychological, and social unfavorable implications.[14]

The present study depicted that mobilization (compression and decompression with glide) in individuals with knee OA, causes in establishment of noteworthy improvement in the discomfort and related symptoms. There was a massive reduction in the pain of patients and enhanced functional proficiency of affected patients. This demonstrates the reliability and validity of the present research study. Results delivered innovative evidence that mobilization of an osteoarthritic knee joint may result in producing an effective way of reducing unremitting pain in various tasks of daily living and thus produce enlightening of functional competence. Mobilization applied in osteoarthritic knee helps in the production of general hypoalgesic effects which therefore can cause pain relief and increase the movement of the knee joint. Based on the respective findings of various research studies, it can be easily concluded that the manual therapy and exercise protocols together benefit patients with knee osteoarthritis and may postpone or avert the requirement for surgical involvement.

Conclusion

The study concluded that after the application of Maitland's mobilization comprising of compression and decompression with glides supplemented with conventional treatment protocol, there was a massive reduction in pain and related symptoms. The results of this study also exhibited an enhancement in range of motion with enhanced functional proficiency of patients affected with knee osteoarthritis. The patient faced less difficulty in using stairs, sitting and standing, using the toilet, walking over even and uneven grounds, and domestic chores. Moreover, there were fewer complaints of stiffness or catching, locking, grinding, and swelling observed after the application of the technique.

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