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KEY WORDS: Knee Osteoarthritis, TENS, Kinsiotaping.

TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION VERSUS KINSIO TAPING IN PATIENTS WITH KNEE OSTEOARTHRITIS

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ABSTRACT

Background: Osteoarthritis (OA) is the most common articular disease, leading cause of chronic disability and high economic costs of treatment.
Aim: This study was conducted to compare between the combined effect of transcutaneous electric nerve stimulation (TENS) in addition to therapeutic physical therapy exercises and Kinsiotaping (KT) in addition to the same exercises.
Material and method: Thirty female patients with moderete knee OA were randomly assigned. Their age ranged from 40 to 55 years. The patients were divided into two equal groups. Group A (15) received TENS and therapeutic physical therapy exercises while group B (15) received KT and the same therapeutic exercises. Functional performance level was measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Painless active and passive range of motion of knee joint were measured by universal goniometer (UG) before treatment and after last session. Both groups received treatment two times per week for six weeks.
Results: There was a significant difference between the two groups in post treatment measurement; group A had significant decrease in the limitation of functional performance and significant increase in knee ROM; active and passive flexion and extension than group B at (p value <0.05).
Conclusion: The combination effect of TENS with therapeutic exercises is highly recommended in treating patients with OA knee than the combination effect of KT tape with therapeutic exercises

INTRODUCTION

Osteoarthritis is primarily a disease of cartilage as it is characterized by the degradation of hyaline cartilage in the joints[1]. OA is one of the most important causes of long-term disability in adults[2]. OA knee increases with age, especially in women[3]. The knee joint is the most common site of arthritis[2].

TENS is a therapeutic method of electrical stimulation aims to provide a degree of symptomatic pain relief by exciting sensory nerves, which stimulate either the pain-gate mechanism and/or the opioid system [4]. TENS is non-invasive, inexpensive and reveals hardly any major side effects[5]. TENS is one of the recommended treatments for pain relief in patients with knee OA [6].

Kinesio tape is a thin, cotton, porous fabric with acrylic adhesive that is non medicated and latex-free. Kinesio taping has been widely used by therapists as an aid for prophylaxis and rehabilitation. Systematic reviews found its effectiveness on musculoskeletal conditions [7]. In knee OA application of KT aligns the knee in more stable position, reduces stress and strain on the soft tissue surrounding the knee and improves OA symptoms[8,9]. Therapeutic exercises in the form of strengthening, stretching and functional exercises are effective for patients with knee OA to reduce pain, disability and improve physical function, strength, and walking speed [10,11]

This study was conducted to compare between the effect of KT and TENS on Functional performance and ROM of knee joint in patients with knee OA.

SUBJECTS AND METHODS

This study was conducted from November 2015 to September 2016 in physical therapy outpatient Clinic of Buridah Center Hospital in Qassim region in Kingdum Saudi Arabia (KSA) to compare between the effects of TENS and KT in patients with knee OA on functional performance and ROM of knee joint. Two factorial pre and post design study was be used. Thirty female patients with moderate OA of the knees were selected. Their age ranged between 40 and 55 years with mean of (42.13±3.66) and their BMI below 30kg/m2 with mean of (26.23±2.48). In case of bilateral knee OA, the most painful one was chosen in this study. They were randomly assigned into two equal groups. Subjects in group (A): 15 patients received TENS, in addition to therapeutic exercises program in the form of strengthening exercises for the quadriceps muscle and stretching exercises of the hamstrings and the calf muscles. Subjects in group (B): 15 patients received KT, in addition to the same exercise program of group (A). The treatment sessions for both groups were received two times per week for a period of six weeks. All patients signed informed consents before participating in this study.

Patients with previous knee operations, recent knee injury, presence of meniscus tear and collateral ligament injury were excluded.

Assessment procedures:

Universal goniometer was used to measure active and passive knee flexion and extension. UG is valid and reliable [12,13]. The patient was in supine lying position; the untested leg was flexed and the tested leg was extended. The patient was asked to flex his lower leg of the tested leg while the examiner fixing the axis of UG on the lateral epicondyle of femur. The stationary arm was placed along the lateral aspect of the thigh, the moveable arm was placed along the lateral aspect of the fibula; both arms were fixed with velcro straps then the reading of active knee ROM was reported. This procedure was repeated 3 times for the tested leg and an average of all 3 measures was recorded.

Functional performance of the patients was assessed by WOMAC functional assessment scale. WOMAC scale was used to asses patients with knee OA using 24 parameters which describe the presence and severity of pain in different activities of daily living,

stiffness and physical function. WOMAC scale is valid and reliable [14-15].

Lower scores indicate better subjective functional abilities. The response points were; None 0 Slight 1, Moderate 2, Severe 3 and Extreme 4. The minimal total possible score is 0 while the maximal total score is 96 (Appendix1).

Treatment instruments:
1-Transcutaneous electrical nerve stimulation
The Company name is Enraf-Nonius in the UK , model Sonoplus 692V With Vacuum. The Sonopuls 692v is the latest innovation in combination therapy.

2-Kinesiotaping
The used tape is brand name which is made in Germany; tape 5cm x 5m - latex free. The tape is hypoallergenic acrylic adhesive and original high quality.

Treatment procedure
(A) Application of TENS:
Procedure of intervention for Group: (A)
Patient was in long sitting position. The area to be treated was cleaned with an alcohol swab then sensation test was done. Two electrodes were placed on both sides of the knee then the parameters were set with intensity 0-100MA, pulse frequency1-150 PPS, pulse duration10-500 usec and symmetrical waveform. and the intensity of was adjusted, to maintain the desired comfortable sensation.

(B) Application of KT
Procedure of intervention for Group: (B)

Patient was in sitting position. The area to be treated was cleaned with an alcohol swab. The tape strips was measured from above top of kneecap into the tibial tuberosity. Tape was cut into form Y -shape then the corners at the tape ends were cut into a rounded form. The base of tape was affixed above top of kneecap into tibial tuberosity. Tape was stretched to fit around knee, then the other side. The affixed tape strips was rubbed.

(C)Therapeutic exercises:
Procedure for intervention for both groups (A&B)

Straight leg raising exercise (SLR); the patient was asked to contract the quadriceps muscle and elevate the limb to 45degre and hold for 6 seconds, slowly lower the limb and then relax for 6 seconds, 3 sets of 10 repetitions were done [16]. Strengthening of the quadriceps muscle: In the form quadriceps set exercise while placing a roll under your knee and active resisted straight leg raising exercise with lifting 2kg (sand bags) 3 sets of 6 repetitions. The SLR exercise was repeated at multiple knee angles drawn on a sheet beside the affected leg (30, 60, 90) degrees respectively. Each exercise at each knee angle was followed by 10 seconds rest period [16,17]. Passive stretching of the calf muscles from supine position was done 3 times, 30 second each [16,17,18]. All patients were advised to do home program straight leg raising exercise 3 times a day in the form of elevating the limb to 45degrees and hold for 6 seconds, slowly lower the limb and then relax for 6 seconds, 3 sets of 10 repetitions [18]. After termination of the 6week study period, all the participants of both groups stopped their programs and then were re-evaluated as in the pre-study state. All data were recorded and statistically analyzed by using:

1 Descriptive statistics (mean and standard deviation) for the general characteristics of the subjects.

2 Paired t-test was used to analyze the differences within groups.
3 Unpaired t-test was used to analyze the differences between groups.

All data statistically significant differences were determined with confidence interval of 95 ($p<0.05$) using Statistical Package for the Social Sciences (SPSS) version 18.

RESULTS :
Group (A): Fifteen patients were included in this group. The data in Table (1) represents their mean age (42.66±4.82) years, mean weight (70.8±7.33) kilograms (Kg), mean height (160.72±4.92) centimeters (cm), and mean BMI (27.12±2.22) Kg/m2.

Group (B): Fifteen patients were included in this group. The data in Table (1) represents their mean age (43.6±3.77) years, mean weight (72.33±8.72) kilograms (Kg), mean height (163.8±8.22) centimeters (cm), and mean BMI (26.35±2.51) Kg/m2. There was no significant difference between both groups in their ages, weights, heights, and BMI where t and p-value were (0.69, 0.48), (0.51, 0.60), (0.43, 0.65), and (0.25, 0.8) respectively.

There was no significant difference in pre treatment assessment between groups Within group difference:

There was significant difference between pre treatment assessment and post treatment assessment of all dependent variables in groups (A&B) as shown in Tables (2,3).

Between groups difference:
There was significant difference between post treatment means of group (A) and post treatment means of group (B) (p-value <0.05) in favor of the first group as shown in Table (4).

Table (1): Physical characteristics of patients in both groups (A & B).

Items	Group (A) Mean±SD	Group (B) Mean±SD	t	p-value	S
Age (yrs)	42.66±4.82	43.6±3.77	0.69	0.48	NS
Weight (Kg)	70.8±7.33	72.33±8.72	0.51	0.60	NS
Height (cm)	160.72±3.55	163.8±8.22	0.43	0.65	NS
BMI (Kg/m2)	27.12±2.22	26.35±2.51	0.25	0.8	NS

Table (2): Difference within group (A) pre and post treatment.

Variable	Mean±SD Group (A)	t	p-value
WOMAC pain	Pre 4.4± (1.8) Post 1.7± (1.6)	19.4	0.001
WOMAC stiffness	Pre 3.8 ± (2.1) Post 1.7± (2.5)	11.2	0.009
WOMAC physical function	Pre 26 ± (1.8) Post 12± (2.1)	14.7	0.001
Active knee flex	Pre 119.53±(13.3) Post 132.4±(8.9)	12.3	0.0001
Passive knee flex	Pre 126.9±(11.5) Post 136±(8.9)	11.2	0.0001
Active knee ext	Pre 133.66±(11.2) Post 143.00±(12.97)	10.1	0.001
Passive knee ext	Pre 137.86±(11.59) Post 150.46±(1.81)	11.5	0.0001

Table (3): Difference within group (B) pre and post treatment.

Variable	Mean±SD Group (A)	t	p-value
WOMAC pain	Pre 3.8± (1.9) Post 2.6± (1.8)	16.56	0.001
WOMAC stiffness	Pre 4.00± (2.1) Post 3.5 ± (2.5)	10.5	0.001
WOMAC physical function	Pre 25± (2.2) Post 19± (2.1)	13.1	0.001
Active knee flex	Pre 118.53±(14.2) Post 124.4±(9.8)	5.2	0.001

Passive knee flex	Pre 127.9±(12.5) Post 131±(9.8)	7.5	0.001
Active knee ext	Pre 132.66±(13.2) Post 133.00±(11.96)	6.5	0.003
Passive knee ext	Pre 139.86±(10.55) Post 141.46±(1.92)	10.3	0.0001

Table (4): Difference between group (A & B) post treatment.

Variable	Mean±SD group (A) post ttt	Mean±SD group (B) post ttt	t	p-value
WOMAC pain	Post 1.7± (1.6)	Post 2.6± (1.8)	2.5	0.001
WOMAC stiffness	Post 1.7± (2.5)	Post 3.5± (2.5)	4.71	0.0001
WOMAC physical function	Post 12± (2.1)	Post 19± (2.1)	4.01	0.0001
Active knee flex	Post 132.4±(8.9)	Post 124.4±(9.8)	2.35	0.001
Passive knee flex	Post 136±(8.9)	Post 131±(9.8)	2.85	0.001
Active knee ext	Post 143.00±(12.97)	Post 133.00±(11.96)	2.57	0.001
Passive knee ext	Post150.46±(1.81)	Post 141.46±(1.92)	4.15	0.012

As shown the pain intensity has decreased and physical function was improved in both TENS and KT but it is clearly deceased with a high percentage in TENS.

There is a statistically significance difference between pre- and post- test for both groups. Physical function improved and knee joint ROM increased in both group especially in TENS group(p value <0.05).

DISCUSSION

Knee OA is very common disease; the impact of both TENS and KT on the treatment of OA in terms of health care utilization is high.

In the present study both TENS and KT treatment led to significant improvement in the signs and symptoms of knee OA. As determined by all efficacy measures, significant pain relief, knee stiffness and physical function improved within 6 weeks, in group A more than group B.

The WOMAC index has been designed specifically to evaluate patients with OA of the knee. It has been shown to be a reliable, valid, responsive and acceptable outcome measure [14-15].

TENS-induced large-diameter afferent activity inhibits ongoing transmission of pain information in the spinal cord (i.e., the gate control theory of pain)[19,20]

The results of the current study is not in agreements with the study done by Palmer et al.,2014 [21]who determined the additional effects of TENS for knee OA when combined with a group education and exercise program (knee group). A total of 224 participants (mean age 61 years, 37% men) were randomized to 3 arms: TENS and knee group (73), sham TENS and knee group (74), and knee group (77). All patients entered an evidence-based 6-week group education and exercise program (knee group). Sham TENS used dummy devices with no electrical output. Blinded assessment took place at baseline and 3, 6, 12, and 24 weeks. The outcome was the WOMAC. All outcomes improved over time (P < 0.05), but there were no differences between trial arms (P > 0.05). All improvements were maintained at 24-week follow up. Conclusion. There were no additional benefits of TENS, failing to support its use.

The differences in the results may be because the age of patients is older tin that study.

Lee et al.,2016 [22] compared between KT and traditional exercises ,30 patients with knee OA were divided into a control group (15) patients, who received conservative physical therapy, and an experimental group (15) patients, who received KT therapy. All patients received treatment three times per week for four weeks. The range of motion was measured using joint goniometers, pain was measured using visual analog scales, and functional evaluation was conducted using the Korean Western Ontario and McMaster Universities Osteoarthritis Index. Results showed the visual analog scale and Korean Western Ontario and McMaster Universities Osteoarthritis Index scores significantly decreased, and the ROM increased more than significantly. KT group showed significantly lower visual analog scale and Korean Western Ontario and McMaster Universities Osteoarthritis Index scores and significantly larger ranges of motion than the conservative treatment group.

Limitation:

Falling down of the tape after several hours from application occurred in some cases. Small sample size. KT tape require long period to measure its effect.

CONCLUSION

Based on the result provided from the current study TENS are highly recommended in treating OA knee patients instead of KT tape In this study use TENS in treatment patients with knee OA more effective than KT

الخلاصة

جهاز تحفيز العصب الكهربائي مقابل الشريط اللاصق (كاينزو) على الألم والحصيله الوظيفيه لألتهاب مفصل الركبه .
الهدف من هذه الدراسه المقارنة بين جهاز تحفيز العصـب الكهربائي والشـريط اللاصق(كاينزو) في تأثيره العلاجي على التهاب مفصـل الركبه ،وأجريت هذه الدراسه على عشرون مريض ممن يعانون من التهاب مفصـل الركبه وتم تقسـيمهم الى مجموعتين بحيث كانت كل مجموعه تتكون من عشـرة مرضى ،احدى هذه المجموعات تلقت العلاج بواسطة جهاز تحفيز العصـب الكهربائي والمجموعه الاخرى تلقت العلاج بالشـريط اللاصق كاينزو وبالاضافه الى برنامج تمارين علاجيه ثابت لكلا المجموعتين بالاضافه الى الكمادات الحاره والباردة لمدة ستة اسابيع . ومن النتائج أتضـح لنا مدي فعالية أستخدام جهاز تحفيز العصـب الكهربي في علاج الألم والحصـيلة الوظيفية لألتهاب مفصـل الركبة.

APPINDEX 1

WOMAC index

0 : not any
1 : a little
2 : moderate
3 : important
4 : very important - extreme

P Subscale :

How much pain do you have:
1: walking on flat surface
2: going up or down stairs
3: at night while in bed
4: sitting or lying
5: standing upright

S Subscale : :

how severe is your stiffness
1:After first wakening in the morning
2:After sitting lying or resting later in the day

PF subscale:

What degree of difficulty do you have
1: descending stairs
2: ascending stairs
3: rising from sitting
4: standing
5: bending to floor
6: walking on flat
7: getting in / out of car
8: going shopping
9: putting on socks / stockings
10: rising from bed
11: taking off socks / stockings
12: lying in bed
13: getting in / off bath
14: sitting
15: getting on / off toilet
16: heavy domestic duties
17: light domestic duties

ا ستمارة وماك

0 - لا شيء
1 - قليلة
2 - متوسطة
3 - كبيرة
4 - كبيرة جدا

أ) الأوجاع:

ما هي شدة الأوجاع التي تحس بها ؟
1 - عندما تمشي على أرض مستوية.
2 - عندما تصعد أو تنزل الدرج.
3 - في الليل و أنت في فراشك.
4 - عند الجلوس أو الاستلقاء.
5 - عند الوقوف.

ب) اليبوسة أو التصلب المفصلي :

ما هي شدة اليبوسة بمفاصلك ؟
1 - عندما تستيقظ في الصباح.
2 - بعد الجلوس أو الاستلقاء أو الاستراحة أثناء النهار.

ج) الحركة الوظيفية :

ما هي شدة الصعوبة ؟
1 - عندما تنزل الدرج.
2 - عندما تصعد الدرج.
3 - عند الوقوف بعد الجلوس
4 - عند الوقوف.
5 - عندما تنحني إلى الأرض.
6 - عندما تمشي على أرض مستوية.
7 - عندما تركب أو تنزل السيارة.
8 - عندما تذهب إلى السوق.
9- عندما تلبس الجوارب (القلسيط، الكلاسط، التقاتير)
10- عندما تقوم من الفراش.
11- عندما تنزع الجوارب (القلسيط، الكلاسط، التقاتير)
12 - عندما تستلقي على الفراش.
13 - عندما تدخل أو تخرج من حوض الاستحمام.
14 - عند الجلوس على الكرسي.
15 - عندما تجلس أو تقوم من المرحاض.
16 - عندما تقوم بأعمال منزلية كبيرة.
17 - عندما تقوم بأعمال منزلية خفيفة.

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