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EFFECT OF EXTRACORPOREAL SHOCK WAVETHERAPY ON PAIN POST CALCANEAL SPUR

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Abstract

Objective—To evaluate the efficacy of extracorporeal shock wave treatment (ESWT) on pain in calcaneal spur. **Methods**— A single blind randomized study was performed in which 15 patients underwent a regular treatment Pre and post experimental design. their ages were ranged from 25 to 45 years old. They were examined before and after treatment with shock wave because of pain post calcaneal spur. They were treated by shock wave therapy with 2000 strokes, 10 Hz frequency and 2.5 bar capacity. Two sessions/ week for 6 weeks. Variations in symptoms were evaluated by visual analogue scale (VAS) and Serum cortisone level. **Results**—A significant decrease of VAS was seen. There is a statistical significant increase in the mean cortisol level after in comparison to before **Conclusion**—ESWT is safe and improves the symptoms of most patients with a painful heel, and reduce pain.

Key word: extracorporeal shock wave, calcaneus spur, pain.

Introduction

Calcaneal spur occurs when calcium deposits build up on the underside of the heel bone, the process that usually continues for many months. Chronic calcaneal spur is a vested disease commonly appearing in adults and it leads to the inflammatory of the plantar fasciitis, disability and as a result to the limitation of social and professional activities **(1,2)**.

Epidemiological data indicates that 46 % of adults suffer numerous or various foot conditions which result in abnormal mechanics of standing and walking and the ‘‘calcaneal spur’’ occurs in 15–20 % of the population. Most of them are caused by overloading around the area around a calcaneal tumor;in this case, the pain is located around the heel and its intensity depends mainly on the degree of mechanical overload. Inflammation of the aponeurosis which is developing in the area of the attachment of the plantar fascia contributes to the formation of undue bone tissue in a neuralgic point. Micro calcifications, which gradually transform into to spurs, appear in the site of damage of singlefibers of the aponeurosis. A common disorder of the foot is ‘‘heel spur’’, which occurs in 15–20 % of the population. The disorder is painful and really troublesome for patients. **(3,4)**.

Painful heel is a common syndrome characterized by severe pain in the inferior or posterior aspect of the heel, which is aggravated by weight bearing, becoming progressively worse and often incapacitating, with evidence of a spur in about 50% of cases. Until now the cause of the condition has been obscure, but numerous factors have been claimed to produce painful heel with a bony spur: functional

overuse, degenerative diseases, inflammatory diseases, and metabolic diseases [5,6].

Treatment of patients with heel spur is a difficult and a lengthy process requiring patience from both the patient and the therapist, so lessening of painis already a success. Sometimes, the only method of treatment is surgery, although spurs tend to recur. The most common therapies include physical therapies, reducing overload in the heel area and pharmacotherapy. [7,8,9]

ESWT is a therapeutic method that applies shock waves to lesions fromthe outside of the body to promote revascularization and to stimulate or reactivate the curing process of connective tissues including tendons and bones, thereby relieving pain and improving function. ESWT can be used for pain relief as well as for muscle strength improvement through appropriatemotor stimulation of muscles and tendons by the shock waves. [10,11] Currently, ESWT is administered for musculoskeletal system diseases, but studies of theeffects of ESWT on chronic low back pain are rare, and few studies have examined its effects on pain, disability, and depression. [12,13]. The purpose of this study was to examine the effects of extracorporeal shock wave therapy on pain in calcaneal spur patients.

Subjects, Material and Methods

I- Subjects:

Fifteen patients complaining of pain post calcaneal spur participated in this study. They were selected randomly from Elminya Outpatient clinic, Deraya University in Elminya. They were selected on the following criteria: Patients are complaining from pain post calcaneal spur; their ages were ranged from 25 to 45 years old. They were selected with no history of osteoarthritis. They had calcaneal spur confirmed by x rays. The patients were examined by a physician before the study and patients were excluded from this study includes: History of any abdominal operations, radiotherapy or chemotherapy, diabetes, suffering from psychological problems, osteoarthritis, skin disease.

Design of study:

Pre and post experimental design. They were consisted of 15 patients with pain post calcaneal spur. They were treated by shock wave therapy with 2000 strokes, 10 Hz frequency and2.5 bar capacity. Two sessions/ week for 6 weeks. [11] All patients were informed of, and consented to, the treatment methods. No other treatment or drug was used during the four weeks before the trials began or during the study period. During the periods of treatment and follow up only the use of insole supports was permitted.

II- Study Materials:

1- Visual analogue scale (VAS): Pain levels were evaluated by a visual analogue scale (VAS), ranging from 0 = no pain to 10 = maximum pain, at rest, after walking on awakening, and after normal daily activity. Such assessment was made before, at the end of the treatment [14.15]. The modifications observed were classified as excellent improvement (a VAS reduction of over 50%), good improvement (a VAS reduction of between 30% and 50%), slight improvement (a VAS reduction of between 15% and 30%). (Appendix III).

2- Serum cortisol level: Cortisol is a potent anti-inflammatory hormone released as the final part of HPA-mediated stress responses. Dysfunction in the later cortisol response may result in widespread inflammation following exposure to subsequent stressors, including pain. Depending on the level of threat that an individual associate with the perception of pain, the physiological response may be exaggerated, resulting in further cortisol dysfunction. Currently, the transfer of scientific knowledge of biomarkers to determine physiological and pathological situations, related to pain, is a challenging process and serum cortisol levels are considered a potential new biologic marker for uncontrolled chronic pain [16,17.18]. A serum cortisol level is collected from patients before and after treatment protocol.

3- Shock wave therapy: Radial Shock wave device, guarantees to generate up to 5,000,000 shots. RSK-600 boasts excellent durability allowing for a quick and secure return on investment. This technology makes RSK-600 an even more powerful and flexible tool. RSK-600 creates unique shockwave pulses by using a projectile 5 times heavier than standard air-pressure systems and a reduced final velocity upon contact with the applicator. The lower peak and longer rise time minimize the stinging,

painful sensation normally related to this therapy. Shock waves were focused at an area 1 cm proximal to the insertion of the tendon in the calcaneus, with the patient in a prone position. Extracorporeal shock wave treatment (ESWT) is based on the use of shock waves— that is, microsecond pressure impulses, which, depending on the energy used, can reduce painful symptoms and fragmentation of calcific deposits [19, 20, 21]. Shockwave has certain physical characteristics. There is a high peak pressure of shockwaves is approximately 50 Mpa with a short lifecycle of approximately 10 ns. In addition, there is, by definition, a fast-initial rise in pressure of less than 10 ns and a broad frequency spectrum that is typically in the range of 16-20 Hz [22].

Statistical analysis:

In this study, the descriptive statistics (the mean and the standard deviation,) was calculated for all patients of the study for all variables. Comparisons was made by independent sample Wilcoxon Signed Ranks Test to compare the variables between all groups of the study. Wilcoxon Signed Ranks Test to compare before and after treatment. A value of $p \leq 0.05$ will be considered statistically significant.

Results:

A total of 15 patients had participated in this study, they were assigned to receive shock wave for 12 session and to have and visual analog scale (VAS) tested before and after the sessions completed Using nonparametric Wilcoxon test (since, there is no prove that the data have no normal distribution see tables 1&2 and graph 1,2,3&4) showed that there are significant differences between before and after of cortisol serum level and visual analog scale (VAS) of studied groups for these demographic data.

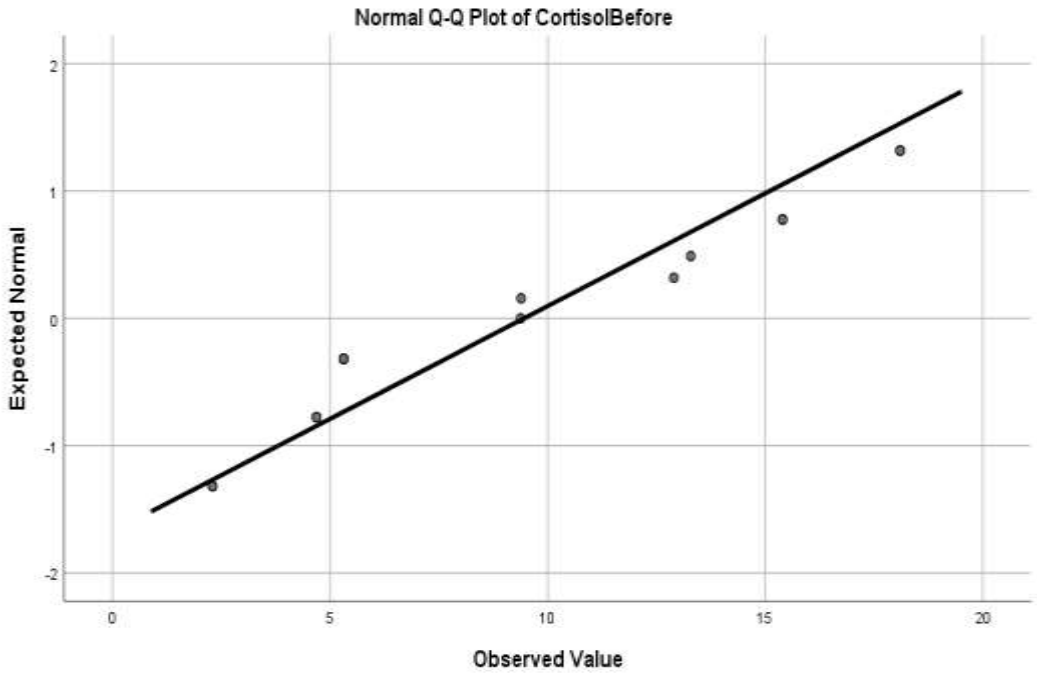
There is a statistically significant increase in the mean cortisol level after in comparison to before within studied group as shown in the table and described in diagram below.

Table (1): - Statistical analysis of difference between serum cortisol level before and after the sessions completed.

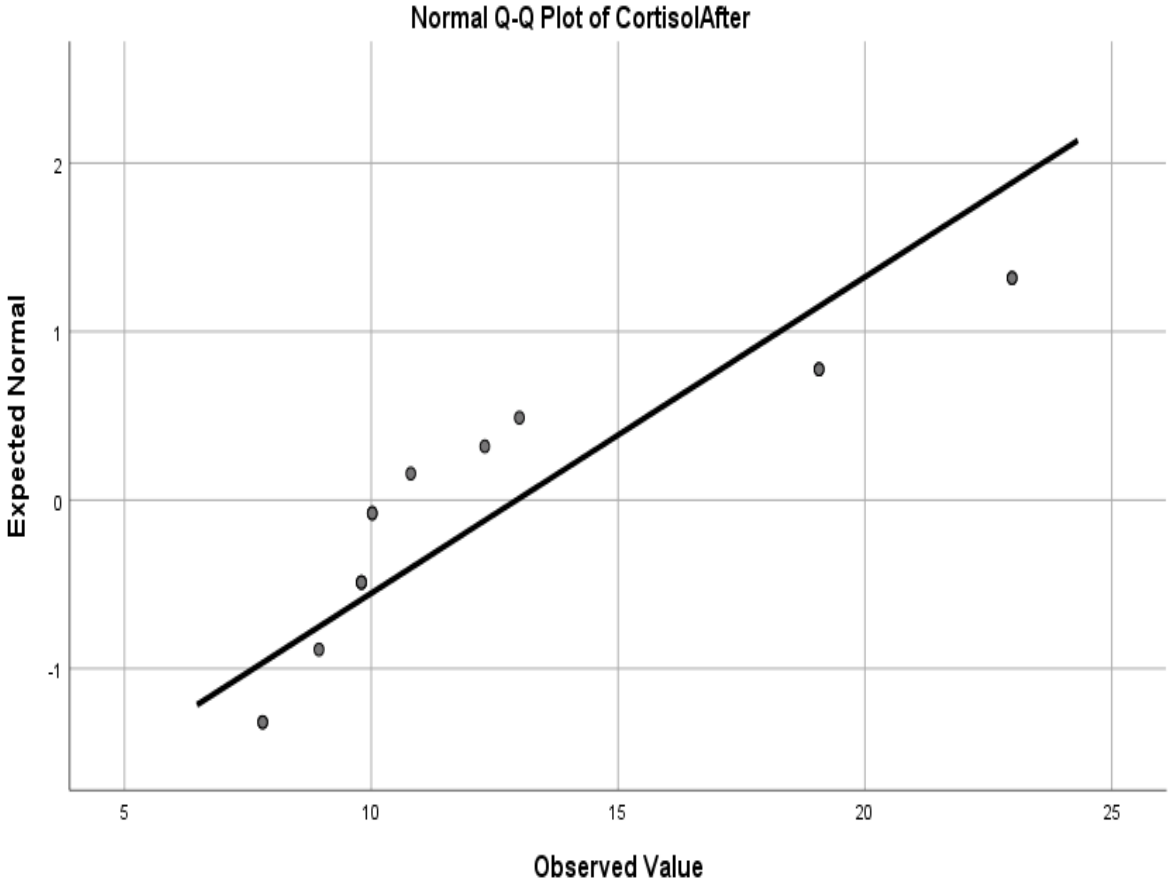
	Cortisol Before	Cortisol After
Mean	9.4580	12.9453
S. d.	5.64475	5.32662
Z. Wilcoxon Signed Ranks Test	-2.956[b]	
Asymp. Sig. (2-tailed)	.003	

	Kolmogorov-Smirnov[a]		
	Statistic	Df	Sig.
Cortisol After	.256	15	.009
Cortisol Before	.235	15	.025

Nonparametric tests /Wilcoxon=cortisol after with cortisol before (paired)



(Figure 1) Diagram of cortisol level before treatment.



(Figure 2) Diagram of cortisol level after treatment.

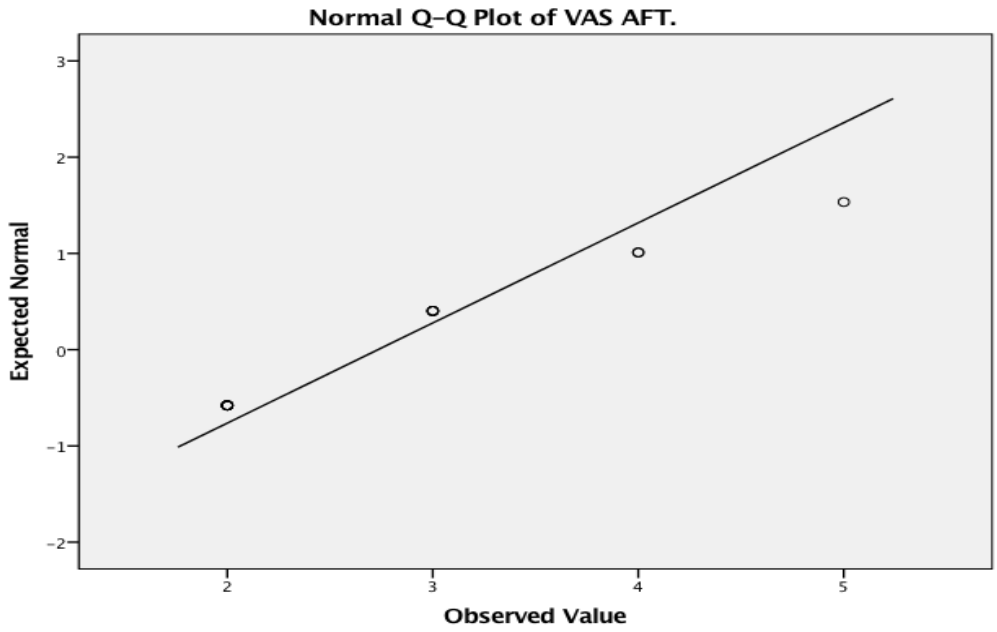
Table (2): Statistical analysis of difference between VAS before and after the sessions completed.

	VAS Before	VAS After
Mean	7.67	2.73
S. d.	1.047	.961
Z. Wilcoxon Signed Ranks Test	-3.426[b]	
Asymp. Sig. (2-tailed)	.001	

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
VAS After	.311	15	.000
VAS Before	.205	15	.091

Nonparametric tests /Wilcoxon= visual analog scale (VAS) after with before (paired)

There is a statistically significant decrease in visual analog scale (VAS) tested after in comparison to before sessions within studied group as shown in the table above and described in diagrams below.

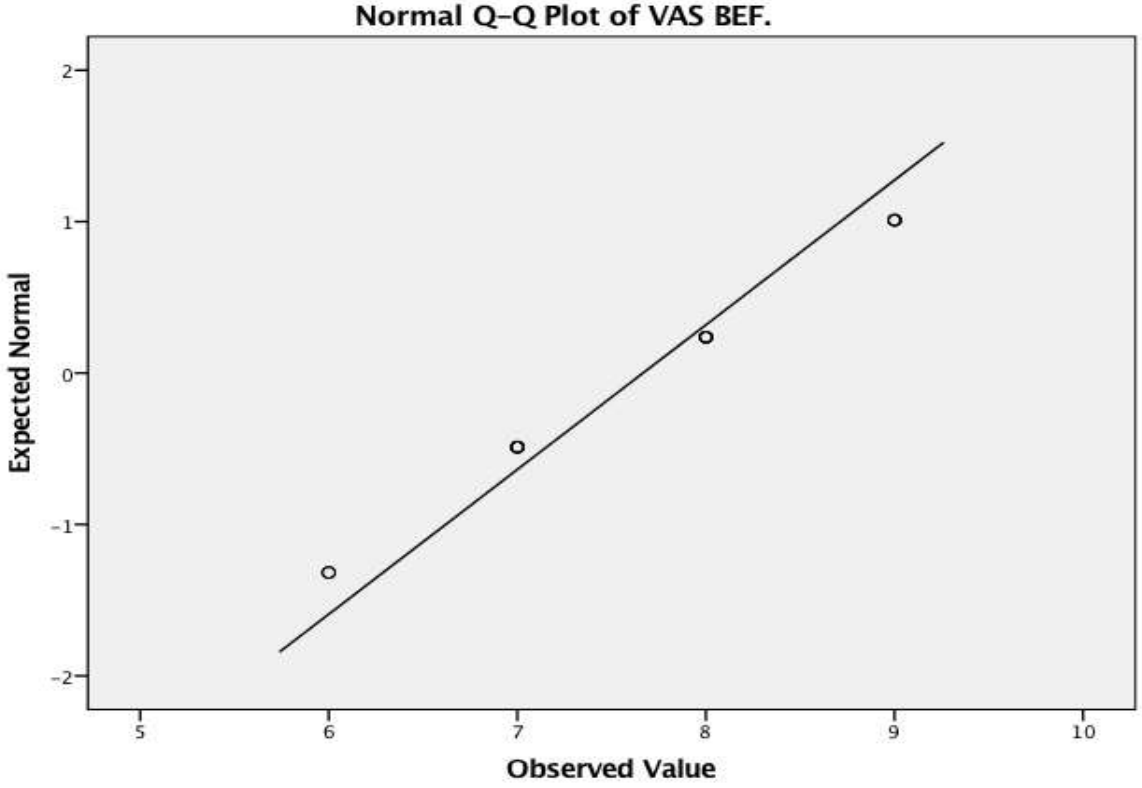


(Figure 3) :- Visual analog scale (VAS) tested after treatment.

(Table 3): Correlations between cortisol level before to VAS before by Using spearman's statistic nonparametric correlations

Correlations

			cortisol before	vas before.
Spearman's rho	Cortisol Before	Correlation Coefficient	1.000	-.439
		Sig. (2-tailed)	.	.102
		N	15	15
	VAS before	Correlation Coefficient	-.439	1.000
		Sig. (2-tailed)	.102	.
		N	15	15



(Figure 4) Visual analog scale (VAS) tested before treatment.

To find out if there is Correlations between cortisol level before and after to VAS before and after by Using spearman's statistic nonparametric correlations shown that there is no correlation as shown in tables 3 and 4.

(Table 4): Correlations between cortisol level after to VAS after by Using spearman's statistic nonparametric correlations

Correlations

			Cortisol After	VAS after
Spearman's rho	Cortisol After	Correlation Coefficient	1.000	.358
		Sig. (2-tailed)	.	.190
		N	15	15
	VAS after	Correlation Coefficient	.358	1.000
		Sig. (2-tailed)	.190	.
		N	15	15

Discussion:

Low energy ESWT has been used in the treatment of pain, occurring in precisely locatable areas of the locomotor apparatus. Rompe et al [(10)] suggested that the pain relief observed after ESWT at energy levels comparable with those used in our study might be similar to the hyperstimulation analgesia described by Melzack [(23)]. The positive clinical outcome of low energy ESWT for chronic plantar fasciitis has been confirmed in clinical studies. Maier et al [(13)] reported that low energy ESWT can be regarded as an optional non-invasive therapeutic method without major side effects which can be used to avoid surgical treatment in patients with chronic courses of plantar fasciitis associated with heel spurs. Perlick et al [(21)] also have had good results in the treatment of chronic plantar fasciitis. In our single blind randomized study, the researchers evaluated the efficacy of ESWT on painful heel with heel spurs and noted its effects on pain levels, the researchers also evaluated the placebo effect by comparing one group of patients who underwent treatment with another group in whom the treatment was simulated. ESWT proved effective in reducing the painful symptoms, and the reduction in pain seen at the end of treatment.

When a shockwave enters tissue, it breaks up and reflect the absorption of kinetic energy by the precise body structures (bone, fat, tendon, ligaments), which are exposed to the shockwave. All techniques of shockwave production (electrohydraulic, electromagnetic and piezoelectric) depend on the conversion of electrical energy to mechanical energy [(24, 25)]. When a sound wave is transmitted into tissue, there are two levels of transmission: low energy and high energy. Low energy has an analgesic effect by either disrupting the cell membranes partially or completely. When high energy (any energy greater than 0.28mJ/mm2) comes in contact with the damaged tissue, there is a direct biological interaction. The body will react by increasing blood flow to the area, initiating vascular neogenesis and a reparative cycle. When you apply high energy to the insertion of a damaged plantar fascia, the reparative healing begins. This process leads to fibroblastic production and new healthy tissue in the area that was once avascular tissue [(26)].

There is a statistically significant increase in the mean cortisol level after in comparison to before within studied group as shown in the table 1 relevant with Rohini G, et al [(27)] that concluded that serum cortisol levels was higher in the chronic periodontitis group compared to the other groups. Positive correlation was found between the cortisol levels and other clinical parameters. The study

reported a statistically significant decrease in visual analog scale (VAS) tested after in comparison to before sessions within studied group as shown in the table 2. Agreed with P. S. Myles, N. Urquhart. [(28)] that demonstrated that the VAS had linear scale properties in patients with mild to moderate pain after surgery, and concluded that the VAS score can be considered as ratio data for statistical analysis and interpretation. Patients with severe pain need immediate assessment and treatment, and such assessment should be quantifiable. The study conclude that the VAS score is a linear measurement of severe acute pain. A change in the VAS score represents a relative change in the

magnitude of acute pain intensity.

To find out if there is Correlations between cortisol level before and after to VAS before and after by Using spearman's statistic nonparametric correlations shown that there is no correlation as shown in tables 3 and 4. The study concluded that

ESWT is safe and improves the symptoms of most patients with a painful heel.

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