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Local Vibration Effects on Iliotibial Band Release in Patients with Knee Osteoarthritis

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ABSTRACT

Background: Osteoarthritis is ranked as the 10th largest contributor to global years lived with disabilities, and its prevalence has more than doubled in the last 10 years**.** The knee joint is the most frequently afflicted joint in Egyptian individuals with primary osteoarthritis approximately 8–15% of the general population has been found to have knee joint osteoarthritis.

Purpose: To evaluate local vibration effects for iliotibial band (ITB) release on pain intensity, pain pressure threshold (PPT), lower limb (LL) function and knee range of motion (ROM) in patients with knee osteoarthritis (OA).

Subjects and methods: A single-blind randomized controlled trial that included thirty patients who suffered from unilateral knee OA. They were recruited from the Police Hospital, Nasr city, Egypt. They were assigned randomly into two groups equal in number, 15 patients each. Control **group (A)** received a conventional physical therapy program while experimental **group (B)** received the same program in addition to ITB release by using local vibration. Treatment sessions were admitted 3 times a week for 4 weeks.

Results: When compared to the pre-treatment condition, the pain intensity decreased, PPT declined, LL functional activity improved, and increased ROM of knee joint was noted in both groups. There was a statistically significant difference between the mean value of all dependent variables in control group, and their corresponding variables in experimental group. Group (A) P-value of pain intensity, PPT, lower limb function, and knee ROM were ($p = 0.001$), ($p= 0.026$), ($p = 0.001$), and ($p= 0.023$) respectively in favor to group B.

Conclusion: The local vibration has a great impact on reducing pain intensity, PPT, and improving LL function and knee ROM by releasing the tension of ITB in patients with knee OA.

Keywords: Iliotibial band release, Local vibrator, Knee osteoarthritis.

INTRODUCTION

One of the most prevalent chronic illnesses, osteoarthritis (OA), is characterized by tight muscles as well as degenerative and adaptive changes in the knee's component parts. The tibiofemoral joint contact pattern is altered as the iliotibial band (ITB) pulls the patella laterally and externally rotates the tibia during knee flexion [(1)]**.** Because life expectancy is consistently rising, it is anticipated that the prevalence of obesity and OA would rise sharply in the aging population globally. This results in disability and decreased joint function. The disease's prevalence has more than doubled in the past ten years, making it the 10th highest contributor to years lived with disability worldwide [(2)]. The knee is the most frequently afflicted joint in Egyptian individuals with primary OA approximately 8–15% of the general population has been found to have knee joint OA [(3)].

One of the mainstays of the conservative treatment of knee OA is physical therapy [(4)]. It offers a range of therapies, including functional retraining methods, balance, coordination, and manual therapy approaches. The suggested methods for treating knee OA include manual treatment and electrotherapy, which physiotherapists are more likely to choose [(5)].

A prior magnetic resonance imaging (MRI) investigation examined the frequency of elevated signal intensity surrounding ITB. According to the findings, higher signal intensity on the lateral side of the knee joint, indicating inflammation or edema surrounding the ITB, was present in almost 75% of individuals with knee OA [(6)]. It was proved that ITB release by static stretching and myofascial release both increase ITB flexibility above baseline measures significantly [(7)].

Previous researchers found that adding vastus lateralis release and ITB stretching to conventional PT program had better outcomes in treating knee OA [(8)]. ITB release was proved to have an added effect in cases of knee OA either when done by using static stretch [(1)] or myofascial release [(9)]. In addition, pain and function were improved significantly.

Vibration is commonly used to relax tension in the limb [(10)], moreover vibration is a simple, easy applied, time and effort saving technique but unfortunately barely studied. This study aimed to detect the effect of using on ITB release by using local vibration on pain intensity, PPT, LL function and ROM of knee joint in patient with unilateral knee OA.

MATERIALS AND METHODS

Design of the study: Randomized controlled trial: Pre and post-test experimental design used.

Sample size calculation: Sample size calculation was done using pain, as reported from pilot study, with 80% power at $\alpha = 0.05$ level, number of measurements 2, for 2 groups and effective size = 0.53 using F-test repeated measure MANOVA within and between interaction. The

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minimum proper sample size was 30 subjects, 15 in each group. The sample size was calculated using the G*Power software (version 3.0.10).

Thirty patients with unilateral knee OA, aged 40-60 years old, were assigned randomly into two groups of equal number, 15 patients each. Group (A) (control group) received a conventional PT program (TENS, Ultrasound and exercises in the form of strengthening for quadriceps, hamstring, hip abductors and stretching of the hamstrings, and calf muscle), and group (B) (experimental group) received a conventional PT program in addition to ITB release by using local vibration. Treatment sessions were admitted 3 times a week for 4 weeks.

Inclusion criteria: Patients with grade II unilateral knee osteoarthritis for more than 6 months and their body mass index (BMI) was < 40.

Exclusion Criteria: Patients with traumatic injury at knee joint, any neurologic condition affecting lower extremity function, knee deformities, who had PT treatment in last 6 months, previous surgery in knee joint and pregnant women.

Assessment of procedures: Height scale and Body weight scale to evaluate BMI [(11)]. Short form-2 McGill Pain questionnaires (SF2-MPQ-2) (Arabic version) was used for pain intensity assessment, which is 36-items Short-Form Health Survey [(12)]. To assess PPT, Pressure algometer was used at the distal iliotibial band trigger points, which are about 1-3 cm proximal to the lateral femoral epicondyle [(13)]. For functional assessment, Lower Extremity Functional Scale (Arabic version) (LEFS-AR**)** was used which has 20-items [(14)]. ROM was assessed by using the Smartphone application (Dr. Goniometer (Dr G) application) [(15)].

Treatment procedures:

Patients in control group received TENS (Zimmer model, German) that was utilized in a traditional manner, with a frequency of 80 Hz and a pulse duration of 50–100 μs. To stimulate big diameter, low threshold non-noxious afferent fibers (A-beta), the stimulation intensity was set to low. In order to avoid discomfort or muscle contraction, the stimulation intensity was adjusted to provide a powerful tingling sensation. It was applied for 30 min [(16)]. The ultrasound (Chattanooga, USA) parameters were frequency of 1 MHz, 2.5W/cm intensity, pulsed mode of 25% for 5 min [(17)].

Exercises were in the form of strengthening for quadriceps (Static Quad, Straight leg raising) and hamstring (using hamstring curl seat) and stretching exercises for hamstring and calf muscle. The patients were asked to hold for 7 seconds and repeat on affected leg for 10 times [(18)].

Patients in the experimental group, however, received the standard treatment in addition to ITB release technique through local vibration by using a massage gun (Phoenix, China) which was used with frequency of 40 Hz to release ITB. The massage gun was moved along the ITB course proximally to distally for 15 min, while the patient was relaxed in a sideline position.

Ethical approval: Every patient signed an informed written consent for acceptance of participation in the study. The Helsinki Declaration's guidelines for research involving human participants were followed. Clinical trials registration database with identifier P.T.REC/012/004366; Research Ethics Committee, Faculty of Physical Therapy, Cairo University.

Data Collection and Statistical Analysis: The mean (X) is an average that characterizes the observation's central tendency. The standard deviation (SD) is a metric used to express how widely the results vary from the mean.

Inferential statistics: Mixed design MANOVA was used to identify the difference within and between each group, and the level of significance was seated at $p \leq 0.05$.

RESULTS

The aim of this study was to determine the effect of local vibration on ITB on pain, PPT knee function and ROM on ITB release in patient with knee OA.

Demographic data of subjects:

In all, thirty patients took part in the investigation, groups A and B's mean ages were 50.1 ± 8.6 and 49.4 ± 10.4 years, the mean values of weight were 82.4 ± 16.2 and 86 ± 18.2 kg, the mean values of height were 162.3 ± 7.3 and 168.8 ± 13 cm and the mean values of BMI were 28.1 ± 6.6 and 28.6 ± 5.5 kg/m^2 respectively. The mean values of the two groups' age, weight, height, and BMI did not differ significantly ($p>0.05$). The number (%) of males of groups A and B were 12 (80%) and 10 (66.7%) and the number (%) of females 3 (20%) and 5 (33.3%). There was no significant difference in sex distribution, between both groups ($p =0.341$).

Normality test: The normality assumption, variance homogeneity, and presence of extreme scores were checked in the data. All measured variables were normally distributed, according to the results of the Shapiro-Wilk test for normality ($p>0.05$).

The effect of ITB release on pain in comparison with other groups, the mean pain values after therapy differed statistically significantly between groups A and B ($p= 0.001$) in favor to group B.

Table (1): Measured variables pre- and post-treatment of both groups

Measured variables	Group A Mean ±SD	Group B Mean ±SD	f-value	P-value (between groups)
Pain (cm)				
Pre-treatment	27.7 ± 9.4	26.1 ± 9.3	2.4	0.643
Post-treatment	21.3 ± 9	11.3 ± 4.8	41.1	0.001*
% of change	23%	57%		
P-value (paired test)	0.001*	0.001*		
PPT (kg)				
Pre-treatment	1.5 ± 0.5	1.5 ± 0.4	1.08	0.939
Post-treatment	2.3 ± 0.8	3 ± 0.9	0.088	0.026*
% of change	53%	100%		
P-value (paired test)	0.001*	0.001*		
Function				
Pre-treatment	45.4 ± 12.5	44.3 ± 12.9	0.296	0.819
Post-treatment	52 ± 14	70 ± 6.4	15.25	0.001*
% of change	14.5%	58%		
P-value (paired test)	0.004*	0.001*		
Knee flexion (degrees)				
Pre-treatment	81.9 ± 20	84.2 ± 15.5	2.96	0.733
Post-treatment	91.1 ± 22	107.3 ± 13.4	11.1	0.023*
% of change	11%	27%		
P-value (paired test)	0.001*	0.001*		

PPT: Pain pressure threshold, *: significant.

Impact of ITB release on PPT:

Within group comparison as at control group**:** The mean of PPT pre- and post-treatment of group A was 1.5 ± 0.5 and 2.3 ± 0.8 kg respectively. The percentage of change was 53%. There was a statistically significant increase in PPT in group A post-treatment compared to that of pre-treatment (p = 0.001). The experimental group**:** The mean of PPT pre- and post-treatment of group B was 1.5 ± 0.4 and 3 ± 0.9 kg respectively. The percentage of change was 100%. There was a statistically significant increase in PPT in group B post-treatment compared to that of pre-treatment (p = 0.001). Between groups comparison, there was a statistically significant difference in the mean values of PPT post-treatment between groups A and B (p= 0.026) in favor to group B.

The impact of ITB release on knee function: Within group comparison, at the control group (A) the mean of knee function pre- and post-treatment was 45.4 ± 12.5 and 52 ± 14 respectively. The percentage of change was 14.5%. There was a statistically significant increase in knee function in group A post-treatment compared to that of pre-treatment (p = 0.004). At experimental group (B) the mean of knee function pre- and post-treatment was 44.3 ± 12.9 and 70 ± 6.4 respectively. The percentage of change was 58%. There was a statistically significant increase in knee function in group B post-treatment compared to that of pre-treatment (p = 0.001). There was a statistically significant difference in the mean values of knee function post-treatment between groups A and B (p= 0.001) in favor to group B.

The impact of ITB release on knee ROM: Within group comparison at control group (A), the mean of knee flexion pre- and post-treatment of group A was 81.9 ± 20 and 91.1 ± 22 degrees respectively. The percentage of change was 11%. There was a statistically significant increase in knee flexion in group A post-treatment compared to that of pre-treatment (p = 0.004). At the experimental group (B) the mean of knee flexion pre- and post-treatment was 84.2 ± 15.5 and 107.3 ± 13.4 degrees respectively. The percentage of change was 27%. There was a statistically significant increase in knee flexion in group B post-treatment compared to that of pre-treatment (p = 0.001). There was statistically significant difference in the mean values of knee flexion post-treatment between groups A and B (p= 0.023) in favor to group B.

DISCUSSION

At the end of 12 sessions, the patients in both groups had decrease in PPT and discomfort, enhancement of LL function capabilities, and ROM of knee joint. The experimental group results showed statistically significant improvement than control group.

This study's primary discovery was the increased therapeutic benefit of adding ITB release by local vibrator

to physical therapy program on pain intensity, PPT, function, and knee ROM.

Because of pain, there is reflex inhibition of muscles activity and decreased ROM of the joint, so muscles become disused in that particular area. A decrease in muscle length is also associated with aging. So, stretching and release are necessary [19].

ITB tightness may be a main cause of anterior and lateral knee pain and so linked with excessive lateral deviation of patella. Also, loading the ITB causes the tibia to shifts alterations in the tibiofemoral contact pattern and lateral displacement of the contact zone on the patella, together with concomitant rotations posteriorly, proximally, and valgus. So, the tight ITB further contribute to early degeneration of the joint [1]. So ITB release regain the balance between medial and lateral knee stabilizers and the proper patellar alignment allowing for a pain free knee fuction in a larger ROM. In agreement with the current study results, previous studies performed ITB release by static streching and myofacial release as both of them increased ITB flexibility, the ITB stretching was better than the conventional physiotherapy alone for knee OA as participants in the conventional physiotherapy with vastus lateralis release and ITB stretching group showed a greater benefit in term of pain intensity, PPT, LL functional activities and ROM than those in the only conventional physiotherapy group. Also, it was approved that the effect of ITB releasing approach in individuals with unilateral knee osteoarthritis to lessen discomfort and enhance function after four weeks intervention by using Numeric Pain Rating Scale (NPRS) and WOMAC respectively [1,8].

One frequent method of relieving tension in the trunk and limb muscles is vibration [10]. It is effective when applied directly to the affected muscle to release muscle tension by using a massage gun for five minutes and improve muscle flexibility as much as the application of static stretching and using massage gun as the application of a local vibration stimulus was effective. In addition, it is overall simple, easy applied, time and effort saving technique, portable, and comfortable [20]. Many studies reported that low-frequency vibration (2–80 Hz) caused inhibition in the muscle activation [21,22].

Conventional program was proved TENS has been shown to be beneficial in treating knee OA since it can greatly reduce pain, reduce dysfunction, and enhance a patient's capacity to walk [23]. Additionally, US is one of numerous physical therapy techniques recommended for treating knee OA patients' pain and function loss [24].

CONCLUSION

local vibration on ITB release in patients with knee OA was effective and beneficial in improving pain intensity, PPT, LL functional activity and ROM of knee joint.

RECOMMENDATIONS

Strongly recommended that the studies should be undertaken to compare the different techniques of ITB release. Further studies are needed to determine the long-term results of this treatment on knee OA. In addition, it is important to add the implementations of ITB release to the routine PT program for the rehabilitation of patients with early knee OA.

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