

**EFFECT OF SHOCK WAVE IN TREATMENT OF SCIATIC NEURALGIA****\*Gamal Salaheldin Elmorsy M.D. and Hend Sayed Abulsalam M.Sc**

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**ABSTRACT**

**Objective:** The purpose of this study was to detect the effect of shock wave in treatment of sciatic neuralgia. **Methods:** Thirty male and female patients suffering from sciatic neuralgia were assigned randomly into two equal groups. Study group (GA) (n=15) and control group (GB) (n=15). The patients in the study group (GA) received shock wave and therapeutic exercise, the patients in control group (GB) received therapeutic exercise only. Parameter of pain assessment through visual analogue scale and balance stability through biodex stability system were measured before and after four weeks of treatment for both groups. **Result:** showed that there was significant decrease in pain and significant improve in balance (over all stability index, medio-lateral stability and antro-post stability) in the study group. There was no significant improvement in pain and stability index in the control group. **Conclusion:** The shock wave was effective method in treatment of sciatic neuralgia.

**KEYWORD:** Sciatic neuralgia, Pain, Balance, Shockwave.**INTRODUCTION**

Sciatica, defined as sciatic neuralgia or lumbosacral radicular syndrome (LSRS), frequently diagnosed debilitating spine disorder with an estimated yearly incidence of 5–10 per 1,000 persons. Sciatica manifests itself as radiating dermatome pain regularly accompanied by diminished jerk reflexes, sensory and motor deficits. The most common cause is a herniated lumbar disc, sometimes combined with bony involvement, compressing an existing nerve root. Less often the radicular pain is caused by a diabetic neuritis, polyradiculoneuropathy, or tumor (Konstantinou and Dunn, 2008).

Many synonyms for sciatica appear in the literature, such as lumbosacral radicular syndrome, radiculopathy, nerve root pain, and nerve root entrapment. Lumbosacral radicular syndrome or sciatic neuralgia is a better description of the disease. For this study sciatica is defined as intense leg pain in an area served by one or more spinal nerve roots and is accompanied by neurological deficit (Koes et al., 2007).

The literal translation of the greek word sciatica "sciatica" is hip pain, which leaves room for dispute about today's use of the word 'sciatica' in scientific communications (Peul et al., 2008).

Sciatica can be considered a referred pain syndrome in which the pain is reported in the lower limb in the absence of any local disturbance. This condition is due to sciatic nerve compression, the most common cause being

herniated disk. Other causes that can be cited were degenerative spine disease, infections, traumatic posterior hip dislocation, congenital anomalies (Dosani et al., 2004).

The symptoms include low back pain, pain along the nerve, sensorial disturbances and weakness of the lower limb muscles innervated by the ischiatic nerve (Kobayashi et al., 2004).

Extracorporeal shockwave therapy (ESWT) has shown effectiveness in many orthopedic disorders including soft tissue tendinopathy and non-union of long bone fractures (Wang, 2003 and Wang, 2012).

Shock wave in orthopedics (orthotripsy) is not used to disintegrate tissues, rather to induce neovascularization, improve blood supply and tissue regeneration. The application of shock wave therapy in certain musculoskeletal disorders has been around for approximately 41 years (Wang, 2003).

The exact mechanism of shock wave therapy remains unknown. Based on the results of animal studies in the laboratory, it appears that the mechanism of shock waves first stimulates the early expression of angiogenesis-related growth factors including endothelial nitric oxide synthases' (ENOS), vessel endothelial growth factor (VEGF) and proliferating cell nuclear antigen (PCNA), then induces the ingrowth of neovascularization that improves blood supply and increases cell proliferation

and eventual tissue regeneration to repair tendon or bone tissues (Wang, 2003).

**Statement of the problem:** Is there is a significant effect of shockwave effective on the treatment of sciatic neuralgia.

#### Purpose of the study

This study was designed to determine the effect of shock wave in the treatment of sciatic neuralgia.

**Significance of the study:** Sciatica is associated with significant short- and sometimes long-term morbidity. This affection, certainly in the industrialized countries, ranks as one of the most costly medical problems (Dagenais *et al.*, 2008).

Extracorporeal shockwave therapy (ESWT) has shown effectiveness in many orthopedic disorders including soft tissue tendinopathy and non-union of long bone fractures. In addition, many studies reported positive effects of ESWT in arthritic joints in animals (Wang, 2012).

For physiotherapy, it is evidence based and new trial for using new instrument in the treatment of sciatic neuralgia.

For patient, it is a trial to improve the patient care and try to improve his quality of life and decrease his disability.

For community, it is a trial to resolve one of the most common problems which affect the most of countries and improve the general public health that will improve their productivity.

The study aim to help the physiotherapist and the community to improve the medical service for the patient and to improve the patient life, making him more effective and independent.

#### This study was delimited to

1. Thirty patients with sciatic neuralgia due to disc bulge, their ages ranging from 30-50years.
2. Duration of pain more than six months.
3. The Patients were medically fit to participate in the study.
4. Assessment procedure: pain provocation tests (tests for sciatica) for initial assessment, visual analogue scale and biodex stability system for pre and post treatment.
5. Treatment procedures: study group (GA): shock wave and the program of therapeutic exercise, control group (GB): the same program of therapeutic Exercise only.

#### Limitations

##### This study was limited by following factor

1. Individual difference in patient and their influences on treatment degree achievement and the rate of recovery.

2. Co-operation of the patient during conducting the study.
3. Differences in gender can influence on the treatment degree achievement as the female are most exposure to be affected due to pregnancy and laxity of the ligament.

#### Basic assumptions

It was assumed that

- All patients would exert maximum effort during the procedure.
- All patients would follow the researcher instructions

#### Null Hypotheses

It was hypothesized that

- There was no significant effect in application of shock wave on the patient with sciatic neuralgia.

#### Definitions of terms

**Over all stability index:** represent the patient ability to control balance in all directions. High values represent patient had difficulty to control and maintain the balance.

**Anterior/posterior Index:** represent the patient ability to control balance in front to back directions. High values represent the patients had difficulty to control and maintain the balance.

**Medial/Lateral Index:** represent the patient ability to control balance from side to side. High values represent patient had difficulty to control and maintain balance.

#### SUBJECTS AND METHODS

This study was conducted during period from 1-10-2015 to 1-8-2016 for successive ten months to investigate the effect of shockwave in treatment of sciatic neuralgia. The study was done in out-patient clinic, Ahmed Maher Teaching Hospital and Biodex Lab, Faculty of physical therapy, Cairo University.

#### I-Subjects

**Selection:** Thirty patients from both sex with sciatic neuralgia had been selected.

The patients were assigned into two equal groups. Study group (Group A) fifteen patients (male and female) had received shockwave and program of therapeutic exercise and control group (group B) fifteen patients (male and female) had received the same program of therapeutic exercise program only.

#### Inclusion Criteria

The patients had been selected according to the following criteria

- Thirty patients with sciatic neuralgia due to disc bulge (second degree), their ages ranged from 30-50years.
- The Patients were diagnosed by neurologist as sciatic neuralgia based on careful clinical assessment

and radiological investigations including X-ray and/or magnetic resonance imaging (MRI).

- Duration of illness more than six months.
- Patients had unilateral leg pain greater than low back pain.
- Numbness and paraesthesia in the same distribution.
- Straight leg raising test (Lasègue's test), (Fajersztajn's test) and Bechterew test positive in all patients.
- All the patients were medically and psychologically stable.

### Exclusion Criteria

The patients had been excluded if they had any of the following criteria

- Perceptual, cognitive or psychiatric disorders.
- Uncooperative patients.
- Patients with phobia from shock wave.
- Patients with fixed contractures in lower limbs.
- Patients with bilateral sciatic pain.

## II-Instrumentation

### A. Assessment instrumentation

- **Biodex stability system (BSS):** Biodex stability system had been used for objective assessment of balance.
- **Biodex Stability System manufacture by** Life medical company, biodex 945-312, code21.

The Biodex Stability System consists of the following,  
**Support rails:** adjustable from 25 inch to 36.5 inch above platform.

**Platform:** Its height is 8 inch above floor, with a diameter of 21.5 inch. The platform could be tilted up to 20 degree from horizontal in all directions.

The BSS had 8 stability level. These levels indicate the stiffness of the platform. Stability level 1 represents the least stable platform and stability level 8 the greatest platform stability.

**Display:** Its height could be adjusted from 51 inch to 68 inch above the platform.

**Display angle:** adjustable from vertical back up to 45 degree. Display view area: 122mm x 92mm.

**Printer:** Bubble-Jet printer, 80 column, centronics parallel interface.



(Figure.14) Biodex Balance System (Faculty of physical therapy, Cairo University).

### B) Treatment instrumentation

#### Shock wave therapy: (Chattanooga)

**Chattanooga Intellect**, line of radial pressure wave units (RPW), (230V), brand of DJO global, USA.

#### The device consists of

- Full color LCD touch-screen interface.
- Convenient storage platform for secure and easy access of hand pieces and gel.
- 360° swivel rotation of interface.
- Compressed Air Output: 1.4 - 5 bars.
- Mode: single shock / continuous shock 0.5-21Hz.

#### Technical Specifications

Main Power: 230 V ~ 50 Hz (Model 2074).

Weight: 33 kg.

Dimensions: 41 x 42 x 114 cm.

Electrical Safety Class: Class 1, Type B.

**Standard accessories included:** D-ACTOR hand piece applicator and accessory kit with the following: Projectile, R15 15mm EWST transmitter and D20-S D-ACTOR 20mm transmitter, cleaning brush, Conductor transmission gel (19oz Bottle).



(Figure.15) Shock wave therapy (Ahmed Maher Teaching Hospital).

### III-PROCEDURES

The study was conducted in out-patient clinic at Ahmed Maher Teaching Hospital. The patients were informed about the physical therapy program.

The patients were assigned into two equal groups (A) and (B) using randomized one by one to each group. All testing sessions were conducted at the same time of the day. All patients signed a written consent before receiving their treatment program and they informed about the method of treatment in details. The patients were asked to wear comfortable clothes, avoid anxiety and emotional stress as much as possible.

**A. Assessment procedures:** The patients were assessed pre and post eight sessions of treatment (Two sessions per week) by.

#### 1-Biodex stability system

##### General Clinical Considerations

- All patients should have a verbal understanding of the Balance System prior to stepping on the device.
- To ensure patient safety, begin each session with the balance platform in the "locked" or Adjust support rail and biofeedback display for patient comfort and safety position.
- Patients should progress from "hands-on" to "hands-off" the support handle. This would ensure that new or unstable patients have an adequate understanding of the Balance System and would help protect the patient against sudden or unexpected movement of the platform.
- Position the display so that the patient can look straight at it. This would help ensure good posture during the test or exercise session.
- There is a learning curve that must be considered when testing with this device. Clinical research suggests three trials would be done prior to testing.
- The patient was asked to stand up straight at the appointed place on the platform and try to keep his/herself as stable as possible during the following conditions
- Unilateral stand on the sound side 20 sec.
- Unilateral stand on the affected side for 20 sec.
- The unilateral stand enhances the observational testing of single leg stance performed by providing an objective measure for the comparing between both sides.

##### The following steps were done

- The examiner pressed (start) to release platform lock and began centering the patient.
- The patients were instructed to achieve a centered position on a slightly unstable platform.
- The platform X coordinate was marked in numbers, where as the platform Y coordinate was marked in letter, the platform was also marked in degree angles from 0 to 45. The patient's heel coordinates would be measured from center of the back of the heel, while foot angle would be determined by finding a

parallel line on the platform to the center line of the foot.

- The examiner press next screen to record patient heel position and foot angles, after introducing feet angles and heel coordinates into the BSS the test was began.
- As the platform advance to unstable state, the patient was instructed to focus on the visually feedback screen directly in the front of patient while standing single limb with both arms at the side of the body without grasping hand rails and attempted to maintain the cursor in the middle of the bull.
- The stability level is 8.
- At the end of each test the data was taken manually from the screen then start the same process for the other leg.
- The variables were (overall Stability index, Antro-posterior stability index, Medio-lateral stability index) for affected and non affected side (both groups), measured before and after treatment.



**(Figure.16) Application of biodex balance system (dynamic stability test). Faculty of physical therapy, Cairo University.**

**2-Visual analogue scale:** The patients were asked to place a mark on the line corresponding to intensity of pain. The distance along the line from the "no pain" marker was then measured with a ruler giving a pain score out of 10.



**(Figure.17) Visual analogue scale.**

#### **(B)Treatment procedures**

##### **Group A (study group) treatment**

The patients had received the shock wave and program of therapeutic exercise. For shock wave the patient lie in a prone lying position, Common ultrasound gel was used



as a contact medium between the applicator and the skin. 2000 impulse, energy level 3-5 bar progressively increase between sessions according to patient tolerance to decrease the patient discomfort during session, ice application after session to decrease the pain after session, frequency 12HZ, energy flux density 0.38 mJ/mm<sup>2</sup> delivered by the head R 15,15mm, radial spreading, were administrated along the sciatic nerve distribution and therapeutic exercise two times per week for successive four weeks.



(Figure.18) Application of shockwave at Ahmed Maher Teaching Hospital.

#### B-Group B (control group) treatment

The patients had received therapeutic exercise only two times per week for successive four weeks. The program consists of following exercise:

#### 1-Specific Exercises for Low Back Strength

A) **Partial Sit-ups.** Partial sit-ups or crunches strengthen the abdominal muscles.

- The patient Keep the knees bent and the lower back flat on the floor while raising the shoulders up 3 - 6 inches.
- Exhale on the way up, and inhale on the way down.
- Perform this exercise slowly 8 - 10 times with the arms across the chest.



(Figure.19) Partial sit up exercise.

B) **Pelvic tilt.** The pelvic tilt alleviates tight or fatigued lower back muscles.

- The patient Lie on the back with knees bent and feet flat on the floor.
- Tighten buttocks and abdomen.
- Press lower back to the floor, hold for one second, and then relax.



(Figure.20) Pelvic tilt exercise.

#### 2- Stretching lower-back muscles.

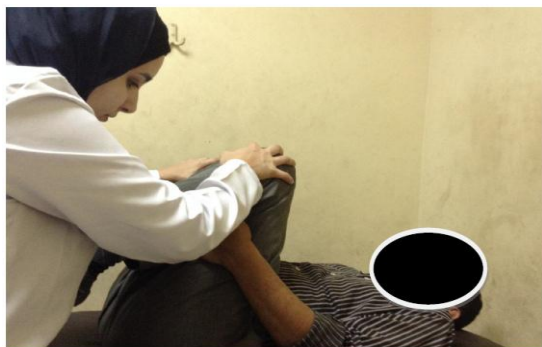
The following were three exercises for stretching the lower back:

A) The patient Lie on the back with knees bent and legs together. Keeping arms at the side roll knees over to one side until totally relaxed. Hold this position for about 20 seconds (while breathing evenly) and then repeat on the other side.



(Figure.21) Stretching exercise for lower back.

B) The patient lie on his back, hold both knee and pull it gently toward chest. Hold for 20 seconds.



(Figure.22) Stretching exercise for lower back.

The purpose of this study was to investigate the effect of shockwave in treatment of sciatic neuralgia. The patients were assigned in two groups: Study group(Group A) and Control group(Group B). Both Groups were treated for sciatic neuralgia due to disc bulge.

In this chapter, results of the study were represented as follows

1. Patients characteristics
2. Biodex results (Affected side) for both groups.
3. Biodex results (non affected side) for both groups.
4. Biodex results

-Comparison between the two groups for pre-treatment and post-treatment (Affected side).

-Comparison between the two groups for pre-treatment and post- treatment (non affected side).

Table (1): The mean value of age and duration of illness between groups (study & control)

Variable	Control	Study	t	P- value
	Mean ±SD	Mean ±SD		
Age (year)	38.40±4.10	39.60 ±4.39	1.259	0.275
Duration (Month)	7.32 ±3.04	7.59 ±2.30	1.371	0.395

\*Significant Level (P < 0.05)

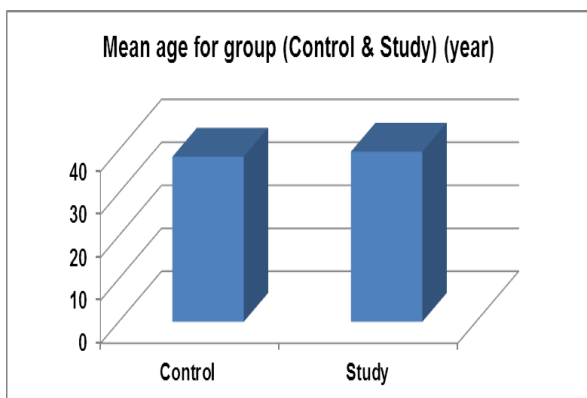


Figure. 23 mean of age for study and control group (years).

### 5. Visual Analogue Scale

Group (A)

Group (B)

Comparison between the two groups for pre-treatment and post-treatment

#### 1. Characteristics of patient

Thirty patients from both genders participated in the study. The patients were diagnosed as sciatic neuralgia due to disc bulge. The patients were assigned randomly into two equal groups. The patients age ranged from (30-50 years) with mean age of group A (GA) 39.60 ±4.39 years and group B (GB) 38.40±4.10 years. The duration of illness of both group more than six months with the mean duration of illness for study group A (GA) 7.59 ±2.30 months and for control group B (GB) 7.32 ±3.04 months. The mean of weight (kg) in study group was (76.45 ±3.85kg) and in control group was (75.59 ±8.09kg). Mean of height (cm) in study group was (165.18 ±12.54cm) and in control group was (168.70 ±12.05cm). The statistical analysis by independent t-test revealed that there was no significant difference (P>0.05) in mean of weight (P=0.698) and height (P=0.527) values between study group and control group.

There was no significant difference between both groups concerning the age and duration of illness.

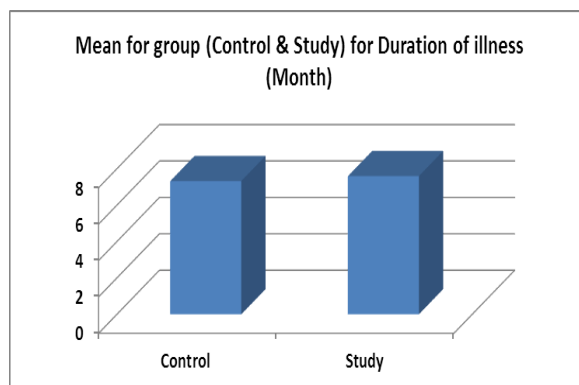
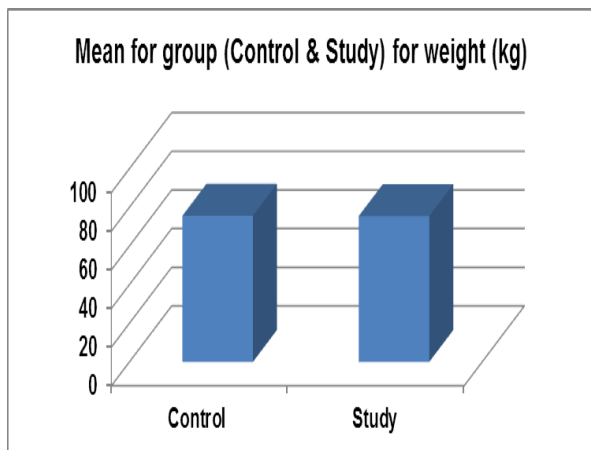


Figure. 24 The mean of duration of illness for study and control group (months).

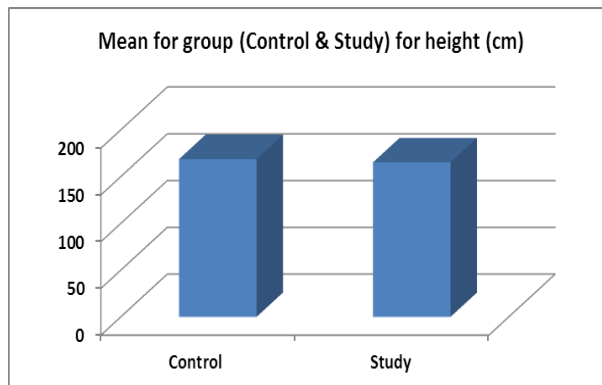
**Table (2): Mean values of patient’s weight and height between study group and control group.**

Items	Weight (kg)	Height (cm)
<b>Study group</b>	76.45±3.85	165.18 ±12.54
<b>Control group</b>	75.59 ±8.09	168.70 ±12.05
<b>t-value</b>	0.915	0.898
<b>P-value</b>	0.698	0.527
<b>P&lt;0.05</b>	NS	NS

NS non significant.



**Figure (25): The mean values of weight between study group and control group.**



**Figure (26): The mean value of height between study and control group.**

**Biodex results for balance (Affected side)**

**1. Group (A): Study group**

As shown in table (3) and figure (27). P- Value revealed that there was high significant difference in **Biodex results (Stability Index)** between pre- treatment and post- treatment evaluation. The pre- treatment median for the **affected side** was 3.70 and decreased significantly post-treatment to 2.30 with associated probability  $p < 0.05$ .

The pre treatment median for **antro-posterior stability index** was decrease significantly from 3.40 to 2.10 with P value<0 .05.

The pre- treatment median for **medio-lateral** stability was decrease significantly from 5.60 to 3.10 with P value< 0.05. There was significant improvement during standing in the affected side in overall stability index, Antro/posterior stability index and medio/lateral stability index.

**Table (3) The median value (Pre & Post) for study group (affected side).**

Variable	Study				Z	P- value
	Pre		Post			
	Median	IQR	Median	IQR		
st.aff	3.70	2.20	2.30	1.40	-3.409	0.001*
st_ap.aff	3.40	2.50	2.10	0.90	-3.413	0.001*
st_ml.aff	5.60	2.60	3.10	1.30	-3.419	0.001*
Aff Affected	ML medio-lateral					
St Stability - Index	AP Antro-Posterior					
* Significant Level (P < 0.05)	IQR: (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> )					
Median: (Megeare center "Avarge")	Z:					

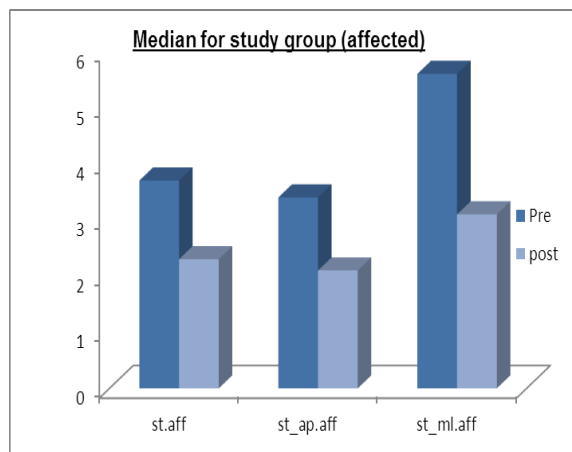


Figure (27) Median of difference variable of balance for study group affected side.

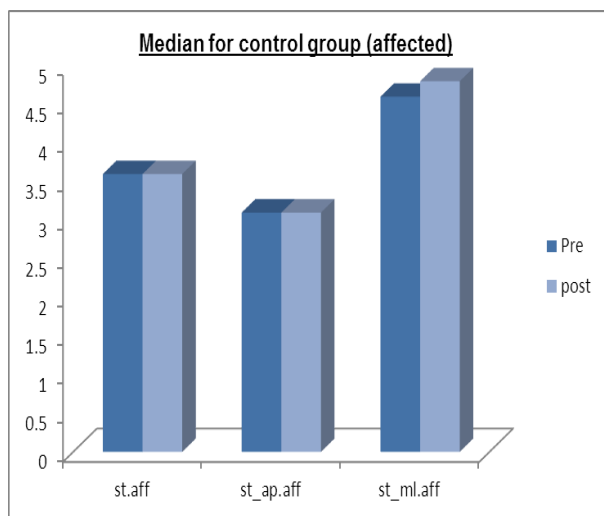
**Group (B) (control group): Affected side**

As shown in table (4) and figure (28). P-value revealed there was no significant difference in **biodes results (Stability Index)** between pre- treatment and post-treatment evaluation with P-value 0.382.

The **AP stability Index** had shown no significant difference post treatment with P value 0.169. The **ML Stability Index** had shown no significant difference pre and post treatment with p value 0.115.

Table (4) The median value of balance between (Pre & Post) treatment for control affected side.

Variable	Control group				Z	P- value	
	Pre treatment		Post treatment				
	Median	IQR	Median	IQR			
st.aff	3.60	1.70	3.60	1.60	-0.874	0.382	
st_ap.aff	3.10	1.10	3.10	0.70	-1.377	0.169	
st_ml.aff	4.60	2.40	4.80	2.40	-0.865	0.387	
ST Stability Index Aff Affected	AP Antro-Posterior ML Medio-Lateral						
* Significant Level (P < 0.05)	<b>IQR:</b> (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> ")						
<b>Median:</b> (Megeare center "Avarge")	<b>Z:</b>						



(Figure. 28) Median of balance for control group (affected side).

**Biodex Results (non-affected side)**

**Group (A) Study Group**

As shown in table (5) and figure (29). There was significant difference in **Stability Index** between pre and post evaluation. The pre treatment median value was 3.60 with significantly decrease to 2.10 with P- Value 0.002.

There was significant difference in **antro-posterior Stability Index** between pre and post treatment. The pre-treatment median Value was 2.90 with significant decrease to 2.00 post treatment, P-value was 0.046.

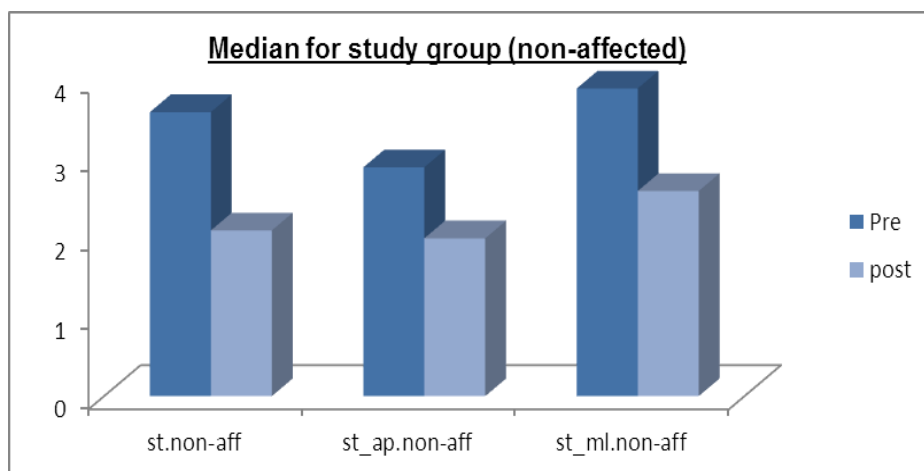
There was significant difference in **ML Stability index** between pre and post treatment. The pre treatment median was 3.90 with significant decrease to 2.60 post treatment.

Table (5) Median value of balance between (Pre & Post) treatment for study group (non- affected side).

Variable	Study				Z	P- value	
	Pre		Post				
	Median	IQR	Median	IQR			
st.non-aff	3.60	1.10	2.10	1.20	-3.069	0.002*	
st_ap.non-aff	2.90	1.60	2.00	0.50	-1.994	0.046*	
st_ml.non-aff	3.90	1.70	2.60	1.50	-2.041	0.041*	
ST stability index AP Antro-posterior	Non Aff non-Affected ML Medio-lateral						
* Significant Level (P < 0.05)	<b>IQR:</b> (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> ")						
<b>Median:</b> (Megeare center "Avarge")	<b>Z:</b>						



P- Value 0.041.



(Figure.29) median of balance variables for study group (non affected side).

**Group (B) Control Group (non affected)**

As shown in table (6) and figure (30). There was no significant difference in **Biodex stability Index** in pre and post treatment evaluation. The median Value in pre treatment was 4.10 with no significant decrease to 3.90. P- Value 0.382.

The **Antro- posterior stability Index** had shown no significant difference in pre and post treatment

evaluation. The median in pre treatment was 1.70 with no significant increase to 1.80. P- Value was 0.204.

The **ML stability Index** had shown no significant difference in pre and post treatment evaluation. The median in pre treatment was 3.90 with no significant increase to 3.90. P Value was 0.107.

**Table (6) Median of balance (Pre & Post) treatment for control group (non- affected side)**

Variable	Control group				Z	P- value
	Pre treatment		Post treatment			
	Median	IQR	Median	IQR		
st.non-aff	4.10	1.90	3.90	1.60	-1.256	0.209
st_ap.non-aff	1.70	2.40	1.80	2.60	-1.269	0.204
st_ml.non-aff	3.90	0.60	3.90	0.60	-1.613	0.107
<b>ST</b> Stability index					<b>Non Aff</b> non-Affected	
<b>AP</b> Antro-posterior					<b>ML</b> Medio-lateral	
* Significant Level (P < 0.05)				<b>IQR:</b> (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> ")		
<b>Median:</b> (Megeare center "Avarge")				<b>Z:</b>		

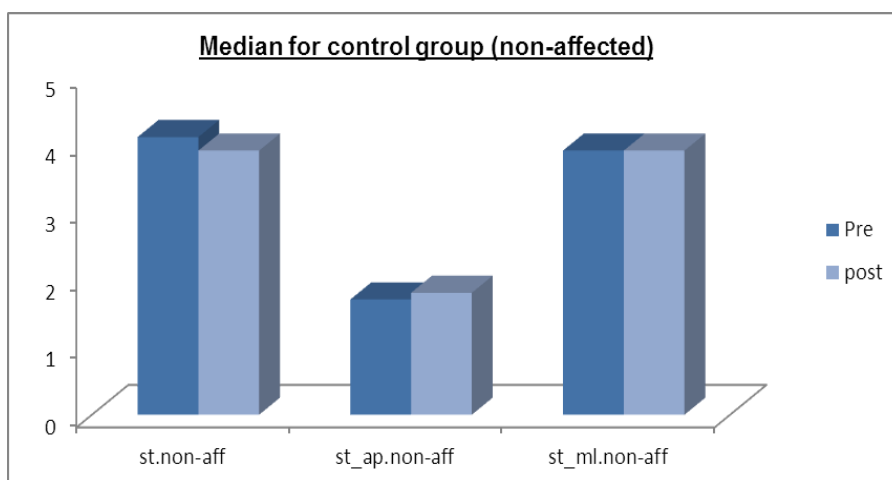


Figure.30 median of balance for control group (non affected side).

**Biodex Stability Results**

**Comparison between study and control group (Affected side)**

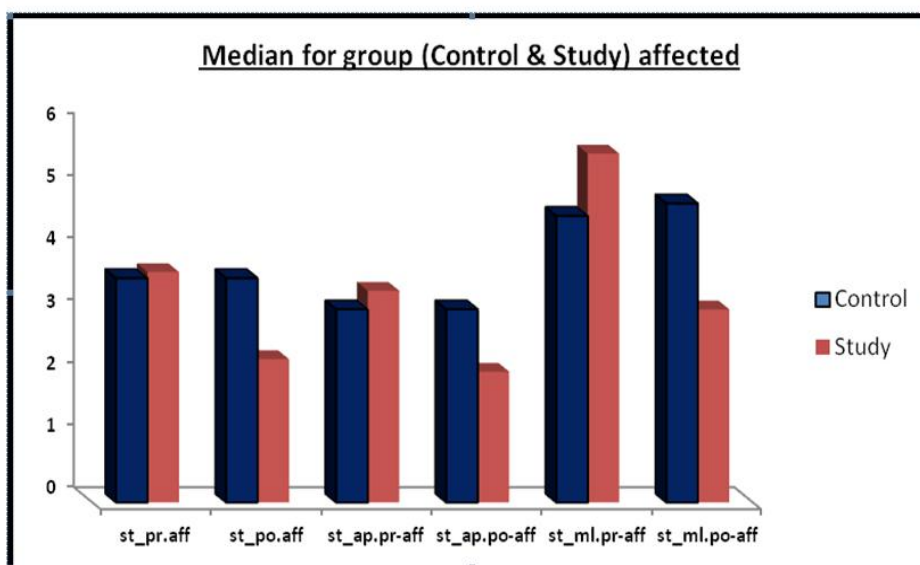
Table (7) and figure (31) illustrated the differences between both groups. Results revealed that there was no significant difference between both groups in pre treatment evaluation, in either affected or non affected side.

In post treatment evaluation, there was significant difference in stability index in the study group with P value 0.002(p<0.01). There was also significant difference in Antro-posterior stability index with P value 0.004(p<0.01).

The medio- lateral stability index of the study group had shown significant difference with P value 0.005(p<0.01).

**Table (7) The median of balance between groups (study & control) for affected side.**

Variable	Control		Study		Z	P- value
	Median	IQR	Median	IQR		
st_pr.aff	3.60	1.70	3.70	2.20	-0.957	0.339
st_po.aff	3.60	1.60	2.30	1.40	-3.095	0.002**
st_ap.pr-aff	3.10	1.10	3.40	2.50	-1.372	0.17
st_ap.po-aff	3.10	0.70	2.10	0.90	-2.874	0.004**
st_ml.pr-aff	4.60	2.40	5.60	2.60	-0.125	0.901
st_ml.po-aff	4.80	2.40	3.10	1.30	-2.807	0.005**
** Significant Level (P < 0.01)			Po Post-treatment			
* Significant Level (P < 0.05)			ML Medio-lateral			
PR Pre-treatment			AP Antro-posterior			
<b>Median:</b> (Megeare center "Avarge")			<b>IQR:</b> (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> ")			
<b>Z</b>			<b>AFF</b> affected side			



**Figure. 31 The median of balance variables between study and control group (affected side).**

**Comparison between study and control group (Non affected side)**

Table (8) and figure (32) illustrated the differences between both groups. Results revealed that there was no significant difference between both groups in pre treatment evaluation, in either affected or non affected side.

In post treatment evaluation, there was significant difference in stability index between groups. There was also significant difference in medio-lateral stability index.

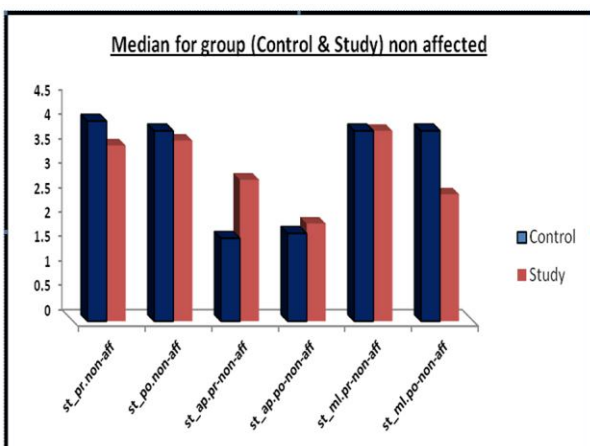
The antro-posterior stability index had shown no significant difference between groups.

**Table (8) The median of balance between groups (study & control) for non affected side.**

Variable	Control		Study		Z	P- value
	Median	IQR	Median	IQR		
st_pr.non-aff	4.10	1.90	3.60	1.10	-1.497	0.134
st_po.non-aff	3.90	1.60	3.70	1.20	-2.02	0.043*
st_ap.pr-non-aff	1.70	2.40	2.90	1.60	-0.252	0.801
st_ap.po-non-aff	1.80	2.60	2.00	0.50	-0.187	0.851
st_ml.pr-non-aff	3.90	0.60	3.90	1.70	-0.638	0.524
st_ml.po-non-aff	3.90	0.60	2.60	1.50	-3.21	0.001**

\*\* Significant Level (P < 0.01)  
 \* Significant Level (P < 0.05)  
 PR Pre-treatment  
 Median: (Megeare center "Avarge")  
 Non Aff non-affected

Po Post-treatment  
 ML Medio-lateral  
 AP Antro-posterior  
 IQR: (Measure for variation "Q<sub>3</sub> - Q<sub>1</sub>")



**Figure. 32 Median of balance for study and control group (non affected side).**

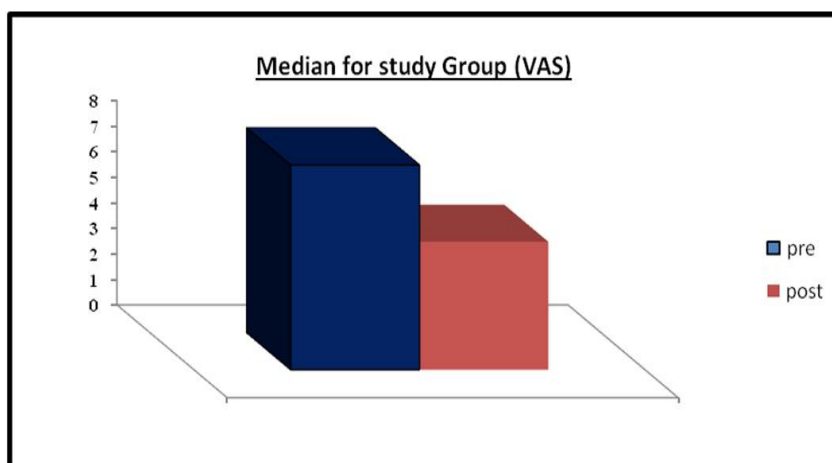
**Visual Analogue Scale (VAS)**

**Study group (Group A):** As represented in table (9) and figure (33). There was significant reduction in the median in pre and post treatment evaluation from 8.00 to 5.00 with P Value 0.01.

**Table (9) the median value of pain intensity between (Pre & Post) for study group (VAS).**

Variable	Study				Z	P- value
	Pre		Post			
	Median	IQR	Median	IQR		
	8.00	2.00	5.00	2.00	-3.431	0.001*

IQR: (Measure for variation "Q<sub>3</sub> - Q<sub>1</sub>")  
 Significant Level (P < 0.05)  
 Median: (Megeare center "Avarge")



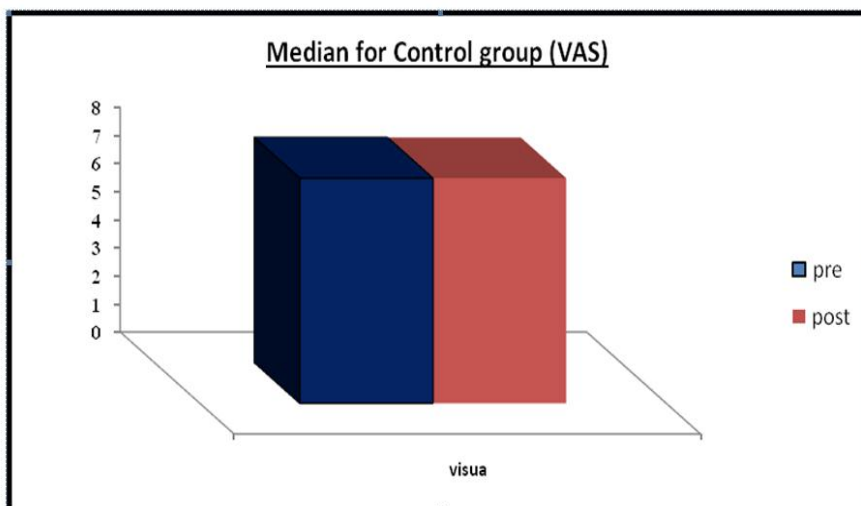
**Figure.33 median for study group (VAS).**

**Control Group (Group B)**

As represented in table (10) and figure (34). There was no significant differences in the median in pre and post treatment evaluation.

**Table (10) Test for the difference between (Pre & Post) for control group VAS.**

Variable	Control				Z	P- value
	Pre		Post			
	Median	IQR	Median	IQR		
VAS	8.00	1.00	8.00	1.00	-1.000	0.317
IQR: (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> Significant Level (P < 0.05))				Median: (Megeare center "Avarge")		



**Figure. 34 the median of pain intensity for control group VAS.**

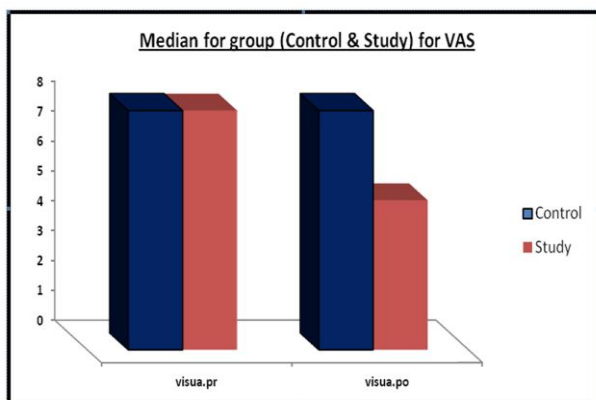
**Comparison between study and control group**

As shown in table (11) and figure (35), there was no significant difference between both study and control group in pre treatment evaluation.

There was significant difference in the study group in post treatment evaluation with P- value 0.001.

**Table (11) the median of pain intensity between study & control group for VAS.**

Variable	Control		Study		Z	P- value
	Median	IQR	Median	IQR		
visua.pr	8.00	1.00	8.00	2.00	-0.79	0.43
visua.po	8.00	1.00	5.00	2.00	-4.31	0.001**
IQR: (Measure for variation "Q <sub>3</sub> - Q <sub>1</sub> Significant Level (P < 0.05))				Median: (Megeare center "Avarge")		



**Figure. 35 the median of pain intensity for study and control group (VAS).**

**SUMMARY OF RESULTS**

The all measured data for pain intensity and balance were non parametric measure so non parametric measures and tests were used (Median and Inter quartile range (IQR), Wilcoxon test inside the group and Mannwhitney test between the groups for paired and unpaired test.

For the study group there was a significant improvement in the median value of balance variables (over all stability index, antro-posterior stability index, medio-lateral stability index) **on affected and non affected side.**



For control group, there was no significant improvement in median value of balance variables (over all stability index, medio-lateral stability index, antro-posterior stability index) **on affected and non affected side.**

In comparison between both groups for balance, there was a significant improvement in the median value of balance variables for study group (over all stability index, antro-posterior stability index, medio-lateral stability index) **on the affected side.**

There was a significant improvement in the median value of balance variables for study group (overall stability index, medio-lateral stability index) for **non affected side** but there was no significant improvement in antro-posterior stability index.

In comparison between study and control group for pain intensity. There was a significant improvement in the median value for pain intensity in the study group.

## DISCUSSION

The sciatic neuralgia is considered one of the most common problems which affect the most populations; Sciatica manifests itself as radiating pain regularly accompanied by diminished jerk reflexes, sensory and motor deficits. The most common cause is a herniated lumbar disc. Shock wave has been reported to be effective in the treatment of patient with pain and inflammation. The current study aimed to assess the effect of shock wave in balance and pain in patient with sciatic neuralgia.

Thirty patients from both genders (8 males and 22 female) were diagnosed as sciatic neuralgia by neurologist. They aged from 30-50 years, were assigned randomly into treatment group. Patients in the study group (GA) (15 patients) were treated by shock wave and program of therapeutic exercise. While the patients in the control group (GB) (15 patients) received the same program of therapeutic exercise. The pain and balance of both groups were assessed (before and after treatment) for pain severity by visual analogue scale and for balance stability by the Biodex stability system (stability index, overall, A/P, M/L) for affected side and non affected side.

In this study, there were no statistical significant differences between two groups in pre-treatment evaluation; this indicates that the patients in the two groups were homogenous.

The results of present study revealed that the pain intensity for study group (GA); there was significant decrease in pain intensity in the study group with P Value 0.001. This could be attributed to the effect of shockwave in pain reduction. This comes in close agreement with **Sangyong, (2014)** who studied the effectiveness of shock wave in patient with low back pain, the pain was reduced following shockwave after

eight sessions in the form of 2,000 (7 times per sec) shockwave impulses (5 Hz) at an energy flux density of 0.10 mJ/mm<sup>2</sup> were delivered using a 17-mm head.

The rationale for the use extra corporal shockwave for osteoarthritis is based on stimulation of soft tissue healing by local hyperemia, neovascularization, inhibition of pain receptors and/or denervation to achieve pain relief and persistent healing of chronic inflammatory processes (**Maier, et al., 2002**).

Shock wave therapy had been demonstrated to be effective in managing pain due to musculoskeletal disorders. However, the analgesic mechanisms of extra corporal shock wave are unclear. Various hypotheses have been proposed. Some suggest that shock waves destroy nerve endings. It has also been suggested that ESWT causes nociceptors to emit nerve impulses at high frequencies during nerve transmission, which prevents pain transmission according to the gate control theory. Another hypothesis is that the chemical medium surrounding the nociceptor is changed and disturbs pain transmission (**Haist and Von, 1996**).

The present study was in consistent with **DiGiovanni et al., (2006)** who studied the effect of extra corporal shock wave for patients with planter faciitis and reported positive treatment effects in decreasing pain and improving function with success ranging from 50 to 90% with a low recurrence rate of five to seven%.

The study by **Caminoto et al, (2005)** evaluated the effects of ESWT on extra-cellular matrix components of affected ligaments in the hind limbs of horses, using ultrasonographic, ultra-structural and immunocytochemical techniques. Compared with the untreated controls, ESWT-treated tissue had smaller, newly formed collagen fibrils and a greater expression of Transforming Growth Factor beta, 4 weeks after treatment. These results have indicated that ESWT appears to facilitate the healing process. Moreover, TGF- $\beta$ 1 has been reported to act as a potent inhibitor of macrophages-induced extracellular matrix degradation and inflammation during the healing of a wound.

The results of the present study were in consistent with **Ching et al., (2006)** who studied the long-term results of Extracorporeal Shockwave treatment for Plantar Fasciitis. A randomized controlled clinical trial in which the patients received 1500 impulses of shockwaves at 16 kV to the affected heel in a single session. Patients in the control group received conservative treatment consisting of nonsteroidal anti-inflammatory drugs, after treatment, the shockwave group showed significantly better pain and function scores as compared with the control group. The overall results were 69.1% excellent, 13.6% good, 6.2% fair and 11.1% poor for the shockwave group; and 0% excellent, 55% good, 36% fair, and 9% poor for the control group. The recurrence rate was 11% (9/81 heels)

for the shockwave group versus 55% (43/78 heels) for the control group.

The results of the present study were in consistent with **Ching et al., (2007)** who studied the effectiveness of Extracorporeal Shockwave for patients with Chronic Patellar tendinopathy. The study consisted of 27 patients (30 knees) in the study group and 23 patients (24 knees) in the control group. In the study group, patients were treated with 1500 impulses of extracorporeal shockwave at 14 KV (equivalent to 0.18 mJ/mm<sup>2</sup> energy flux density) to the affected knee at a single session. Patients in the control group were treated with conservative treatments including nonsteroidal anti-inflammatory drugs, physiotherapy, exercise program and the use of a knee strap. At the 2- to 3-year follow-up, the overall results for the study group were 43% excellent, 47% good, 10% fair and none poor. For the control group, the results were none excellent, 50% good, 25% fair and 25% poor. The study concluded that extracorporeal shockwave therapy appeared to be more effective and safer than traditional conservative treatments in the management of patients with chronic patellar tendinopathy.

The results of present study were in consistent with **Shih et al., (2015)** who studied the effect of extracorporeal shock wave ESWT for the patients with coccydynia. A randomized controlled trial in which the patient treated by extra corporeal shock wave. The patients received 2000 shots of ESWT in the coccyx area per session for four sessions (one session a week for 4 consecutive weeks). The frequency used was 5 Hz and the pressure was 3–4 bars.

This study concluded that ESWT appeared to be useful in relieving the pain of coccydynia and more effective in reducing pain syndromes than the use of physical modalities. ESWT was recommended as an alternative method for treating patients with coccydynia.

The studies by **Jin et al., (2014)**, A meta analysis study, which study the effect of extra corporeal shockwave on spasticity in patients after brain injury. This meta-analysis was done to assess the effects of extracorporeal shock wave therapy (ESWT) on reducing spasticity immediately and 4 weeks after application of ESWT. Five studies were ultimately included in the meta-analysis. The Modified Ashworth Scale (MAS) grade was significantly improved immediately after ESWT compared with the baseline values. The MAS grade at four weeks after ESWT was also significantly improved compared with the baseline values.

The results of the present study were in consistent with **Rompe et al., (1996)** who studied the effect of extracorporeal shock wave therapy in chronic lateral epicondylitis in which the patients received low-energy shock-wave therapy in the form of 3000 impulses of 0.08

mJ/mm<sup>2</sup>. There was significant alleviation of pain and improvement of function after treatment.

The results of present study are in contradiction with the finding of **Haake et al., (2002)**. A Randomized multicenter trial which studied the effectiveness of extracorporeal shock wave therapy in the treatment of lateral epicondylitis. The patients received extracorporeal shock wave therapy with three treatments of 2000 pulses and a positive energy flux density (ED+) 0.07 to 0.09 mJ/mm<sup>2</sup>. The success rate was 25.8% in the group treated with extracorporeal shock wave therapy and 25.4% in the placebo group, a difference of 0.4%. The study concluded that extracorporeal shock wave therapy was ineffective in the treatment of lateral epicondylitis. The previously reported success of this therapy appears to be attributable to inappropriate study designs. The study recommended that extracorporeal shock wave therapy be applied only in high-quality clinical trials until it is proved to be effective. It seems that the number of sessions not enough to produce the effect (three sessions only) and the energy flux density was low.

The results of the present study were in consistent with **Hammer et al., (2000)** who studied the effect of extra corporeal shockwave in patient with lateral epicondylitis and painful heel. Both groups received 3000 shock waves of 0.12 mJ/mm<sup>2</sup> three times at weekly intervals. After a follow-up of 5 and 6 months respectively, pain measured on a visual analogue scale (VAS) decreased significantly in both groups. The success rate (excellent and good results) was 63% in tennis elbows and 70% in painful heels. ESWT seems to be a useful conservative alternative in the treatment of both conditions.

The results of the present study was in contradicted with the finding of **Speed et al (2006)**. They studied the effect of extra corporeal shock wave therapy(ESWT) for patients with lateral epicondylitis. Adults with lateral epicondylitis were randomised to receive either active treatment (1500 pulses ESWT at 0.12 mJ/mm<sup>2</sup>) or sham therapy, monthly for three months. All were assessed before each treatment and one month after completion of therapy. Outcome measures consisted of visual analogue scores for pain in the day and at night. Seventy-five subjects participated and there were no significant differences between the two groups at baseline. Both groups showed significant improvements from two months. No significant difference existed between the groups with respect to the degrees of change in pain scores over the study period. At three months, 50% improvement from baseline was noted in 35% of the ESWT group and 34% of the sham group with respect to pain.

It seems that the number of sessions not enough to produce the effect (three sessions only) and the gap between the sessions was too large (one month) which could affect the result, the method of assessment was

subjective (Visual Analogue Scale) which not enough for assessment.

The improvement of balance stability in GA rather than GB could be attributed to the effect of shock wave to improve the balance, this come in close agreement with **Sangyong et al., (2014)** who studied the effects of extracorporeal shockwave therapy on Patients with Chronic Low Back Pain and their Dynamic Balance Ability in which the patients divided into an extracorporeal shockwave therapy group (ESWTG: n=13) and a conservative physical therapy group (CPTG, n=15). An exercise program that included Williams' exercises and McKenzie's exercises was performed by both groups. The program was implemented twice a week for six weeks. The visual analog scale (VAS) was used to measure the chronic low back pain of the patients. In the VAS comparison between the groups after the treatment, the ESWTG showed a significantly larger improvement in dynamic balance ability.

The improvement in pain and function in GA rather than GB could be attributed to the effect of shock wave in decrease pain and inflammation and improve the function, this comes in close agreement with **Chan et al., (2015)** who studied the effect of extracorporeal shockwave on frozen shoulder patients' pain and functions. Thirty frozen shoulder patients were divided into two groups: an extracorporeal shock wave therapy group of 15 patients and a conservative physical therapy group of 15 patients. The ESWT group, the patients received 1,000 shock waves at 2.5 Hz, with the energy adjusted from 0.01–0.16 mJ/mm<sup>2</sup>, depending on the degree to which the patients endured pain, two times per week for six weeks, In intra-group comparisons, the two groups showed significant decreases in terms of visual analog scales and patient-specific functional scales, although the extracorporeal shock wave therapy group showed significantly lower scores than the conservative physical therapy group. Extracorporeal shock wave therapy is considered an effective intervention for improving frozen shoulder patients' pain and functions.

The result of statistical analysis of the current study showed that the shock wave had a significant effect on sciatic neuralgia rather than therapeutic exercise, as there was a significant improvement of the affected side in single leg stance GA presenting in the overall stability and medio-lateral stability and antero-post stability.

Based on the results of present study, The shock wave had a significant effect in improvement in overall stability index, medio-lateral stability index and antero-post stability index in affected and non affected side and there was significant improvement in pain in patient with sciatic neuralgia.

The significant improvement on the non affected side could be attributed the improvement of balance on

affected side so the distribution of body weight would be equally on both side.

## CHAPTER VI SUMMARY, CONCLUSION AND RECOMMENDATIONS SUMMARY

This study was conducted to evaluate the efficacy of extracorporeal shock wave for the patients with sciatic neuralgia. The clinical diagnosis was confirmed by radiological investigations (x-ray or MRI) and pain provocation test.

Thirty patients (male and female) had sciatic neuralgia with duration of illness more than six months at least. They were 22 females and 8 males ranged from 30-50 years, they were assigned randomly into two groups, study group GA (n=15) received shock wave and therapeutic exercise and control group GB (n=15) received therapeutic exercise only. Treatment was done three times per week for successive four weeks (one month).

All the patients of the two groups were subjected to assessing pain intensity by visual analogue scale (VAS) and assessing balance stability by Biodex stability index (BSI). Assessment was done before and after four weeks of treatment (the end of treatment) for both groups.

Comparison between both study and control group, the statistical result proved that there was significant decrease in pain intensity in group A and no significant difference in pain in group (B). There was a significant difference presenting on overall stability index and medio-lateral, antero-posterior stability index in group A in the affected side and non affected side.

However there was no significant improvement in balance stability (affected side and non-affected side) in GB.

## CONCLUSION

Based on the results and finding of this study, it is possible to conclude that: The extra corporeal shock wave therapy is an effective method to decrease pain and inflammation and improve the balance in patients with sciatic neuralgia The extracorporeal shock wave therapy is a safe and beneficial method in treating sciatic neuralgia.

## RECOMMENDATIONS

**The following recommendations are suggested for further researches**

- Further studies should be conducted in comparison between high energy and low energy shock wave in patients with sciatic neuralgia.
- Further studies should be conducted in the relation between sciatica and gait abnormality.
- Further studies should be conducted to determine the biological effect of shock wave.

- Further studies should be conducted for other radicular pain.
- Further studied should be conducted for chronic low back pain.
- Similar studied should be conducted with adding core muscle stability exercise.

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