



## SHOCK WAVE THERAPY VERSUS INTERFERENTIAL THERAPY IN THE MANAGEMENT OF OSGOOD-SCHLATTER DISEASE

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### ABSTRACT

**Background and purpose:** Osgood-Schlatter disease is a well-known and sport-associated overuse injury of the tibial tuberosity apophysis. Longlasting Osgood-Schlatter diseased-associated pain and a reduced ability to play sports can be the consequence. So, the purpose of this study was to investigate the therapeutic effect of extracorporeal shock wave therapy versus interferential therapy in controlling the pain in

Osgood-Schlatter disease. **Materials and methods:** The study was experimental, pre & post design. Forty Osgood-Schlatter children their age were 12-14 years old were chosen for the study and randomly distributed in two groups. Group A receive interferential therapy in addition to the conventional therapy program to osgood-schlatter disease and Group B receive shock wave therapy in addition to the same conventional therapy in group A. Therapy was applied three times weekly for 8 weeks. The severity of knee pain was measured by Visual Analog Scale in a weight bearing position (walking or standing) in parallel bars, rang of motion of knee flexion was measured by plastic goniometr and Western Ontario McMaster universities (WOMAC) index to assess pain, stiffness, and physical function were measured before as well as after the end of treatment program. **Results:** Revealed statistically significant improvement in the measuring variables of both groups when comparing their pre and post treatment mean values. Significant differences in the measured variables were also obtained in favor of the group (B) when compared with what of group (A). **Conclusion** The

obtained results strongly supported the application of shock wave therapy help to reduce pain of Osgood-Schlatter disease.

**KEYWORDS:** Osgood-Schlatter; Shock wave therapy; interferential therapy; Knee brace.

## INTRODUCTION

Osgood–Schlatter disease or syndrome (also known as Apophysis of the tibial tubercle, or knobby knees) is an irritation of the patellar ligament at the tibial tuberosity. It is characterized by painful lumps just below the knee and is most often seen in young adolescents<sup>[1]</sup> Risk factors may include overzealous conditioning (running and jumping), but adolescent bone growth is at the root of it. Osgood–Schlatter disease generally occurs in boys and girls aged 9–16 coinciding with periods of growth spurts.<sup>[2]</sup> It occurs more frequently in boys than in girls, with reports of a male-to-female ratio ranging from 3:1 to as high as 7:1. It has been suggested that difference is related to a greater participation by boys in sports and risk activities than by girls.<sup>[3]</sup> The condition is usually self-limiting and is caused by stress on the patellar tendon that attaches the quadriceps muscle at the front of the thigh to the tibial tuberosity Following an adolescent growth spurt, repeated stress from contraction of the quadriceps is transmitted through the patellar tendon to the immature tibial tuberosity.<sup>[4]</sup> This can cause multiple sub acute avulsion fractures along with inflammation of the tendon, leading to excess bone growth in the tuberosity and producing a visible lump which can be very painful, especially when hit.<sup>[5]</sup> Activities such as kneeling may also irritate the tendon. Diagnosis is made clinically.<sup>[7]</sup> Treatment is conservative with RICE (Rest, Ice, Compression, and Elevation), and if required acetaminophen, ibuprofen and/or Co-Coda mol or stronger if in 'acute phase' and (the pain is severe and continuous in nature). The condition usually resolves in 2–3 years on average.<sup>[8]</sup> Bracing or use of an orthopedic cast to enforce joint immobilization is rarely required and does not necessarily give quicker resolution. Sometimes, however, bracing may give comfort and help reduce pain as it reduces strain on the tibial tubercle.<sup>[9]</sup> Extracorporeal Shockwave Therapy (ESWT) is a new alternative therapeutic method based on technology generating non-focused shockwaves, a so called "ballistic principle". The pulses are transferred via a convex surface on the applicator resulting in a radial or conical dispersion of the energy in every single shockwave.<sup>[10]</sup> The increase in pressure in the tissue is built up very quickly resulting in a high energy level and appropriate energy dispersion in the tissue. Shock wave therapy (SWT) works on one level to treat pain through over stimulation of the "pain transmission nerves "or "hyper stimulation

analgesia, and local production of pain inhibiting substance.<sup>[11]</sup> Higher level shock waves can also induce tissue changes, by increasing metabolic activity and blood flow through the area, and activating the body's own repair mechanisms<sup>[12]</sup> Interferential current therapy is the application of alternating medium frequency current amplitude modulated at low frequency (0–250 Hz). This is presumed to improve the circulation, thus bringing about faster healing of the muscles<sup>[13]</sup> IFT is believed to work by passing currents across cell membranes; these currents vary depending upon the tissue involved. By using particular frequencies in the range, different systems within the body can be stimulated or used to increase the blood supply, which in turn hastens the healing rate.<sup>[14]</sup> IFT is used to treat pain especially conditions like sports injuries; arthritic conditions; bruising and swellings, back pain, Osgood-Schlatter disease, rheumatoid arthritis, muscular pain.<sup>[15]</sup> The present study aims to compare the effect of two sets of electrotherapy on the improvement of ROM and reduction of pain osgood-schlatter disease in children and also to compare which set of electrotherapy would lead to better results.

### **Subjects, Instrumentation & Procedure**

Subjects: forty participant of both sexes diagnosed with Osgood–Schlatter disease (22 males and 18 females) participated in this study. Subjects were suffering with knee pain due to Osgood-Schlatter disease that was radio logically confirmed by the radiologist or consultants aged between 12 and 14 years old. They were exclude if they had bleeding disorders, local malignancy, fever, tumors, people with cardiac pacemakers or with any metallic implants, abnormal skin sensation ,obvious deformity, history of knee surgery or knee trauma, excessive weakness joint injection within 4 weeks of the study, inadequate communication skills & unable to comply with exercise protocol. Equal to or greater than 3 cm on a 10 cm visual analogue scale (VAS). The study sample was divided randomly into two groups of equal number (A and B). Group A received Interferential current Therapy (ICT) plus conventional physical therapy. Group B: shock wave therapy in addition to the same conventional physical therapy conducted to the group (A).

### **INSTRUMENTATIONS**

#### **For evaluation**

1-Visual analog scale (VAS) the severity of knee pain was evaluated by Visual Analog Scale (VAS) after patients had remained in a weight bearing position (quadruped position). The

VAS instrument consisted of horizontal line which is 10 cm long with anchor points of 0 (no pain) and 10(maximum pain).

2- The "Myrin" goniometer made in Sweden consists of a small fluid-filled box fixed to a plate upon which it can be rotated. In the box are a compass needle, which is affected by the earth's magnetic field, and an inclination needle, which is affected by gravity. For range of motion assessment, movement in the horizontal plane (round a vertical axis) is read from the compass needle Movement in the vertical plane (round a horizontal axis) is read from the inclination needle. The box is fixed to the appropriate part of the body with the help of a Velcro fastening strap.

### **For treatment**

1- The "Shock Master" producing shock waves is a low to medium-energy range, and it is a radial shock wave delivery system that it's approved for distribution and use in the United States by the Food and Drug Administration (FDA).

### **2- Interferential current Therapy**

(IFC) Description of apparatus SONOSTIM (Class 1-type BF, Norm: 601-1) was a combined unit used to introduce interferential current for group 1. This unit introduced a quadripolar IF as well as bipolar mode. The unit was provided with two output channels for interferential currents.

### **Procedures**

#### **I-For evaluation**

The researcher explained the treatment procedure and the exercise regime with full demonstration. Each participant was given an exercise compliance sheet containing exercise figures and tables to record frequency and repetitions of each exercise. Participants were told to be dropped from the study for less than 80% compliance. 1-Pain is measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and can't easily be directly measured. Operationally a VAS is usually a horizontal line, 100mm in length, anchored by word descriptors at each end. The patient marks the line the point they feel which represents their perception of their current state. The VAS score is determined by measuring in millimeters from left hand end of the line to the point that the patient marks.

## **2- Assessment of pain, stiffness, and physical**

### **Function by WOMAC questionnaire**

The patient was asked about degree of pain while (walking on flat surface, going up and down stairs, at night while in bed, sitting or lying and standing upright). The patient was asked about degree of stiffness after first wakening in the morning and after sitting lying or resting later in the day. The patient was asked about the degree of difficulty while descending stairs, ascending stairs, rising from sitting, standing, bending to floor, walking in flat surface, getting on or out of car, going shopping, putting on socks, rising from bed, taking of socks, lying in bed, getting in/off bath, sitting, getting on/off toilet, heavy domestic duties and light domestic duties). The patient response to every question is none = 0, slight = 1, moderate = 2, severe = 3, and extreme = 4. Minimal total score = 0 and maximal total score= 96.

### **3-ROM**

The patient was in prone lying position; the goniometr was fixed fibular side of lower leg just above the lateral malleolus with inclination needle is perpendicular on the ground and set the needle at zero, we measured firstly passive ROM to exclude any other complication such as joint stiffness or soft tissue contracture then we measured active ROM, patient was asked to bend his/her knee as much as he/she can.

All subjects were measured on the same day and at the same time, before they had stretching for that day. Measurements were taken before treatment, post 8weeks of treatment.

### **For treatment: Group A**

The exercises were carried out by patients of both groups. Exercise protocol: Isometric exercises for Quadriceps (three items) and Hamstrings (one item) with 10 seconds hold, 20 repetitions (=1set), 3 sets each. Hip Abductor dynamic strengthening exercises, 3 sets (1 set=20 repetitions) for with 1 kg weight. Free ROM exercises 10 repetitions. Hot water fomentation once per day for 15 minutes for all groups. All patients were advised to wear knee caps while in weight bearing positions such as standing and walking. Postural & ergonomic care (precautions): Patients were advised to avoid crossed leg sitting, squatting & restrictions in use of stairs. Home exercise program Patients were advised to repeat the same exercise protocol at home in addition to interferential current stimulation at a frequency of 100 Hz the duration of the treatment was thirty minuets every session. The two electrodes were placed at both side of the knee joint. Group B: received the same designed exercise program in group A in addition to application of SWT the treatment area was prepared with a

coupling gel to minimize the loss of shock waves at the interface between applicator tip and skin. The treatment was performed with the Shock Master. The applicator (hand-piece) was pressed upon treatment area with application pressure categorized as "medium". As the patient adjusted to the shockwave-induced pain, the applied energy was increased during the treatment, analgesia of the treatment zone was not necessary. Each patient received 2000 shock/session, energy flux density 0.18mJ/mm<sup>2</sup>, energy level 2-4, pulse rate 160/min., 6Hz).

**Statistical analysis.** The collected data of the ROM, pain and physical function parameters of both groups were statistically analyzed to compare between the effects of SWT and IF in Osgood-Schlatter children. Descriptive statistics were done in the form of mean and standard deviation to all measuring variables in addition to the age, weight and height. Paired t-test was conducted for comparing pre and post treatment mean values in each group. Unpaired t-test was conducted to compare pre and post treatment mean values of all measuring variables between both groups. All statistical analyses were conducted through SPSS version 20.

## RESULTS

### A: Subject characteristics

Table 1, showed the mean± SD age, weight, height, and BMI of control and study groups. There was no significant difference between both groups in the mean age, weight, height, and BMI ( $p > 0.05$ ).

**Table 1 T test for comparison between control and study groups in mean age, weight, height, and BMI.**

|                          | Study X±SD   | Control X±SD | p-Value |
|--------------------------|--------------|--------------|---------|
| Age(years)               | 14±1.36      | 14±1.35      | 0.89*   |
| Weight(Kg)               | 40.06± 4.54  | 39.66±5.43   | 0.82*   |
| Height(cm)               | 142.12± 4.59 | 146.33±8.85  | 0.11*   |
| BMI(kg/cm <sup>2</sup> ) | 20.75± 1.93  | 21.31±2.55   | 11.09*  |

X, Mean; SD, standard deviation; p-value, level of significance.

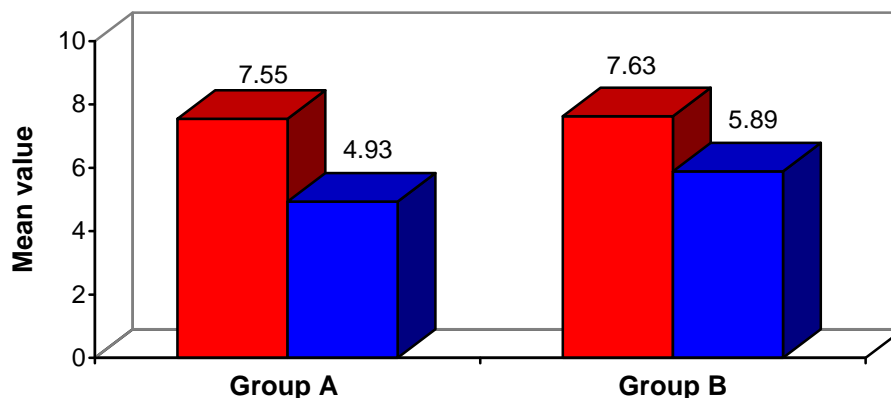
**B: Pain intensity:** the collected data from this study represent the statistical analysis of the pain intensity was measured before and after two months of treatment for the two groups. The raw data of the measured variables for the two groups were statistically treated to determine the mean and standard deviation. Student-test was then applied to examine the significance of the treatment conducted for each group. The obtained results in this study revealed no significant differences when comparing the pre-treatment mean values of the two groups ( $P >$

0.05). Significant improvement was observed in all the measuring variables of the two groups study A and study B, when comparing their pre and post-treatment mean values. After treatment significant difference was observed when comparing the post-treatment results of the two groups in favor of the study group B ( $P < 0.05$ ).

**Table 2: Comparison between mean values of pain measurements measured pre- and post-treatment within the same group and between the two studied groups.**

|                | Group A (n= 15) | Group B (n= 15) | p value |
|----------------|-----------------|-----------------|---------|
| <b>Pre</b>     | 6.73 ± 0.74     | 6.80 ± 0.81     | 0.816   |
| <b>Post</b>    | 3.57 ± 0.62     | 2.47 ± 0.35     | 0.001** |
| <b>p value</b> | 0.05**          | 0.05**          |         |

Data are expressed as mean ± SD.  $p > 0.05$  = not significant. \*\* $p < 0.01$  = highly significant.



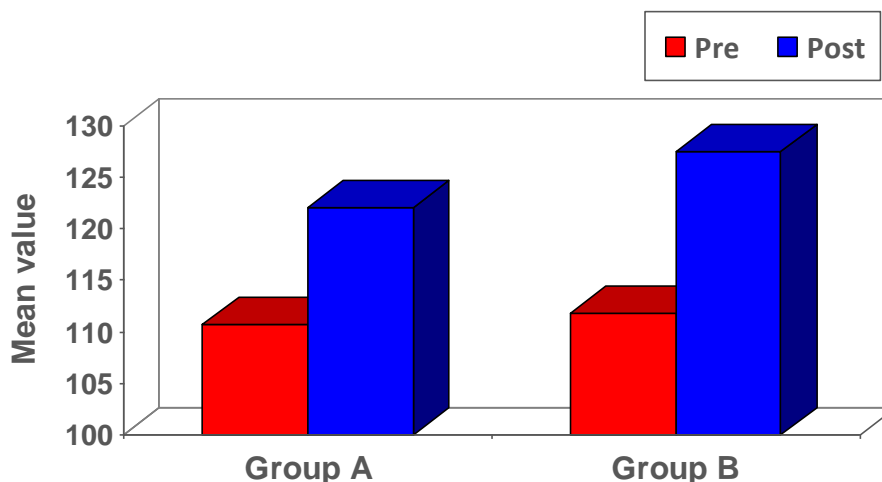
### C: ROM of knee flexion

As shown in table 3&fig2: there are no significant differences when comparing the pre-treatment mean values of the two groups. Significant improvement was observed in all the measuring variables of the two groups study A and study B, when comparing their pre and post-treatment mean values. After treatment significant difference was observed when comparing the post-treatment results of the two groups in favor of the study group B.

**Table 3: Comparison between mean values of knee range of motion measured pre- and post-treatment within the same group and between the two studied groups.**

|                | Group A (n= 15) | Group B (n= 15) | p value |
|----------------|-----------------|-----------------|---------|
| <b>Pre</b>     | 110.73 ± 3.35   | 111.87 ± 5.82   | 0.229   |
| <b>Post</b>    | 122.13 ± 2.83   | 127.53 ± 2.56   | 0.05**  |
| <b>p value</b> | 0.05**          | 0.05**          |         |

Data are expressed as mean ± SD.  $p > 0.05$  = not significant. \*\* $p < 0.01$  = significant.



**Fig. 2:** Comparison between mean values of knee range of motion measured pre- and post-treatment within the same group and between the two studied groups.

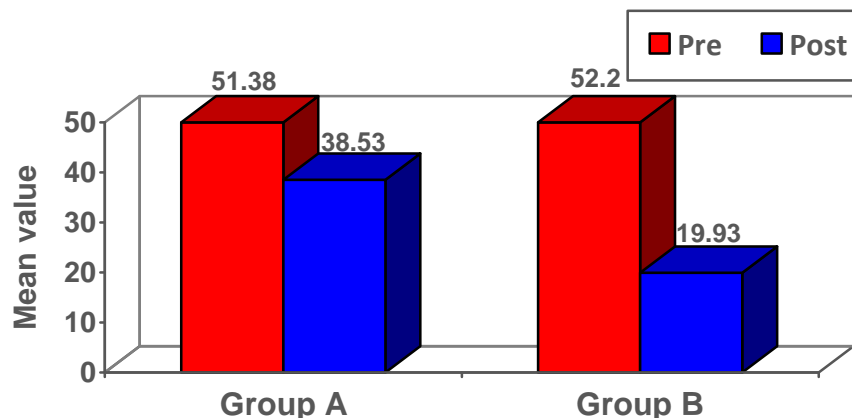
#### **D: Western Ontario McMaster universities (WOMAC) index**

As shown in table 4&fig3: there are no significant differences when comparing the pre-treatment mean values of the two groups. Significant improvement was observed in all the measuring variables of the two groups study A and study B, when comparing their pre and post-treatment mean values. After treatment significant difference was observed when comparing the post-treatment results of the two groups in favor of the study group B.

**Table 4:** Comparison between mean values total WOMAC).measured pre- and post-treatment within the same group and between the two studied groups.

|                | Group A (n= 15) | Group B (n= 15) | p value |
|----------------|-----------------|-----------------|---------|
| <b>Pre</b>     | 51.33 ±14.08    | 52.4 ± 18.93    | 0.886   |
| <b>Post</b>    | 38.73 ±12.8     | 19.93 ±11.09    | 0.05**  |
| <b>p value</b> | 0.05**          | 0.05**          |         |

Data are expressed as mean ± SD.  $p > 0.05$  = not significant. \*\* $p < 0.01$  = highly significant.



**Fig. 3:** Comparison between mean values of total WOMAC).measured pre- and post-treatment within the same group and between the two studied groups.



## DISCUSSION

Osgood-Schlatter children have lower levels of fitness and strength than their healthy peers. The physical therapist, along with the sports therapy care team, can assist in preparing an individual to begin or progress to a physical activity program that enhances fitness level, body composition and overall well-being. so this study aimed to compare between the effects of SWT and IT on ROM, pain and physical activity parameter in children with Osgood-Schlatter. Comparing between mean values of pre-treatment results of pain and physical activity parameter in both groups revealed no significant differences but also showed significant increase in their values. Also, pre-treatment mean values of ROM parameters including in both groups showed non significant differences 326 but showed a significant decrease in their values in comparison to the normal values of the children in the same age group which indicated that they had also gait problems. Also, pre-treatment mean values of Western Ontario McMaster universities (WOMAC) index parameters including in both groups showed no significant differences but showed a significant increase in their values in comparison to the normal values of the children in the same age group which indicated that they had also.

ROM and physical activities impairments could be due to decreasing of the muscle strength, diminished proprioception and lack of coordination. This comes in agreement with Guskiewicz<sup>[16]</sup> who reported that, maintenance of postural balance includes a sensory process involving the articular mechanoreceptors, vestibular system and visual system. Sensorimotor information is then processed in the central nervous system.

Sensorimotor information is then processed in the central nervous system. Finally, there is a motor response involving various muscle groups, including those around the ankle, thigh, trunk and neck. A child with Osgood- Schlatter may experience impaired balance at both the sensory and motor levels. The position of the COG relative to the base of support may not be accurately sensed because of the destruction of the knee mechanoreceptors following injury.

Comparing between pre and post treatment mean values of the pain ,ROM and physical activities parameters in the both groups showed sig- significant improvement at the end of the treatment program. This improvement could be attributed to increasing in muscle strength and improve circulation. This is supported by Karimi et al.<sup>[17]</sup> who mentioned that an appropriate motor response for postural balance control requires an intact neuromuscular

system and sufficient muscle strength to return the center of mass within the base 360 of support when balance is disturbed. Our results came in agreement with several authors found that the conventional physical therapy was effective in increasing ROM. This finding related to stretching exercises which increased flexibility and also strengthening exercises which increase the muscles power Deyle et al., Sharma and Gupta<sup>[18]</sup> studied the effect of interferential current on bifida children. They mentioned that, improvement in ROM parameters could be due to increasing in muscle strength, although muscle strength was not specifically tested in this study, previous studies have shown that adult stroke patients showed significantly increased muscle performance. This effect on muscle strength is further confirmed by the fact that trained patients in previous studies usually experience a feeling of muscles fatigue after treatment, indicating that training on the interferential current not only acts as a passive guide for movements but also requires active involvement of the lower limb muscles. James D et al.<sup>[19]</sup> reported Electrical stimulation for pain relief has widespread clinical use, though the direct research evidence for the use of IFT in this role is limited. Logically one could use the higher frequencies (90-130Hz) to stimulate the pain gate mechanisms & thereby mask the pain symptoms. It remains possible that relief of pain may be achieved by blocking C fiber transmission at >50Hz. Although this mechanism has been. The improvement seen in the study group B may be due to ESWT is an effective modality to reduce pain. Pain relieve and improve circulation assist in improving ROM and functional activity of the child this results come in agreement with Ulrich et al.<sup>[20]</sup> and Dal et al.<sup>[21]</sup> who stated that, Moreover, strengthening of muscles could improve the shock absorption mechanism and help in stabilizing the joint. The preliminary results suggested that regeneration of articular cartilage defect might be promoted by SWT, due to the release of growth-inducing substances such as basic fibroblast growth factor, effective to reduce pain in patients suffering with Osgood-Schlatter disease knee. It clearly shows that in patients suffering with Osgood-Schlatter disease along with exercises and other interventions. ESWT consists of bursts of the same alternating high frequency current, interspersed with a cut off phase, during which heat can be dissipated in the tissues. ESWT uses electrical energy to direct a series of magnetic pulses through injured tissues .proposed (theoretically) with IFT but not have been categorically demonstrated Walker et al.,<sup>[22]</sup> Our results were disagree with Gundog et al.,<sup>[23]</sup> who stated that when analysis of variance (ANOVA) with repeated measures over time was used to compare the mean scores of each of the different groups such as active, placebo and control group of ESWT electromagnetic energy at pre treatment and post-treatment at 1 month and 3 months follow up there was no significant difference on the

baseline data. Pain reduction may be attributed to the effect of infrared which was used in a form of heat for pain relief and reduction of muscle spasm. In addition, it increases in sensory responses via an increase in endorphins; this could affect the pain gate mechanism Bobbert *et al.*<sup>[24-26]</sup>

## CONCLUSION

This study shows shock wave therapy is more effective than Interferential therapy to reduce pain and to improve functional abilities in knee Osgood- Schlatter disease.

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