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Comparative Effects of Therapeutic Ultrasound and Shockwave Therapy on Pain and Quality of Life in Patients with Chronic Heel Spur

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ABSTRACT

Background: Calcaneal spurs are abnormal bone projections that typically form at the inner aspect of the heel bone, specifically at the site where the plantar fascia and certain small muscles of the foot attach. These spurs are relatively common and are often detected incidentally during foot X-rays taken for other medical reasons, such as prior injury to the ankle or foot. **Objective:** To determine the effects of therapeutic ultrasound and extracorporeal shockwave therapy on improving quality of life and chronic heel spur pain. **Methodology:** This study was a single-blinded, randomised controlled trial conducted at Sehat Medical Complex, Lahore, during 10 months. Accounting for a 10% attrition rate, the total sample size has been adjusted to 41 participants using a non-probability convenient sampling technique. Patients diagnosed with chronic heel spur pain persisting for more than one month, confirmed through imaging, aged 30–60 years, both genders, were included. Patients with systemic inflammatory conditions such as rheumatoid arthritis or gout, a history of previous steroid injection for less than six weeks, and individuals with contraindications to ultrasound or shockwave therapy, such as pacemakers or implanted devices. Follow-up assessments were conducted at baseline and after eight weeks. Parametric statistical tests were supported by normal data distributions and confirmed a paired sample t-test for within-group analysis and an independent t-test for between-group analysis. **Results:** The mean difference of the visual analogue scale of the therapeutic ultrasound group was 1.22±0.07, mean difference of quality of life was 21.88±4.95. The mean score of the foot function index of the ultrasound group before treatment was 63.50±5.55 after the treatment was 46.89±4.58. In the shockwave therapy group, the mean difference of pain score was 2.25±0.16, and the mean difference of quality of life was -11.38±2.95. Mean of function index was 80.11±5.68, and after the treatment was 34.00±4.30. **Conclusion:** Group B shows significant variations. Both interventions were effective in improving patient outcomes, but shockwave therapy is more effective in improving pain intensity, quality of life and foot function.

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INTRODUCTION

Calcaneal spurs are bony projections that typically form at the medial tubercle of the calcaneus, where the plantar fascia and intrinsic muscles of the foot attach. They are believed to develop as a result of mechanical stress from weight-bearing activities, combined with traction forces at the site of tissue attachment. This mechanical load may trigger endochondral ossification within the apophyseal soft tissues. Calcaneal spurs are frequently observed on foot radiographs, often as incidental findings in patients undergoing imaging for unrelated complaints such as foot or ankle injuries.[1,2,3] Epidemiological studies show that approximately 46% of adults experience various foot-related problems that interfere with normal standing and walking mechanics. Among these, calcaneal spurs are seen in about 15–20% of the general population.[4]

Heel pain is categorised under musculoskeletal disorders, which make up a significant portion of the non-communicable disease burden globally, contributing to around 6.8%. This condition not only reduces patients' quality of life but also increases healthcare costs and contributes to prolonged periods of disability. Effective management of heel pain requires precise identification of its cause. One such treatment approach is extracorporeal shock wave therapy (ESWT) - a modern, non-invasive technique that has shown success in alleviating pain and addressing its underlying causes. The therapeutic benefit of ESWT is derived from its physical characteristics, which lead to biological responses such as enhanced blood flow, stimulation of cellular activity, promotion of tissue repair, and disruption of the pain–muscle tension cycle.[5,6]

Therapeutic ultrasound is a widely used modality in physical therapy, known for its ability to promote tissue healing and reduce pain. It employs high-frequency sound waves that penetrate deep tissues, generating mechanical and thermal effects. These effects include increased blood flow, enhanced tissue extensibility, and stimulation of cellular repair processes.[7] Additionally, therapeutic ultrasound (TUS) reduces inflammation and improves the flexibility of soft tissues, making it a valuable tool in managing chronic musculoskeletal conditions.[8] Chronic heel spur pain significantly affects quality of life and daily function. Limited comparative evidence exists to guide clinicians in selecting the most effective treatment. This study aims to address the gap by comparing the effects of TUS and ESWT on pain and quality of life in chronic heel spur patients, providing evidence to inform effective, evidence-based treatment strategies.

METHODOLOGY

This study was a single-blinded, randomised controlled trial conducted at Sehat Medical Complex, Lahore, during 10 months. The sample size is 37, calculated from G Power 3.1.9.7. Accounting for a 10% attrition rate, the total sample size has been adjusted to 41 participants using a non-probability convenient sampling technique.[9] Patients diagnosed with chronic heel spur pain persisting for more than one month, confirmed through imaging studies like X-ray or ultrasound, aged 30–60 years, both genders were included.[10] Patients with systemic inflammatory conditions such as rheumatoid arthritis or gout, a history of previous steroid injection for less than six weeks, and individuals with contraindications to ultrasound or shockwave therapy, such as pacemakers or implanted devices.[11]

In Group A (TUS), participants received TUS as the primary intervention for managing chronic heel spur pain. The TUS treatment was administered using a frequency of 1 MHz, which is effective for targeting deeper tissues. The intensity will range from 0.8 to 2.0 W/cm^2, depending on patient tolerance, and was applied in a continuous mode to maximise thermal effects. Each treatment session lasted for four minutes, and treatment sessions were conducted daily, Monday through Friday, for two weeks in a series of ten treatments. The TUS application was focused on the medial calcaneal tubercle and the surrounding inflamed soft tissues to reduce pain and promote tissue healing.[10]

In Group B (ESWT), participants underwent extracorporeal shock wave therapy using a pneumatically operated device—specifically, the BTL-5000 SWT Power combined with a high-intensity laser (12W). Before treatment, all patients were briefed on how the shock wave therapy works and were informed about any potential side effects associated with the procedure. Each of the project participants underwent a series of 5 treatments at seven-day intervals. The shockwave therapy was administered in continuous mode with a frequency of 10 Hz, delivering 2500 impulses per

session. The pressure settings varied by session: 2.5 bar for the first and second treatments, 3.0 bar for the third, and 3.5 bar for the fourth and fifth sessions.

During treatment, patients lie in a prone position on the examination table, with a half roller placed under the ankles to promote relaxation of the ankle joints. In line with the manufacturer's guidelines, not only was the most tender spot identified during palpation treated, but the surrounding tissues were also targeted. A standard ultrasound gel was applied as a coupling medium to ensure effective transmission of the shockwaves.[9] The outcome measuring tools are the Visual Analogue Scale (VAS), Foot Function Index (FFI), and the 36-Item Short Form Survey (SF-36) for quality of life (QOL).

Data was analysed using SPSS version 23. Quantitative variables were expressed as mean and standard deviation, while qualitative variables were presented as frequencies and percentages. The Shapiro-Wilk test was used to assess the normality of the data. Data follows a normal distribution, paired sample t-test within-group comparisons over time, while the independent sample t-test was used for between-group comparisons of treatment effects. A 95% confidence interval was used, and a p-value ≤0.05 was considered statistically significant.

RESULTS

Mean score of VAS of the TUS group before the treatment was 6.80±1.29, and after the treatment was 5.05±1.37. The mean difference of VAS of the therapeutic ultrasound group was 1.22±0.07. Mean score of QOL of the therapeutic ultrasound group before the treatment was 42.89±8.51, and after the treatment was 66.72±13.47. The mean difference in QOL of the therapeutic ultrasound group was 21.88±4.95. The mean score of FFI of the ultrasound group before treatment was 63.50±5.55 after the treatment was 46.89±4.58. Meanwhile, in the shockwave therapy group, the mean VAS at day 1 was 8.03±1.24 and after the treatment was 2.54±1.40, while the mean difference was 2.25±0.16 along with a p-value less than 0.05.

Mean of QOL at day 1 was 21.00±5.46, and after the treatment was 78.11±8.41. The mean difference QOL of the ESWT group was 11.38±2.95, with a p-value less than 0.05. The mean of FFI at day 1 was 80.11±5.68, and after the treatment was 34.00±4.30. The significant increase in quality of life, foot function index and improvement in pain intensity after shockwave therapy was greater than ultrasound therapy. The p-value is less than 0.05, which shows there is a significant difference between the TUS and ESWT groups, but shockwave therapy shows greater improvement.

DISCUSSION

The purpose of our study was to compare the effects of therapeutic ultrasound and shockwave therapy on pain and quality of life in patients with chronic heel spurs to improve pain intensity, quality of life and foot function. For this purpose, VAS and FFI and QOL scales were used. In addition, subjects completed post post-intervention questionnaire to determine the difference between patients' levels of comfort between the groups. The results of this study have shown that the TUS group and shockwave therapy group had significant differences in post-treatment values of pain intensity, quality of life and foot function paired t-test was applied for within-group analysis. The mean values indicate that there is an increase in both quality of life and foot function and a decrease in pain after the treatment session. The result of this study reveals that there is a significant difference between post-treatment values of pain intensity, quality of life and foot function ($p<0.05$) across the group analysis.

An important goal of increase foot function and prevent any trauma, like further heel spurs. This study focuses on two types of interventions used to improve pain intensity, quality of life and foot.

Table 1: Demographic data

		Group A	Group B
Age		49.56 (5.79)	45.89 (8.98)
Height		5.31 (0.61)	5.01 (0.56)
Weight		97.56 (10.86)	82.32 (14.60)
BMI		38.95 (9.18)	38.06 (10.34)
Gender	Male	8 (44.4)	8 (42.1)
	Female	10 (55.6)	11 (57.9)

Table 2: Within and between-group comparison

Between-Group Analysis		Pre Mean (S.D)	Post Mean (S.D)	p-value
VAS	A	6.80 (1.30)	8.03 (1.24)	<0.001
	B	5.05 (1.38)	2.54 (1.40)	
		<0.01	<0.01	
QOL	A	42.89 (8.52)	21.00 (5.47)	<0.001
	B	66.72 (13.48)	78.11 (8.42)	
		<0.01	<0.01	
FFI	A	63.50 (5.56)	80.11 (5.69)	< 0.001
	B	46.89 (4.59)	34.00 (4.31)	
		<0.01	<0.01	

Function. The results of the current study suggested that ESWT showed improvement after the treatment, more than TUS. In the shockwave therapy group, the mean VAS at day 1 was 8.03±1.24 after the treatment was 2.54±1.40, while the mean difference was 2.25±0.16, along with a p-value less than 0.05. Mean of QOL at day 1 was 21.00±5.46, and after the treatment was 78.11±8.41. The mean difference QOL of the shockwave therapy group was -11.38±2.95 with a p-value less than 0.05. The mean of FFI at day 1 was 80.11±5.68, and after the treatment was 34.00±4.30. The significant increase in quality of life, foot function index and improvement in pain intensity after shockwave therapy was more than Ultrasound Therapy. These results are consistent with the results of a previous study conducted in 2022 by Aleksander et al. conducted a study on the effects of shock wave therapy on pain and daily functioning in patients with heel spurs. They suggested that shockwave therapy had the effect of reducing both the frequency and severity of pain.

Lizis et al conducted a study in 2018 on the effectiveness of TUS and ESWT on the symptoms of calcaneal spur. Both groups showed improvements, but the results revealed evidence that patients with CS can obtain significant health benefits from foot care with ESWT. Another article shows consistency with our results of El Molla et al. in 2021 on the efficacy of ESWT in the treatment of plantar fasciitis in calcaneal spur patients using ultrasonography. Significant PF thickness reduction, VAS, and Roles and Maudsley score improvement were observed (p<0.001). Results showed PF thickness increases significantly in calcaneal spur patients and responds to treatment. ESWT decreases the thickness of the PF and improves pain and function significantly.

Another study by Elhakk et al. was conducted in 2022 on the efficacy of ESWT on pain in calcaneal spurs. Variations in symptoms were evaluated by VAS and serum cortisone level. The results of this study showed that significant decrease in VAS. There is a statistically significant increase in the mean cortisol level after compared to before. This study concluded that ESWT is safe and improves the symptoms of most patients with a painful heel and reduces pain.

CONCLUSION

The study showed that both shockwave and ultrasound therapy have significant effects in improving pain, quality of life and function of patients with chronic heel spurs. But according to the mean difference and comparing with previous studies, it is concluded that the shock wave therapy is more effective than ultrasound therapy.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of Data and Materials: Data will be

made available upon request. The corresponding author will submit all dataset files.

Competing interests: None

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CONSORT Guidelines: All methods were performed following the relevant guidelines.

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