Original Article

Effect of Extra-corporeal Shock-wave Therapy in the Management of Chronic Plantar Fasciitis

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ABSTRACT

Plantar fasciitis is a progressive degenerative condition of the plantar fascia which is reported to be one of the most common causes of lower heel pain in adults. Extracorporeal Shock Wave Therapy is being used for the management of plantar fasciitis now a day. The aim of the study was to find out the effects of Extracorporeal Shock-wave therapy in patients with chronic plantar fasciitis. A randomized clinical trial was conducted from May to October 2015, on 60 patients aged more than 18 years with plantar fasciitis attending in the department of Physical Medicine and Rehabilitation (PMR) in the Dhaka Medical College Hospital (DMCH) to observe the effectiveness of Extracorporeal shock-wave therapy (ESWT) in the treatment of plantar fasciitis and its therapeutic outcomes.60 patients were allocated randomly into intervention group (Group A) and control group (Group B). Data were composed through face to face interview using a questionnaire based on 1.Visual analogue scale, 2.Modified Roles and Maudsley score, and 3.100-point Scoring System for Plantar Fasciitis. But after 8 weeks, score was found lower in Group A than Group B (p<0.05).The usual total pain score was higher in 100-point Scoring System for Plantar Fasciitis (p<0.001) after 8 weeks of treatment as well average function score (0.001) in Group A. Patient satisfaction was also found higher in Group A by using Modified Roles and Maudsley score. Extracorporeal shock-wave therapy showed effective, so it can be suggested for the patients.

Keywords: *Plantar fasciitis, extracorporeal shock-wave therapy (ESWT)*

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INTRODUCTION

Plantar fasciitis (PF) is a progressive degenerative disorder of the plantar fascia subsequent from recurrent trauma at its beginning on the calcaneus. Plantar fasciitis is the commonest cause of inferior heel pain in adults. Other names for plantar fasciitis include painful heel syndrome, heel spur syndrome.[1]

The word "fasciitis" means inflammation is an inherent component of this condition. However, recent research suggests that some presentations of Plantar fasciitis manifest non-inflammatory, degenerative processes and should more be termed "plantar fasciosis".[2] Plantar fasciitis is synonymous with inflammation of the plantar fascia. In fact, the suffix "-ītis" essentially implies an inflammatory disease. Plantar fasciitis is widely described in the literature as having a multifactorial and widely disputed etiologyThe term Plantar fasciitis is used to describe a painful heel with inflammation of the plantar fascia at its origin. Plantar fasciitis is one of the common cause of heel pain, affecting 10% or more of the general population.[4] It may be due to strain to the origin of the plantar fascia or to biomechanical abnormalities of the foot.[5] Though a heel spur may present, but up to 27% of patients were without symptoms.[6] It mentions a clinical condition of pain in the plantar aspect of the heel, characteristically worse on

arising in the morning and after periods of prolonged sitting. The etiology of plantar fasciitis is not clear and probably multifactorial. Some rheumatologic disease like sero-negative spondyloarthopathy also may develop plantar fasciitis.

However, management advocated for plantar fasciitis have included rest, ice, stretches, non-steroidal anti-inflammatory drugs.[7], corticosteroid injection[8], iontophorosis, orthotics,[9] Tuli heel cups[10],night splints[11] ,heat, ultrasound[12], below the knee non weight bearing casts[5] , and short leg walking casts[13]. A very few number of patients undergo surgery. Extra corporeal shock wave therapy is well established for the treatment of urological condition. It was introduced in the 1980s for the treatment of insertion tendinopathies[14].ESWT is an application procedure where shock waves are passed through the skin to the painful part of the foot, by means of a special device. Extracorporeal means external to the body. The shock-waves are machine-driven sound waves; they are audible, low energy sound waves, which work by increasing blood stream to the injured area. This accelerates the body's healing process .It usually requires a course of three to four treatment, one to two weeks apart.

Extracorporeal shock-wave therapy for musculoskeletal conditions is assumed to offer extended analgesia and aids the healing process. It has been suggested as management for chronic plantar fasciitis.[15]Patients with chronic plantar fasciitis will be more efficiently treated by ESWT, so recommend ESWT to be used for patients who are not improving after 3 months of conservative measures.[16]It is safe and effective and has produced a very good rate of success in relief of pain and functional status.[17]

The aim of this study is to assess further the clinical efficiency of high energy shock wave therapy for the treatment of chronic plantar fasciitis throughout a twelve therapeutic session.

MATERIALS AND METHODS

A Randomized clinical trial (RCT) was accompanied in the Physical Medicine and Rehabilitation (PMR) Department, Dhaka Medical College Hospital, Dhaka, Bangladesh to establish the effect of Extra-corporeal Shock-wave Therapy in the management of chronic plantar fasciitis. One was a intervention group which is treated with Extracorporeal shock wave therapy (ESWT) along with NSAIDs, Exercises, orthotic as heel cushion/ shoe modification like slight high heel with heel cushion while control group did not receive Extracorporeal shock-wave therapy (ESWT). Intervention group and control group were done by lottery method and single blinding method was applied.

Patients attending in the Physical Medicine & Rehabilitation department, Dhaka Medical College Hospital, who were suffering from plantar fasciitis and more than 18 years of age, were the study population.

Diagnostic criteria of Plantar Fasciitis

- Aching, piercing in sole of foot.
- Foot pain that occurs immediately steps out of bed or get to feet after persistent periods of sitting.
- Pain that may decline subsequently patients have been on feet for a though, only to reappearance later in the day.
- Abrupt heel pain that builds steadily
- Foot pain that has carry on for more than a few days
- Limping

Inclusion criteria

- Age limit more than 18 years
- Unilateral single-site plantar medial heel pain
- Symptoms greater than 3 months
- Participation in a prearranged stretching package within the last 3 months
- Tenderness on confined pressure above the medial calcaneal tuberosity with passive dorsiflexion of the foot
- Visual Analogue Scale (VAS) score more than 5 (0- to 10-cm scale) for pain throughout the first few minutes of walking in the morning
- Modified Roles and Maudsley Score of 3 (FAIR) or 4 (poor)
- Readiness to relinquish any other concomitant therapies for the duration of the study

Exclusion criteria

- Previous surgery, conservative or physical therapy management within 3 months
- Pesplanus, pescavus or any other foot deformity
- Corticosteroid injection within few days
- Documented autoimmune or systemic disease
- Coagulation abnormalities
- Peripheral vascular disease
- Diabetes
- Local tumor
- Any previous trauma/fracture
- Infections

Sixty patients with chronic plantar fasciitis who satisfy the selection criteria were taken as sample. They were distributed into two groups (Group-A and Group-B). Each group comprises of 30 patients. Sampling technique was Simple random sampling by lottery. At first suitable participants were nominated and then separated into two groups; Group A and Group B.

Group A: ESWT+ NSAID+ Exercise+ Orthotics

Group B: NSAID+ Exercise+ Orthotics

a) ESWT: Patient was treated with shock-wave therapy three times weekly for four weeks of a total 12 sessions. The top of the applicator was placed directly to the proximal aspect of plantar fascia. Direction was 90degree to the joint. Gel is used for granting penetration. Shock-wave treatment was administered for 10 minutes per session at an 800 shocks with frequency of 4Hz, an intensity of 2-3 Bars.

b) NSAIDs: Tab. Etoricoxib 90 mg at night orally for two weeks was prescribed with coverage of Cap. Omeprazole 20mg twice daily. Same commercial preparation was used.

c) Exercise: Plantar fascia stretching at a rate of 10 repetitions twice daily was prescribed and demonstrated to all patients.

d) Orthotics: Heel cushions/ Medial arch support.

Data were collected through face to face interview. Before the interview, the detail of the study was explained to each eligible participant.

Demographic variable:

a. Age b. Sex c. Educational status d. Socio-economic condition

Three scales were used in this study

(1) Visual analogue scale (1-10)

(2) Modified Roles and Maudsley score

(3) 100-point Scoring System for Plantar Fasciitis

Data processing and exploration

Data processing and exploration was done by using Statistical Packing for the Social Sciences (SPSS) software Version 16.At first questionnaire was checked for completeness after completion of data collection. Data were entered into computer using SPSS 16. Then data were checked thoroughly after frequency run and necessary cleaning and editing done. An analysis plan was developed as per specific objectives of the study. Distribution was checked for normality and log transformation was done if any variable had data that was not normally distributed.

At the beginning of analysis, expressive analysis was done. Means and standard deviations were calculated for continuous variables when frequencies and percentages were calculated for categorical variables. Student's t-test was performed to assess the mean differences. Statistical significance was defined as $p<0.05$ and $p<0.01$ was defined as highly significant. Data were presented by tables and graphs.

RESULT

This Randomized Controlled Trial was conducted among 60 persons with chronic plantar fasciitis of both sexes. The 60 patients were further distributed arbitrarily into two groups; Group A and Group B. Patients in Group A were treated with Extracorporeal shock-wave therapy (ESWT) along with NSAIDs, Exercises, orthotic as heel cushion and Group B were managed with shoe modification like slight high heel with heel cushion. Data were analyzed with SPSS software using appropriate statistical methods and were presented in this chapter in tables and graphs. The finding were divided into several sections and organized as follows;

Background characteristics

VAS scores of both groups at 0 week, 2nd week, 4th week, 8th week.

Modified Roles and Mausdley scores of both groups at 0 week, 2nd week, 4th week,8th week.

100- Point scoring system for plantar fasciitis (pain score, function score and total score) of both groups at 0 week, 2nd week, 4th week, 8th week.

Background characteristics

Background information was collected from the participants. It included participant's age, sex, educational status and socio-economic status. These characteristics were displayed in tables and figures.

Age

Table 1 shows average age of the patients was 48.13 years with standard deviation of ±9.88 years. Minimum age of the participants was 32 years where the maximum was 67 years. The mean age of Group A was 47.27 years (±9.19) while it was a little bit higher in Group B (49.00±10.67).

Table 1 Age distribution in two groups

Age in year	Mean	±SD	Minimum	Maximum
Group-A	47.27	9.19	32	62
Group-B	49.00	10.67	32	67
Total	48.13	9.88	32	67

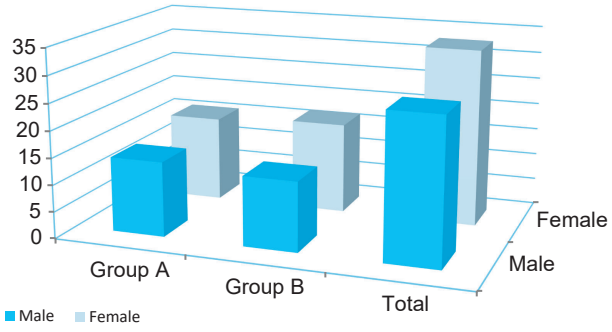

Fig.-1: *Sex distribution in groups*

Figure 1 shows among the participants, female were 55% (33) and the rest 45% (27) were male. Among 30 participants of Group A, 14 were male and 16 were female. Among equal number of participants in Group B, 13 were male and 17 were female.

Educational status

Educational status of the participants was divided into four categories: the participants who were illiterate or can sign only or did not pass primary school was categorized as "below primary", the participants who completed primary education but did not pass SSC were categorized as "primary to SSC" and the participants who passed SSC or HSC was categorized as "SSC to HSC" and above them were leveled as "graduate and above".

Table II shows all participants, among them 31.6% had completed SSC or HSC, 30% participants completed their graduation or above. In group A, 16.7% participants were below primary level of education.

Table II : Educational status of participants of both groups

Educational status	Below primary	Primary to SSC	SSC to HSC	Graduate and above
Group A	4 (13.3%)	8 (26.7%)	8 (26.7%)	10 (33.3%)
Group B	6 (20.0%)	5 (16.7%)	11 (36.6%)	8 (26.7%)
Total	10 (16.7%)	13 (21.7%)	19 (31.6%)	18 (30.0%)

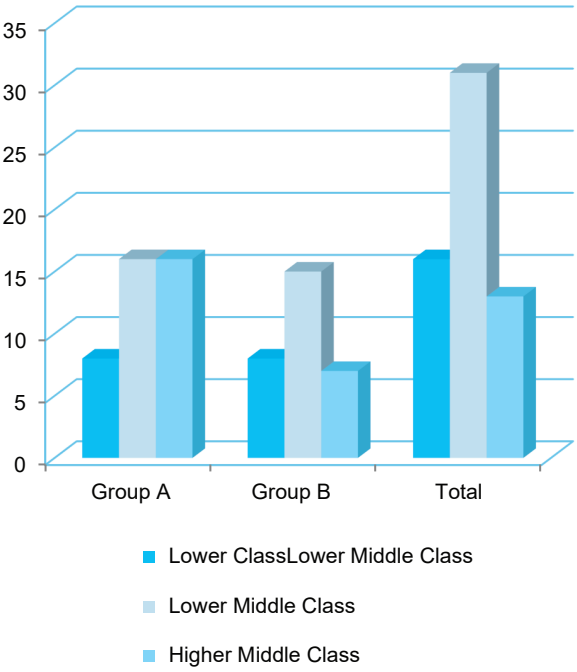

Fig 2 : Socio-economic status of the participants

Socio-economic status

Figure 2 shows socio-economic status of the participants was divided into lower socio-economic, lower-middle, higher-middle and higher class on the basis of their monthly family income. Among the participants, belonged to lower middle socio-economic class (average income 12,000 taka) 31 (51.6%), higher middle class (average monthly income 20,000 taka) participants were 13 (21.7%). There were no participant in higher class (monthly income >20,000 taka) while 16 (26.7%) in lower class (average monthly income were <12,000 taka). The proportion remained almost unchanged when they were divided into Group A and Group B.

Visual Analogue Scale (VAS) scores

Visual Analogue Scale (VAS) scores of both intervention group (Group A) and control group (Group B) were recorded at various intervals. Patients were advised to point their score on a Visual analogue scale and the score was recorded. VAS scores were recorded at beginning of the study (0 week), after 2 week, after 4 week and after 8 week. After that, student's t-test was performed to measure the mean difference among two groups at different time interval.

Table III shows Visual Analogue Scale (VAS) scores that were recorded at the beginning of the study for both of the groups. The mean VAS scores were almost equal for the both groups (Group A- 7.47±0.63; Group B-7.67±0.80). At the end of second week, VAS scores was dignified again and till then scores remained close for both groups (Group A-7.20±0.76; Group B- 7.40±0.62). This technique was repeated at the end of fourth week and then mean score was set up lower in Group A (5.40±0.72) than that of Group B (6.33±0.61). Scores were recorded for the last time at the end of eight week. The mean score remained lower in Group A (4.07±0.94) than in Group B (5.20±0.66). The differences found statistically significant (p value >0.05) at fourth and eighth week.

Table III Visual Analogue Scores of both groups

	Group	Mean ±SD	P value
VAS (0 week)	Group A	7.47 0.629	NS
	Group B	7.67 0.802	
VAS (2 week)	Group A	7.20 0.761	NS
	Group B	7.40 0.621	
VAS (4 week)	Group A	5.40 0.724	<0.05
	Group B	6.33 0.606	
VAS (8 week)	Group A	4.07 0.944	<0.01
	Group B	5.20 0.664	

VAS= Visual Analogue Scale

Modified Roles and Maudsley Score

Modified criteria of Roles and Maudsley score was developed on the basis of patient compliance about a treatment. There are four grading in this scale; score 1= Excellent, score 2= Good, score 3= Fair, score 4= Poor.

Table IV (a) shows at the beginning of the study, 26 patients experienced poor with pain and 4 felt fair in Group A, while it was 24 and 6 respectively in Group. After 2 weeks, 15 patient experienced fair and 1 patient experienced good in Group A, while 13 patients felt fair and no patient felt good in Group B. At the end of treatment, 8 patients felt excellent and 17 patients felt good in Group A. No patient felt poor in Group A after completion of treatment. After completion of treatment, no patient felt excellent while three patients felt poor in Group B.

Table IV (b) shows after 2 weeks of treatment, the Group A had mean Modified Roles and Maudsley (MRM) score 3.43±0.57 while the score was 3.57±0.50 in Group B. MRM score was lower (more compliance) after 4 weeks of treatment in Group A (2.57±0.51) than in Group B (3.23±0.61). The situation remained unchanged after 8 week (1.90±0.67 in Group A and 2.67±0.43 in Group B). All of the differences were statistically significant.

Table IV (a) MRM score of both groups

	Group	Poor	Fair	Good	Excellent
0 week	Group A	26 (87.7%)	4 (13.3%)	0 (0.0%)	0 (0.0%)
	Group B	24 (80.0%)	6 (20.0%)	0 (0.0%)	0 (0.0%)
2nd week	Group A	14 (46.7%)	15(50.0%)	1 (3.3%)	0 (0.0%)
	Group B	17 (56.6%)	13 (43.3%)	0 (0.0%)	0 (0.0%)
4th week	Group A	0(0.0%)	16 (53.3%)	14 (46.7%)	0 (0.0%)
	Group B	12 (40.0%)	16(53.3%)	2 (6.7%)	0 (0.0%)
8th week	Group A	0 (0.0%)	5 (16.7 %)	17 (56.7%)	8 (26.7%)
	Group B	3 (10.0%)	20 (66.7%)	7 (23.3%)	0 (0.0%)

Table IV (b) MRM score of both groups

	Group	Mean	±SD	P value
MRMS(2 week)	Group A	3.43	0.568	<0.05
	Group B	3.57	0.504	
MRMS(4 week)	Group A	2.57	0.507	<0.01*
	Group B	3.23	0.606	
VAS (8 week)	Group A	1.90	0.662	<0.01*
	Group B	2.67	0.434	

MRMS= Modified Roles and Maudsley Score, *= Highly Significant (HS)

100 –Point Scoring System for plantar fasciitis score

"100 –Point Scoring System for plantar fasciitis", measures pain in two domains; 70-points for pain score and 30-point for function score. Both pain score and function score were measured and compared.

Pain score

Table V shows pain scores were almost equal for both groups at 0 week (Group A-19.93±7.03; Group B-20.20±6.18) and end of 2nd week (Group A-20.20±6.53; Group B-20.67±6.78). At the end of 4th week, Group A scored higher (27.27±6.78) than Group B (24.67±6.33). But the above differences were not statistically significant. After 8th week Group A had better pain score (36.87±8.31) than Group B (33.40±8.01) and the difference was statistically significant.

Function score

Table VI shows function scores were also almost equal for both groups at 0 week (Group A-13.60±0.89; Group B-13.80±1.06) and end of 2nd week (Group A-14.00 ±1.39; Group B-14.33±1.32). after 4th week, Group A scored a little higher (18.87±2.73) than Group B (16.93±1.98). None the above differences was statistically significant. After 8th week Group A achieved better function score (21.47±2.97) than Group B (19.13±2.97) and the difference found statistically significant (p<0.05).

Table V : 100 –Point Scoring System for plantar fasciitis (pain score) of both groups

	Group	Mean	±SD	P value
100-PSS(pain score); 0 week	Group A	19.93	7.032	NS
	Group B	20.20	6.183	
100-PSS(pain score); 2nd week	Group A	20.20	6.531	NS
	Group B	20.67	6.774	
100-PSS(pain score); 4th week	Group A	27.27	6.782	NS
	Group B	24.67	6.332	
100-PSS(pain score); 8th week	Group A	36.87	8.312	<0.05
	Group B	33.40	8.013	

Table VI : 100 –Point Scoring System for plantar fasciitis (function score) of both groups

	Group	Mean	±SD	P value
100-PSS(function score); 0 week	Group A	13.60	0.894	NS
	Group B	13.80	1.064	
100-PSS(function score); 2nd week	Group A	14.00	1.390	NS
	Group B	14.33	1.322	
100-PSS(function score); 4th week	Group A	18.87	2.726	NS
	Group B	16.93	1.982	
100-PSS(function score); 8th week	Group A	21.47	2.968	<0.05
	Group B	19.13	2.968	

Total score for 100- Point Scoring System for plantar fasciitis

Table VII shows total scores were also almost equal for both groups (Group A-33.5±7.83; Group B-34.00±6.93) at week and by the end of 2nd week (Group A-34.20±7.62; Group B-34.00±7.76), and those were not statistically important as well. After 4th week, Group A had a higher (46.13±8.34) than Group B (41.60±7.52). This difference was statistically significant (p<0.05). After 8th week of management, Group A attained better score (58.33±10.46) than Group B (52.53±8.74) and this difference was found statistically significant (p<0.01).

Table VII: Total score for 100- Point Scoring System for plantar fasciitis

Group		Mean	±SD	P value
100-PSS (0 week)	Group A	33.53	7.825	NS
	Group B	34.00	6.928	
100-PSS (2nd week)	Group A	34.20	7.622	NS
	Group B	34.00	7.764	
100-PSS (4th week)	Group A	46.13	8.337	<0.05
	Group B	41.60	7.518	
100-PSS (8th week)	Group A	58.33	10.456	<0.01
	Group B	52.53	8.740	

DISCUSSION

Plantar fasciitis is a most common presenting disorder of foot in which symptoms become chronic and functionally incapacitating. It occurs in similar proportions in all culture, interferes with equality of life and work performances. It is common reason for medical consultations. Along with other treatment, recently, ESWT has been advised for treatment of this condition. A randomized clinical study was accompanied on 60 patients with plantar fasciitis attending in the physical medicine and rehabilitation department in the Dhaka Medical College Hospital to assess the efficacy of Extracorporeal Shock-wave therapy (ESWT) in the treatment of plantar fasciitis and its therapeutic outcome. The patients were randomly divided into two groups by lottery; Group-A and Group-B. In Group-A, Extracorporeal shock-wave therapy (ESWT) along with NSAIDs, Exercises, orthotic as heel cushion/ shoe modification like slight high heel with heel cushion and Group-B NSAIDs, Exercises, orthotics as heel cushion/ shoe modification will be given for a period of 8 weeks.

Visual Analogue Scale (VAS) scores of both intervention group (Group A) and control group (Group B) were recorded at various intervals. VAS scores were recorded at the beginning of the study for both of the groups. The mean VAS scores were almost equal for the both groups (Group A-7.47±0.63; Group B-7.67±0.80). After then, at the end of second week, VAS scores were measured again and till then scores remain close for both groups (Group A-7.20±0.76; Group B-7.40±0.62). This procedure was repeated after fourth week and then the mean score was found lower in Group A (5.40±0.72) than that of Group B (6.33±0.61). Scores were recorded for the last time at the end of 8th week. The mean score remained lower in group A (4.07±0.94) than in Group B (5.20±0.66). The mean difference were found statistically significant (p value > 0.05) at fourth and eighth week.

Similar study was conducted by Krishnan et al., in 2012 in Delhi, India among 25 patients. The mean pretreatment VAS for the entire group was 9.2±0.7. Four weeks after treatment the VAS decreased to 3.4±1.9. This difference was statistically significant (p<0.05). VAS scores were improved in both of the studies though improvement was greater in the study of Krishnan et al.

On the other hand, at the beginning of the study, 26 (87.7%) patients experienced poor with pain and 4 (13.3%) felt fair in Group A, while it was 24 (80.0%) and & (20.0%) respectively in Group B. After 2 weeks, 15(50.0%) patient experienced fair and 1 patient experienced good in Group A, while 13 (43.3%) patient felt fair and no patient felt good in Group B. At the end of treatment, 8(26.7%) patients felt excellent and 17(56.7%) patients felt in Group A. No patient felt poor in Group A after treatment completed. After completion of treatment, no patient felt excellent while three patients felt poor in Group B. In the study of Krishnan et al., 2012 four weeks post treatment, 18(72%) heels were rated as `1` (excellent), 4 (16%) as `2` (good), and 1(4%) as `3`(fair) and `4` (poor or unchanged).Though excellent were more in Krishnan et al's study, the scenario in both study was similar.

Another study was conducted by Chen et al., in Taiwan in1999 on similar topic by using 100-point scoring system among 74 patients. The average total pain scores were 29.3±14.6 pretreatment and 49.2±13.9 post treatment (p<0.001). The average function scores were 15.2±4.6 pretreatment and 21.6±6.0 post treatment (p<0.001).

On the other hand this study also revealed similar result. The average total pain score were 19.93±7.03 pretreatment

and 38.87±8.31 post treatment (p, 0.001). The average function scores were 13.60±0.89 pretreatment and 21.47±2.97 post treatment (p<0.001).This study was found consistent with most of the other studies.

CONCLUSIONS

This study found the effect of Extra-corporeal Shock-wave Therapy in the treatment of chronic plantar fasciitis when treated together with other treatment choices. The patients treated with Extra-corporeal shock-wave therapy along with other options had better presentation than those who did not receive extracorporeal shock-wave therapy. The effect was better after 4th week and it was clear after 8 week of extracorporeal shock-wave therapy. There was no significant difference between two groups after two weeks of treatment. So it may be recommended that extracorporeal shock-wave therapy might be rewarding after 4 weeks of treatment. Extracorporeal shock-wave therapy showed better compliance, and can be suggested by the physicians.

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