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Pain and Functional Outcome of Shortwave Diathermy as an Adjuvant Therapy in Knee Osteoarthritis

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Abstract:

***Background**: Short-wave diathermy (SWD) is an electrotherapeutic modality used in the conservative treatment of knee osteoarthritis (KOA). To evaluate the effectiveness of shortwave diathermy (SWD) in context to our physical, social, occupational and socioeconomic condition adjuvant to other treatment option for knee osteoarthritis (OA). **Methods**: 80 patients aged 49-65 with KOA were randomized into two groups. One group (n=40) was treated with SWD (thrice in a week for six weeks), NSAIDs (naproxen 250 mg), Activity of Daily Living(ADL), Exercise (Quadriceps strengthening exercise), the other (n=40) with NSAIDs, ADL, Exercise. Patients were assessed before treatment and at every week interval for six weeks. Outcome measures included visual analogue scale (VAS) for knee pain, Western Ontario and McMaster University Osteoarthritis Index (WOMAC) and range of Motion(ROM). **Results**: There was highly significant improvement (P<0.001) observed in group A patient (83.81%) compared to group B (69.70%) in visual analogue scale, also in WOMAC score it is seen highly significant improvement (P<0.001) in group A patient (87.49%) compared to group B (79.37%). Comparison of range of motion in goniometer there was not showed significant improvement between groups A (18.06%).and group B (21.81%). **Conclusion:** SWD is effective in management of pain in OA knee joint and thus improve patient functional outcome. SWD is helpful to reduce the symptoms of chronic OA-knee joints and decrease the necessary of intake of NSAIDs and thereby side effects of NSAIDs may be reduced.*

***Keywords:** Knee; Degenerative Joint Disease; Shortwave Diathermy*

Introduction:

Knee Osteoarthritis(KOA) is one of common causes of disability in elder age people now a days. The medical treatment of osteoarthritis (OA) remains symptomatic for the most part with unproven and unsatisfactory option of treatment. Two modalities of treatment are generally used. Drugs, including analgesic and nonsteroidal anti-inflammatory agents, are prescribed for pain, and physiotherapy to improve function as well as alleviate symptoms.[1] OA of the knee is associated with in older age, high BMI, previous trauma, associate inflammatory arthritis, and certain metabolic diseases such as acromegaly and calcium pyrophosphate dehydrate (CPPD) arthropathy.[2]

Osteoarthritis is characterized clinically by knee pain for most days of prior month, crepitus with active joint motion, morning stiffness lasting ≤30 min, bony enlargement of the knee on examination, limitation of motion and age ≥38 yr[3].

The main symptoms associated with KOA include pain, stiffness, joint instability, joint swelling, and muscle weakness. These cause marked function allimitations that observed in walking, stair-

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climbing, and housekeeping among elderly population, leading to a significant decrease in quality of life[4,5]

KOA is not a curable disease and at the end-stage surgery is preferable.[6,7] During the course of the disease to alleviate the signs and symptoms and, slowing disease progression a variety of pharmacological and non-pharmacological treatments are offered to patient.[7] A number of medical guidelines have been developed to assist caregivers in the choice of therapy for the management of KOA, and the majority of these guidelines include exercise, Activity of Daily Living and a variety of physical therapy modalities.[7,8]

Short-wave diathermy (SWD) is one of the oldest forms of electrotherapeutic modalities traditionally used by physical therapists to treat symptoms of KOA[9-11]. SWD typically utilizes electromagnetic radiation at 27.12 MHz, which is applied in either a continuous (CSWD, thermic-provide radiation in the form of continuous trains) or a pulsed (PSWD, a thermic-provide radiation in the form of pulse trains) mode, with the latter delivered in the form of pulse trains. [10, 11]. In a survey of 41 Irishhospital-based physiotherapy departments, CSWD and PSWD were specified as treatments for acute osteoarthritis (OA) by 34.8% and 73.9% of the respondents, respectively, and for chronic OA by 97.8%and 59.4% of the respondents, respectively.[10] Patients with knee OA have shown that quadriceps weakness, in particular, is the single most important predictor of lower limb functional limitations[12].

Isometric exercises are a reasonable initial approach for strengthening in patients who cannot tolerate repetitive joint motion, for example, with painful, inflamed joints. Isometric contractions held for 6 seconds, performed at 70% of the maximal voluntary contraction (MVC) and repeated 5 to 10 times daily.Since endurance is believed to be often impaired in OA individuals, energy conservation techniques can play an important role in maximizing functional independence by shaping the patient's habits and environment so that the most function can be accomplished with the least amount of effort. Finally, an Occupational therapy can help to teach the concept of joint protection techniques to the patient.[13]

In our country, very few attempts were made to see the effect of SWD on OA knee. As SWD has its beneficial effect on OA knee by early reduction of pain and improve functional outcome thus reducing the need for chronic use of NSAID which has many side effects (e.g. NSAIDS causing anorexia, nausea, gastric upset, gastric ulcer, GI bleeding, psychosis, nephropathy etc.). This early reduction of pain has positive So in the present study, an attempt was made to find out the effect of SWD on reducing symptoms of OA knee and improve functional outcome.

Materials and Methods.

This case-control study was conducted in the department of Physical Medicine & Rehabilitation in National Institute of Traumatology and Orthopedic Rehabilitation (NITOR) from October 2017 – April 2018. The patients aged between 40-70 years of both sex with Osteoarthritis were selected according to the criteria developed by the American College of Rheumatology (ACR)[8.] A total of 80 patients (male 46, female 34) were randomly(the patients were randomized by drawing lottery) selected of which 40 were treated with non-steroidal anti-inflammatory drugs (NSAIDs), ADL and exercise and the rest 40 were treated with NSAIDs {Naproxen (250 mg) twice daily orally after meal for two weeks}, ADL, Quadriceps strengthening exercise (against weight 11/2 kg 5 repetition 3 /4 times daily), SWD (continuous mode with plate electrode three times in week for six week). Patient having morning stiffness more than 30 min, secondary osteoarthritis of the knee joints,any evidence of malignancy, swelling & effusion (for excluding inflammatory arthritis) and any evidence of infection on the skin over the knee joints, with metallic implant, pacemaker, intrauterine device, with gravid uterus, ESR>40 mm 1st hour, TC> 12000 cm, S creatinine >1.2 mg/dl were excluded from the study. first nature of the study was discussed with the patients and verbal and written consent was taken from the patient or care givers. History, clinical examination including measurement of ROM by goniometer as discussed in the operational procedure and relevant investigations were done. After the treatment of the patients as per schedule, the patients were followed up weekly. All data were recorded at first attendance and during the remaining follow-up in the data sheet. The results were expressed as mean ± SD and the level of significant was expressed by *p*-value unless otherwise stated. Statistical analysis

was done by using SPSS package for Windows. Student's't' tests and chi square test were done to see the level of significance.

Results:

Table-I

Baseline characteristics of participant:

Parameter	Group A	Group B	P value
Age (years)			
40-49	20(50)	16(40)	0.656ns
50-59	18(45)	22(55)	
60-69	2(5.0)	2(5.0)	
Mean±SD Range	49.85±3.60	49.60±4.28	0.778^{ns}
SEX			
Male	18(45)	16(40)	0.651ns
Female	22(55)	24(60)	
Socioeconomic status			
Low	8(20)	10(25.0)	0.592ns
Middle	32(80)	30(75.0)	
High	0	0	
BMI(KG/M^2)			
Mean+SD	24.86+2.38	25.28=2.45	0.430
Range	20.70-30.44	20.76-29.05	

Table-1 The mean age of the participants was 49.85 ± 3.60 years with a majority of females (57.5%). In group A and group B, respectively, mean (±SD) BMI 25.28±2.45 and 24.86±2.38 kg/m^2.

Table-II

Baseline characteristics of knee

Parameter	Group A (N=40) No(%)	Group B (N=40) No (%)	P value
Knee involvement			0.075
Right	20(50.0)	14(35.0)	
Left	16(40.0)	14(35.0)	
Both	4(10.0)	12(30.0)	
Onset of pain			0.007
Sudden	4(10.0)	14(35.0)	
Gradual	36(90.0)	26(65.0)	
Character of pain			0.0001
Constant	2(5.0)	16(40.0)	
Intermittent	14(35.0)	16(40.0)	
Sharp	2(5.0)	0	
Dull	22(55.0)	8(20.0)	
Deformity of knee			0.499
Varus	4(10.0)	6(15.0)	
None	36(90.0)	34(85.0)	
Range of motion			0.011
Normal	0	6(15.0)	
Restricted		34(85.0)	
(Flexion 105°-<135°)	40(100.0)		
Tenderness			0.077
Present	36(90.0)	30(75.0)	
Absent	4(10.0)	10(25.0)	

Table-III

Assessment of pain measured by Visual Analogue Scale

Group	Pretreatment (Mean±SD)	1st week	2nd week	3rd week	4th week	5th week	6th week
A(n=40)	6.45±1.13	4.60±1.03	3.65±1.12	2.75±0.95	2.35±1.08	1.65±0.98	1.15±0.92
B(n=40)	6.85±0.92	5.95±1.34	5.05±1.22	4.55±1.18	3.75±2.06	3.00±1.01	2.15±0.92
P value		0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}
95% CI		11.11 to 19.5	13.09 to 22.72	19.43 to 29.02	13.52 to 23.59	13.76 to 24.55	8.94s to 19.28

Table-IV

Assessment of patient condition measured by WOMAC score

Group	Pretreatment (Mean±SD)	1st week	2nd week	3rd week	4th week	5th week	6th week
A(n=40)	44.15±9.38	30.10±8.27	23.05±9.59	16.40±7.72	27.00±10.10	7.80±4.64	5.65±3.64
B(n=40)	56.70±9.24	49.00±9.30	40.65±9.72	35.10±9.25	12.65±7.06	19.25±8.46	12.25±6.85
P value		0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}	0.0001^{***}
95% CI		16.17 to 21.86	16.26 to 26.12	20.62 to 30.23	13.2 to 24.23	11.48 to 20.5	4.61 to 11.62

Table-V

Assessment of range of motion (degree) obtained by goniometer.

Group	Pre-treatment (Mean±SD)	1st week	2nd week	3rd week	4th week	5th week	6th week
A(n=40)	115.25±8.94	123.00±8.83	126.90±8.04	129.90±8.78	131.90±7.44	133.75±6.96	135.65±8.20
B(n=40)	107.75±16.29	109.40±8.61	113.65±8.51	116.25±9.27	122.35±9.02	125.90±9.21	129.50±10.03
P value		0.006**	0.045*	0.03*	0.917ns	0.358ns	0.358ns
95% CI		-7.07 to -1.19	-7.07 to -8.12	-7.3 to -2.35	-3.83 to 4.25	-2.19 to 5.99	-1.03 to 8.53

Table-VI

Status of knee condition in different score after treatment

Parameters	Group A (n=40) (Mean±SD)	Group B (n=40) (Mean±SD)	P value
Visual analogue scale			
Pretreatment	6.45±1.13	6.85±0.92	
Post treatment	1.15±0.92	2.15±0.92	
Improvement (%)	83.81	69.700	.0001***
WOMAC score			
Pretreatment	44.15±9.38	56.70±9.24	
Post treatment	5.65±3.64	12.25±6.85	
Improvement (%)	87.49	79.37	0 .0001***
Range of motion (degree) (Active movement was restricted due to pain)			
Pretreatment	115.25±8.94	107.75±16.29	
Post treatment	135.65±8.20	129.50±10.03	
Improvement (%)	18.06	21.81	0.123ns

Table II shows baseline characteristics in the two study groups. Onset and character of pain showed statistically significant distribution between the two groups (P<0.01 and P<0.001, respectively). Other factors like knee involvement showed no significant distribution(between the two groups. In group A, onset of pain was sudden in 4 (10%) and gradual in 36 (90%) cases; however, in group B, onset was sudden in14 (35%) only and gradual in 26 (65%) cases (P<0.01). In group A and group B, respectively, character of pain was constant in 2 (5%) and 16 (40%), intermittent in 14 (35%) and 16 (40%), sharp in 2 (5%) and none (o%), and dull in 22 (55%) and 8 (20%) cases (P<0.001). Deformity was Varus in 4 (10%) and 6 (15%) of group A and group B patients, respectively, and the rest 36 (90%) and 34 (85%) showed no deformity (not significant). Local swelling was present in 6 (15%) and 2 (15%), and absent in 34 (85%) and 34 (85%) of group A and group B patients, respectively. (Not significant). Range of motion restricted in all 40 (100%) patients of group A and in 34 (85%) patients of group B (P<0.05). Tender was present in 36 (90%) and in 30 (75%)

patients of group A and group B, respectively (not significant).

Table-III Visual Analogue Scale showed highly significant improvement (P was 0.0001,95% CI was 19.5 to 11.11) in group A patients compared to group B at the end of 1st week & continue as same thereafter. Finally, it was found that there was significant improvement in Group-B than Group-A after 6th week (P was 0.0001, 95% CI was 8.94 to 19.28,).

Table-IV WOMACscore showed highly significant improvement (P was 0.0001,95% CI was 16.17 to 21.86) in group A patients compared to group B at the end of 1st week & continue as same thereafter. Finally, it was found that there was significant improvement in Group-B than Group-A after 6th week (P was 0.0001, 95% CI was 4.61 to 11.62).

Table-6 ROM showed highly significant improvement (P was 0.006 ,95% CI was -7.07 to -1.19) in group A patients compared to group B at the end of 1stweek but showed significant improvement thereafter. Finally, it was found that there was no significant improvement in Group-A than Group-B after 6th week (P was 0.358, 95% CI -1.03 to 8.53,).

Table 7 shows pretreatment and post treatment mean (±SD) values of different follow up scores, and comparison between pretreatment and post treatment percent change. Visual analogue scale showed highly significant improvement (P<0.001) in group A patient (83.81%) compared to group B (69.70%), also WOMAC score showed highly significant improvement (P<0.001) in group A patient (87.49%) compared to group B (79.37%). Comparison of range of motion showed no significant improvement when compared between groups A (18. 06%).and group B (21.81%)

Discussion:

Outcome of treatment: The most important finding of the current study is the outcome of the patients with OA knee. The significant improvement of symptoms within both the groups began to appear at the end of first week. But, no significant difference of improvement was found to begin between the groups at this stage. At the end of fourth week significant improvement were observed between the groups. The trends of improvements were continued throughout the whole period of six weeks of study. At the end of 6th week significant improvement of symptoms of both the groups were found. And, in comparison between two groups, the significant improvement was found in the group of patients who received Short Wave Diathermy, do Isometric quadriceps strengthening exercise, taking NSAIDand maintain Activities of Daily Living than that of the patients who were not advised Short Wave Diathermy but received quadriceps strengthening exercise, NSAIDs and follows Activities of Daily Living only.

In a study by Rognid H et al[15] it was found that home based exercise program can significantly reduce pain in OA knee joints. In our study, we also found marked reduction of knee pain in exercise groups. American College of Rheumatology subcommittee also recommends quadriceps strengthening exercise for knee OA[8]. Quadriceps weakness is common among patients with OA knee, in whom it had been believed to be a manifestation of disuse atrophy, which develops because of unloading of the painful extremity. In a study by Shakoor MA et al [16], it was found that isometric quadriceps strengthening exercise is effective in decreasing joint pain for the patient with knee OA. Another study done by the same author has found that activity modification is very much helpful for the treatment of osteoarthritis of the knee. Kneecap, walking stick and use of high commode are also helpful for maintaining proper posture and thus to reduce pain and disability of the patients with osteoarthritis of the knee[17]. In another study, Kenneth D et al[18] found that an exercise program may be as effective in decreasing joint pain as treatment with an NSAID. Patient with hip and knee OA can participate conditioning exercise programs to improve fitness and health without increasing joint pain or increasing their requirement for analgesic agents or anti-inflammatory drugs. They described the preference of isometric exercises over isotonic exercises. On the other hand,Adegoke et[19] al found that patient treated with SWD had significantly greater knee ROM and higher functional score than patient

treated with ice at the beginning of the study, the two groups were equivalent on the three dependent variables (pain, ROM, Functional index score) at the end of the study. In a comparative study for the effect of Ultrasound therapy and SWD on OA knee Dr. FalahSalim Manhalet al[20] recommended using ultrasound therapy for the management of chronic knee joint osteoarthritis accompanied by inflammation or effusion, because it gives better effect in decreasing edema than the short wave diathermy. They found the ultrasound and short wave diathermy procedures are highly effective in treatment of knee osteoarthritis, but ultrasound therapy is more preferable by improved patients than short wave in the management of edema accompanying chronic knee osteoarthritis.

In my study I have found SWD Over knee is effective in the treatment of OA knee joints. So, SWD on Knee can be applied to patients to reduce the symptoms of chronic OA knee joints and decrease the intake of NSAIDs and thereby side effects of NSAIDs can be reduced.

Conclusions:

SWD may be effective along with other treatment modality in management patient difficulties in OA knee joints.SWD is necessary to reduce the symptoms of chronic OA-knee joints and decrease the necessity intake of NSAIDs and there by side effects of NSAIDs may be reduced.

Limitations of the study

Sample number was small as period of study was short.Since the study was conducted in only one selected hospital (NITOR) the study result may however differ from other hospitals.Our sampling procedure was non-probability purposive sampling, so our findings were not free from biasness.

References:

1. McAlindonTand Dieppe P: The medical management of osteoarthritis of the knee: an inflammatory issue? *Br J Rheumatol,*1990;29: 471-73
2. IBMclnnes, Ralston S H: Rheumatology and bone disease: In: Davidson's principles &practices of medicine Brian R Walker, Nicki RColledge, Stuart H Ralston, Ian DPenman : 22th edition ,Edinburgh, Churchill livingstone, 2014:1081-86
3. Altman R, Asch E, Bloch D, et al: Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and therapeutic criteria committee of the American rheumatism association, *arthritis rheum* 1986;29(8):1039– 49
4. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y,Wilson PW, et al. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study. Am J Public Health 1994; 84:351e8.
5. Zhang Y, Jordan JM: Epidemiology of osteoarthritis. Rheum DisClin North Am 008; 34:515e29.
6. Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD,Arden N, et al. OARSI recommendations for the management ofhip and knee osteoarthritis, part II: OARSI evidence-based,expert consensus guidelines. Osteoarthritis Cartilage2008;16:137e62.
7. Porcheret M, Jordan K, Croft P. Treatment of knee pain in olderadults in primary care: development of an evidence-basedmodel of care. Rheumatology (Oxford) 2007;46: 638e48.
8. Hopman-Rock M, de Bock GH, Bijlsma JW, Springer MP,Hofman A, Kraaimaat FW. The pattern of health care utilization of elderly people with arthritic pain in the hip or knee. Int JQual Health Care 1997; 9:129e37
9. Shields N, Gormley J, O'Hare N. Short-wave diathermy: a review of existing clinical trials. PhysTher Rev 2001; 6:101e18.
10. Shields N, Gormley J, O'Hare N. Short-wave diathermy in Irishphysiotherapy departments. Br J TherRehabil2001; 8:331e9.
11. Shields N, Gormley J, O'Hare N. Short-wave diathermy: current clinical and safety practices. Physiother Res Int2002; 7:191e202

12. N A Segal y, NA Glass y, J:Quadriceps weakness predicts risk for knee joint space narrowingin women in the MOST cohort.A. Osteoarthritis and Cartilage 18 (2010): 769e775770

13. Todd P S, Jong-H Kim, Doreen Stiskal, Patrick Foye, Robert Nadler et al: Osteoarthris in Delisa's physical Medicine &rehabilitation, Principles and practice, Walter R. Frontera ,5thedition, Lippincott Williams &wilkins,2010: 781-810

14. Moskowity RW. Clinical and laboratory findings in Osteoarthritis. In: Arthritis and allied condition- A textbook of rehumatology. McCarty, Koopman WJ (eds). Lea &Febiger, 1993: 1735-60.

15. Rogind H, Bibow-Nielson B, BodilJensen,PT, Hans C, Moller ,henningBliddal et al. The effect of a physical training program on Patients with osteoarthritis of the knees. Arch phys med rehabil. 1998; 79:11 1421-7.

16. Shakoor MA, Rahman MS, Azad AK and Islam MS. Effects of isometric quadriceps muscle strengthening exercise on chronic steoarthritis of the knee. Banladesh Med Red Counc Bull 2010; 36:20-22.

17. Shakoor MA, Md Abu Taslim; Effects of activity modification on the patients with osteoarthritis of the knee. Banladesh med red counc bull. 2007; 33(2):55-59.

18. Kenneth D, Burns R, et al. A randomized comparing aerobic exercise and resistance exercise with a health education program in older adults with knee OA. The fitness arthritis and seniors trial (FAST). JAMA. 1997; 277:125-31.

19. Adegoke BOA Gbeminiyi, MO: Efficacy of Ice and shortwave diathermy in the management of Osteoarthritis of the Knee. *African Journal of biomedical research, Vol. 7 (2004); 107 – 111 ISSN 1119 – 5096*

20. Falah S M, Abdullah E M,Suhad A. H. Effectiveness of short wave diathermy and therapeutic ultrasound on the management of patients with knee osteoarthritis; Sci. J. Nursing, 2007; Vol. 20, No. 1-2:11-19.