Effectiveness of Short Wave Diathermy and Therapeutic Ultrasound on The Management of Patients With Knee Osteoarthritis.

Dr. Falah Salim Manhal *

Dr. Abdullah Eiada Mecheser **

Suhad Abdul Hussein ***

Abstract

Objective : The present study is aimed to evaluate the effectiveness of short wave diathermy and ultrasound therapy for the management of patients with knee osteoarthritis

Methodology : all patients who referred to the Medical Rehabilitation Unit in Baghdad Teaching Hospital and Sadr A!-Qanat Center. The period of the study was from October 2004 to April 2005, total number of patients was 24 (9 male and 15 female). Age range of patients was 42-70 years. Complete clinical and radiological examinations were achieved on all patients and referred to the Medical Rehabilitation Unit for physiotherapy. Short wave diathermy and ultrasound therapy were applied on all patients.

Results : Demographic distribution revealed that female gender, the ages more than 50 year, the weight with grade II obesity were the most affected. Clinical observations indicated that chronic and severe cases were the most obvious. The study revealed that deformity, muscle wasting, local inflammation, and effusion were recorded in most patients. Outcomes of treatment with short wave and ultrasound therapies were nearly equally regarding their well-effectiveness, patient's acceptance, and patient's improvement. It was concluded that the ultrasound therapy is more preferable than short wave diathermy in the management of oedema accompanying chronic knee osteoarthritis. **Recommendation** : Further cohort studies are required to evaluate the effects of these procedures on a large sample of patients. Key **wards** : Knee osteoarthritis, Physiotherapy, Short wave diathermy, Ultrasound therapy

Introduction

Osteoarthritis is a degenerative joint disease characterized by the break down of the extracellular matrix of chondrocytes in the affected joints Although symptoms of osteoarthritis occur earlier in women, the prevalence among men and women is equal. In addition to age, risk factors include joint injury, obesity, and mechanical stress. Osteoarthritis is by far the most common joint disorder in the world, and is one of the leading causes of disability and pain in the elderly [(1)].

* Lecturer, College of Health and Medical Technologies, Baghdad "
Lecturer , College of Health and Medical Technologies, Baghdad ""*
College of Health and Medical Technologies, Baghdad

The diagnosis is largely clinical because radiological findings do not always correlate with symptoms [2]. Pain and loss of function are the major clinical symptoms leading to the diagnosis of osteoarthritis. Further clinical findings allow the diagnosis of osteoarthritis with a high level of sensitivity and specificity at the hip joint, knee and hand. Standard X-rays of the joint confirm the definitive diagnosis while standard serological examinations are mostly only necessary for differential diagnosis .

Non-pharmacological interventions are the first line therapy for osteoarthritis. Four general areas are available: aids and appliances, exercise and physiotherapy, education and behavioral change and alternative and complementary therapies [4].

Therapeutic ultrasound and short wave diathermy are two of several physical therapy modalities suggested for the management of pain and loss of function due to osteoarthritis .

The primary advantage of ultrasound therapy is that tissue high in collagen, such as tendons, muscles, ligaments, joint capsules, joint menisci, intramuscular interfaces, nerve roots, periosteum, cortical bone and other deep tissue may be selectively heated to the therapeutic range without causing a significant tissue temperature increase in skin or fat[.

The present study was designed to prospectively and randomly investigate number of patients with knee osteoarthritis referred to the rehabilitation unit for short wave and ultrasound treatment. The following criteria were adopted to evaluate the differential effectiveness of these methods; duration of treatment (number of sessions), effectiveness, patient acceptance, adverse effects, range of motion, and patient-assessed gait improvement..

Methodology

Patients

A total of twenty four patients (9 males and 15 females) attending the Rheumatology and Medical Rehabilitation Unit at Baghdad teaching Hospital and Sadr Al-Qanat Center were consecutively selected for the purpose of this study. The design of study was prospective and random study conducted during the period from October 2004 to April 2005. The study patients were with osteoarthritis of knee joint and were seeking for physiotherapy management.

A questionnaire form was designed for each patient in this study. This form consisted of several markers dealt with demographical characteristics, clinical observations and outcomes of physiotherapy procedures.

All patients were submitted to a complete clinical and radiological examination by specialist doctors and finally, a diagnosis of osteoarthritis in the knee joint was made. These study patients were referred to the medical rehabilitation units for physiotherapy management. In this study, two physiotherapy procedures, short wave and ultrasound interventions were selected for the purpose of studying differential effectiveness of these procedures. Methods **1. Short wave procedure**

A total of 12 patients with knee osteoarthritis were subjected to a course of short wave therapy (7 females and 5 males). The course of treatment was in the range of 6-10 sessions.

The nature of the treatment was explained to the patient. The part of the treated area was adequately exposed. Thermal sensation was tested and recorded. The part to be treated and indeed the whole patient were supported in a position that was safe,

convenient, and comfortable. Metal objects^ synthetic materials and any thing damp were removed from the area of the field. All patients were given precise instructions about the degree of warmth that ought to be experienced. *The following contraindications were taken into account*[7]:

1. Large area loss of sensation
2. Venous thrombus
3. Arterial insufficiency
4. Hemorrhage
5. Metal in tissues
6. Pregnancy
7. Neoplasm
8. Tuberculosis
9. Deep X-ray therapy
10. Cardiac pace makers
11. Some intrauterine devices

The following measurements and steps were undertaken for application [6].

1. Short wave diathermy (SWD) uses wave length of the electromagnetic spectrum.
2. Frequency: 27 mega cycles / second
3. Wave length: 11 meter
4. Depth of penetration: full body
5. Greatest heating in fat tissue
6. Applied using condenser field or cable technique
7. Dosage: In chronic cases: 1-4 Watt, duration 20 min, daily.

In acute cases: 1-3 Watt, duration 2.5-10 min, on alternative days. **2.**

Ultrasound procedure

A total of 12 patients with knee osteoarthritis were subjected to a course of _lrasound treatment (8 females and 4 males). The course of treatment was in the ringe of 6-10 sessions.

The nature of the treatment was explained to the patient. The operator was tested, _-; a small quantity of oil was placed on the treatment head of the machine. A -pling medium such as oil is necessary to transmit ultrasound from treatment head be patient to avoid refraction of sound energy. The clothing of the patients was B uved from the area of application. It was stressed that the skin must be clean and The treated patient was in the comfortable position and the part to be treated was .;. supported. The treatment was continually moved to ensure that the sound : _y does not concentrate on one tissue area [6][7].

Frequency of waves employed for medical purposes are between 500,000 and j.000 cycles per second, that of 1,000,000 cycles per second being the most - ■ iely used. The following contraindications and precautions were taken into account[6].

1. Acute inflammation, trauma or hemorrhage j
2. Bleeding disorders
3. Poor thermal regulation
4. Malignancy
5. Insensitivity
6. Ischemia
7. Atrophic skin.
8. Tuberculosis

9. Presence of anesthetic areas
10. Vascular insufficiency

The dosage that has been applied for ultrasound method was 0.25-1.0 w/cm, twice daily for 3 min in acute cases, and 1.0-3 w/cm, alternative day for 8-10 min in chronic cases [8]'

Data analysis

Raw data was computerized using the Statistical Packages for Social Sciences (SPSS) version 7.5 for Windows software package. For all analysis, statistical significance was considered at significant level *P* values of > 0.05.

Results

Out of the 24 patients admitted with osteoarthritis of knee joint, there were 9 (37.5%) male and 15 (62.5%) female with the age range of 42-70 years. Demographic characteristics of study patients are shown in Table 1. The majority of patients were in age above 50 years and with grade II obesity.

Table 2 shows clinical observations of study patients. It was demonstrated that most of patients were with severe and mechanical pain which involves both knees. Chronic cases with duration of more than one year were observed in 50% of patients. Deformity, muscle wasting and local inflammation or effusions were recognized in the majority of patients.

Outcomes of short wave interventions observed in the management of the study patients were shown in Table 3. It was demonstrated that most of study patients improved at < 6 sessions, good patients acceptance was detected in 83%. There were no any side effects and hazard to user observed using short wave technique. The majority of patients (83%) have shown improvement after follow up of 4 weeks.

Outcomes of therapeutic ultrasound interventions observed in the management of the study patients were shown in Table 4. It was demonstrated that most of study patients improved at < 6 sessions, good patients acceptance was detected in 91%. There were no any side effects and hazard to user observed using short wave technique. The majority of patients (75%) have shown improvement after follow up of 4 weeks.

Table (1) Demographic characteristics of the study patients (n = 24)

Characteristic	**Frequency**	**Per**
Age		
• < 50 years.....	**5**	**20.**
• > 50 years.....	**19**	**79**
Gender		
• Male	**9**	**37**
• Female.....	**15**	**62**
Weight *		
• Within normal	**4**	**1-**
Grade I obesity ..	**9**	
Grade II obesity .	**10**	
Grade *III* obesity	**1**	

* According to body mass index (BMI) in Kg/m with guidelines of WHO cut-off values

Table (2) Clinical features the of study patients (n = 24)

Features	Number	Percentage
Clinical presentation		
• Pain.....	24	100%
• Difficulty in moving	18	75%
• Stiffness	9	37.5%
Nature of pain		
• Mechanical.....	23	95.8 %
• Inflammatory	15	62.5 %
• Nocturnal	9	37.5 %
• Sudden deterioration. Involvement of pain		
• Unilateral	15	37.5 %
• Bilateral	9	62.5 %
Duration of illness		
• Days.....	4	16.7%
• Months ..,	8	33.3 %
• Years	12	50%
Severity-of illness		
• Severe	17	70.8 %
• Moderate.....	7	29.2 %
Deformity		
• Present	15	62.5 %
• Absent.....	9	37.5 %
Muscle wasting		
• Present	19	79.2 %
• Absent.....	5/'	20.8 %
Local inflammation or effusion		
• Present	14	58.2 %
• Absent.	10	41.7%

Table (3) Outcomes of observed short wave interventions on the management of study patients (n = 12)

Outcome	Number	Percentage
Improved at < 6 sessions.....	7	58.3
Good patient's acceptance.....	10	%
No side effects	12	83%
No hazard to user.....	12	100%
Cost moderately.....	12	100%
Patients improved after 4 weeks follow up	10	100%
		83%

Table (4) Outcomes of observed ultrasound interventions on the management of the study patients (n = 12)

Outcome	Number	Percentage
Improved at < 6 sessions	7	58.3
Good patient's acceptance	11	%
No side effects.....	12	91%
No hazard to user	1	100%
Cost moderately	2	100%
Patients improved after 4 weeks follow up	12	100%
	9	75%

Discussion

The principle objective of this study was to explain a differential effectiveness of short wave and ultrasound interventions in patients with knee osteoarthritis. The demographic distribution of the study patients revealed that, regarding to age, patients at age < 50 years were 5 (20 %) and at age > 50 years were 19 (79 %). These results indicate that most knee osteoarthritis occurs at ages over 50 years, which is more compatible with previous studies .

It was shown that females constituted 15 (62%) of the total number of stud} patients, whereas males were 9 (37 %). This finding reflects that the figure of knee osteoarthritis is more distributed in females than males, which is more compatible with previous studies

In this study, the weights of patients were also recorded, and it was shown that most cases were recorded with over weight. This result confirms the effect of high weight as a predisposing factor in the occurrence of knee osteoarthritis . '.

The clinical observations were also investigated. All patients were admitted with pain, some of them even at rest. Difficulty in moving was found in 18 patients (75%) with some limitation of their activities. Joint stiffness especially with initial use was found in 9 patients (37.5%) and it is within a range of 5-20 minutes in most **oil** them. Mechanical pain, in term of motion-related pain, was the most prevalent observation both in males and females. Inflammatory and nocturnal pain were equally recorded in 15 (62 %) patients, while sudden deterioration was only in 9 (37.5%)

::.ents, a result which indicated a gradually- developed knee osteoarthritis [4]. It was An that 15 (62%) of the study patients developed a bilateral pain with this type of »se. Severe illnesses were detected in 17 (70 %) of the study patients, an —ration which reflects a more refractory nature of this disease [5][6]. Presence of I rmity was shown in 62% of patients in this study, which indicates that the nerve rrly of the musculoskeletal architecture could be affected, or due to loss of articular tilage in the medial compartment[7][8]. Osteoarthritis usually increases slowly year . ;• ear; in many patients, the disability never reaches the stage at which treatment is •juired. In other patients, increasing pain, stiffness, or deformity drives the patient to nand measures for its relief [9] . However, the cases with muscle wasting were elected in 79% of patients. The periarticular muscle weakness may contribute to gression of osteoarthritis through decreased neuromuscular protective mechanisms i functional joint instability. The intermediate stage of knee osteoarthritis consists destruction of cartilage by enzymatic action and granulation tissue spreading over : articular surface of knee joint. Laxity of capsule and soft tissue inflammation in rtjcular also may occur. Finally joint swelling plus marked muscle wasting may .Local inflammation or effusions were observed in 14 (58 %) patients, a r which reflects the more deleterious nature of chronic knee osteoarthritis in this of patients who developed a non-specific inflammation and effusion of synovial

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Procedure outcomes

Characteristics of devices, of the study patients, and the therapeutic ■::cation of short wave and ultrasound methods all were reported.

Aort **wave diathermy:** Out of the total, 12 (50%) patients in both sexes were ■mitted to short wave diathermy in several sessions. It was shown that 7 (58.3%) .nts were improved at a range of 1-6 sessions, a result which reflects the Bfectiveness of the procedure. The remaining cases which were more refractory to agement might have an underlying condition which prevent good response or :ht need additional sessions. Further clinical investigations may resolve this issue.

In this study, patient's acceptance was observed in 10 (83 %) patients; this . vation might reflect an individual preference for choosing a comfortable method r physiotherapy. This type of physiotherapy was shown to be free of side effects id, if applied carefully, there were no any hazardous effect both on applier and iients. Short wave diathermy has an effect on nerves, provided that the heating is I excessive, it appears to reduce the excitability of nerves [I0]. The effect of short _. e diathermy on muscle tissue could be explained by rising in temperature that races relaxation of muscle and increases the efficacy of their action. However, cessive heating may cause destruction of tissue and coagulation [11].

The device in use was shown to have a moderate cost according to the study iients that is because it is an available and easily performed procedure. Patient's -rovement was recorded in 10 (83 %) patients after a period of 4 weeks follow-up, - ich indicates a good performance in management.

I **Ultrasound therapy:** Out of the total, 12 (50 %) patients were submitted to .-rapeutic ultrasound technique in several sessions. It was recorded that 7 (58.3 %) iients were improved at a range of 1-6 sessions, a result which indicates effectively - cedure. The remaining cases, which were most refractory to management, might .-. e an underlying condition that prevent good response or might need to additional sssions. Further clinical investigations may resolve this issue.

Short Wave Diathermy and Therapeutic Ultrasound on Knee Osteoarthritis.

In this study, patient's acceptance was observed in 11 (91 %) patients; this observation might reflect an individual preference for choosing a comfortable method for physiotherapy. This type of physiotherapy was shown to be free of side effects and, if applied carefully, there were no any hazardous effect both on applier anc patients [1*1 * 3]. Therapeutic ultrasound when applied to biological tissue may induce clinically significant responses in cells, tissues and organs through both thermal and non-thermal biophysical effects. Indications and uses of therapeutic ultrasound could be restricted to the following situations: soft tissue healing and repair, scar tissue and joint contracture, chronic inflammation, bone health, pain reduction, remove odema, and placebo effects.

The device in use was shown to have a moderate cost according to the stud> patients that is because it is an available and easily performed procedure. Patient's improvement was recorded in 9 (75 %) patients after a period of 4 weeks follow-up. which indicates a good performance in management.

Conclusions and recommendations

Osteoarthritis is more common in women than men, and the weight plays an important predisposing factor in osteoarthritis of knee joint. The ultrasound and shon 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 odema accompanying chronic knee osteoarthritis.

The study recommends using ultrasound therapy for the management of chronic knee joint osteoarthritis accompanied by inflammation or effusion because it gives better effect in decreasing odema than the short wave diathermy. Further cohort studies are required to evaluate the effects of these procedures on a large sample of patients.

References

1. McAlindon, T. and Dieppe. P.: The medical management of osteoarthritis of the knee: an inflammatory issue? *Br J Rheumatol.* 29.1990, pp. 471-473
2. Felson, D. and Zhang. Y.: An update on the epidemiology of knee and hip osteoarthritis with a view to prevention. *Arthritis Rheum,* 41,1998, pp. 1343-55.
3. Goldberg, V.; Ketteldamp. D. and Colyer. R.: Osteoarthritis of the knee. In. Osteoarthritis: Diagnosis and Medical-Surgical Management. Philadelphia: W.B. Saunders co., 1992
4. Malemud, C: The role of growth factors in cartilage metabolism. *Rheum Dis Clin North Am,* 19,1993, pp. 569-80.
5. Altman, R.; Asch, E.; Bloch, D.; Bole. D.; Borenstein, K. and Brandt, K.: Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. *Arthritis Rheum,* 29,1986, pp. 1039-49.
6. Hochberg, M.; Altman, R.; Brandt, K.; Clark, B.; Dieppe, P. and Griffin, M.: Guidelines for the medical management of osteoarthritis. Part II. Osteoarthritis of the knee. American College of'Rheumatology. *Arthritis Rheum,* 38,1995, pp. 1541-6.
7. Jan, M. and Lai, J.: The effects of physiotherapy on osteoarthritic knees of females. / *Formos MedAssoc,* 90,1993, pp. 1008-1013
8. Hochberg, M.; Altman, R.; Brandt, K.; Clark, B.; Dieppe, P. and Griffin, M.: Guidelines for the medical management of osteoarthritis. Part I. Osteoarthritis of the hip. American College of Rheumatology. *Arthritis Rheum,* 38,1995, pp. 1535-40.
9. Chamberlain, M.; Care, G. and Harfield, B.: Physiotherapy in osteoarthrosis of the knees: a controlled trial of hospital versus home exercises. *Int Rehabil Med,* 4, 1982, pp. 101-106,

10. Lorig, K.; Lubeck, D.; Kraines, R. and Seleznick, M.: Holman HR. Outcomes of self-help education for patients with arthritis. ***Arthritis Rheum,*** 28, 1985, pp. 680-5.
11. Kovar, P.; Allegrante, J.; MacKenzie, C; Peterson, M.; Gutin, B. and Charlson, M.: Supervised fitness walking in patients with osteoarthritis of the knee. A randomized, controlled trial. ***Ann Intern Med,*** 116, 1992, pp. 529-34.
12. Lane, N.: Exercise: A cause of osteoarthritis. ***J Rheumatol,*** 22, 1995, (suppl 43), pp.3-6.
13. Minor, M.; Hewett, J.; Webel, R.; Anderson, S. and Kay, D.: Efficacy of physical conditioning exercise in patients with rheumatoid arthritis and osteoarthritis. ***Arthritis Rheum,*** 32, 1989, pp. 1396-405.
14. Felson DT, Anderson JJ, Naimark A, Walker AM, Meenan RF. Obesity and knee osteoarthritis. The Framingham Study. ***Ann Intern Med*** 1988; 109:18-24.
15. Felson, D.; Zhang, Y.; Anthony, J.; Naimark, A. and Anderson, J.: Weight loss reduces the risk for symptomatic knee osteoarthritis in women. The Framingham Study. ***Ann Intern Med,*** 116, 1992, pp. 535-9.