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Comparative Effect of Faradic and Russian Currents on the Quadriceps Muscle in Patients with Knee Osteoarthritis

Neha Rani[1], Sonam Verma[2], Karishma Das[3], Palas Pramanick[4], Komal Chauhan[5]
[1, 2, 3, 4]*School of Medical and Allied Science, Sanskriti University, Mathura, Uttar Pradesh – 281401*
[5]*Students of Sanskriti University*

Abstract: ***Osteoarthritis is amongst the most common musculoskeletal condition which affects overall function and quality of life in the Indian population. Clinical features of knee osteoarthritis include pain that affects the functional mobility of joints and thus interferes with walking and activities of daily living. Quadriceps function declines with age, and is further impaired in patients with knee and may contribute to the risk of falls. The aim of the present study was to compare the effect of Faradic and Russian Currents on the quadriceps muscle in Patients with knee osteoarthritis.***
Objectives: To evaluate the effect of Faradic Currants on the quadriceps muscle for the management ofknee osteoarthritis. To evaluate the effects of Russian Currants on the quadriceps muscle for the management of knee osteoarthritis. To Comparative effects between Faradic and Russian Currants on the quadriceps muscle formanagement of knee osteoarthritis.
Methodology: Permission from the head of the department of Sanskriti University Mathura, and approval from the ethical committee. Patients pre-diagnosed with grade II OA were selected for this study. Consent was taken from the patients after confirming the diagnosis of Grade II OA. The subjects were divided into two groups (15 in each group): one group consist of a Faradic current + quadriceps isometric exercise (5 days a week for 4 weeks) and the second group consisted of a Russian current + quadriceps isometric exercise (5 days in a week for 4 weeks).
Result: The statistics are done based on the objectives and hypotheses and it has been organized by following three sections: Section I: Frequency and percentage distributions of socio-demographic variables.Section II: Effectiveness of pre and post-test values. Section III: Comparison of Faradic Currants and Russian Currants Values.
Conclusion: This study concludes that faradic current and Russian current show significant effect in quadriceps muscle in patients with knee osteoarthritis and there is no significant difference between faradic and Russian current on quadriceps muscle Patients with knee osteoarthritis.But the only significant difference in WOMAC scores after intervention (The WOMAC score ismore decreased in Russian as compared to faradic current)
Keywords: osteoarthritis, Russian current, faradic current

I. INTRODUCTION

Knee osteoarthritis (OA) joint disease commonly occurs in the elderly population and it causes significant pain and functional limitations [1]. OA is classified into Primary OA and Secondary OA. Primary OA occurs as a result of natural wear and tear of knee joint structures due to aging, overuse, or obesity, whereas Secondary OA occurs due to known primary causes like trauma, infection [2]. The Kellgren and Lawrence scale classifies OA into four grades as follows: Grade 0 indicates no radiographic findings of OA; Grade 1 indicates minimum osteophytes of doubtful clinical significance; Grade 2 indicates definitive osteophytes with unaffected joint space; Grade 3 indicates definitive osteophytes with moderate joint space narrowing; and Grade 4 indicates definitive osteophytes with severe joint space narrowing and subchondral sclerosis [3]. Pathologically it is characterized by focal loss of articular hyaline cartilage with the proliferation of new bone at the margins, subchondral sclerosis, and remodelling of joint contour [4].

The earliest symptom of OA knee is pain. Patients also complain of crepitus, stiffness, and swelling of the joint. On examination, tenderness along the joint line, terminal limitation of movement, weakness, and atrophy of the quadriceps femoris muscle. The radiographic features of OA knee include narrowing of joint space, osteophyte formation, loose bodies, and subchondral sclerosis [5]. Joint space narrowing occurs due to the erosion of the cartilage as part of the degenerative process associated with arthritis but the best method of evaluating the progression of the cartilage destruction is through measurement of joint space width [6].

A recent survey in India reported that the prevalence of OA in older adults more than 65 years of age was 32.6% in the pastoral population and 60.3% in the urban population [7]. Men are affected more commonly than women [8].

Various measures are available for the treatment of OA knee such as conservative management including pharmacotherapy (NSAIDS, Corticosteroid therapy), physiotherapy, and surgical management [5]. Manual therapy, physical therapy modalities, taping techniques, patient education and therapeutic exercises, and orthosis are all used to treat knee OA [9].

According to the World Journal of Orthopedics 2011, isometric exercises are helpful in improving muscle function. Exercises such as static Quadriceps, static hamstrings, strengthening the vastus medialis, mini squats, use of Quadriceps table, and 10 to 15 repetitions, done 5 days a week for 2 weeks have proved to be effective in improving muscle strength [10,11]. Quadriceps femoris muscle plays an important role in the mechanics of the knee joint [12]. It is the only muscle crossing anterior to the axis of the knee and is the prime mover for knee extension. During the quiet standing and stance phase of gait, the knee is an intermediate joint in a closed chain.

The quadriceps muscle controls the amount of flexion at the knee during initial contact and also causes knee extension through reverse muscle pullon the femur during mid-stance. It also controls the amount of flexion during pre-swing (heel off to toe off) and excessive heel rise during an initial swing. With the loss of quadriceps function, the patient lurches the trunk anteriorly during initial contact to move the center of gravity anterior to the knee so that it is stable or rotates the extremity outward to lock the knee; with fast walking there may be extreme heel elevation during initial swing [13].

Russian current is a medium-frequency current. Russian current was developed for upgrading muscle strength in Russian Olympic athletes and was found to increase force earn up to 40%. Russian current is an Alternating Current modulated sinusoidal with 2500-Hz transfer in a series of bursts (a 10-millisecond burst and a 10-millisecond interval). It has been reported that the most commonly used electric stimulation to increase muscle strength,reduce pain and improve physical function in Russian current [14].

Neuromuscular stimulation may be an alternative approach for muscle-strengthening training programs. Faradic current may be the better mode of electrical stimulation to boost muscle strength and muscle mass. Voluntary muscle contraction followed by the faradic current may result in functional faradism at the same time.

The functional paradigm is an essential portion of neuromuscular stimulation which can be useful in boosting muscle mass and strength of muscle and improving functional mobility in knee OA.

To improve the muscle strength and size of muscle fiber, each contraction of the muscle followed by faradic stimulation simultaneously may be a better and more useful rehabilitative way of knee OA. Although previous studies found improvement in muscle mass, strength of muscle, and function after the implementation of faradic current stimulation [15]. Surged faradic current is used for upgrading muscle strength and vascularity of muscle [16]

A. Purpose of the Study

Many Previous studies investigated the effectiveness of Russian current and also faradic current on the quadriceps muscle in Patients with knee osteoarthritis but no comparativestudy was performed between the effect of faradic and Russian current on the quadriceps muscle for the management of knee osteoarthritis. So this study will conduct to examine the Comparison between the effect of faradic and Russian current on the quadriceps muscle for the management of knee osteoarthritis.

B. Significance of the Study

This study will be conducted to find out the comparative effect of Russian and faradic current for the management of OA knee this study will be beneficial to create better physiotherapy treatment protocols for the management of OA knee and this study aims toprovide important information about the management of OA and to impart knowledge.

C. Aims of the Study

To find out the Comparison between Faradic and Russian Currants on the quadricepsmuscle in Patients with knee osteoarthritis.

D. Objectives

1) To evaluate the effect of Faradic Currants on the quadriceps muscle for the management ofknee osteoarthritis.
2) To evaluate the effects of Russian Currants on the quadriceps muscle for the management ofknee osteoarthritis.
3) Comparative effects between Faradic and Russian Currants on the quadriceps muscle formanagement of knee osteoarthritis.

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E. Research Hypothesis

1) Null Hypothesis (H_0): There will be no significant difference between Faradic andRussian current on the quadriceps muscle in patients with knee osteoarthritis.

2) Experimental Hypothesis (H_1): There will be a significant difference between Faradicand Russian current on the quadriceps muscle in patients with knee osteoarthritis.

II. MATERIALS & METHODOLOGY

1) Sample Size: 45 subjects (3 groups and 15 subjects in each group)

2) Data Collection: Data collection were done from SCPM Medical College Haripur road gonad.

a) Inclusion Criteria

- Pre-Diagnosed case of Grade II OA patients
- Age: 45-60yr
- Gender: Both male & female
- Complaining of knee pain that has lasted longer than 3 months,
- A pain level that is medium

b) Exclusion Criteria

- Any recent hip or knee surgeries & fractures Patients with neurological deficit
- Soft tissue injuries of lower limb
- Any systemic illness

III. VARIABLES

A. Dependent

1) NPRS (Numeric pain rating scale),

2) Goniometric measurement for ROM of knee,

3) Timed Up and Go (TUG) test,

4) Western Ontario and McMaster Universities Osteoarthritis Index

B. Independent

1) Faradic current

2) Russian current

IV. INSTRUMENTATION

1) A stopwatch

2) Standard Chair with arm rest

3) Universal Goniometer

4) Weighing machine

5) A stadiometer

6) Couch

7) Electrical stimulation machine having Faradic Current

8) Electrical stimulation machine having Russian Current

A. Procedure

A total of 30 subjects were enrolled in this study. Both males and females participated inthis study for 45 -60 years. The subjects were made to sign the informed consent form before the study. The consent form was explained in a language which comfortable for the patient. 30 subjects were randomly selected in the treatment groups (Group A&B) by simple random sampling by chit-picking method on the basis of inclusion and exclusion criteria. Participant‘s demographic data was collected including their body weight in kg measured by using the weighing machine, Height in cm measured by using the stadiometer and Participant‘s BMI which is in Kg/m^2 was calculated using the participant's weight and divided by the square of the appropriate height.

Baseline measurements for pain intensityby NPRS, knee ROM by goniometer, Timed Up and Go (TUG) test, and WOMAC were taken for every patient after that faradic current + Quadriceps isometric was applied for group A and Russian current + Quadriceps isometric was applied for group B than post-intervention outcome measures were taken at the end of 4th week.

Figure 3.3: Height Measured by Stadiometer.

V. BASELINE AND POST-INTERVENTION MEASUREMENTS PROCEDURE

1) *NPRS (Numeric Pain Rating Scale):* Baseline and after 4th-week measurements for knee pain intensity by NPRS in which asked the patients to select the numerical value of the scale i.e. range 0-10 and express verbally which indicates about his/her pain intensity [18].
2) *Range of Motion of Knee:* Baseline and after 4th-week measurements for active range of motion of the knee was measured by a universal goniometer and recorded in degrees. These measurements were taken for knee flexion and knee extension. According to Norkin & White when measuring knee flexion the patient was placed in a supine lying with the knee extension. Position the hip in 0 degrees of extension, abduction, and adduction. The femur Stabilization was done to prevent rotation, abduction, and adduction of the hip. The testing position was to hold the anterior thigh with one hand and the ankle with the other hand Move the patient‘s thigh to approximately 90 degrees of hip flexion and move the knee into flexion. To prevent further hip motion stabilize the thigh and guide the lower leg into knee flexion. When resistance is felt the end of the range of knee flexion occurs. Goniometer placement was the fulcrum placed over the lateral epicondyle of the femur, the Stationary arm with the lateral midline of the femur, using a greater trochanter as a reference, and the movement arm with the lateral midline of the fibula, using the lateral malleolus and fibular head as a reference and during measurement of knee extension the patient placed in supine lying. A folded towel is placed under the ankle to ensure that the knee is in full extension. The femur Stabilization was done to prevent rotation, abduction, and adduction of the hip. Goniometer placement in knee extension measurement is the same as knee flexion [34]

Figure 3.4: Goniometry for Knee ROM.

3) *Timed Up and Go (TUG) Test:* Baseline and after 4th week measurements for TUG test subjects were instructed to stand up from the chair, walk 3 meters comfortably and safely than come back and sit in the chair. The time taken to complete this task was measured with a stopwatch [36].

Figure 3.5: Timed Up and Go (TUG) test.

4) *WOMAC Arthritis Index:* The Western Ontario and McMaster Universities Arthritis Index was done before (pre) and after (post) the intervention, including five response levels for each item, representing different degrees of intensity (none, mild, moderate, severe, or extreme) that was scored from 0 to 4. The pain dimension or scale includes five items asking about pain at activity or rest. The stiffness dimension includes two questions. The function dimension explores the degree of difficulty in 17 activities. The final score for the WOMAC was determined by adding the aggregate scores for pain, stiffness, and function. Scores range from 0 to 96 for the total WOMAC where 0 represents the best health status and 96the worst possible status. The higher the score, the poorer the function. Therefore, an improvement was achieved by reducing the overall score [37]

VI. INTERVENTION

1) *Group A: Faradic current + quadriceps isometric exercise (5days in a week for 4 week)*

After taken the baseline measurement of the patient we started the intervention of the patients who are randomly selected in group A than applied the faradic current after the resting period of 10 min following quadriceps isometric exercise. For faradic stimulation the patient were placed comfortable in supine lying position on a couch with pillow placed below the knee joint adequate positioning of standard carbon rubber electrodes of equal paired size were placed on the quadriceps muscle of the arthritic knee joint .the electrodes was securely fixed using Velcro strap and set the electrical stimulation intensity which was set at the maximum tolerance of the patient. Parameters included rectangular biphasic symmetric current, pulse duration of 400 µs and stimulation frequency of 80 Hz. The session was given for 10 min and was comprised of 10 s of stimulation followed by 20 s of rest for 5 days/week for 4 weeks. For quadriceps isometric exercise Patients were in supine position with legs straight with the towel roll placed under the knee, patients were asked to press the knee on the towel roll. This exercise aimed to strengthen quadriceps muscle**.** The patient was instructed to maximally activate their thigh muscles in order to straighten their knee. This exercise was of 3 sets of 10 repetitions each for 5 days/week for 4 weeks (20 days).

Figure 3.6: Faradic current stimulation.

2) *Group B: Russian current + quadriceps isometric exercise (5days in a week for 4 week).*

After taken the baseline measurement of the patient we started the intervention of thepatients who are randomly selected in group B than applied the Russian current after theresting period of 10 min following quadriceps isometric exercise. For Russian stimulationthe patient were placed comfortable in supine lying position on a couch with pillow placedbelow the knee joint adequate positioning of standard carbon rubber electrodes of equalpaired size were placed on the quadriceps muscle of the arthritic knee joint .the electrodeswas securely fixed using Velcro strap and set the electrical stimulation intensity which wasset at the maximum tolerance of the patient. Russian Current of 2500 Hz with pulse frequency of 50 Hz, symmetric pulses of sinusoidal form, with a pulse duration of 200-300 µs, 2-3 seconds ramp up, 2 seconds ramp down for comfort and a duty cycle of 50% was applied for 10 minutes duration for 5 days/week for a period of 4 weeks after that instructed the patient to quadriceps isometric exercise. This exercise was of 3 sets of 10 repetitions each for 5 days/week for 4 weeks.

Figure 3.7: Russian current stimulation.

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VII. DATA ANALYSIS

Analysis was done for 30 subjects who completed the study. The outcome variables of the study included Knee pain intensity on NPRS, Knee range of motion by Goniometry, TUG and WOMAC.

Paired t-test was used for comparing the pretreatment and post-treatment scores of each variable for both the groups (within group analysis). Independent t-test was applied to compare the outcome values between the group A and group B. The value of all two groups i.e. Group A (Faradic current) and Group B (Russian current), were compared at the pre testand after 4th Week of treatment. Statistical significance was set at $P < 0.05$. P value > 0.05 was considered as non significant difference while P value < 0.05 was considered to have represented a significant difference. Value of confidence interval was set at 95%.

A. Result

The statistics done based on the objectives and hypotheses and it has been organized byfollowing three sections.

- *Section I:* Frequency and percentage distributions of sociodemographic variables.
- *Section II:* Effectiveness of pre and posttest values.
- *Section III:* Comparison of Faradic Currants and Russian Currants values

1) Section I: Frequency and percentage distributions of sociodemographic variables.

Table 5.1: Frequency and percentage distributions of sex

n=15 n=15

	Faradic Currants		Russian Currants	
Sociodemographic Data	Frequency	Percentage	Frequency	Percentage
Sex				
Male	7	46.7	7	46.7
Female	8	53.3	8	53.3

The above table implies that maximum 8(53.3%) samples in faradic currants as well as inRussian currants are females, 7(46.7%) of the samples are males in each.

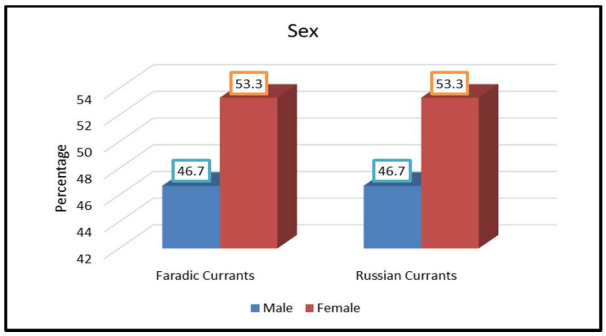

Figure 5.1: Frequency and percentage distributions of sex

Table 5.2: Frequency and percentage distributions of age

n=15 n=15

	Faradic Currants		Russian Currants	
Sociodemographic Data	Frequency	Percentage	Frequency	Percentage
Age in years				
1) 45 to 49	7	46.7	5	33.3
2) 50 to 54	4	26.7	5	33.3
3) 55 to 60	4	26.7	5	33.3

The above table implies that in faradic currants the maximum 7(46.7%) samples are between the age 45 to 49 years, 4 (26.7%) samples are between 50 to 54 years and the remaining 4(26.7%) samples are between 55 to 60 years. Whereas in Russian currants 5(33.3%) samples are in between 45 to 49 years, another 5(33.3%) samples are in 50 to 54 years and the remaining 5(33.3%) samples are between 55 to 60 years.

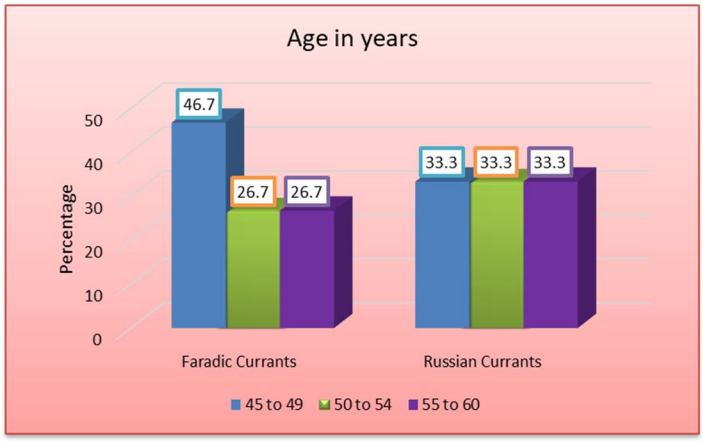

Figure 5.2: Frequency and percentage distributions of age

Table 5.3: Frequency and percentage distributions of Weight (kg)

n=15 n=15

	Faradic Currants		Russian Currants	
Sociodemographic Data	Frequency	Percentage	Frequency	Percentage
Weight (Kg)				
51 to 59	1	6.7	2	13.3
60 to 68	8	53.3	3	20.0
69 to 77	5	33.3	3	20.0
78 to 86	1	6.7	5	33.3
87 to 95	0	0	1	6.7
96 to 104	0	0	1	6.7

The above table explains that in the faradic currants the maximum 8 (%53.3) samples weight was between 60 to 68 kg, whereas in Russian currants the maximum 5 (33.3%) samples weight is between 78 to 86 kg.

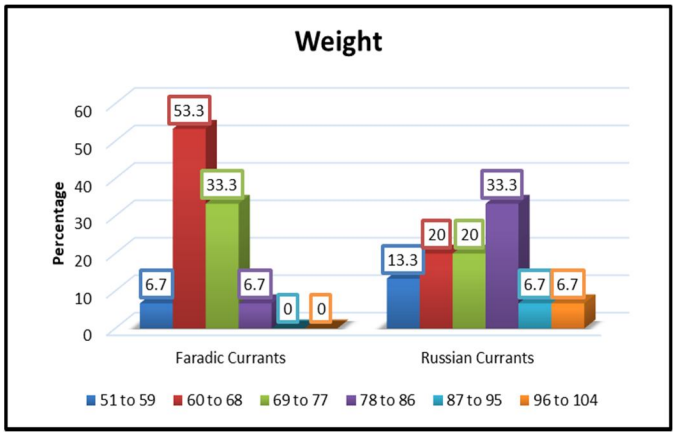

Figure 5.3: Frequency and percentage distributions of Weight (kg)

Table 5.4: Frequency and percentage distributions of Height (cm)

n=15 n=15

	Faradic Currants		Russian Currants	
Sociodemographic Data	Frequency	Percentage	Frequency	Percentage
Height				
150 to 155	2	13.3	4	26.7
156 to 161	4	26.7	2	13.3
162 to 167	6	40.0	4	26.7
168 to 173	3	20.0	5	33.3

The above table implies that in the faradic currants the maximum 6(40.0%) samples height is between 162 to 167, whereas in Russian currants maximum 5(33.3%) samples height is between 168 to 173.

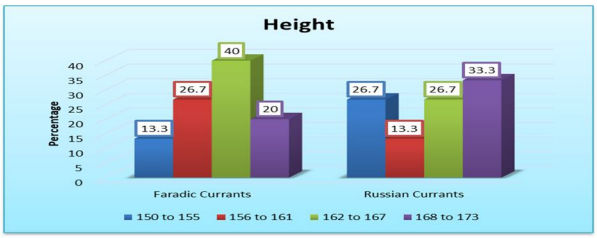

Figure 5.4: Frequency and percentage distributions of Height (cm)

Table 5.5: Frequency and percentage distributions of BMI (kg/m2)

n=15 n=15

	Faradic Currants		Russian Currants	
Sociodemographic Data	Frequency	Percentage	Frequency	Percentage
BMI (kg/m2)				
22 to 27	13	86.7	6	40.0
27 to 32	2	13.3	7	46.7
32 to 37	0	0	2	13.3

The above table implies that in the faradic currants the most 13(86.7%) samples BMI (kg/m2) is 22 to 27 whereas in Russian currants the maximum 7(46.7%) samples BMI (kg/m2) is 27 to 32.

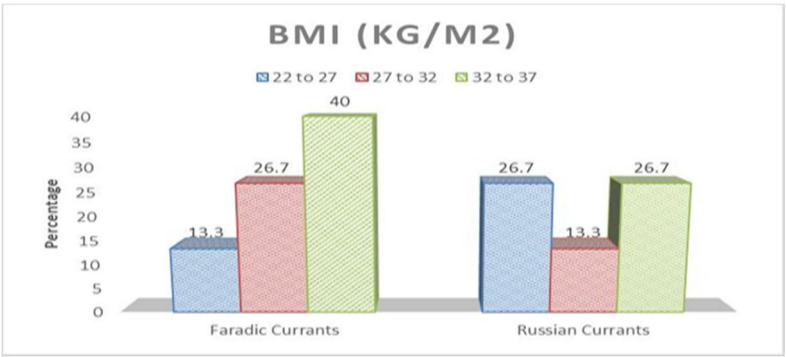

Figure 5.5: Frequency and percentage distributions of BMI (kg/m2)

2) Section II: Effectiveness of pre and post test values

Table 5.6: Effectiveness of pre and post test Faradic Currants values

n=15

Pre-test and Post-test Faradic Currants Aspects	Standard Error Mean	Mean	SD	Students paired t-test	Significance
Pre-Pain - Post Pain	0.192	3.133	0.743	16.328	0.000; P<0.05; S
Pre Knee-flexion - Post Knee flexion	1.059	7.867	4.103	7.425	0.000; P<0.05; S
Pre-Knee-Extension – Post-Knee Extension	.452	9.933	1.751	21.969	0.000; P<0.05; S
Pre-TUG - Post TUG	.279	3.200	1.082	11.451	0.000; P<0.05; S
Pre WOMAC - Post WOMAC	.487	7.533	1.885	15.480	0.000; P<0.05; S

S=Significant; SD= Standard deviation; DF=14

The above Table depicts the calculated value of each aspect is higher than the tabulated value at a 0.05 level of significance. So, there is a significant difference between pre-test and post-test Faradic Currants values.

Table 5.7: Effectiveness of pre and post-test Russian Currants values

n=15

Pre-test and Post-test Russian Currants Aspects	Standard Error Mean	Mean	SD	Students paired t-test	Significance
Pre Pain - Post Pain	0.133	3.533	.516	26.500	0.000; P<0.05; S
Pre Knee-flexion - Post Knee flexion	1.018	7.467	3.944	7.333	0.000; P<0.05; S
Pre Knee-Extension - Post Knee Extension	1.018	10.867	3.944	10.672	0.000; P<0.05; S
Pre-TUG - Post TUG	.223	4.200	.862	18.873	0.000; P<0.05; S
Pre WOMAC - Post WOMAC	.696	10.400	2.694	14.952	0.000; P<0.05; S

S=Significant; SD= Standard deviation; df=14

The above Table depicts the calculated_t'value of each aspect are higher than the tabulated value of 2.145 at 0.05 level of significance. So, there is a significant difference between pre-test and post-test Russian Currants values

Table 5.8: Effectiveness of Faradic Currants and Russian Currants in Pre and Post-Pain Values

n=15+15

Faradic Currants and Russian Currants Aspects	Standard Error Mean	Mean	SD	Independent t-test	Significance
Pre-Pain Faradic Currants	.192	6.47	.743	0.498	P>0.05; NS
Pre-Pain Russian Currants	.187	6.33	.724		
Post-Pain Faradic Currants	.232	3.33	.900	1.740	P>0.05; NS
Post-Pain Russian Currants	.200	2.80	.775		

The above table depicts that the t-test value of pre-pain and post-pain in Faradic currants and Russian currants are lower than the tabulated value of 2.048 at a 0.05 level of significance. So, there is no significant difference between Faradic Currants and Russian Currants in Pre and post-Pain values.

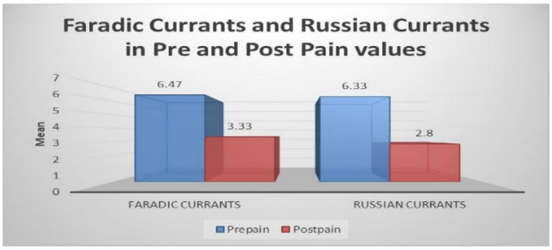

Figure 5.6: Effectiveness of Faradic Currants and Russian Currants in Pre and PostPain values

Table 5.9: Effectiveness of Faradic Currants and Russian Currants in pre and postKnee flexion values

n=15+15

Faradic Currants and Russian Currants Aspects	Standard Error Mean	Mean	SD	Independent t-test	Significance
Pre Knee flexion Faradic Currants	1.291	119.47	4.998	0.469	P>0.05; NS
Pre Knee flexion Russian Currants	1.515	118.53	5.866		
Post Knee flexion Faradic Currants	.826	127.33	3.200	0.962	P>0.05; NS
Post Knee flexion Russian Currants	1.113	126.00	4.309		

The above table depicts that the t test value of pre and post Knee flexion in Faradic currants and Russian currants are lower than the tabulated value 2.048 at 0.05 level of significance. So, there is no significant difference between Faradic Currants and Russian Currants in pre and post Knee flexion values.

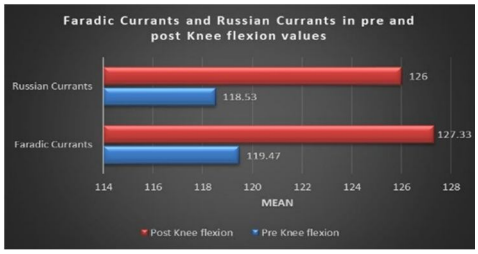

Figure 5.7: Effectiveness of Faradic Currants and Russian Currants in pre and postKnee flexion values

Table 5.10: Effectiveness of Faradic Currants and Russian Currants in pre and postKnee Extension values

n=15+15

Faradic Currants and Russian Currants Aspects	Standard Error Mean	Mean	SD	Independent t-test	Significance
Pre Knee Extension Faradic Currants	1.080	10.93	4.183	0.228	P>0.05; NS
Pre Knee Extension Russian Currants	1.380	10.53	5.343		
Post Knee Extension Faradic Currants	1.000	1.00	3.873	0.768	P>0.05; NS
Post Knee Extension Russian Currants	1.420	.33	5.499		

The above table depicts that the t test value of pre and post Knee Extension in Faradic currants and Russian currants are lower than the tabulated value 2.048 at 0.05 level of significance. So, there is no significant difference between Faradic Currants and Russian Currants in pre and post Knee Extension values.

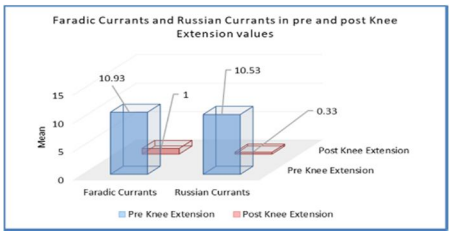

Figure 5.8: Effectiveness of Faradic Currants and Russian Currants in pre and postKnee flexion values

Table 5.11: Effectiveness of Faradic Currants and Russian Currants in pre and postTUG values

Faradic Currants and Russian Currants Aspects	Standard Error Mean	Mean	SD	Independent t-test	Significance
Pre TUG Faradic Currants	.262	16.20	1.014		
Pre-TUG Russian Currants	.349	16.40	1.352	0.458	P>0.05; NS
Post-TUG Faradic Currants	.309	13.00	1.195		
				1.871	P>0.05; NS

The above table depicts that the t-test value of pre and post-TUG in Faradic currants and Russian currants are lower than the tabulated value of 2.048 at a 0.05 level of significance. So, there is no significant difference between Faradic Currants and Russian Currants in pre and post-TUG values.

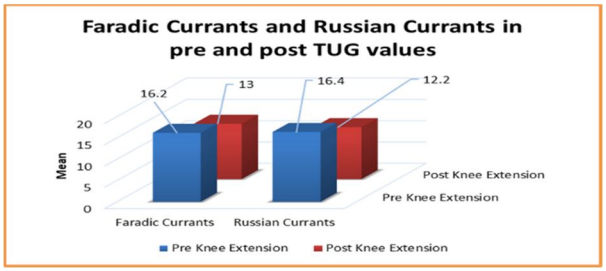

Figure 5.9: Effectiveness of Faradic Currants and Russian Currants in pre and post-TUG values

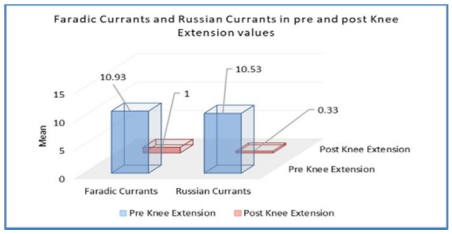

Table 5.12: Effectiveness of Faradic Currants and Russian Currants in pre and post-WOMAC values

n=15+15

Faradic Currants and Russian Currants Aspects	Standard Error Mean	Mean	SD	Independent t-test	Significance
Pre-WOMAC Faradic Currants	.947	41.80	3.668		
Pre-WOMAC Russian Currants	.910	40.00	3.525	1.370	P>0.05; NS
Post WOMAC Faradic Currants	1.201	34.27	4.652		
				3.172	P<0.05; S

S=Significant; NS=Not Significant SD= Standard deviation; df=28

The above Table depicts the calculated value of Pre WOMAC Faradic and Russian Currant t-test values are lower than the tabulated value of 2.048 at 0.05 level of significance. So, there is no significant difference between Faradic Currants and Russian Currents pre-WOMAC values.

In the Post WOMAC Faradic Currants and Post WOMAC Russian Currant t-test values are higher than the tabulated value 2.048 at 0.05 level of significance. So, there is a significant difference between Faradic Currants and Russian Currants WOMAC values.

VIII. DISCUSSION

The study was designed to determine the effect of Faradic and Russian currents on the quadriceps muscle in patients with knee OA. The purpose of the study was to compare the effect of Faradic and Russian currents on quadriceps muscle in patients with knee OA in order to increase ROM of the knee, decrease pain and improve functional ability of knee joint. The findings of this study are based on the objectives and hypotheses and it has been organized by following three sections.

1) Section I: Frequency and percentage distributions of Sociodemographic variables.

The present study shows that the maximum 8(53.3%) samples in faradic currants as well as in Russian currants are females, 7(46.7%) of the samples are males in each. In faradic currants the maximum 7(46.7%) samples are between the age 45 to 49 years, 4 (26.7%) samples are between 50 to 54 years, and the remaining 4(26.7%) samples are between 55 to 60 years. Whereas in Russian currants 5(33.3%) samples are between 45 to 49 years, another 5(33.3%) samples are between 50 to 54 years, and the remaining 5(33.3%) samples are between 55 to 60 years. In the faradic currants, the maximum 8 (%53.3) samples weight was between 60 to 68 kg, whereas in Russian currants the maximum 5 (33.3%) samples weight is between 78 to 86 kg. In the faradic currants, the maximum of 6(40.0%) samples' height is between 162 to 167, whereas in Russian currants maximum of 5(33.3%) samples' height is between 168 to 173. In the faradic currants, the 13(86.7%) samples' BMI (kg/m2) is 22 to 27 whereas in Russian currants the maximum 7(46.7%) samples' BMI (kg/m2) is 27 to 32.

2) Section II: Effectiveness of pre and post-test values.

The present study revealed that there is a significant difference between pre-test and post-test Faradic Currants values and also there is a significant difference between pre-test and post-test Russian Currants values. It means Faradic and Russian current both are effective on quadriceps muscle in patients with knee osteoarthritis in order to increase ROM of the knee, decrease pain and improve the functional ability of the knee joint.

3) Section III: Comparison of Faradic Currants and Russian Currants values.

In this study, we found that there is no significant difference between Faradic Currants and Russian Currants in Pre and post Pain (NPRS) values, in pre and post Knee flexion values, pre and post Knee Extension values, in pre and post TUG values, and in pre WOMAC values (Therefore, the H_0 is accepted and the H_1 is rejected) but there is a significant difference between Faradic Currants and Russian Currants post WOMAC values(Therefore, the H_0 is rejected and the H_1 is accepted).

A study conducted by Vaz et al on neuromuscular electrical stimulation (NMES) reduces structural and functional losses of the quadriceps muscle and improves the health status of patients with knee osteoarthritis. This study concluded that the NMES strength training program was successful in counteracting the deleterious effects of OA on the knee extensor muscles. NMES reduced muscle weakness and increased muscle thickness and fascicle length. NMES training appears to offset the changes in quadriceps structure and function, aswell as improve the health status of patients with knee OA [15].

The previous study conducted by Dr. Raghav s. et al to determine the comparative effect of the functional paradigm over strengthening exercises in reducing pain, joint stiffness, functional limitation, and improving isometric quadriceps muscle strength and quality of life in patients with knee osteoarthritis. This study revealed that the reduction of pain, joint stiffness, and functional limitation in both groups may be attributed to increased quadriceps muscle strength and thereby improve function which leads to decreased pain and disability. The results of this study show that the functional paradigm was an effective Protocol for reducing pain, joint stiffness, functional limitation, and improving quadriceps muscle strength [25].

According to Ward AR et al the effect of Russian current stimulation is believed to relieve pain re-educates muscle function, prevent muscle atrophy and restore function. Russian current can cause depolarization of sensory and motor nerve fibers. It activates a fast type II motor unit and evokes muscle contraction which leads strengthening of muscle. [14]

Michael G Parker et al. conducted a study on torque responses in human quadriceps to burst modulated alternating current at 3 carrier frequencies namely, 2500 Hz, 3750, and 5000 H_z in 23 healthy subjects, and concluded that burst modulated alternating currentgiven at 2500 Hz produces greater electrically induced torque than those generated at 3750 Hz and 5000 Hz. According to this study, we used a Russian current stimulator having 2500 H_z frequency in the present study [38].

According to a previous study, the improvement in function could be attributed to the analgesic effect of Russian current and exercises which lead to decreased pain and increase strength of the quadriceps. Strength gain was also associated with improvement in confidence during mobility [39].

Some previous studies revealed that Russian current stimulation of the peripheral muscle causes an increase in the spinal routes excitability, and changes in the cortical activation pattern, and improves the recruitment of fast twitch (fatigable) muscle fibers which are responsible for strength [40]. Also, there could be some neural adaptations that increase the capacity of voluntary muscle contraction that was impaired in patients with knee OA [41].

A study conducted by Anand B.H, Snehal R.D et al on the effect of Russian currenton questions Quadriceps muscle strength with primary knee osteoarthritis.

This study concluded that the Russian current group Shows better improvement in pain an increase inmuscle strength and greater improvement of the functional score (WOMAC) [26].

IX. LIMITATIONS

There are several limitations to this study. The sample size in the present study was small, No follow-up was done, the strength of the quadriceps muscle was not included, and Radio graphical findings were not measured in this study.

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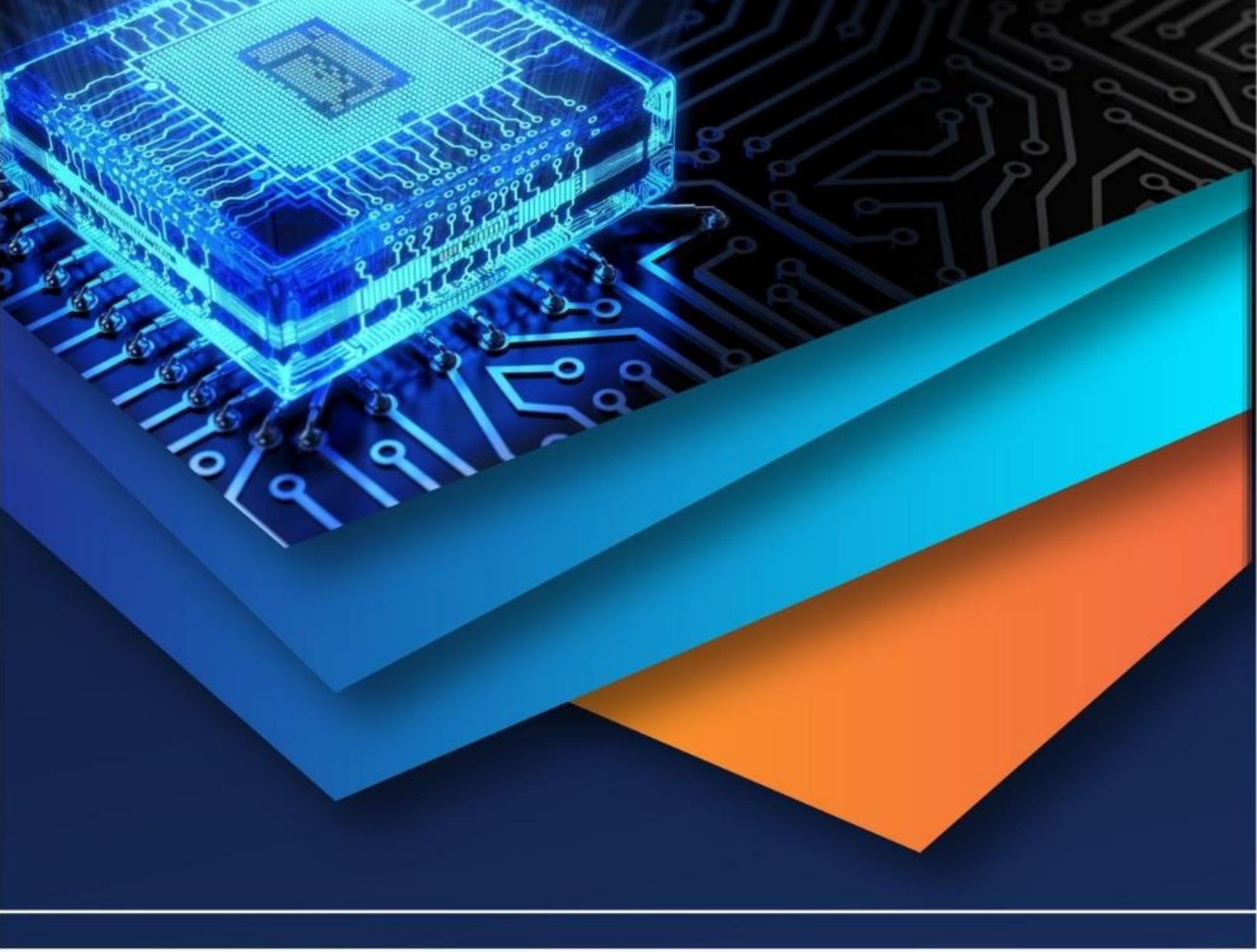

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