

# Knee osteoarthritis with special emphasis to physiotherapy treatment focusing various stimulation technique

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**Abstract-** Knee osteoarthritis (OA) is associated with quadriceps atrophy and weakness, so muscle strengthening is an important point in the rehabilitation process<sup>23</sup>. Since pain and joint stiffness make it often difficult to use conventional strength exercises, neuromuscular electrical stimulation (NMES) including various stimulating technique for quadriceps muscle may be an alternative approach for these patients.

Treatment options include conservative approach (eg, medication,activity modification, functional rehabilitation, functional bracing, physiotherapy) and surgery (eg, TKR,Osteotomy etc for chronic cases where conservative approach fail ). Studies comparing conservative treatments with more aggressive operative interventions are required to fully evaluate the efficacy of these treatments. In this review, I focus on various new treatment techniques for knee osteoarthritis. So this review is to introduce some new physiotherapy techniques helpful for management of knee osteoarthritis.

**Index Terms-** Knee osteoarthritis, electrical stimulation for quadriceps, physiotherapy for knee osteoarthritis, knee taping

## I. INTRODUCTION

**P**urpose of the review: The purposes of this review are to: (1) describe treatments that physical therapists may( mainly electro-physical modalities focus) use to enhance the benefit of rehabilitation, (2) discuss current research( Mainly focused on stimulation technique) related to physical therapy treatment for knee osteoarthritis, and (3) identify characteristics from recent research that may influence the responsiveness of individuals with knee osteoarthritis to physical therapy

**Recent findings :**Physical therapists provide a variety of interventions, such as manual therapy techniques, balance, coordination, and functional retraining techniques, knee taping techniques, electrical stimulation, and foot orthotics to assist in overcoming some of the barriers that make participation in exercise and physical activity difficult. Recent research implies that a number of factors may influence the responsiveness to physical therapy treatment for individuals with knee osteoarthritis. Factors such as the mode of treatment delivery, treatment compliance issues, mechanical characteristics such as joint laxity and malalignment, and radiographic severity are discussed. (G. Kelley Fitzgerald and Carol Oatis)

Knee osteoarthritis (OA) is a painful condition causing disability and muscle weakness. Radiographic evidence of OA occurs in the majority of people by 65 years of age and in about

80% of those who are more than 75 years of age<sup>1,2</sup>. Pathologic changes in OA involve the whole joint in the form of focal and progressive hyaline articular cartilage loss with concomitant changes in the bone underneath the cartilage, including development of marginal outgrowths, osteophytes, and increased thickness of the bony envelope (bony sclerosis). Soft-tissue structures in and around the joint are also affected<sup>3</sup>. Knee OA is an important cause of disability in older people due to chronic joint pain, loss of range of motion, and muscle weakness.

Exercise therapy aims at reduction of pain and disability.This is achieved through improvement of muscle strength, joint stability, range of joint motion, and aerobic capacity. Certainly, in patients with OA, regular exercise can improve pain control, proprioception, controlled strength, instability, and endurance, all of which improve functional independence<sup>4,5</sup>.

The term of biofeedback (BF) refers to the use of appropriate instrumentation to transduce muscle potentials into auditory or visual signals for the purpose of increasing or decreasing voluntary activity. BF improves the rate of functional recovery of the quadriceps femoris muscle significantly during the muscle strengthening exercises<sup>6</sup>. The mechanism of pain relief with electrical stimulation (ES) is explained by the gate-control theory developed by Melzac and Wall. ES causes facilitation in substantia gelatinosa at the level of medulla spinalis by stimulating A- $\alpha$  and A- $\beta$  fiber, which do not transmit pain sense and reduces pain sense by inhibiting A- $\Delta$  and C fiber which transmit pain sense in presynaptic area. Electrical stimulation increases muscle strength, and decreases joint stiffness and spasm in muscle as well<sup>7</sup>.

Osteoarthritis (OA) is characterized by damaged articular cartilage of synovial joints. About 17% of people aged over 45 years suffer from pain and loss of function due to symptomatic knee osteoarthritis<sup>8</sup> and 40% of people aged over 65 years have symptomatic OA of the knee or hip<sup>9,10</sup>. The prevalence of arthritis and more especially OA increases with age<sup>11</sup>.

Transcutaneous electrical nerve stimulation (TENS) is a non-pharmacological, inexpensive and safe form of analgesia<sup>12</sup>. The pain modulating effect of TENS is assigned to peripheral components which may be regulated by central mechanisms<sup>13</sup>. The inhibitory effect of tens is based on the 'Gate Control Theory' of pain perception as described by Melzack and Wall<sup>14</sup>. This theory suggests that stimulation of large (A-beta) afferent cutaneous fibers activate the inhibitory-interneurons in the dorsal horn of medulla. This may weaken the transmission of nociceptive signals from small diameter A-delta and C-fibers. As

OA is a dynamic process that involves phases of inflammation with possible increase of pain during these phases, TENS may be indicated as a facilitator for exercise. The use of TENS to relieve knee pain in osteoarthritis of the knee is recommended in various clinical guidelines as a conservative treatment to relieve knee pain<sup>15,16</sup>. However, Rutjes et al.<sup>17</sup> conclude in their meta-analysis that adequate evidence to support the use of any type of transcutaneous electrostimulation in patients with knee osteoarthritis is lacking.

Individuals with osteoarthritis (OA) of the knee joint commonly display marked weakness of the quadriceps muscles, with strength deficits of 20 to 45% compared with age and gender-matched controls<sup>18</sup>. Persistent quadriceps weakness is clinically important in individual with OA as it is associated with impaired dynamic knee stability<sup>19</sup> and physical function. Moreover, the quadriceps have an important protective function at the knee joint, working eccentrically during the early stance phase of gait to cushion the knee joint and acting to decelerate the limb prior to heel strike, thereby reducing impulsive loading<sup>20</sup>. Weaker quadriceps have been associated with an increased rate of loading at the knee joint and recent longitudinal data have shown that greater baseline quadriceps strength may protect against incident knee pain, patellofemoral cartilage loss<sup>21</sup> and tibiofemoral joint space narrowing.

The role of the quadriceps muscle in mediating risk for knee osteoarthritis (OA) is a common subject of investigation. The quadriceps muscle is a principal contributor to knee joint stability and provides shock absorption for the knee during ambulation. Clinically, weakness of the quadriceps muscle is consistently found in patients with knee OA. Research has shown that higher quadriceps muscle strength is associated with a reduced risk for incident symptomatic knee OA. However, there is limited evidence to suggest that quadriceps muscle plays a significant role in the incidence of radiographic knee OA. In addition, greater quadriceps muscle strength is associated with a lower risk for progression of tibiofemoral joint space narrowing and cartilage loss in women<sup>22</sup>.

Knee osteoarthritis (OA) is associated with quadriceps atrophy and weakness, so muscle strengthening is an important point in the rehabilitation process<sup>23</sup>. Since pain and joint stiffness make it often difficult to use conventional strength exercises, neuromuscular electrical stimulation (NMES) may be an alternative approach for these patients. Additionally, NMES training increased the knee extensor torque by 8% and reduced joint pain, stiffness, and functional limitation<sup>23</sup>. In conclusion, OA patients have decreased strength, muscle thickness, and fascicle length in the knee extensor musculature compared to control subjects. NMES training appears to offset the changes in quadriceps structure and function, as well as to improve the health status in patients with knee OA.

## II. METHODS

The literature pertaining to knee OA from 1984 to 2013 has been included. Searches were conducted for the period upto 2013 of the PEDro, Medline, Cinahl and Cochrane databases and relevant articles in English were retrieved. Literature mainly related to various stimulation technique in management of knee osteoarthritis were reviewed.

Search up to December 2013 was undertaken to identify relevant trials for this review. The following methods were used:

the MEDLINE database was searched using combinations of the key words "rehabilitation", "physical therapy", "osteoarthritis", "stimulation", "quadriceps" and "knee OA" from 1984

the Cochrane Collaboration's register of trials and reviews was searched using the key words "knee osteoarthritis" and "knee osteoarthritis rehabilitation";

the Physiotherapy Evidence Database (PEDro) was searched on the basis of "electrical stimulation for knee OA" and "physical modalities for OA" categories.

In addition, reference lists and bibliographies of related journal articles and books were searched manually for additional trials.

All studies in the English concerning effectiveness of the electrical stimulation and various physiotherapy approach for knee osteoarthritis patients were included.

Exclusion criteria were: studies related to surgical and medical management for OA was excluded

The new literature has been combined with the earlier knee OA position statement to produce the following document.

### 1.NMES TECHNIQUE FOR QUADRICEPS MUSCLE

NMES on quadriceps muscles for 20 minute including three sessions weekly for three month. Neuromuscular electrical stimulation procedures on quadriceps (two electrodes on the muscle attachment sites). Electrodes are placed over the vastus medialis near the knee and on the proximal thigh over the vastus lateralis in several studies. A portable electrical stimulator (Ionoson, Physiomed, Germany) delivered biphasic symmetric rectangular pulses (frequency of impulses 2500Hz, train of pulses frequency 50 Hz). The stimulus output is interrupted every 10 ms to create "bursts" of stimulation every second. The 10ms off period was not detectable by the subject. A total of 10 maximal contractions sustained for 10 seconds each with a 50 second off time defined a treatment session (according to methodology of stimulation prepared by Yakov Kots in year 1989 called in literature "Russian stimulation" and recognized as one of the types of the NMES. The intensity was between 55 and 67mA (mean of 58.89 mA). Stimulation was performed with a current which produced strong, visible motion effects. Electrodes were made of conductive carbon rubber (8 × 6 cm). Before application of electrodes the skin was cleaned by use of alcohol. The total time of single procedure was 20 minutes. Quadriceps was stimulated at 60° of knee flexion. The procedures were repeated 3 days a week for three month.

**Study:** Neuromuscular electrical stimulation was studied as a treatment option for osteoarthritis by Dr. Laura Talbot from The Johns Hopkins University. NMES is achieved by sending small electrical impulses through the skin to the underlying motor units (nerves and muscles) to create an involuntary muscle contraction. Thirty-four adults with radiographically (x-ray) confirmed symptomatic knee osteoarthritis were involved in the study. The study participants were randomly given standard arthritis education (12-week Arthritis Self-Management Course) with or without NMES. The NMES group used a portable electrical muscle stimulator 3 days a week for quadriceps training and strengthening. Over 12 weeks, the intensity of

isometric contraction was increased incrementally to 30-40 percent of maximum. The results indicated that:

- The stimulated-knee extensor showed a 9.1 percent increase in 120 degree QF peak torque compared to a 7 percent loss in the education only group.
- The chair rise time decreased by 11 percent in the NMES group, while the education only group had a 7 percent reduction.
- Both groups improved their walk time by about 7 percent.
- Severity of pain reported following intervention (either NMES or education) did not differ between groups.

The research team led by Talbot concluded that a home-based NMES treatment plan appears promising for increasing quadriceps femoris strength in adults with knee osteoarthritis without making arthritis symptoms worse.

## **2. APPLICATION OF RUSSIAN CURRENT STIMULATION FOR QUADRICEPS MUSCLES**

Russian current (medium frequency alternating current) is a type of electrical stimulation which has been advocated for use in increasing muscle force. It was originally developed for improving muscle strength in Russian Olympic athletes and was found to increase force gain up to 40% in elite athletes.<sup>24</sup> The stimulation was given for duration of 10 minutes (10/50/10 regimen-10 sec "on" followed by 50 sec "off" and again 10 sec "on".)

## **3. BIOFEEDBACK TRAINING FOR QUADRICEPS MUSCLES**

The patient seated with the hip at 90° and knee at 25-30° of flexion. Two superficial electrodes (Enraf Myomed-432) should be placed sequentially over the patient's rectus femoris, vastus medialis, and vastus lateralis muscles. The patients were asked to perform an isometric contraction. The patient should suppress his or her knee on the rolled pillow that is placed under the knee and hold it contracted in that position for 10 s. Fifty s of relaxation should be given to the patient. The patient should be asked to try to increase the visual and auditory signals that she perceived at every contraction. Outcome measures for pain were visual analogue scale (VAS) pain score in activity, at night, at rest and Western Ontario McMaster osteoarthritis index (WOMAC) pain score<sup>25</sup>.

Disability and stiffness were assessed with WOMAC physical function and stiffness score. One repetition maximum (RM) and 10 RM were used for measuring quadriceps strength (Elliott KJ et al 2002 ). 1 RM and 10 RM performed bilaterally. Objective assessment of functional performance was obtained by timing the patients walking as fast as they could for 50 m, ascent and descent of a straight flight of stairs consisting of 10 steps.

## **4. MOTOR POINT STIMULATION FOR QUADRICEPS MUSCLES( ELECTRICAL STIMULATION FOR QUADRICEPS)**

The patient was seated on the treatment chair with the hip at 90° and knee at 60° of flexion. The ankle of the patient was stabilized with a 5-kg load to prevent the isotonic contractions of the quadriceps muscle. Two of the four electrodes were placed

on rectus femoris and vastus medialis muscles and the other two were placed on the vastus lateralis muscles' motor points (Endomed-CV 405). The asymmetric biphasic wave was applied with the frequency of 50 Hz and 200 μs of phase time. The intensity of the current was arranged separately one by one for each patient until apparent muscle contraction was established (70-120 mA). The stimulation was applied as 10 s of contraction and 10 s of relaxation.( Dilek Durmuş et al. Clin Rheumatol 2007)

## **5. TENS FOR QUADRICEPS MUSCLE**

It has been suggested that a specialized therapy is needed in combination with conventional resistance exercise to overcome decreased neural drive to the muscle.<sup>26-27</sup> Sensory transcutaneous electrical nerve stimulation (TENS) applied to the knee has been reported to excite inhibited motor neuron pools and immediately increase maximal quadriceps voluntary activation in people with arthritic knees.<sup>28</sup> Spatiotemporal gait parameters, such as walking speed, have been found to improve following resistance training augmented with sensory electrical stimulation.<sup>29</sup> Currently it remains unknown whether therapeutic exercise in conjunction with sensory TENS will affect peak knee flexion angle and external knee flexion moments, parameters thought to dictate energy attenuation during gait.

**Evidence:** The Select System TENS units (EMPI, Inc., St. Paul, MN, USA) were provided to all participants in the active TENS and placebo groups. Active TENS consisted of a continuous, biphasic pulsatile current (150 Hz, 150 ms).<sup>30,28</sup> The active TENS group used self-selected stimulus amplitude that resulted in a strong sensory but submotor stimulation.<sup>28</sup> Participants were instructed on how to increase and decrease stimulus amplitude, which could be adjusted between 1 and 60 mA. Participants in the placebo group received the same stimulators, and were instructed to increase the stimulus amplitude until they felt a small sensory stimulation. Following 30 seconds of stimulation, placebo TENS units were programmed to automatically decrease the current until no current was emitted. The gradual decrease in current lasted approximately 10 seconds. Participants were told that the current parameters were set to a subsensory level and the unit was delivering the treatments as long as the indicator light was on. Participants were instructed to maintain the amplitude at a level of '3' throughout the day.

The four electrodes were applied over the superior and inferior medial poles of the patella as well as the superior and inferior lateral poles of the patella in both groups and the electrical currents in the two channels were crossed.<sup>30,28</sup>

## **6. PULSED ELECTRICAL STIMULATION IN THE MANAGEMENT OF OSTEOARTHRITIS OF THE KNEE**

(Robyn E. Fary et al Arthritis & Rheumatism Vol. 63, No. 5, May 2011, pp 1333-1342)

**Evidence:** PES is delivered through capacitive coupling using surface electrodes and conduction gel. While often being grouped with transcutaneous electrical nerve stimulation (TENS) , it does differ from TENS and interferential therapy in its specific electrical current parameters and its proposed method of action . In particular, it is delivered at subsensory intensity. That

subsensory electrical stimulation is reported to be effective in managing pain suggests a local mechanism of action. This mechanism is at present poorly understood. However, there are many pain-mediating receptors in the periphery that may be affected by an externally applied electrical field by virtue of their endogenous electrical potential and the role of polarization in receptor function and nociceptor stimulation. It is possible that externally applied electrical stimulation interferes with this process and thus reduces pain perception. PES is also reported to be a potential disease modifier through its capacity to up-regulate chondrocyte activity. This assertion has yet to be tested in humans, mainly because long-term effectiveness and compliance with use have yet to be established. Additionally, Farr et al. in a prospective, longitudinal study referred to a dose-response relationship, suggesting that increasing PES use results in better pain management.

**Intervention.** A commercially available TENS stimulator (Metron Digi-10s) was modified by a biomedical engineer to deliver PES current parameters as follows: pulsed, asymmetrically biphasic, exponentially decreasing waveform with a frequency of 100 Hz and pulse width of 4 msec. Current was delivered via 120 mm × 80 mm multiple-use conductive silicone electrodes inserted into larger calico pockets (175 mm × 100 mm) to increase the contact surface area and reduce current density. Electrodes, positioned over the anterior distal thigh (anode) and anterior to the knee joint itself (cathode), were coupled to the skin using hypoallergenic conduction gel and secured with specially made neoprene wraps. The placebo device was identical in appearance and method of use; however, the current flow was programmed to turn off after 3 minutes. Since this was a subsensory treatment, this change was not detectable by participants. PES is also reported to be a potential disease modifier through its capacity to up-regulate chondrocyte activity.

#### **Another study PES**

A double-blind, randomized, placebo-controlled trial by Fary et al. (2011) evaluated the effectiveness of pulsed electrical stimulation in the symptomatic management of osteoarthritis (OA) of the knee. Thirty-four patients were randomized to PES and 36 to placebo. Primary outcomes measured pain by visual analog scale (VAS). Other measures included Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores for pain, function, and joint stiffness, Short-Form 36 health survey and perceived effect on quality of life and physical activity. Over 26 weeks, both groups showed improvement in pain scores. There were no differences between groups for changes in WOMAC pain, function, and stiffness scores, SF-36 physical and mental component summary scores, patient's global assessment of disease activity or activity measures. Fifty-six percent of the PES-treated group achieved a clinically relevant 20- mm improvement in VAS pain score at 26 weeks compared with 44% of controls. The authors concluded that PES was no more effective than placebo in managing osteoarthritis of the knee.

Farr et al. (2006) reported on a prospective, cohort study examining the use of PES for the treatment of osteoarthritis of the knee in 288 patients. The device was used for 16 to 600 days with a mean of 889 hours. Improvement in all efficacy variables

was reported. A dose-response relationship between the effect and hours of usage was observed as cumulative time increased to more than 750 hours. Improvements in the patient's or physician's global evaluation of the patient's condition occurred in 59% of patients who used PES less than 750 hours and in 73% of patient's who used it more than 750 hours. The lack of a control group weakens the evidence of this study.

**7.MAGNETIC PULSE TREATMENT**(Nicolo Pipitone and David L. Scot.Magnetic Pulse Treatment for Knee Osteoarthritis: A Randomised, Double-Blind, Placebo-Controlled Study. Current medical research and opinion vol. 17, no. 3, 2001, 190–196)

Treatment was administered by unipolar magnetic devices manufactured and supplied by Snowden Healthcare Ltd (Nottingham, UK). These are exclusively pain therapy devices that generate pulses of magnetic energy via a soft iron core treated with 62 trace elements. Pulses are selectable at three base frequencies (3 Hz, 7.8 Hz and 20 Hz). They have a rise time of 1 µs, a decay time of 10 µs, a low magnetic output (< 0.5 gauss) and a range of activity of up to 30cm around the unit. Medicur devices run on 9 V batteries and switch off automatically after a 10 min period. Each device is fitted with a control light that shows as long as the device is in operation. Based on previous evidence from uncontrolled observations, patients were instructed to use the Medicur magnetic devices three times a day (once in the morning, once in the afternoon and once in the evening) for the whole duration of the study. The 7.8Hz frequency was prescribed for the morning and afternoon treatment, while the 3 Hz frequency was prescribed for the evening. The Medicur devices require no wires or electrodes and need only be held close to the area to be treated, which facilitates the patients' compliance. Since the magnetic energy emitted by this device can penetrate as far as 30 cm, both knees could be treated simultaneously whenever necessary by holding the device between the knees or by placing the device on one knee while keeping the knees together. A Velcro band was provided to hold the device in place, but its use was left to the discretion of the patients. They explained to the patients that they should not expect the devices to cause any noise or particular sensation. Patients were instructed to record the treatment in a special sheet to facilitate assessment of compliance and not to change their basic therapeutic regimen for the duration of the study. The use of medications was checked at each assessment, although no formal pill counts were done. Finally, we encouraged patients to report any adverse event that they might experience during the treatment with the magnetic devices.

In conclusion, this study has 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. Given the study design, the results obtained in our population cannot possibly be generalised to all patients with painful conditions. Further studies using different types of magnets, treatment protocols and patient populations are needed to prove or refute the efficacy of PEMF therapy in different conditions.

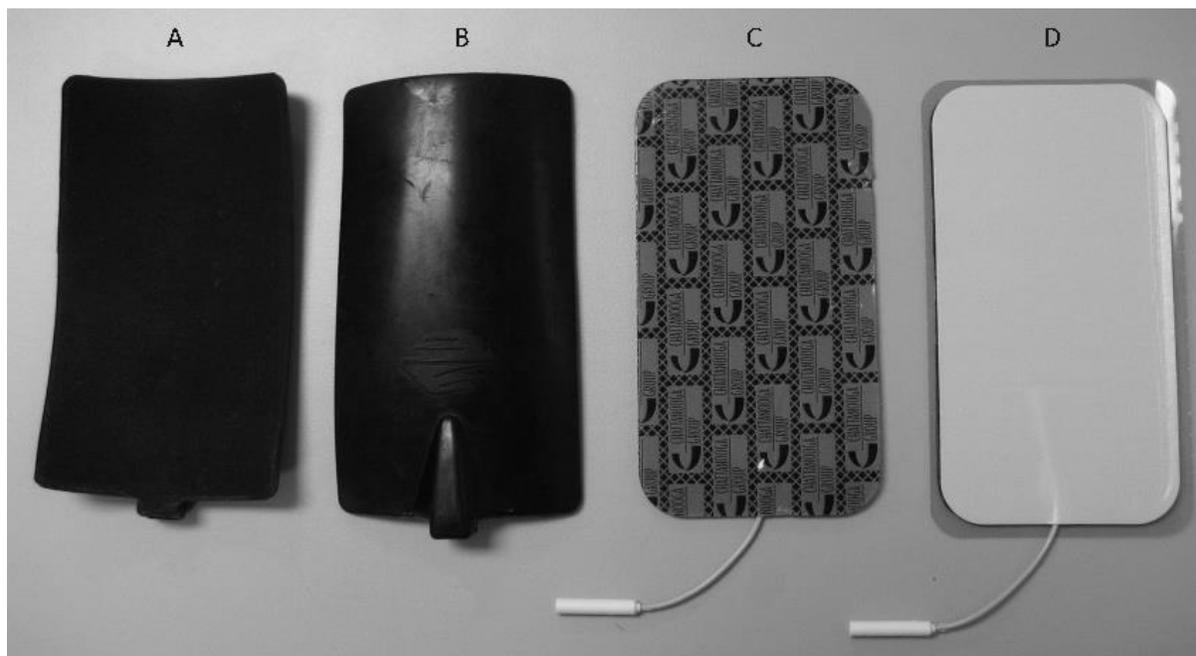
#### **8.IFT**

A multi-center, randomized single-blind, controlled study by Burch et al. (2008) to investigate the benefits of the combination of interferential (IF) and patterned muscle stimulation in the treatment of osteoarthritis (OA) of the knee. The study randomized 116 patients with OA of the knee to a test or control group. The devices used to deliver the electrical stimulation were pre-programmed to deliver either IF plus patterned muscle stimulation (test group) or low-current TENS treatment (control group). Both groups were treated for 8 weeks. Subjects completed questionnaires at baseline and after 2, 4 and 8 weeks. Primary outcomes included the pain and physical function subscales of the Western Ontario MacMaster (WOMAC) OA Index and Visual Analog Scales (VAS) for pain and quality of life. The mean changes from baseline to last visit in quality of life VAS rating were similar between the two groups (18.17 vs. 18.16). Patients in the test group had a greater decrease in the overall pain VAS (27.91 vs. 23.19;  $P=0.29$ ) at their last visit, but the difference between treatment groups did not achieve statistical significance. However, if only patients who completed the study (49 in test group and 50 in control group) were included for the analysis, the difference between groups in mean change from baseline increased from 4.71 to 9.40 for overall pain VAS rating and achieved statistical significance ( $P = 0.038$ ). Although the study design was a randomized controlled trial of sufficient size, the study was manufacturer sponsored, with intervening treatment variables, 10% drop out rate and the treatment effect did not reach sufficient significant difference.

### **9.APPLICATION OF TAPPING TECHNIQUE FOR KNEE OSTEOARTHRITIS**

Patellofemoral taping techniques are frequently used in knee rehabilitation programs. It has been recommended that these techniques be used to supplement exercise for individuals with knee OA to reduce pain during exercise and functional activities<sup>31</sup>. The taping techniques are relatively simple to apply and can be taught to patients for self-management purposes. Recently, a single-blind, randomized controlled trial was performed to determine the effectiveness of patellofemoral taping for relieving knee pain and improving self-reported measures of physical function and general wellness<sup>32</sup>. Subjects were randomly assigned to receive the taping treatment, receive a placebo taping treatment, or to receive no taping. The tape was worn continuously over a 3-week period, with reapplication of the tape performed weekly. The treatment period was 3weeks, with an additional 3-week follow-up period. Concomitant treatments that were administered to subjects were not described. A relatively large effect for the taping group compared with the control group was achieved for knee pain (effect size = 1.00 to 1.19) and the physical function score for the WOMAC (0.83). The taping group was 7 times more likely to have a reduction in pain compared with the no tape group. The placebo taping group was 4.5 times more likely to have a reduction in pain compared with the no tape group. Although there appears to be a placebo effect in applying tape to the knee, the therapeutic tape provided an effect above the level of placebo in this study<sup>32</sup>. Approximately 30% of subjects in the taping group did not have patellofemoral involvement yet the taping appeared to reduce their symptoms. This may indicate patellofemoral taping has a general effect on reducing knee pain. The mechanism for pain modulation using taping is not known at this time.

**Fig 1. Type of electrode used in electrical stimulation**



## **10.MANUAL THERAPY OPTION FOR KNEE OSTEOARTHRITIS**

[Henry Pollard et al. The effect of a manual therapy knee protocol on osteoarthritic knee pain: a randomised controlled trial. J Can Chiropr Assoc 2008; 52(4)]

### Intervention Group

The intervention group received a MIMG(Macquarie Injury Management Group) chiropractic knee protocol, explained in Figures 2 and 3. It consists of a non-invasive myofascial mobilisation procedure and an impulse thrust procedure performed on the symptomatic knee of participants. It cases were OA was bilateral; mobilisation was perform on both knees. The mobilisation procedure directed a small, sustained load and specific force to the patellofemoral articulation in a pre-determined direction of movement. This load was achieved through the active extension and flexion of the knee in the range starting from 90<sup>0</sup>of knee flexion to available full extension.

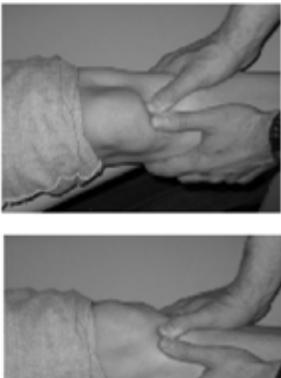
During this movement, the patella is actively mobilised in a supero-inferior direction in a plane directed tangentially to the patella. In this position, minimal compressive load is placed upon the patellofemoral articulation, as this movement is usually perceived as painful in osteoarthritic patients. This allows the subject to actively articulate through knee flexion and not excessively tighten the quadriceps to cause a vector that compresses the patella onto the femur. A positive orthopaedic test finding is pain reproduction upon compressing patellofemoral structures. The mobilization procedure stretches the joint capsule in the sagittal plane, gently mobilises any restriction to normal movement within the limits of patient tolerance and likely loosens adhesions of the patellofemoral articulation. In addition, it may be used on anterior thigh musculature to effectively mobilise tight myofascial thigh structures.

**Figure 2 Macquarie Injury Management Group Knee Protocol Part One: Myofascial Mobilisation Technique**

Technique Table 1: Myofascial Mobilisation Technique	
Description of technique	Illustration of the technique
<p>The patient lies supine near the homolateral edge of the couch.</p> <p>The practitioner sits on the homolateral side of the couch with the cephalad thigh under the leg of the patient's involved limb and superior to the patients knee.</p> <p>The patients lower hamstring area rests on the practitioners thigh with their knee able to rest in 90° of flexion.</p>	
<p>The practitioner has a choice of two contacts:</p> <ol style="list-style-type: none"> <li>1. A pincer contact with the thumb and index either side of the medial and lateral superior poles of the patella</li> <li>2. A reinforced web contact supporting the medial and lateral superior poles of the patella. The second position is recommended for those practitioners with a hypermobile thumb.</li> </ol>	 
<p>The patient is then instructed to begin actively extending their knee through the pain free range of motion while the practitioner maintains contact at the patella.</p> <p>The force through the patella is in a plane applied at a tangent to the angle of the knee to avoid a compressive load.</p>	
<p>The patient extends the knee as far as possible in a pain free manner from the initial starting position. The practitioner maintains the contact at the patella during this movement.</p> <p>This is repeated up to ten times.</p> <p>Patients are able to cease participation at any point during the application of the procedure. In addition, an impulse thrust may be applied at any point through the range of motion</p>	 
<p>Alternatively, the initial contact can be taken with a bias towards medial or lateral rotation of the patella.</p> <p>This picture demonstrates a contact applied with medial rotation. Generally, the practitioner adopts a start position where the patella is held medially to enhance medial rotation or laterally to enhance lateral rotation. This position is held through the subsequent flexion and</p>	

extension ranges of motion, rather than trying to actively apply such traction or rotation throughout the range of motion.

**Figure 3 Macquarie Injury Management Group Knee Protocol Part Two: Myofascial Manipulation**

Technique Table 2: Myofascial Manipulation	
Description of technique	Illustration of the technique
<p>The patient lies supine near the homolateral edge of the couch, with the involved knee overhanging the edge of the couch.</p> <p>The practitioner stands on the homolateral side of the couch with the patients leg (at the level of the lower calf) gripped between the thighs to apply a distractive force to produce traction over the tibio-femoral joint.</p>	
<p>The practitioner contacts the knee with hands either side. Both thumbs contact on the tibial tuberosity and the fingers wrap around the knee to the distal end of the popliteal space.</p> <p>Care should be exercised not to place too much digital pressure in the popliteal space.</p> <p>An impulse type thrust is then delivered, directed in the caudal direction to mobilise the joint in a near full extension position.</p>	
<p>Alternatively, the initial contact can be taken with a bias towards medial or lateral rotation of the tibio-femoral joint.</p> <p>Generally, the practitioner adopts a start position where the tibia is held with medial rotation or lateral rotation. This position is held through the subsequent traction and impulse thrust</p>	

**11.APPLICATION OF SHORTWAVE**

Before start the treatment the therapist evaluated the safety measures of the shortwave diathermy device. Patient’s thermal sensation of the treatment part was evaluated and all metal objects, materials, clothing and electronic devices from treatment part were removed. Patient was positioned in supine lying and short wave diathermy pads were applied in contraplanner method for 20 minutes on affected knee. The spacing between the pads and treatment part is maintained by the placing of eight folded towels. Intensity was maintained and adjusted to produce comfortable warmth based on patient’s feedback.

**12.APPLICATION OF ULTRASOUND**

The patients positioned comfortably to receive therapeutic ultrasound with parametric settings of 1 MHz in frequency, continuous mode and 1.5 W/cm<sup>2</sup> of intensity with 5cm<sup>2</sup> sized transducer for 10 minutes of treatment duration. After coating the skin with coupling media (Aquasonic gel), Ultrasound was delivered by moving the treatment head over the anterior, superior and posterior regions of the affected joint in slow, circular and overlapping fashion.

**13. ELECTRODE PLACEMENT AND PROCEDURE FOR STIMULATION OF QUADRICEPS STUDY** (Brian G et al. 2011)<sup>33</sup>

**Procedures**<sup>33</sup>

**Stimulating Electrode Setup.** Before the stimulating electrodes were applied, the skin was shaved and, if necessary, debrided and cleaned. All participants were seated in the dynamometer while the investigator marked the positions for the electrodes. The exact electrode positions were marked with a felt-tip pen, allowing the investigator to replicate positioning between electrode type and electrode configuration conditions. The vastus configuration consisted of positioning the superior aspect of the proximal electrode at the height of the greater femoral trochanter, with the medial electrode border in line with the anterosuperior iliac spine. The distal electrode was positioned with the inferior aspect of the electrode 3 cm superior to the patella and the medial border of the electrode in line with the midline of the patella. The rectus configuration consisted of positioning the superior aspect of the proximal electrode at the height of the greater femoral trochanter, with the midline of the electrode aligned with the anterosuperior iliac spine. The distal electrode was positioned with the inferior edge 3 cm superior to the patella and the midline of the electrode in line with the midline of the patella. New self-adhesive electrodes were simply applied to the marked areas. However, before placement, a layer of conductive gel was applied over the stimulating electrode surface of the carbon-impregnated electrodes, and after being placed on the marked points, they were applied to the leg by the same investigator and secured with an elastic bandage. The cathode of the stimulating electrodes always was positioned distally, whereas the anode was positioned proximally, regardless of the electrode condition.

**Quadriceps Activation Testing** <sup>33</sup>. Participants were secured in the chair of the dynamometer unit with hips flexed to 85° and knees flexed to 90°. All landmarks were aligned according to the specifications of the manufacturer and previously reported in the literature. A graded warmup was conducted using the first electrode condition assigned to the participant to ensure that participants could exert maximal effort during the test and were accustomed to the stimulus. A series of submaximal contractions at 25%, 50%, and 75% of their perceived maximal voluntary isometric contractions (MVICs) were paired with submaximal stimuli at 25%, 50%, and 75% of the maximal testing voltage of 125 V. In addition to submaximal trials, participants performed 3 to 5 practice MVICs until the investigator was confident that each participant could exert maximal effort. During testing, an exogenous stimulus was applied to the quadriceps when the test administrator observed that a maximal force plateau had been reached. All participants were given oral encouragement from the investigator and were provided visual feedback from a computer screen depicting a force tracing in real time. Participants were encouraged to generate force to reach a target that was scaled to be slightly higher than the MVICs produced during their practice trials. Two acceptable trials separated by a 60-second rest period were performed and averaged for each electrode condition. The same 125-V stimulus was applied to the resting quadriceps muscle 60 seconds after the 2 active contraction trials. This series of contractions was performed 4 times to test both electrode configurations and electrode types.

### III. DISCUSSION

Knee osteoarthritis is a common complaint managed by physiotherapist and need for effective management is clear. Physiotherapy encompasses a variety of interventions such as manipulative therapy, exercise therapy, electro-physical modalities, foot orthosis, braces and education. The efficacy of these and other interventions is important as evidence based practice becomes increasingly important.

### IV. CONCLUSION

The treatment of knee osteoarthritis is currently limited to the management of symptoms rather than reducing disease progression. An evidence based approach to management should include patient education about OA and its management, including pain management, options to improve function, decrease disability, and prevent or retard progression of the disease. Common current treatment strategies involve pharmacological treatments, non-pharmacological treatments and surgical interventions. Analgesic and anti-inflammatory drugs are widely used in management, despite known serious adverse effects associated with long term NSAID use and doubts about their efficacy. Paracetamol is the primary oral analgesic and, if successful, the preferred long term analgesic. NSAIDs are considered in patients unresponsive to paracetamol. Current best evidence suggests NSAIDs may be beneficial in the reduction of pain in the short term, but there is no support for their long term use.

Beside this technique there are other measure to overcome osteoarthritic knee which include patient education, do and donts, use of assistive device including use of can and knee cap and various multidisciplinary health care including physiotherapy approach.

### CLINICAL IMPLICATION

Electrical stimulation treatment could be used alone or in combination with exercise treatment in clinical setting and isometric exercises could be undertaken as a home program. (Turk J Phys Med Rehab 2008;54:54-8)

### APPENDIX

OA: Osteoarthritis, NSAID: Non Steroidal Anti-inflammatory Drug, TENS: Transcutaneous Electrical Nerve Stimulation

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