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Pulses of progress: Russian current therapy in managing knee osteoarthritis

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Abstract

Background: Knee osteoarthritis (OA) is a degenerative joint condition that is largely caused by wear and tear and the progressive loss of articular cartilage. Clinical signs include knee discomfort that worsens with movement, stiffness, oedema, and crepitus. Russian current is a modulated medium-frequency sinusoidal alternating current that is used to alleviate pain and increase muscular strength.

Case Presentation: The patient was a 55-year-old female who had been diagnosed with bilateral grade III OA after experiencing discomfort during exercise and swelling on the medial side of both knees for 8 months. The outcome measurements were the Numeric Pain Rating Scale (NPRS) for pain and the Western Ontario and McMaster Universities Arthritis Index (WOMAC) for function. The patient got Russian current six times per week for four weeks, combined with conservative knee exercises.

Result: The patient's NPRS improved from 8 to 3 points and 7 to 3 points on the right and left knees, respectively. After completing the physiotherapy program, the right knee's WOMAC score decreased by 61 points, while the left knee's score decreased by 45 points.

Conclusion: The patient's pain and function improved significantly. So, Russian current combined with conservative knee exercises may be a viable therapeutic option for osteoarthritis.

Keywords: Knee osteoarthritis, numeric pain rating scale, WOMAC scale, Russian current

Introduction

Osteoarthritis (OA) is one of the most common chronic diseases, affecting the knee joint in older persons. It is distinguished by the slow deterioration of articular cartilage, alterations in subchondral bone, and synovial inflammation, all of which cause pain, stiffness, swelling, and functional impairment. The increased global prevalence of OA is raising health concerns, particularly among the elderly (Cross *et al.*, 2014) ^[5]. Despite multiple conservative treatment options, including pharmaceutical and non-pharmacological therapies, managing knee OA remains a substantial issue (Hunter & Bierma-Zeinstra, 2019) ^[12].

Russian current, invented by Kots in the 1970s, is a medium-frequency alternating current (2500 Hz) modulated into 50 Hz bursts with a particular duty cycle. It is commonly used in rehabilitation to increase muscular strength, alleviate discomfort, and improve joint function (Ward & Shkuratova, 2002) ^[16]. Russian current has been proven to enhance muscular contraction by activating deep muscle fibers, which can be especially useful in treating muscle weakness associated with knee OA (Alnahdi, Zeni, and Snyder-Mackler, 2012) ^[11].

The present case study investigates the effectiveness of Russian current therapy, combined with conservative exercises, in improving pain and function in a patient with bilateral knee OA. The outcome measures include the Numeric Pain Rating Scale (NPRS) for pain assessment and the Western Ontario and McMaster Universities Arthritis Index (WOMAC) for functional performance.

Literature Review

Knee Osteoarthritis Pathophysiology

Knee osteoarthritis predominantly damages cartilage, subchondral bone, and the synovial membrane, resulting in joint deterioration. Aging, obesity, joint trauma, and genetic susceptibility are the key risk factors for knee osteoarthritis. Cartilage degeneration causes joint space shortening, osteophyte development, and increased friction between bones, leading in discomfort,

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inflammation, and a restricted range of motion (Hosseinadeh *et al.*, 2021)^[11].

Nonsteroidal anti-inflammatory medicines (NSAIDs), intra-articular corticosteroid injections, and physical therapy exercises focused at increasing joint mobility and muscle strength are examples of traditional treatment techniques (Glyn-Jones *et al.*, 2015)^[9]. While these treatments are beneficial for pain management and function restoration, long-term dependence on pharmaceuticals may result in side effects, necessitating the use of alternative remedies.

Russian Current in Pain Management and Rehabilitation

Electrical stimulation in rehabilitation has gained popularity over the years due to its therapeutic effects. Russian current, in particular, has been demonstrated to promote muscular strength, reduce discomfort, and enhance joint function (Ward & Shkuratova, 2002)^[16]. This modality operates at a medium frequency, allowing for greater penetration into muscle fibres and hence stronger muscular contractions than low-frequency currents (Alnahdi *et al.*, 2012)^[1].

Russian current has been shown in studies to relieve pain in patients with musculoskeletal illnesses, including knee OA, by boosting endorphin release, improving blood circulation, and encouraging tissue repair (Johnson *et al.* 2007)^[13]. Furthermore, the strengthening benefits of Russian current have been proven to be particularly useful in patients with knee OA, who commonly exhibit quadriceps weakness and decreased proprioception (Alnahdi *et al.*, 2012)^[1].

Despite the promising outcomes associated with Russian current, its use in clinical settings for knee OA remains relatively limited. Further studies are required to assess its long-term efficacy and safety, particularly when combined with conservative exercise programs.

Case Presentation

Patient History and Examination: A 55-year-old woman complained of bilateral knee discomfort, swelling, and trouble walking, climbing stairs, and crouching, among other everyday tasks. Based on a clinical examination and radiographic evaluation, the patient was diagnosed with grade III knee OA after their symptoms had been worse over the previous eight months. The patient had no prior history of knee injuries or operations, and their modest hypertension was treated with medication. The patient stated that extended standing and walking made the discomfort worse and that it was particularly noticeable on the left knee.

Upon examination, the patient reported oedema in both knees, crepitus during knee flexion and extension, and discomfort across the medial joint line. Flexion was limited to 90 degrees for the right knee and 85 degrees for the left, limiting range of motion. With an NPRS score of 8 points for the right knee and 7 points for the left, the patient claimed severe discomfort during weight-bearing activities, and muscle strength tests showed bilateral quadriceps weakening (rated 3/5).

Treatment Plan: A physiotherapy program that included conservative knee exercises and Russian current treatment was planned for the patient. Applying Russian current to the

quadriceps muscles of both knees at a frequency of 2500 Hz, with a duty cycle of 10 seconds on/50 seconds off and a 50 Hz burst modulation, was part of the therapy regimen. Duration of session: 15 minutes, six sessions each week for four weeks. Concurrent conservative knee exercises, such as quadriceps sets, hamstring stretches, and non-weight-bearing knee flexion and extension exercises that emphasize mobility and strength.

Outcome Measures: Two primary outcome measures were used to assess the effectiveness of the intervention:

Numerical Pain Rating Scale (NPRS): The Numerical Pain Rating Scale (NPRS) is a widely used tool for assessing pain intensity in individuals with conditions like knee osteoarthritis (OA). It involves the patient rating their pain on a scale from 0 to 10, where:

- 0 represents "no pain."
- 10 represents "the worst pain imaginable."

This tool is easy to administer, requires no equipment, and has proven reliability and validity for pain assessment across various populations, including those with knee osteoarthritis. (Jensen *et al.*, 1986)^[3].

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is a widely utilized, self-administered questionnaire designed to evaluate pain, stiffness, and physical function in individuals with hip and knee osteoarthritis (OA). It comprises 24 items divided into three subscales:

Pain (5 items): Assesses the degree of pain experienced during various activities.

Stiffness (2 items): Evaluates the amount of joint stiffness experienced after first waking and later in the day.

Physical Function (17 items): Measures the difficulty in performing daily activities.

Each item is typically scored on a scale from 0 (no symptoms) to 4 (extreme symptoms), with higher scores indicating greater levels of pain, stiffness, or functional limitation. The WOMAC is valued for its sensitivity to changes in a patient's condition, making it a reliable tool for both clinical assessments and research studies.

Results: Following four weeks of treatment, the patient reported significant improvements in pain and functional performance.

NPRS Scores: The patient's VAS score for the right knee decreased from 8 -points to 3 -points, while the left knee score decreased from 7 -points to 3 -points, indicating substantial pain relief.

WOMAC Scores: The patient's WOMAC score for right knee decreased by 61 points, while the left knee's score decreased by 45 points. Table: Outcome Measures Before and After Treatment

Table: Outcome Measures Before and After Treatment

Outcome Measure	Pre-Treatment (Right Knee)	Post-Treatment (Right Knee)	Pre-Treatment (Left Knee)	Post-Treatment (Left Knee)
NPRS Score (points)	8	3	7	3
WOMAC Score (points)	89	28	82	37

Discussion

The findings of this case study suggest that Russian current therapy may be an effective adjunct for managing knee osteoarthritis (OA), particularly when combined with conservative exercise programs. The marked decrease in NPRS scores indicates its ability to alleviate pain, likely through enhanced muscle strength and improved joint function (Johnson *et al.*, 2007) [13]. Additionally, the improvements in WOMAC scores reflect better functionality, as the patient reported reduced difficulty in performing daily activities that were previously hindered by pain and weakness.

While conservative exercise alone is a well-established approach for managing knee OA (Fransen *et al.*, 2015) [9], incorporating Russian current appears to provide additional advantages, particularly in reducing pain and boosting muscle strength. This observation aligns with earlier studies that highlight the superior outcomes of combining electrical stimulation with therapeutic exercises compared to exercises alone (Alnahdi *et al.*, 2012) [1].

Nonetheless, this case study has limitations, such as the short duration of the intervention and the absence of long-term follow-up. Further research is necessary to evaluate the sustainability of the observed benefits over time and to compare the effectiveness of Russian current with other modalities, including transcutaneous electrical nerve stimulation (TENS) and ultrasound therapy.

Conclusion

Russian current therapy, when used alongside conservative knee exercises, shows significant promise as an effective treatment approach for managing knee osteoarthritis (OA). This combined intervention has demonstrated potential in alleviating pain, improving joint functionality, and enhancing the overall quality of life for individuals with OA. By incorporating targeted electrical stimulation to strengthen muscles and optimize joint mechanics, this therapy may offer advantages over standalone exercise programs.

However, despite these encouraging outcomes, the evidence remains limited by the small scale and lack of control in current studies. To establish the full potential of Russian current therapy as a standard treatment for knee OA, robust research involving larger sample sizes and well-designed randomized controlled trials is essential. Such studies would provide greater insight into its efficacy, safety, and optimal application parameters. Furthermore, this research could help develop detailed, evidence-based protocols tailored to different patient profiles, ensuring consistent and reliable results across diverse populations.

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