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# ROLE OF RUSSIAN CURRENT MODALITY COMBINED WITH EXERCISE IN NON-SURGICAL ACL REHABILITATION

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**Abstract**

The primary objective of the present study is to evaluate the effectiveness of Russian current modality with specified exercises programe in reducing pain, function disability and improving ROM in individuals affected with ACL tear or injury. Pre and post evaluation was performed on 30 participants using the goniometer and **KOOS** (knee injury and osteoarthritis outcome score)**.** The findings suggest a significant reduction in pain level and improvement in range of motion and functional abilities following the intervention. These data suggest that the application of Russian current modality with specified exercises is effective intervention for treating Non-surgical ACL Tear or injury .

# INTRODUCTION

Ligament injuries are prevalent source of musculoskeletal joint pain and functional limitations. Such injuries disturb the delicate balance between joint stability and mobility, leading to abnormal force distribution across the joint. This imbalance can damage surrounding joint structures [(1,2)]. Ligaments are robust, fibrous connective tissues that connect two or more bones within the musculoskeletal framework. They may present as elongated, opaque bands or short, thick segments within joint capsules,

varying in size, shape, orientation, and anatomical position[3,4].The knee joint is a most complex structure and weight bearing joint in human body and it is considered highly complex due to its structure and functional demands. It is formed by the articulation of the femur, tibia, fibula, and patella, and is supported by many surrounding soft tissue structures, including the joint capsule, menisci, ligaments, tendons, and muscles. To maintain stability during movement and weight-bearing activities, the knee relies on multiple ligaments such as the medial collateral ligament, lateral collateral ligament, anterior cruciate ligament (ACL), posterior cruciate ligament, medial and lateral patellofemoral ligaments, and the patellar ligament[5,6]. Since the knee is exposed to continuous loading and frequent movement, it is highly vulnerable to both traumatic and degenerative changes. These factors can lead to conditions such as meniscal injuries, ligament tears, and osteoarthritis, ultimately affecting joint stability and function[7,8,9].

Injury to the ligament (tears and sprain) particularly the ACL are common in active individuals. Anterior cruciate ligament is an important intra-articular ligament of the knee joint because it resists anterior tibial translation and rotational stress. The anterior cruciate ligament (ACL) originates from the medial and anterior aspect of the tibial plateau and runs superiorly, laterally, and posteriorly toward its insertion on the lateral femoral condyle. The ACL consists of two major fiber bundles, namely anteromedial and posterolateral bundles[4,10].

Anterior cruciate ligament (ACL) injuries are notably frequent and severe, particularly in the context of athletic activities. These injuries typically result in joint swelling, compromised movement mechanics, muscle weakness, and diminished functional capabilities[3,4]. Furthermore, ACL injuries are often linked with long-term complications such as meniscal damage, cartilage lesions, and a heightened risk of developing early post-traumatic osteoarthritis.

Management of ACL injury generally includes two main approaches: surgical treatment and non-surgical treatment. The choice of treatment depends on factors such as the severity of the injury, level of physical activity, functional instability, and the individual needs of the patient[11,12,13]. In proposed study we select the non surgical treatment of ACL injury. After reviewing many articles, research paper and recent studies that suggests the goal of treatment of ACL injury is to prevent episodes of recurrent knee instability and to protect the meniscus and articular cartilage from further trauma. This can be accomplished by nonsurgical treatment involving activity modification, lower extremity strength, and stability training and appropriate bracing. Progressive weight bearing and weight shifting can help to maintain neuromuscular activation patterns, and isolated and integrated lower extremity strengthening can be started as joint motion permits[14,15,16]. After the acute phase, rehabilitation after ACL injury can progress to recovery and functional phases. Recovery includes modalities as needed for pain, progressive strengthening, and sports-specific movement pattern progression. Functional phase activities include manual therapy, power and endurance of lower extremities, diagonal and multiplanar movements, increased neuromuscular and proprioceptive training[17].

Cryotherapy (application of ice) refered as a therapeutic intervention which helps to remove heat from the tissues and it is commonly applied in the management of acute soft tissue injuries[18]. Local cryotherapy can be administered through different methods, including ice packs, cold water immersion, cooling garments, and ice

combined with compression, all of which are widely used in clinical and sports settings[19]. primary purpose of cryotherapy is to reduce pain following injuries involving muscles, tendons, or ligaments. In addition to pain relief, it is also believed to help lower tissue metabolism, minimize secondary tissue damage, control inflammation, reduce swelling, and limit the formation of hematoma after injury[20].

Pulsed current and burst-modulated alternating current are commonly used forms of electrical stimulation in clinical rehabilitation settings[21,22]. The Burst Modulating Alternating Current include Russian current and interferential current, both of which are frequently applied to improve muscle performance and assist in rehabilitation. Russian current has gained considerable attention for its role in enhancing skeletal muscle performance, particularly in healthy muscles. Its effectiveness has been supported in both research and rehabilitation practice[23]. Russian current has commonly been applied to prevent loss of muscle strength in musculoskeletal, neurological and respiratory condition. Mostly the current is applied as a part of multi model rehabilitation with co- intervention including functional training, exercises and massage[23].Russian current consists of a 2500 Hz alternating current delivered in rectangular bursts at a frequency of 50 Hz, with each burst lasting approximately 10 milliseconds and a duty cycle of 50%.Clinically, Russian current is commonly used to improve the force-generating capacity of muscles. In addition to strengthening muscles[24], it has also been reported to help reduce pain, improve local blood circulation, promote muscle hypertrophy, and facilitate muscle contraction during rehabilitation.

Strengthening exercise[25,26], also known as resistance or strength training, is a type of exercise designed to improve muscular strength and endurance. It involves the contraction of muscles against an external form of resistance, which may include free weights, resistance bands, machines, body weight, or even water resistance[25,27,28]. The primary aim of strength training is to enhance muscle performance and achieve outcomes such as improved joint stability, greater muscular endurance, increased muscle strength, power, and muscle mass. Regular participation in resistance training also contributes to maintaining lean muscle tissue and improving bone density, making it an important component of both rehabilitation and overall physical fitness[26,29,30].

Exercise therapy is considered one of the key components of rehabilitation. Along with exercise therapy, different forms of electrotherapy are also commonly used in clinical practice. Therefore, in the present study, variations of electrotherapy have been incorporated along with rehabilitation exercises in order to evaluate their effectiveness in the management of ligament injuries.Non-surgical ACL rehabilitation is a critical area in physiotherapy, yet there is limited consensus on Modalities (Russian Current), cryotherapy when combined with exercise, offer superior outcomes. While both approaches are widely used, there is a lack of studies evaluating their clinical effectiveness, particularly in terms of pain relief, functional recovery, and patient satisfaction. Additionally, in resource-limited settings, understanding the cost-effectiveness and practicality of machine-based modalities is essential. This study aims to bridge this gap by providing evidence-based insights to guide rehabilitation protocols and improve recovery in non-surgical ACL patients.

## AIM & OBJECTIVES OF THE STUDY

- To assess the efficacy of electrotherapy (Russian current) in rehabilitation to improve pain and disability in the treatment of non operative ACL rehab.
- To assess the effectiveness of exercise in rehab to improve gait, strength and balance in the treatment of non operative ACL rehab.

## MATERIALS AND METHODOLOGY

The cross sectional research design was used in study. A cross sectional study is a sort of observational research in which data is collected at a single moment in time to evaluate the relationship between variables. The study used randomized sampling as its sample design. The participants were affected with ACL Tear or injury. These individuals were involved in the study to see how electro-therapy (including Russian current and cryotherapy) with specific exercises program affected their condition. Paper and pencil for data recording, chair for participants to sit on during assessment and treatment, a treatment couch, Thera band, electrotherapy modality, cryotherapy instrument goniometer, assessment form consent form, towel for comfort or support were all used in the study.

### SELECTION CRITERIA:

**Inclusion Criteria:** The study would likely include patients who meet specific criteria such as:

- Informed consent/ willingness to participate in the study
- Age group 18 – 40
- Males and females with ACL tear or injury (grade I and grade II tear)
- Diagnosed with special orthopedic test (Lachman test, Anerior Drawer Sign) and MRI.

**Exclusion Criteria:** Certain factors exclude patients from the study, such as:

- Patient with recent fracture / stress fracture
- Any unhealed wound present at treatment site
- Age group less than 18 and more than 40
- Neurological Disorders
- Orthopedic Surgeries: History of orthopedic surgery in the last year related to KNEE.

## SAMPLE SIZE AND STUDY DURATION

For this study the sample size was 30 people the individual were chosen at random from the research population to guarantee representativeness and adequate data for analysis. The Study was carried out (5 times a week) for six weeks, individuals in a clinical environment had therapy as part of the study in pacific college of physiotherapy, pacific medical university (Udaipur), after obtaining ethical committee approval dated 11-9-2025, **PMU/IEC/MPT/2025/24**. All participants completed information and consent form at recruitment. This time frame allowed for evaluation of subjects response to the therapy as well as any changes in their pain, range of motion and functional ability. Each session was scheduled for 40-45 minutes. This period was set aside to ensure the patient had enough time to execute the procedure correctly.

## PROCEDURE

Permission for conduct Study is taken from the institutional ethical committee of PMCH **(PMU/IEC/MPT/2025/24)**, Pacific medical university bhilo ka bedla Udaipur(RAJ).

Individuals Diagnosed with ACL Tear or injury by the Physiotherapy department, Orthopedic department OPD; treated conservatively initially assessed for the inclusion or exclusion criteria. Prior to the

treatment procedure, all participants were informed about the purpose, procedures, potential benefits, and possible risks of the study. Written informed consent was obtained from each participant prior to enrollment.

30 subjects were selected on the basis on inclusion criteria treated with Russian current therapy and exercise therapy.

**Electrotherapy Modality**

**Cryotherapy -** Ice packs 15-20 min, 2-3×/day will be applied.

**Russian current -** Quadriceps setting (10 sec on / 50 sec off, 10-15 min) will be administered

Common exercise protocol will be designed for rehabilitation to improve strength, gait , balance and proprioception:

Phase 1 – Acute Phase (Weeks 0–2)

**Goals:** Reduce pain/swelling, restore extension, initiate quad activation

- **Heel Slides** - 3×15
- **Quadriceps Sets** - 10×10 sec
- **Hamstring Isometrics** - 10×10 sec will be performed
- **Glutes activation** - 3×10 will be carried out
- **Partial Weight-Bearing with Crutches** – As tolerated will be allowed
- **Weight Shifts** - 3×10 each side **will be practiced**
- Ankle toe movement will be performed
- Sitting calf raises will be performed

**Phase 2 – Strength & Neuromuscular Phase (Weeks 2-4)**

**Goals:** Full ROM, strength gains, static balance control

- Pedocycle – 10-15 min
- Straight Leg Raises (4 planes)
- Terminal Knee Extension with Band
- Hamstring Curls (Band/Light Weight)
- Mini Squats (0–45°) Step-Ups (Low Step)
- Single-Leg Stance
- Gluteus Activation
- Hamstring Activation Sitting/Standing Calf Raise

**Phase 3 – Advanced Strength & Functional Phase (Weeks 6–12)**

**Goals**: Dynamic stability, functional strength, sport prep

- Leg Press (0–60°)
- Bulgarian Split Squats Hamstring Curls (Machine/Band**)**
- Lateral Band Walks
- Single-Leg Stance on Unstable Surface with Perturbations
- Side-to-Side Step-Overs
- Forward & Lateral Lunges

## RESULTS

A total of 30 participants were included in the study, 13 females and 17 males. In the 18–24 years age group 12 participants, 25–30 years age group,9 participants, 31–35 years age group, 4 participants, 36–40 years age group, 5 participants were participated.

**TABLE 1: KNEE FLEXION (GONIOMETER)**

| Timepoint | N | Minimum | Maximum | Mean | Std. Deviation | t-value | p-value | Result |
|---|---|---|---|---|---|---|---|---|
| 0 Week | 30 | 108 | 115 | 111.9 | 2.2 | 18.76 | <0.001 | Significant |
| 6 Week | 30 | 122 | 130 | 127.4 | 2.5 | | | |
| Overall | 60 | 108 | 130 | 119.6 | 7.8 | | | |

**GRAPH 2: KNEE FLEXION (GONIOMETER)**

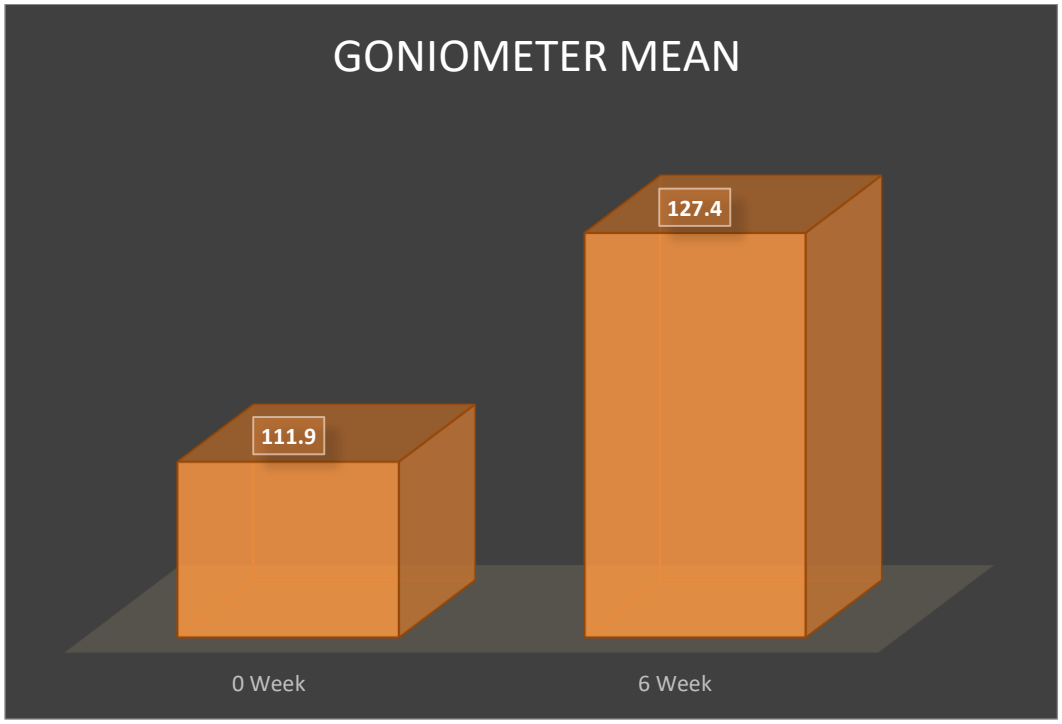


Table 1 and Graph 1 show the changes in knee flexion At baseline, the mean knee flexion was 111.9°, indicating a slightly higher level of restriction initially.

After 6 weeks, the mean knee flexion increased significantly to 127.4°, which is closer to the normal range; this shows greater improvement. The increase in both minimum and maximum values indicates

that all participants improved. The standard deviation values indicate consistent improvement across the group.

The t-value (18.76) and p-value (<0.001) show that the improvement is highly statistically significant.

**TABLE 2: KOOS**

| Timepoint | N | Minimum | Maximum | Mean | Std. Deviation | t-value | p-value | Result |
|---|---|---|---|---|---|---|---|---|
| 0 Week | 30 | 54 | 61 | 57.8 | 2.0 | 21.45 | <0.001 | Significant |
| 6 Week | 30 | 72 | 79 | 76.2 | 2.1 | | | |
| Overall | 60 | 54 | 79 | 67.0 | 8.9 | | | |

**GRAPH 2: KOOS**

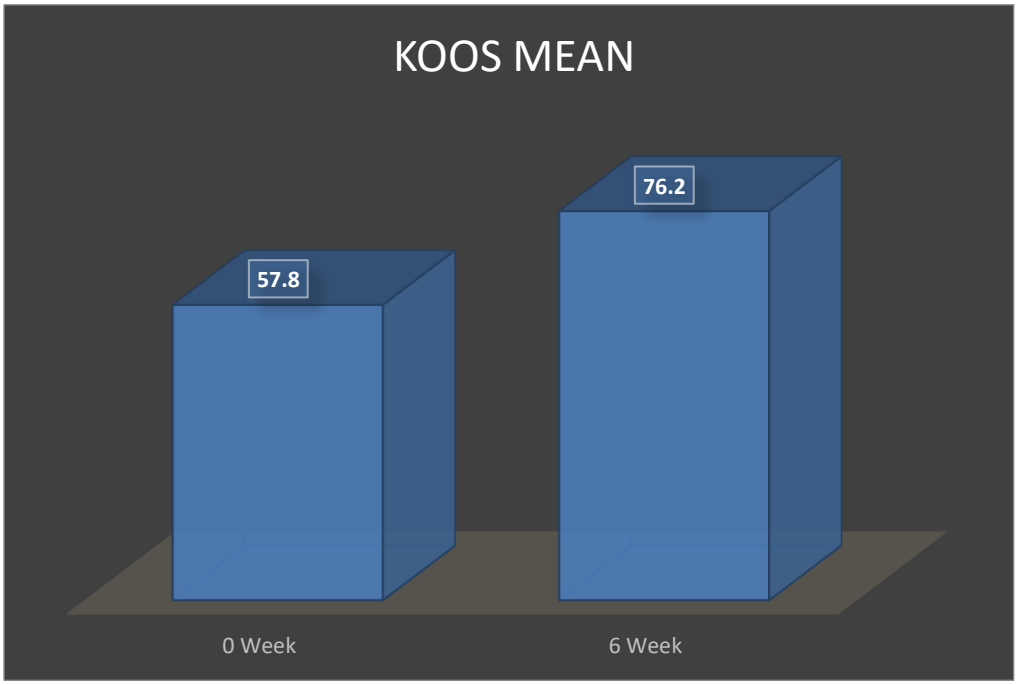


Table 2 and Graph 2 present the functional improvement. At baseline, the mean KOOS score was 57.8, indicating moderate functional limitation. After 6 weeks, the mean score increased to 76.2, showing a large improvement in function, pain reduction, and quality of life. The t-value

(21.45) and p-value (<0.001) confirm that this improvement is statistically highly significant. The graph clearly shows a sharp upward trend, indicating strong functional recovery.

## DISCUSSION

The present study was design to examine the effects of electrotherapy(Russian current), combined with exercise, in individuals affected with ACL tear or injury treated without surgery. A total of 30 patients were included and assessed using pre- and post-intervention outcome measures. The outcome measures used were the knee injury and osteoarthritis outcome score (KOOS) and range of motion measured with a goniometer. The findings suggest a significant reduction in pain level and improvement in range of motion and functional abilities following the intervention. These data suggest that the application of Russian current modality and cryotherapy with specified exercises is effective intervention for treating ACL tear or injury.

When the findings of the present study were compared with the existing literature, a moderate to strong correlation was observed between the results of the current study and those reported in previous research. An article published by Song D et.al,(2022) on the functional recovery on knee joint after ACL injury reported that intermediate frequency current stimulate the quadriceps muscle and improve knee function range of motion and decrease the pain. These findings are also support the results of our study and further support our outcome.

ACL injuries have become increasingly common not only among athletes but also within the non-athletic population due to several contributing factors such as altered lifestyle, reduced physical conditioning, poor movement mechanics, and inadequate muscular support around the knee joint. Keeping these factors in consideration, the present study was designed to evaluate the effectiveness of Russian current modality cryotherapy, and exercise therapy approaches in individuals with ACL injury. After completion of the 6-week intervention program, this combined approach demonstrated noticeable improvements in range of motion and functional ability. A possible reason for this difference may be related to the physiological effects of electrical stimulation. Following ACL injury, normal knee biomechanics are often disrupted, resulting in reduced neuromuscular control, quadriceps weakness, and movement asymmetry.

Russian current stimulation promotes muscle contraction through medium-frequency electrical impulses, which may help improve muscle activation, enhance local circulation and metabolism, and reduce muscular inhibition. These effects may have contributed to the greater functional improvement observed in that group. Another possible explanation may be that the participants included in the study were from a non-athletic population, where physical and functional demands are generally lower than those seen in athletes. Although the intervention period was limited to 6 weeks due to factors such as time constraints, patient participation, and adherence to treatment sessions, this rehabilitation protocol produced satisfactory clinical improvements. Future studies with larger sample sizes and longer follow-up durations, preferably extending up to six months, are recommended to better understand the long-term effectiveness of these interventions.

## CONCLUSION

The findings of the study showed that exercise combined with Russian current modality and cryotherapy program is statistically significant improvements over a 6-week intervention period in terms of improvements in range of motion and functional ability. The findings and results of the present study are clinically important for physiotherapists involved in musculoskeletal and orthopedic rehabilitation, as well as for rehabilitation professionals and rehabilitation specialists. The use of exercise combined with Russian current modality and cryotherapy program may contribute to improving treatment strategies in the field of Non-surgical ACL Tear or injury. The results of this study can be applied clinically to assist healthcare professionals in the better management. However, further studies with a larger sample size and more rigorous inclusion and exclusion criteria are required to validate and generalize these findings.

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