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Effectiveness of Periosteal Electric Dry Needling Among Patients with Knee Osteoarthritis: An Experimental Study

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Abstract

Background: One of the most common degenerative conditions, osteoarthritis, is thought to be caused in part by myofascial trigger points. Dry needling is a common treatment for myofascial trigger points.

Objective*:* To examine Periosteal electric dry needling stacks up with a conventional treatment in terms of pain reduction, Range of motion of knee, muscle strength of knee, functional status, and Quality of life.

Materials and method: Between the ages of 45 and 65, male and female patients with pre-diagnosed knee Osteoarthritis participated in an experimental interventional investigation. Numeric pain rating scale (NPRS) for pain management, the western Ontario and Mc Master universities Arthritis Index (WOMAC) for functional status World health Organization Quality of life (WHOQOL-BREF) for check quality of life, Range of motion and Muscle strength of knee were measured in both the experiment and control group where physiotherapeutic modalities with Muscle strength exercise, Resistance exercise, and weight bearing & non weight bearing exercise were given and another one. Periosteal electric dry needling procedures were administered to the experimental group in addition to the therapy described for the control group. When statistical significance was set up at p 0.05, statistical techniques like the paired t-test were used.

Results*:* Numeric pain rating scale (NPRS), The western Ontario and Mc Master universities Arthritis Index (WOMAC), World health Organization Quality of life (WHOQOL-BREF), Range of motion and Muscle strength of knee Results from experimental and control groups' pre-post-tests both showed better improvement and statistical significance. And while there is a significant difference in compression between both groups, the experiment intervention appears to be more successful when comparing the percentage change in post value between the two groups.

Conclusion: It is a method that will be useful for future study. Our research suggests that people with knee osteoarthritis may benefit from periosteal electric dry needling as a kind of treatment.

Keywords**:** Osteoarthritis knee, Dry Needling, NPRS, DN therapy, Periosteal Electrical Dry Needling.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

I. INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease, are older than age 65. The prevalence of knee OA will increase as per world's population becomes older [1]. Age, being overweight, and lengthy periods of bending or kneeling can all contribute to knee OA [2]. because demographic changes will increase the number of older people and the prevalence of obesity [3]. Additionally, menopause's abrupt decrease in sex hormones has been linked to osteoarthritis. The quadriceps, which make up the biggest set of muscles around the knee and have the greatest capacity to exert and absorb pressure there, are especially susceptible to atrophy in persons who have OA of the knee [4]. Various advantages come from physical activity, such as improved function, a better range of motion, increased muscle strength, reduced pain, and a slight possibility of developing in new chronic conditions [5]. OA is the second most prevalent rheumatologic condition and the most common joint illness. At age 65, nearly 45% of women already present symptoms, whereas 70% of people over that age have with radiological evidence. One of the main factors affecting mobility, especially in women, is knee OA [6]. Chronic discomfort and the inability to do daily activities like walking, climbing stairs, long standing, squatting are signs of knee OA. The primary emphasis of therapy for knee OA is symptom control up to the point where joint replacement is required [7]. Many organisations recommend a variety of treatment, including nonsteroidal anti-inflammatory medicines (NSAIDs), which can be taken orally or administered topically, intraarticular corticosteroids, and acetaminophen [8].

Patients with musculoskeletal problems have been proven to benefit right away with dry needling (DN), including better range of motion, decreased muscle tone, and pain alleviation [9]. DN can be done on the skin's surface or by inserting needles at different depths inside the body. The ease of administration, minimal danger of severe tissue trauma, lack of risk of nerve and visceral injury, and patient comfort are only a few benefits of superficial DN [10]. A needle is inserted into a muscle at a specified location during the DN, also known as deep needling procedure, to treat myofascial trigger points (MTrPs). Electromyography may be used to find trigger points, which are hyperactive regions of muscle where acetylcholine activity is multiplied by 1,000 because of a damaged motor end plate [11]. A local twitch response, which is characterised by a brief contraction of the muscles, is triggered when a needle is inserted into a particular trigger location [12]. The LTR (latent trigger points) may be impacted by altering one's environment to improve pain tolerance and decrease sensitivity. As a result, the spinal cord's nociception and heterosynaptic inhibition are reduced [13]. Needles must be inserted, moved, and removed during the operation. A guide tube directs the needle as it is inserted. Pain is considerably diminished with the use of a guide tube. Needles are adaptable crafting tools since they may be made in a variety of diameters and lengths [14]. A smaller needle (approximately 13 mm) is used to operate on the surface, while a much larger needle (about 20 mm) is utilised to work on the deeper structure. There are only four main categories that can be used for dry needling. Various needle manipulation techniques include 1. Pistoning, often referred to as "rapid movement of the needle in and out of the MTrPs," is carried out initially. 2. By angling the needle, as in fanning or fishing, changes in pistoning can be accomplished. Rossi advises fiddling with the needle for at least 30 seconds at a 1 Hz frequency. According to one theory, fanning aids in locating trigger locations and causes a twitch response [15]. 3. Third, depending on personal taste, the needle can be spun in either a clockwise or anticlockwise direction after being inserted into the target region and through the skin. If collagen is handled, it is more likely to gather and wrap around a needle. Within minutes after needle rotation, collagen is drawn in that direction, causing connective tissue fibroblasts to have a biological reaction. 4. The mechanical signal is translated by the fibroblast, which starts cellular and extracellular reactions such neuromodulation and wound healing [16].

A complementary and alternative therapy called electrode based DN, also known as electrical dry Needling (EDN) [4]. An important benefit of using EDN in clinical settings or acupuncture research is the ability to accurately set stimulation frequency and intensity. Pharmacological interventions are more expensive and less effective than DN [17]. Pain, stiffness, and function of patients with severe knee OA have significantly improved after undergoing periosteal electric stimulation for both medium- and long-term lengths of time. However, periosteal stimulation and acupuncture have recently been shown to be successful in treating knee osteoarthritis [10]. The current body of evidence seems to support the use of Dry Needling technique without injectate James D. et al.'s (2018) study shows that was reducing pain and disability and increasing function status helpful for those with knee osteoarthritis. One of systematic review studies were found that DN therapy significantly reduced pain and improved physical function compared to sham, exercise, or control interventions in 2021. Khan I et al. (2021) investigated the effects The best results from dry needling for reducing trigger points come when paired with other physiotherapeutic procedures. A skilled therapist is also required for pinpointing the trigger sites, formulating a risk-reduction strategy, and lowering the risk of damage associated with DN on acute or chronic leg pain.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

Kobayashi (2016) study looked at DN therapy helped persons feel less pain and improvement of physical function in people with hip or knee OA. In a 2017 research, Yan T et al. was found that can be helpful in reducing pain, enhancing function, and restoring knee ROM in those with knee OA. Peshkova et al. (2022), Shown that Patients with hip or knee OA who had DN treatment to the MTrPs of the soft tissues 9 experienced rapid pain relief and improvements in physical function. [3,19,20,5,23,24]. The article of Periosteal Electrical Dry Needling as an Adjunct to Exercise and Manual Therapy for Knee Osteoarthritis James D showed that the work done on pain, stiffness, functional status, and disability on OA knee patients with significant effect. But this study is being conducted with an aim to find out effect of EDN when used conventional therapy in the management of knee OA along with relieving Knee OA pain, increasing knee range of motion, strengthening supporting muscles of knee, improving functional status, and enhancing patients' Quality of life.

II. MATERIALS AND METHODS

Patients were randomly allocated to either conventional therapy or conventional therapy with Periosteal electric dry needling following a complete assessment. To assure the blinded allocation, a statistician who had no other involvement in the experiment and who had not input on the data processing or interpretation created a random table of numbers on a computer. The random assignment is put on the index card at the sampling sites where the data were gathered compared 2 treatment protocols for the management of knee OA. conventional therapy versus conventional therapy with electrical dry needling technique. Patients with Knee osteoarthritis Grade II and Grade III were conducted at the Deen Healthcare orthopaedic physiotherapy clinic. Patients were assessed using a range of outcome measures, such as included for physical functional status measured by the (WOMAC score) The University of Western Ontario and McMaster, knee pain intensity as measured by the Numerical rating pain scale (NPRS), Range of motion of knee (ROMK), Muscle strength of Knee (hamstring/quadriceps muscle) (MSK), Quality of life measured by the WHOQOL-BREF total score. Comparison between two groups was the goal of the experimental research design. A before-and-after clinical investigation was developed to investigate how periosteal electric Dry Needling affected pain in persons with mild to moderate Knee OA. The study was approved by the ethics committee at department of physiotherapy, Amity University, Noida (Ref: No NTCC/MPT-Ortho/22-23/ November 2022/18).

46 people made up the study's sample size and were split into two groups. 30 control groups and 16 experimental groups. Consecutive individuals with painful OA knee from Deen health care clinic were screened for eligibility criteria and recruited grade II grade III OA knee who had already received a diagnosis from an orthopaedic surgeon or consultant from a physiotherapist. For patients Inclusion criteria to be Aged between 45 – 65 years, both male and female, X-RAY diagnosis cases of knee osteoarthritis KELLGREN LAWRENCE grade 2 and 3 (Grade 2 and grade 3 of OA knee was take after being diagnosed by a radiologist). Patients where Exclusion criteria was History of major trauma around the joint, History of surgery near knee or TKR (Total knee replacement), History of TKR (Total knee replacement), Psychological disorder, History of neurological disorder, History of intra-articular injection, and Continuing's physiotherapy treatment for osteoarthritis knee. Instruments Required was Pen, Papers, Chart (NPRS, WOMAC, WHOQOL), Dry needles (Sterile acupuncture needles) Size was 0.25 mm × 30 mm (small) 0.30m × 40 mm (middle) 0.31m × 50 mm (large), electrical dry needling stimulator, Universal goniometer, Cable tensiometer and Cotton as shown as figure 1.1 , 1.2, 1.3

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

Figure-1.1 Acupuncture Needles

Figure: 1.2 Needle Stimulation

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

Figure : 1.3 Back side of Needle Stimulation

III. INTERVENTIONS

All participants received between 4 treatment sessions at a frequency of 1 to 2 times per week over a 2-week period. Both groups received conventional therapy (interferential therapy and Hot Moist Pack and exercise (1. Towel rolled For Isometric Quadriceps of Knee, 2. Knee Extension with Resistance, 3. Knee Flexion with Resistance, 4. weight bearing, non–weight-bearing exercises) on each session. In addition, the dry needling group also received electrical dry needling protocol for 20 to 30 minutes on each treatment session. Before the treatment Assessments was done prior to the treatment protocol, which was include the following 1.NPRS scale for checking pain, 2.Range of motion assessed by universal goniometer, 3.Muscle strength of the quadriceps and hamstrings was assessed by cable tensiometer, 4.Functional status assessed by WOMAC scale, 5.Quality of life assessed by WHOQOL- BREF scale and The subject was informed of the process prior to the application of any procedures.

In experimental group Patients received at all treatment sessions 60 minutes of the lower extremity. Experimental group volunteers were used, and they received- 1. The knee area received the heated, Hot Moist pack for 5-10 minutes, 2. interferential therapy-The patients received an alternating current while recumbent for 10-15 minutes. The 4-pole electrodes were placed over the painful area, as well as the medial and lateral sides of the knee. Used an electrode to stimulate the skin and underlying nerves of the patients, including the nerves that convey pain, 3. Exercises -A. Towel rolled For Isometric Quadriceps of Knee-Under the knee, place a little towel that has been wrapped up. Push the back of the knee into the towel that has been rolled up while gradually contracting the quadriceps muscle on top of the leg. 5 seconds of contraction holding before releasing. Release slowly, allowing five seconds of pause between each contraction. One (1) time every day, perform three (3) sets of 10 repetitions, B. Knee Extension with Resistance-Place an ankle on the same side as the chair, a resistance band around one of the chair's legs and sit on the chair. Then, slowly return to the extension position and holding the position for five seconds. Those are one rep. 1 time every day, perform three (3) set of 5 repetitions, C. Knee Flexion with Resistance-Start in a seated position and place a band around the ankles. One leg act as the anchor, whilst the symptomatic leg was going to do the work. Pull the heel of the symptomatic leg back towards you, bending the knee against the resistance of the band. Control the movement you return to the start position holding the position for five seconds. Those are one rep. 1 time every day, perform three (3) set of 5 repetitions, D. weight bearing, non–weight-bearing exercises. Non-Weight Bearing Exercises- Using stationary bicycle for riding, lifting weights, or using resistance bands while seated, Isometric exercises. Yoga and Swimming advised for in home and Weight Bearing Exercises- Advised for Walking after dinner and work in the morning, Waking up and down the stairs.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

Dry Needling with electrical Needle stimulation was given for 20 to 25 minutes during each treatment session. Sterile acupuncture needles used in 3 sizes: 0.25 mm×30 mm, 0.30 mm×40 mm, and 0.30 mm×50 mm. All patients received 4 treatment sessions at a frequency of 2 times per in a week over a 2-week period. the Control group was assessed using the same process as Group A before therapy was administered to them. Subjects was given on a control group consisting of the same procedure as like group A experimental therapy except Electric Dry Needling Technique. After giving treatment to both groups A and B, all the assessments were checked and compared before and after as shown in figure 2.1, 2.2.

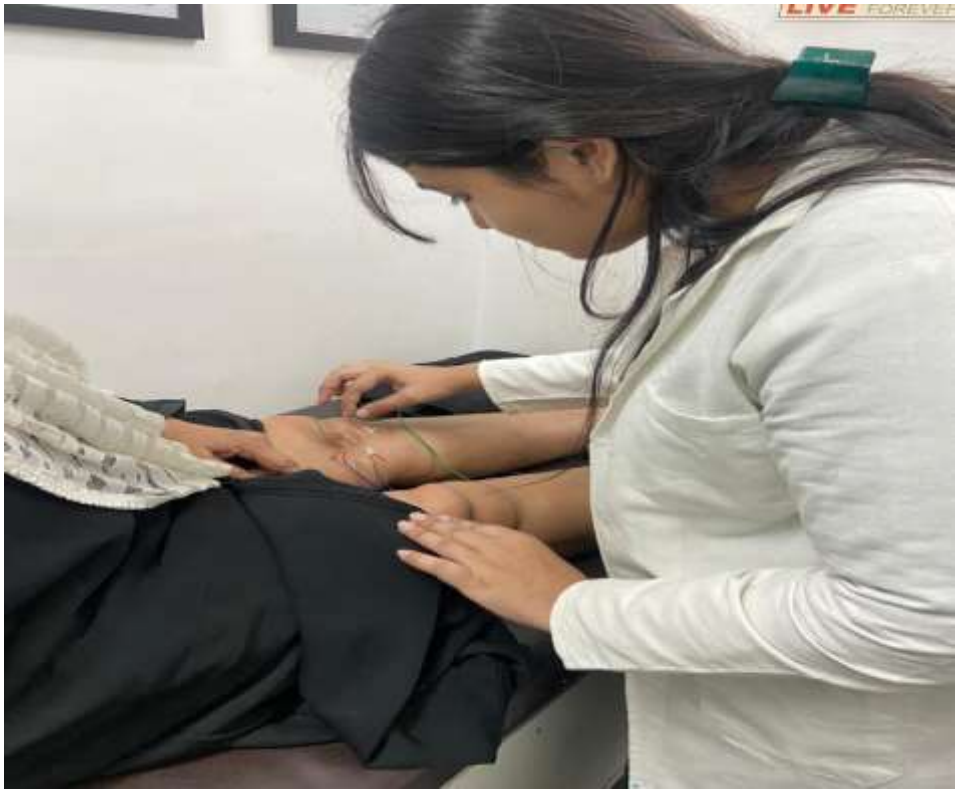

Figure: 2.1 : Periosteal Electrical Dry Needling protocol for knee osteoarthritis.

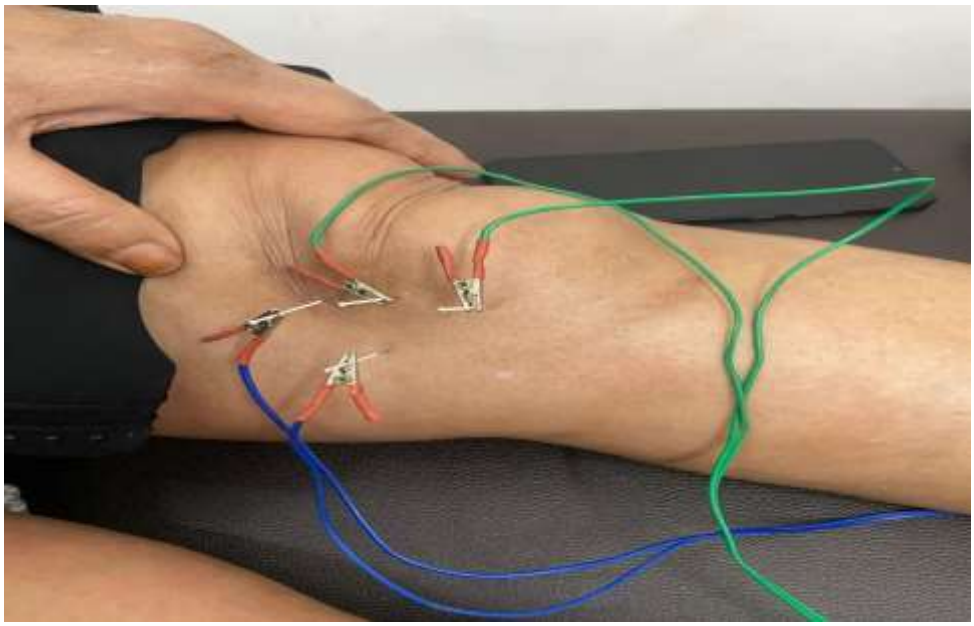

Figure 2.2 : Dry Needling with periosteal Electrical Stimulation for patient with OA knee.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

IV. STATISCAL ANALYSIS

In the present study, statistical analysis of the obtained results was carried out using SPSS version 23. To continue the data, an Excel spreadsheet was filled up, organised, and statistically evaluated. Several statistical techniques were used, including the mean, the paired t-test, and the unpaired t-test. With value of $P<0.05$, data were statistical significance change between the pre and post-test in the NPRS, WOMAC, WHOQOL-BREF, ROM, and knee muscular strength.

Table:1 Descriptive data on the age and gender of knee osteoarthritis patients

Variables	Categories	Experimental group (n=16)	Control group (n=30)
Gender	Female	10	19
	%	62.5%	63.3%
	male	6	11
	%	37.5%	36.7%
Age	Mean ± SD	56.68 ± 5.505	55.83 ± 5.226

N=46

Table :1 The above of the table shows the patient distribution by gender, mean age, and standard deviation, with 62.5% of patients being female and 37.5% of patients being male in the trial group. Additionally, in the control group, 36.7% of patients were men and 63.3% of patients were women. In this study, the mean patients age was 56.68 years in the experimental group and 55.83 years in the control group. In Experiment group taken 16 patients and control taken 30 patients with knee OA Grade II and Grade III both groups in this study demonstrated pre- and post- t-test statically significant with $P>0.05$ for NPRS and WOMAC scores for both periods. After doing the Unpair T test, P value was determined between the Control and Experimental groups in comparison. Because of this, it can be seen from the comparison that the experimental group and control group both demonstrated significant differences, but the experimental group's experimental interventions were more successful than the control groups in terms of % change in post value. All pre-test and post-test WHOBREF domains 1, 2, 3, and 4 showed statically significant pre and post paired t test results was $P> 0.05$ in Experimental groups. But domain 3 showed insignificant pre and post paired t test results ($p < 0.05$) in the control group. Comparing the percentage change in post value between the two groups of the experiment suggests that the intervention was successful but was not statistically proven to be superior to the control group in the comparison between the two groups of the control and experimental groups after performing an Unpair T test $P< 0.05$. The intervention appears to be more successful in domain 3 than the experimental group, although this is not statistically supported. In this study, the paired t test revealed that the range of motion (ROM) of the right & left knee flexion and extension in the experimental and control both groups was statically significant with $P>0.05$. Right & left knee flexion and extension were compared between the two groups, Control and Experimental. Although there is a statically significant difference between the experimental group and the control group in terms of post value percentage change, the experiment intervention was more effective and decreased ROM then the control group. The results of the paired t test indicated that MS for the right & left knee flexion and extension showed statically significant differences with $P> 0.05$. When comparing the percentage change in post value between the two group experiment interventions, right & left knee flexion and extension of the control & experimental group all show significance differences between the experimental group and the control group in terms of post value percentage change, the experiment intervention was more effective and then the control group.

V. DISCUSSION

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

This research approach intends to promote knee range of motion, knee muscular strength, and quality of life while also enhancing joint function and reducing discomfort. In this study, the 46 patients were separated into two groups: Group A included 16 patients from the experimental group, and Group B included 30 individuals who had been diagnosed with knee OA Grade II and Grade III by a radiologist. There was no gender bias in the study, which included both men and women. The subject was chosen for a 45–65 age range, and both inclusion and exclusion criteria were checked. A general evaluation was then conducted to shortlist the candidate based on the inclusion criteria. Group A was given the PEDN techniques with conventional therapy, whereas Group B, named as a conventional group, was given interferential therapy, and manual technique physiotherapeutic protocol. Group A was given the therapy protocol for 2 times in a week for 60-65 minutes, consequently 2 weeks, and Group B was given the therapy protocol for 2 times in a week for 40-45 minutes, consequently 2 weeks. The rest were given in between sessions for 1-2 minutes. The therapeutic protocol was based on the James R Dunning [3] and the study duration was based on Thomas, P [26].

Before the Application of any techniques, the subject was informed about the procedure. Prior to the treatment protocol, assessments included an NPRS scale to measure pain, a universal goniometer to measure range of motion, a cable tensiometer to measure muscle strength in the quadriceps and hamstrings, a WOMAC scale to measure functional status, and a WHO-QOL scale to measure quality of life. In the experimental group, there were 62.5% female patients and 37.5% male patients. In the study's control group, there were 36.7% men and 63.3% women patients. In this investigation, the mean patient age was 56.68 years for the experimental group and 55.83 years for the control group.

To evaluate the impact of adding PEDN to manual treatment and exercise on individuals with knee osteoarthritis who are experiencing pain, stiffness, and impairment. In comparison to the experimental group receiving simply manual therapy and exercise, the group receiving exercise programme, PEDN, and stiffness reported noticeably superior improvements in pain intensity, stiffness, physical function status, disability, and discontinue using medication. The therapy programme lasts for six weeks, with one to two sessions each week totalling 10 to 12 dosages for the patients [3]. In our study, the patients received a total of 3–4 doses during the treatment protocol's two-week length and frequency of 1–2 sessions each week. Compare the impact of incorporating PEDN into a traditional therapy on the degree of pain, functional activity, patients' quality of life, range of motion (ROM), and MS of the knee. significantly more improvements were had. When post-test percentages were calculated, the experimental group outperformed the control group. The periosteum is the tough outer layer of bone, and PEDN is a novel method that involves inserting tiny needles there and stimulating them electrically. By boosting blood flow, lowering inflammation, and releasing endorphins, this technique is thought to aid in healing and reduce pain. It has been discovered that adding electrical stimulation to dry needling can improve its therapeutic benefits. Electrodes affixed to the skin close to the needles or through the needles themselves can administer the electrical stimulation. To target certain painful or dysfunctional locations, the electrical stimulation's strength and frequency can be changed. The fact that PEDN may be used to treat a variety of ailments, such as musculoskeletal pain, sports injuries, and chronic pain syndromes, is one of its potential advantages. Additionally, it has been used to treat visceral and neurological conditions like migraines and digestive issues [29]. that was based on a study that was published in the Journal of PEDN Technique Aide into Exercise and Manual paired Therapy for Knee Osteoarthritis.

Another 2017 study indicated that periosteal electrical dry needling was beneficial in reducing pain and enhancing range of motion in individuals with shoulder impingement syndrome. This study was also published in the Journal of Acupuncture and Meridian Studies.[30]. As shown in results from experimental and control groups' pre-and post-t tests both shown reduction pain, increased Functional status, increased Quality of life, increased range of motion of knees, and increased Muscle Strength of knee better improvement and statistical significance. And while there is a significant difference in compression between both the control and experiment groups, the experiment intervention appears to be more successful when comparing the percentage change in post value between the two groups. EDN treatment is ongoing Reduced discomfort and improvement in the knee's muscle tigger point, as well as improvements in the patients' quality of life and range of motion. Periosteal electrical dry needling might have dangers and adverse consequences, just like any other medical therapy. These include discomfort, bruising, infection, harm to the nerves, and organ piercing. It is crucial to get medical attention from a qualified professional who can accurately evaluate your problem and decide whether periosteal electrical dry needling is the best course of action for you.[31] Periosteal electrical dry needling is a promising method that may

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treat several illnesses, but further study is required to completely comprehend its advantages and disadvantages.[32]

A. Limitations of the study

- The population size is less.
- The study duration period is less, and the study population covers only the city area.
- Since there was no follow-up while the patient was receiving treatment, it was impossible to determine whether the observed clinical improvements persisted over time.

B. Future scope

- Future studies may conduct on the male and females separately. Population size may increase than this study, and the treatment duration period may vary.
- Future research should include a long-term monitoring and explore the efficacy of various electrical DN doses and kinds.

VI. CONCLUSION

Results from experimental and control groups' pre-and post-t-tests both shown reduction pain, increased Functional status, increased Quality of life, increased range of motion of knees, and increased Muscle Strength of knee and statistical significance. And while there is a significant difference in compression between the control and experiment groups, the experiment intervention appears to be more successful when comparing the percentage change in post value between the two groups. So, it is a helpful approach for upcoming research. Our findings indicate that periosteal electric dry needling should be taken into consideration for the therapy of knee osteoarthritis patients.

VII. REFFRENCES

1. Arslan, I. G., Damen, J., de Wilde, M., van den Driest, J. J., Bindels, P., van der Lei, J., Schiphof, D., and Bierma-Zeinstra, S., 2022, Incidence and Prevalence of Knee Osteoarthritis Using Codified and Narrative Data from Electronic Health Records: A Population-Based Study. Arthritis care & research, 74(6), 937–944. https://doi.org/10.1002/acr.24861
2. Brosseau L, Taki J, Desjardins B, 2017, The Ottawa panel clinical practice guidelines for the management of knee osteoarthritis. Part two: strengthening exercise programs. Clin Rehabil. 2017; 31:596–611.
3. Dunning, J., Butts, R., Young, I., Mourad, F., Galante, V., Bliton, P., and Fernández-de-LasPeñas, C., 2018, Periosteal electrical dry needling as an adjunct to exercise and manual therapy for knee osteoarthritis: a multicenter randomized clinical trial. The Clinical journal of pain, 34(12), 1149.
4. Fransen M, McConnell S, Harmer AR, 2015, Exercise for osteoarthritis of the knee. Cochrane Database Syst Rev. 2015; 1: CD004376.
5. Kobayashi S, Pappas E, Fransen M, 2016, the prevalence of patellofemoral osteoarthritis: a systematic review and meta-analysis. Osteoarthritis Cartilage. 2016; 24:1697–1707.
6. Pal, C. P., Singh, P., Chaturvedi, S., Pruthi, K. K., & Vij, A. (2016). Epidemiology of knee osteoarthritis in India and related factors. *Indian journal of orthopaedics*, *50*(5), 518–522. https://doi.org/10.4103/0019-5413.189608
7. Griswold D, Wilhelm M, Donaldson M, Learman K, and Cleland J. 2019, The effectiveness of superficial versus deep dry needling or acupuncture for reducing pain and disability in individuals with spine-related painful conditions: a systematic review with meta-analysis. Journal of Manual & Manipulative Therapy. 2019 May 27; 27(3):128-40.
8. Heidari B., 2011, Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. Caspian journal of internal medicine, 2(2), 205–212.
9. Kalichman L, and Vulfsons S. 2010, Dry needling in the management of musculoskeletal pain. *The J Amer Board Fam Med*; 23(5):640–6.
10. Gattie E, Cleland JA, and Snodgrass S, 2017, The effectiveness of trigger point dry needling for musculoskeletal conditions by physical therapists: a systematic review and metaanalysis. Journal of Orthopaedic & Sports Physical Therapy. 2017 Mar; 47(3):133-49
11. Dunning, J., Butts, R., Henry, N., Mourad, F., Brannon, A., Rodriguez, H., and Fernándezde-Las-Peñas, C., 2018, Electrical dry needling as an adjunct to exercise, manual therapy and ultrasound for plantar fasciitis: A multi-center randomized clinical trial. PloS one, 13(10), e0205405.
12. Alburquerque-García A, Rodrigues-de-Souza DP, Fernández-de-las-Penas C, and Alburquerque-Sendín F. 2015, Association between muscle trigger points, ongoing pain, function, and sleep quality in elderly women with bilateral painful knee osteoarthritis. J Manipulative Physiol Ther 2015; 38:262-8
13. Dommerholt J. 2011, Dry needling–peripheral and central considerations. *J Man Manip Ther*; 19(4):223–7.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 8, 2024

14. Cunha JE, Barbosa GM, Castro PA, Luiz BLF, Silva AC, and Russo TL, 2019, Knee osteoarthritis induces atrophy and neuromuscular junction remodeling in the quadriceps and tibialis anterior muscles of rats. *Sci Rep* 2019; 9:6366

15. Badshah Y, Shabbir M, Hayat H, Fatima Z, Burki A, Khan S, 2021, Genetic markers of osteoarthritis: early diagnosis in susceptible Pakistani population. *J Orthop Surg Res* 2021; 16(1):124.
16. Damen J, van Rijn RM, Emans PJ, Hilberdink WK, Wesseling J, and Oei EH, 2019, Prevalence and development of hip and knee osteoarthritis according to American College of Rheumatology criteria in the CHECK cohort. *Arthr Res Ther*; 21(1):4.
17. Vázquez-Justes, D., Yarzábal-Rodríguez, R., Doménech-García, V., Herrero, P., and Bellosta-López, P., 2020, Effectiveness of dry needling for headache https://doi.org/10.1016/j.nrl.2019.09.010
18. Farazdaghi MR, Kordi Usefinejad A, Abdollahian N, Rahimi M, and Motealleh A. 2021, Dry needling trigger points around knee and hip joints improves function in patients with mild to moderate knee osteoarthritis. *J Bodyw Mov Ther*; 27(2):597–604.
19. Rahou-El-Bachiri Y, Navarro-Santana MJ, Gómez-Chiguano GF, Cleland JA, López-de-Uralde-Villanueva I, Fernández-de-Las-Penas C, 2020, Effects of trigger point dry needling for the management of knee pain syndromes: A systematic review and meta-analysis. J Clin Med 2020; 9:E2044.
20. Khan I, Ahmad A, Ahmed A, Sadiq S, and Asim HM. 2021, Effects of dry needling in lower extremity myofascial trigger points: systematic review. *J Pak Med Assoc*, 71(11):2596–603.
21. Vervullens S, Meert L, Baert I, Delrue N, Heusdens CHW, Hallemans A, Van Criekinge T, Smeets RJEM, and De Meulemeester K. 2021, The effect of one dry needling session on pain, central pain processing, muscle co-contraction and gait characteristics in patients with knee osteoarthritis: a randomized controlled trial. *Scand J Pain*; 22:396–409.
22. Lara-Palomo, I. C., Gil-Martínez, E., Antequera-Soler, E., Castro-Sánchez, A. M., Fernández-Sánchez, M., & García-López, H. (2022). Electrical dry needling versus conventional physiotherapy in the treatment of active and latent myofascial trigger points in patients with nonspecific chronic low back pain. Trials, 23(1), 238. https://doi.org/10.1186/s13063-022-06179-y
23. Ma, Y. T., Dong, Y. L., Wang, B., Xie, W. P., Huang, Q. M., & Zheng, Y. J. (2023). Dry needling on latent and active myofascial trigger points versus oral diclofenac in patients with knee osteoarthritis: a randomized controlled trial. BMC musculoskeletal disorders, 24(1), 36. https://doi.org/10.1186/s12891-022-06116-9
24. Peshkova, M., Lychagin, A., Lipina, M., Di Matteo, B., Anzillotti, G., Ronzoni, F., Kosheleva, N., Shpichka, A., Royuk, V., Fomin, V., Kalinsky, E., Timashev, P., and Kon, E., 2022, Gender-Related Aspects in Osteoarthritis Development and Progression: A Review. International journal of molecular sciences, 23(5), 2767. https://doi.org/10.3390/ijms23052767.

25. Sánchez-Romero EA, Pecos-Martín D, Calvo-Lobo C, Ochoa-Sáez V, Burgos-Caballero V, and Fernández-Carnero J. 2018, Effects of dry needling in an exercise program for older adults with knee osteoarthritis: A pilot clinical trial. *Medicine (Baltimire)*; 97(26): e11255.
26. Perreault, T., Cummings, M., Dommerholt, J., Hayes, D., & Hobbs, J.G. (2022). Periosteal Needling to the Cervical Articular Pillars as an Adjunct Intervention for Treatment of Chronic Neck Pain and Headache: A Case Report. *Applied Sciences*.
27. Blanco-Díaz, M., Ruiz-Redondo, R., Escobio-Prieto, I., De la Fuente-Costa, M., Albornoz-Cabello, M., & Casaña, J. (2022). A Systematic Review of the Effectiveness of Dry Needling in Subacromial Syndrome. Biology, 11(2), 243. https://doi.org/10.3390/biology11020243
28. Ceballos-Laita, L., Jiménez-Del-Barrio, S., Marín-Zurdo, J., Moreno-Calvo, A., Marín-Boné, J., Albarova-Corral, M. I., & Estébanez-de-Miguel, E. (2021). Effectiveness of Dry Needling Therapy on Pain, Hip Muscle Strength, and Physical Function in Patients With Hip Osteoarthritis: A Randomized Controlled Trial. Archives of physical medicine and rehabilitation, 102(5), 959–966. https://doi.org/10.1016/j.apmr.2021.01.077
29. Kim, Y. S., Lee, H. J., Kim, J. H., & Kim, D. H. (2019). Periosteal electric dry needling for knee osteoarthritis: a pilot study. Journal of Acupuncture and Meridian Studies, 12(6), 169-174. doi: 10.1016/j.jams.2019.04.003
30. Woehrle J, Roman G, and Russell B. 2015, dry needling and its use in health care a treatment modality and adjunct for pain management. *J Pain Relief*; 4:194
31. Huang, Y., Xu, G., Wang, D., Lin, Z., & Chen, J. (2020). Effectiveness of periosteal needling in the treatment of knee osteoarthritis: A systematic review and meta-analysis. Journal of Traditional Chinese Medicine, 40(5), 781-789. doi: 10.19852/j.cnki.jtcm.2020.05.012
32. Kim, J. H., Kim, D. H., Kim, Y. S., & Lee, H. J. (2021). Effect of periosteal dry needling on pain and function in patients with knee osteoarthritis: a randomized controlled trial. Acupuncture in Medicine, 39(1), 21-29. doi: 10.1136/acupmed-2020-011764

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