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Research Article

Shock wave therapy versus Interferential therapy in the Management of Osgood-Schlatter disease with Knee Brace

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Abstract

Osgood-Schlatter disease is a well-known and sport-associated overuse injury of the tibial tuberosity apophysis. Long-lasting Osgood-Schlatter diseased-associated pain and a reduced ability to play sports can be the consequence. To investigate the therapeutic effect of extracorporeal shock wave therapy versus interferential therapy in controlling the pain in Osgood-Schlatter disease. 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. 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). 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 (Nowinski and Mehlman, 1998). 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 (Yashar et al., 1995). 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 (Vreju et al., 2010). 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 (Sinding- Larsen and Johansson syndrome at Who Named It?). Following an adolescent growth spurt, repeated stress from contraction of the quadriceps is transmitted through the patellar tendon to the immature tibial tuberosity (Kujala et al., 1985). 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 (Gholve et al., 2007). Activities such as kneeling may also irritate the tendon. Diagnosis is made clinically (Cassas and Cassettari-Wayhs, 2006). Treatment is conservative with RICE (Rest, Ice, Compression, and Elevation), and if required acetaminophen ,ibuprofen and/or Co-Codamol 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 (Bach et al., 2004) . 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 (Orhan et al., 2004). 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 (Hamiman et al., 2004). 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. 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 (Trock et al., 1993).

Interferential current therapy is the application of alternating medium frequency current (4,000 Hz) amplitude modulated at low frequency (0–250 Hz). This is presumed to improve the circulation, thus bringing about faster healing of the muscles (McCarthy et al., 2006). 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 (Johnson and Tabasam, 2003). 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 (Hurley et al., 2004).

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 lateral epicondylitis (22 males and 18 females) participated in this study. Subjects were suffering with knee pain due to Osgood-Schlatter disease that was radiologically 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 its 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 regimen 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 measured14.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 inn 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 was 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/mm2, energy level 2-4, pulse rate 160/min., 6Hz).

Results

The results of pre and post treatment values were compared with each group. The results revealed significant improvement in both groups. As revealed from table (1) and Fig. (1) was observed in mean values of pain measured in both groups at the end of treatment as compared with the responding mean values before treatment $p<0.05$. Also table 1 and figure 1 showed significant improvement in mean value group B at the end of treatment as compared with the responding mean values before treatment $p<0.05$.

As revealed from table (2) and fig. (2) was observed in mean values of knee ROM measured in group A at the end of treatment as compared with the responding mean values before treatment $p<0.05$. Also table 2 and figure 2 showed significant improvement in mean value of knee ROM measured in group B at the end of treatment as compared with the responding mean values before treatment $p<0.05$

As revealed from table (3) and Fig. (3) was observed in mean values of total WOMAC. Measured in group A at the end of treatment as compared with the responding mean values before treatment $p<0.05$ .Also table 3 and figure 3 showed significant improvement in mean value of total WOMAC measured in group B at the end of treatment as compared with the responding mean values before treatment $p<0.05$.

Discussion

The comparison of pre and post study scores of VAS and WOMAC in Group A are significant as the p-value < 0.05 in both (Table1). It clearly shows that ESWTis an effective modality to reduce pain in patients suffering with knee 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

Table 1. Pain sub score for both groups.

Measure	Group A	Group B	t-test	P value
Pain intensity				
Pre intervention	6.55 ± 1.79	6.73 ± 1.29 0	7.5	P < 0.05
Post intervention	3.57 ± 1.51	5.12 ± 1.41	4.2	P <0.05
ROm				
pre	116± 11.2	115±10.3		
post	127±14.2	136±7.2		
wokn				
Pre	51.2±14.2	52.2±12.2		
post	38.2±13.3	19.2±12.2		

p< 0.05= highly significant

Figure 1. Mean values of pain test in both groups (A and B).

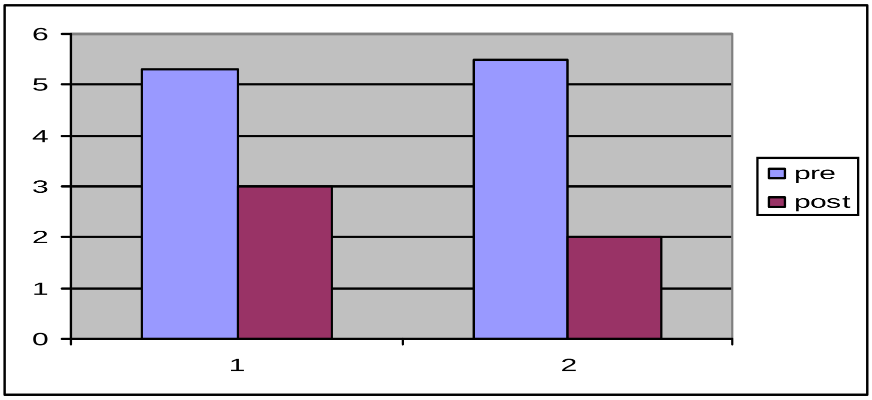


Table.2 Knee ROM

Measure	Group A	Group B	t-test	P value
Pre intervention	**116.53± 15.42**	**115.13±10.13**	**0.5**	**P > 0.05 NS**
Post intervention	**127.40± 14.59**	**136.60 ± 7.27**	**2.6**	**P < 0.05 S**

p< 0.05= highly significant

Figure 2. Mean values of knee ROM in both groups (A and B).

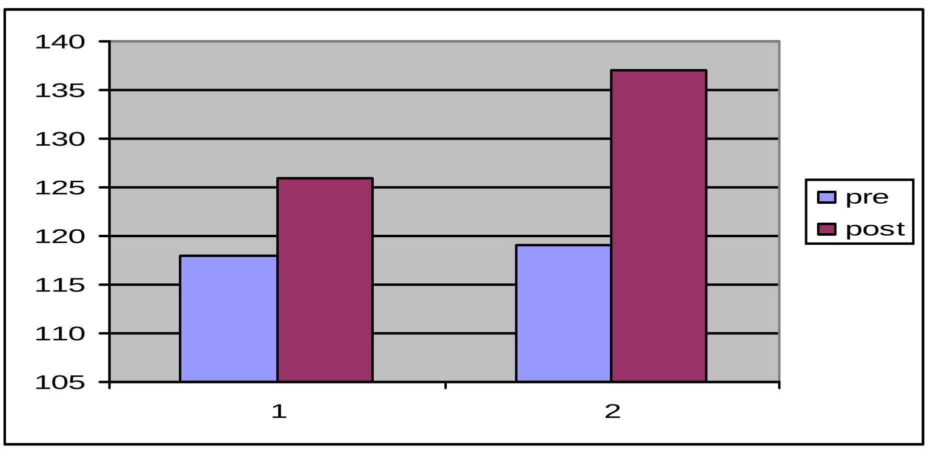
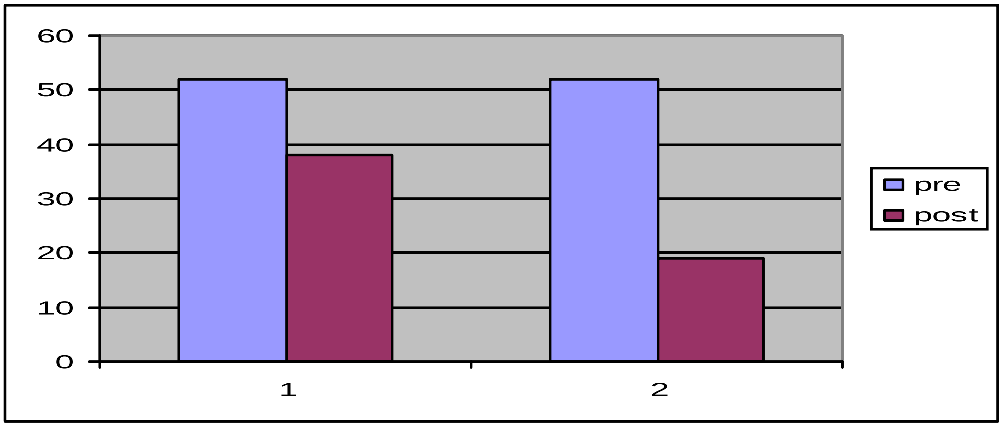


Table 3. Measurement of total WOMAC

Time of measurements	Group (A) Mean ±SD	Group (B) Mean ±SD	t-test	P-value
Pretreatment	51.33 (± 14.08)	52.4 (± 18.93)	0.03	P >0.05
Post treatment	38.73 (±12.8)	19.93 (±11.09)	18.47	P < 0.05

p< 0.05= highly significant.

Figure 3. Mean values of mean value total WOMAC): in both groups (A and B).



whereby each magnetic pulse induces a tiny electrical signal that stimulates cellular repair (McCarthy et al., 2006). Documented studies have also demonstrated the effectiveness of ESWT in healing soft-tissue wounds; suppressing inflammatory responses at the cell membrane level to alleviate pain and increasing range of motion. Johnson and Tabasam(2003)in their study had shown beneficial effects with ESWT electromagnetic energy in amelioration of symptoms, subjective improvement in functional ability and decrease in objective findings in small groups in patients with Osgood-Schlatter disease knee. Our results were supported by the work of (Hurley et al., 2004) who investigated the stimulative effect of SWT on the articular cartilage regeneration on 8 New Zealand rabbits which are randomly assigned ino two groups (A) and (B), group (A) was given active SWT while group (B) was given placebo ESWT. 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, ILGF-I and TGF-β1is effective to reduce pain in patients suffering with Osgood-Schlatter disease knee. 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 fibre transmission at >50Hz. Although this mechanism has been proposed (theoretically) with IFT but not have been categorically demonstrated (Walker et al., 2006). Effectiveness of IFT has been evidenced by Burch et al., (2008), they found that patients in their test group, who received IFT plus patterned muscle stimulation to treat OSGOOD-SCHLATTER DISEASE knee pain, reported greater reduction in pain. Seventy percent of the patients in the test group had 20% or more reduction in the WOMAC pain subscale, and the patient percentage was significantly higher than in the control group. After only 2 weeks of treatment, the test group already started to show this greater pain relief than the control group .They concluded that these significant results may in part be due to IFT stimulation(Burch et al., 2008).

Our results were disagree with Gundog et al., (2012) 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., 1986). Moreover, strengthening of muscles could improve the shock absorption mechanism and help in stabilizing the joint. Stretching the muscle was thought to restore blood flow to the muscle and interrupt the pain spasm pain cycle (Felson et al., 2000). 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., 2005).

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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