RESEARCH ARTICLE

EFFECT OF PULSED ELECTROMAGNETIC ENERGY THERAPY ON PAIN AND FUNCTION IN PARTICIPANTS WITH KNEE OSTEOARTHRITIS

Binal A Gajjar, Megha S Sheth, Srishti S Sharma, Neeta J Vyas
SBB College of Physiotherapy, Ahmedabad, Gujarat, India

Correspondence to: Binal A Gajjar (gajjar_binal2228@yahoo.co.in)

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ABSTRACT

Background: Osteoarthritis (OA) of knee is an important cause of pain and functional limitation in older people. Some studies show pulsed electromagnetic energy therapy (PEME) reduces pain and disability. The efficacy of PEME therapy in knee osteoarthritis is not known in Indian population.

Aims & Objective: To compare the effect of PEME therapy versus conventional therapy on pain and function in participants with knee OA.

Materials and Methods: A quasi experimental study of 20 participants fulfilling the inclusion and exclusion criteria, by selective sampling was conducted at college of physiotherapy. Participants were randomly allocated into 2 groups. Group A was given PEME therapy with Magnetodyne with frequency 15Hz for 30 minutes, 6 days/week for 2 weeks. Group B was given conventional physiotherapy in the form of hot pack to the knee for 10-15 minutes. Both groups also received a set of 10 repetitions of quadriceps drill and stretching of tight muscles for 30sec-3 repetitions. Visual Analogue Scale (VAS) was used to assess knee pain and Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) was used to measure knee pain, stiffness and physical function.

Results: Difference in VAS and WOMAC scores were calculated using t-test. Mean difference in VAS score for Group A (4.08 ± 1.10) and Group B (1.40 ± 0.21) was significant with significant difference in favor of Group A (t= 7.57, p <0.001). Mean difference in WOMAC for Group A (27.50 ± 13.80) and Group B (8.50 ± 3.71), also showed a significant difference with more difference in Group A (t= 4.20, p<0.001).

Conclusion: PEME therapy reduces pain and improves physical function in participants with knee OA.

Key Words: Pulsed Electromagnetic Energy (PEME) Therapy; Pain; Function; Osteoarthritis

Introduction

Osteoarthritis of knee is a degenerative synovial joint disease. Osteoarthritis (OA) frequently affects the knee and afflicts the constantly increasing elderly population.[1] OA is the number one musculoskeletal disorder in the developed world and it ranks among the top problems of the health care systems in developed countries. It is the most common form of arthritis and is a leading cause of physical disability, increased health care usage, and impaired quality of life.[2] It involves cartilage loss, synovial inflammation, subchondral bone lesions and meniscus extrusion. Patients present with a combination of pain, deformity, inflammation, stiffness and muscle atrophy. With the lack of cure, non-surgical treatment is usually directed to symptomatic relief and prevention of functional dysfunction.[3]

Management options such as medication, exercise, self-management programs and surgery largely focus on providing symptom relief and maintenance of function, but do not, in general, address the disease process itself. Pulsed electromagnetic energy (PEME) therapy has proved to be safe and has also shown promising therapeutic effectiveness on bone and cartilage related pathologies, including knee and cervical spine OA.[4-9] Several studies recommend that PEME reduces pain and disability in people with knee OA. The efficacy of pulsed electromagnetic field therapy in knee osteoarthritis is not known in Indian population. So the objective was to study the effect of pulsed electromagnetic energy therapy on pain and function in participants with knee OA.

Materials and Methods

A quasi-experimental study was conducted at the physiotherapy department, General Hospital. Males and females above 40 years; having OA knee diagnosed by the orthopedic department according to the American College of Rheumatology criteria; experiencing mild to moderate pain and stiffness for more than 3 months were included. Individuals were excluded if they had other forms of arthritis; signs of acute inflammation, traumatic lower extremity injury, taken corticosteroids, visco-supplement injections, sedatives or opioids within the previous 3 months; had a history of knee infection, knee surgery or major limiting cardiovascular and neurological deficits. 20 participants, 10 in each group were included by convenience sampling. Nature and purpose of the study was explained and informed written consent was obtained.

The duration of intervention was 2 weeks. The study was conducted for 3 months from August to October 2013.

The equipment used for low frequency pulsed electromagnetic energy (PEME) therapy was Magnetodyne Therapy device M80 with Applicator for the limbs and hot pack. The outcome measure used for pain intensity was Visual analogue scale (VAS)[10] and for physical function was Western Ontario McMasters Arthritis Index (WOMAC) [11]. Group A was given PEME using coil applicator. The parameters used for the treatment was frequency 15 Hz[12] with sinusoidal current 3 mA. Treatment duration was 30 minutes for 6 days in a week for 2 weeks. Group B was the control group in which hot pack was given to the knee for 10-15 minutes for 6 days in a week for 2 weeks. Both groups were given exercises in the form of a set of 10 repetitions of Q drills including ankle toe movements, static quadriceps exercise, last degree knee extension, straight leg raise in 3 positions: supine, side-lying and prone and high sitting knee extension. Stretching of the tight hamstrings, tendoachillis and rectus femoris was also performed with 30 sec hold for 3 repetitions. Level of significance was kept at 5%. All data are represented as the mean ± SD and were analyzed using SPSS version 16. Differences in VAS and WOMAC scores were calculated for both the groups. The two tailed paired t- test was used to compare within group changes from baseline for each observation. Between group differences were evaluated using the two tailed unpaired t- test.

Results

Comparison of difference in mean VAS and WOMAC scores within groups A and B are shown in tables 1 and 2. Differences between the groups are shown in table 3. Statistically significant difference was seen within the groups in both outcomes and between the groups too ($p<0.001$). No adverse reactions to therapy were observed.

Table-1: Mean difference in VAS scores in groups A and B

Group	Pre VAS (Mean ± SD)	Post VAS (Mean ± SD)	p value
A	5.67 ± 1.12	1.59 ± 1.09	<0.001*
B	4.97 ± 1.52	3.57 ± 1.58	<0.001*

* Significant

Table-2: Mean difference in WOMAC scores in groups A and B

Group	Pre WOMAC (Mean ± SD)	Post WOMAC (Mean ± SD)	p value
A	38.80 ± 17.40	11.30 ± 6.01	<0.001*
B	44.10 ± 13.21	35.60 ± 14.14	<0.001*

* Significant

Table-3: Mean difference in VAS and WOMAC scores between the groups

	VAS (Mean ± SD)	WOMAC (Mean ± SD)
Group A	4.08 ± 1.10	27.50 ± 13.80*
Group B	1.40 ± 0.21	8.50 ± 3.71
p value	<0.001	<0.001

* Significant

Discussion

Both the groups showed improvement in pain and function in participants with osteoarthritis of knee. The results of the present study indicate that PEME therapy is more effective in reducing pain and improving function in participants with OA knee than conventional treatment. The results are in accordance with those of Pipitone et al[13] who demonstrated a statistically significant benefit in terms of reduction of pain and disability in patients with knee OA resistant to conventional treatment in the absence of significant side effects.

PEME therapy has been demonstrated to enhance fibroblast[14], chondrocyte[15,16], osteoblast metabolism[17], modulate the effects of hormones and neurotransmitters on the receptors of different cell types[18]. Lannitti T et al[19] showed that PEME therapy produces a significant benefit in terms of reduction in knee-related pain, stiffness, and physical function in elderly patients with knee OA. Trock and colleagues also reported an improvement in pain and functional performance in patients affected by knee OA undergoing PEMF therapy for about 1 month, if compared to control group.[20]

J VanNguyen and Marks R described potential benefits of application of pulsed electromagnetic fields to osteoarthritic joints.[21] There is a decrease in joint and muscle pain, decrease in joint swelling and decreased joint swelling. This leads to increase in mobility, decrease in impairment, decrease in disability and improvement in quality of life.[21] These findings are similar to the present study. In opposition to the studies mentioned above, Ozgüçlü and co-workers performed a study involving 40 patients undergoing PEMF therapy for 2 weeks and found no differences between sham & treated group concerning WOMAC pain, stiffness, and physical function scores.[22]

Exercise in the form of quadriceps drill was also prescribed to both the groups. Deyel GA et al[23] and Roddy E et al[24] also found that exercises are effective in improving physical function in participants with knee OA. The results of the study also show improvement in group B which was given hot pack and exercises. The mechanism of pain relief could be that heat leads to local vasodilatation which increases blood flow to the affected area. Pain may also be reduced by the pain gate control mechanism.[25] Roger J et al[26] reported that heating agents are one of the effective therapeutic modalities to elevate nociceptive threshold, which may reduce pain and improve function in Group B.

Thus the present study shows that low frequency PEMF

therapy can be used in clinical practice to relieve pain and to improve function in participants with OA knee and it is more effective than conventional treatment. Further studies can be designed to determine effectiveness of PEMF therapy in the long-term follow-up and outcome measure can include radiographic changes.

Conclusion

PEME therapy produces a significant benefit in terms of reduction in knee related pain, and improves physical function in participants with knee OA.

References

1. Silverstein FE, Graham DY, Senior JR, Davies HW, Struthers BJ, Bittman RM, et al. Misoprostol reduces serious gastrointestinal complications in patients with rheumatoid arthritis receiving nonsteroidal anti-inflammatory drugs. A randomized, double-blind, placebo-controlled trial. Ann Intern Med 1995;123:241-9.
2. Michael JW, Schlüter-Brust KU, Eysel P. The epidemiology, etiology, diagnosis, and treatment of osteoarthritis of the knee. DtschArztebl Int 2010;107:152–62.
3. McCarthy CJ, Callaghan MJ, Oldham JA. Pulsed electromagnetic energy treatment offers no clinical benefit in reducing the pain of knee osteoarthritis: a systematic review. BMC Musculoskelet Disord 2006;7:51.
4. Gislason GH, Jacobsen S, Rasmussen JN, Rasmussen S, Buch P, Friberg J, et al. Risk of death or reinfarction associated with the use of selective cyclooxygenase-2 inhibitors and nonselective nonsteroidalantiinflammatory drugs after acute myocardial infarction. Circulation 2006;113:2906-13.
5. Jick H, Kaye JA, Russmann S, Jick SS. Nonsteroidal anti-inflammatory drugs and acute myocardial infarction in patients with no major risk factors. Pharmacotherapy 2006;26:1379-87.
6. Solomon DH, Avorn J, Stürmer T, Glynn RJ, Mogun H, Schneeweiss S. Cardiovascular outcomes in new users of coxibs and nonsteroidal antiinflammatory drugs: high-risk subgroups and time course of risk. Arthritis Rheum 2006;54:1378-89.
7. Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K. et al Development of criteria for the classification and reporting of osteoarthritis: classification of osteoarthritis of the knee. Arthritis Rheum 1986;29:1039-49.
8. Altman RD. Classification of disease: Osteoarthritis. Semin Arthritis Rheum 1991;20:40-7.
9. Wu CW, Morrell MR, Heinze E, Concoff AL, Wollaston SJ, Arnold EL, et al. Validation of American College of Rheumatology Classification Criteria for Knee Osteoarthritis Using Arthroscopically Defined Cartilage Damage Scores. Semin Arthritis Rheum 2005;35:197-201.
10. Boonstra AM, Schiphorst Preuper HR, Reneman MF, Posthumus JB, Stewart RE. Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. Int J Rehabil Res 2008;31:165-9.
11. Bellamy N1, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. J Rheumatol 1988;15:1833-40.
12. Robertson VJ, Ward AR, Low J, Reed A. Electrotherapy Explained. 4th ed. London, United Kingdom: Elsevier Science Ltd; 2006.
13. Pipitone N, Scott DL. Magnetic pulse treatment for knee osteoarthritis: a randomised, double-blind, placebo-controlled study. Curr Med Res Opin 2001;17:190-6.
14. Murray JC, Farndale RW. Modulation of collagen production in cultured fibroblasts by a low-frequency pulsed magnetic field. Biochim Biophys Acta 1985;838:98-105.
15. Smith RL, Nagel DA. Effects of pulsing electromagnetic fields on bone growth and articular cartilage. Clin Orthop Relat Res 1983;181:277-82.
16. Rodan GA, Bourett LA, Norton LA. DNA synthesis in cartilage cells is stimulated by oscillating electric fields. Science 1978;199:690-2.
17. Rubin CT, Mcleod KJ, Lanyon LE. Prevention of osteoporosis by pulsed electromagnetic fields. Science 1989;71:411-7.
18. Adey WR, Lin JC. Biological effects of radiofrequency electromagnetic radiation. Electromagnetic interaction with biological systems. New york. 1989; p. 109-40.
19. Iannitti T, Fistetto G, Esposito A, Rottigni V, Palmieri B. Pulsed electromagnetic field therapyfor management of osteoarthritis-related pain, stiffness and physical function: clinicalexperience in the elderly. Clin Interv Aging 2013;8:1289-93.
20. Trock DH1, Bollet AJ, Dyer RH Jr, Fielding LP, Miner WK, Markoll R. A double-blind trial of the clinical effects of pulsed electromagnetic fields in osteoarthritis. J Rheumatol 1993;20:456-60.
21. van Nguyen J, Marks R. Pulsed Electromagnetic Fields for Treating Osteo-arthritis. Physiotherapy 2002;88:458-70.
22. Ozgüçlü E, Cetin A, Cetin M. Additional effect of pulsed electromagnetic field therapy on knee osteoarthritis treatment: a randomized, placebo-controlled study. Clin Rheumatol 2010;29:927-31.
23. Deyle GD, Allison SC, Matekel RL, Ryder MG, Stang JM, Gohdes DD, et al. Physical Therapy Treatment Effectiveness for Osteoarthritis of the Knee: A Randomized Comparison of Supervised Clinical Exercise and Manual Therapy Procedures Versus a Home Exercise Program. Phys Ther 2005;85:1301-17.
24. Roddy E, Zhang W, Doherty M, Arden NK, Barlow J, Birrell F, et al. Evidence-based recommendations for the role of exercise in the management of osteoarthritis of the hip or knee—the MOVE consensus. Rheumatology (Oxford) 2005;44:67-73.
25. Robertson V, Ward A, Low J, Reed A. Electrotherapy Explained: Principles and Practice. 4th ed. Philadelphia, PA: Elsevier; 2010. p. 333.
26. Allen RJ. Physical agents used in the management of chronic pain by physical therapist. Phys Med Rehabil Clin N Am 2006;17:315-45.

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