

Plantar fasciitis: patients outcomes after 12-week Exercises Rehabilitation program

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Abstract

Background: Plantar fasciitis is one of the most common disorders of foot associated with pain and limitations to activities. **Aim:** To investigate outcomes of patients with plantar fasciitis after 12-week exercises rehabilitation program. **Patients and methods:** Research design: A randomized controlled trial. Sample and setting: Sixty-four patients with plantar fasciitis attended to orthopedic department and orthopedic outpatients clinic at Assiut University Hospitals. Patients were assigned randomly into 2 equal groups as odd number (intervention group) and double number (control group). This study introduced exercises rehabilitation program to intervention group. Outcomes were measured at the time of assessment in orthopedic department and orthopedic outpatients clinic and then each 4 weeks for 12-week in orthopedic outpatients clinic. Tools: assessment sheet for patient with plantar fasciitis, numeric pain rating scale, foot functional index, American orthopedic foot and ankle society scale and exercises adherence logbook. **Results:** Statistical significant difference (p.value <0.05) was found between intervention and control groups at the second and third month of follow up as regard numeric pain rating scale (p.value <0.05), foot functional index (p.value <0.001) and American orthopedic foot and ankle society scale (p.value <0.05). **Conclusion:** The 12-week exercises rehabilitation program; plantar fascia stretching, Achilles tendon stretching and roll plantar fascia with frozen water bottle reducing pain and improving functional recovery and foot function for patients with plantar fasciitis. **Recommendations:** The 12-week exercises rehabilitation program should be advocated as one of the significant modalities to manage pain and improve functional recovery and foot function for patients with plantar fasciitis.

Keywords: Plantar fasciitis; Exercises rehabilitation program; Patients outcomes.

Introduction

Plantar fasciitis is a common cause of heel pain in young and older adults. It is an overuse injury causing inflammation at the plantar fascia and surrounding perifascial structures. It is estimated that more than 1 million of the population in the United States annually seek treatment for plantar fasciitis. It is thought to be caused by overuse from prolonged

running or standing (Becker and Childress, 2018; Ling and Wang, 2018).

The typical pain of plantar fasciitis is localized to the medial calcaneus and usually occurs in the morning or after a prolonged activity. Pain can be reduced after performing light activities, but it returns with prolonged weight-bearing activities (Martin et al. 2014). Pain during walking may result in restrictions

in patients' foot function, working, walking capacity, social participation and quality of life. Patients with plantar fasciitis walk more slowly than healthy people in order to avoid/reduce pain (Chang et al., 2014). Loss of muscle strength, flexibility and development of inactive lifestyle can result from lack of walking and activities (Beeson, 2014).

Plantar fasciitis is more common in middle aged obese women and young athletes male. It takes place in patients whose lifestyle causes irregular stretching of the plantar fascia, repetitive microtrauma in runners, prolonged standing and heel spur. Weakness of the extrinsic and intrinsic foot muscles may result in recurrent symptoms of plantar fasciitis as a result of improper joint positioning and functioning of the muscle during walking (Beeson, 2014; Hotta et al., 2015; Thompson et al., 2014).

Diagnosis of patient with plantar fasciitis can be made through the patient history, clinical manifestations and objective assessments such as level of pain, muscle tightness, palpation, range of motion of joint or muscle strength. Diagnostic imaging may be used to exclude other causes of heel pain as heel spurs or inflammation of tissues (Thong-On et al., 2019).

Most patients with plantar fasciitis usually respond to conservative treatment. Rest period accompanied by anti-inflammatory drugs and ice pack, stretching, and orthosis are recommended. If the patient still symptomatic, corticosteroid injection should be considered prior to any surgical management in patients with refractory plantar fasciitis (Agyekum and Ma, 2015; Kukreja et al., 2017).

Understanding the anatomy and kinematics of the ankle and foot, the dynamic and static function of the plantar fasciitis during walking and the contributing risk factors associated with plantar fasciitis aid in developing a proper treatment plan and preventative protocol for this condition (Çil et al., 2019; Thong-On et al., 2019).

The rehabilitation nurses are key contributors to the care of the patients with chronic conditions and disability. They provide direct care and education, perform activities to maintain and restore function and prevent complications, direct carryover of skills taught and practiced during treatment plan, design and implement treatment strategies rely on scientific nursing theory related to self-care and promote patients health status. They have the responsibility to assure that the patients care is individualized, appropriate to their needs and the care is carried out comprehensively according to the plan. They analyze, synthesize, and evaluate patients' status and coordinates educational activities through incoming calls to ensure that the highest level of effective patient outcomes are achieved through adherence to the plan of care (Camicia et al., 2014; Çol and Purut, 2018).

The exercise rehabilitation programs can improve recovery of patients with plantar fasciitis because they reduce muscle tightness and increase muscle strength. There is no specific type of exercises mentioned in the literature to be the best ones to improve symptoms of plantar fasciitis; hence, it is remain uncertain that which type of exercises will improve more plantar fasciitis symptoms (Thong-On et al., 2019).

Significance of the study:

Pain associated with plantar fasciitis cause impaired foot function, significant gait-related disability and stiffness. Plantar fasciitis, if not treated soon or properly after the initial symptoms, it frequently becomes chronic and difficult to resolve. So, patients with plantar fasciitis are in essential need for rehabilitation exercises program to improve their condition; reducing pain and improving functional recovery and foot function.

Aim of the study

This study was aimed to investigate outcomes of patients with plantar fasciitis after 12-week exercises rehabilitation program.

Hypothesis

The hypothesis of this study was that the 12-week exercises rehabilitation program for patients with plantar fasciitis may have different positive effects on reducing pain and improving functional recovery and foot function.

Operational definition

Outcomes: pain, functional recovery, foot function

Patients and Methods

Design

A randomized controlled trial research design was used to investigate outcomes of patients with plantar fasciitis after 12-week exercises rehabilitation program.

Setting

The study was carried out at [Assiut University Hospitals, orthopedic department and orthopedic outpatients clinic].

Sampling and sample size

Patients diagnosed with plantar fasciitis were recruited from the orthopedic department and orthopedic outpatients clinic at Assiut University Hospitals. All eligible patients with unilateral plantar fasciitis who agreed to participate in the study were included. Patients with plantar fasciitis were considered eligible for the study by history, symptoms and physical examination. Radiological examination by heel X-ray was performed to all patients to exclude other pathologies. The inclusion criteria included male and female ≥ 18 years, having painful and tender heel at the medial tubercle of calcaneus, heel pain in the morning or after prolonged activities and having a clinical diagnosis of plantar fasciitis. Patients over 65 years, pregnancy, and those who had past history of ankle corticosteroid injection or foot surgery and those with other foot pathology were excluded.

Sample size was calculated (G power software) as 52 cases, 26 per group. Calculated sample size for testing differences between two independent means two tailed. Used power 95 %, effect size 0.8, and error 0.05

Tools

I. Assessment sheet for patient with plantar fasciitis

It included both demographic and medical data for patients with plantar fasciitis. Demographic data included: age, gender, level of education and occupation. Medical data included: co-morbidities, weight, body mass index, duration of pain, affected leg and characters of pain.

Numeric pain rating scale

It is used to measure pain intensity and consists of 11-item ranging from (0 to 10). The lower limit 0 = no hurt/pain whereas the upper limit 10 = greater pain intensity (**McCaffery and Beebe, 1989**). It was adopted by the researchers to measure the intensity of pain associated with plantar fasciitis.

Foot Functional Index (FFI)

It was developed by **Budiman et al. 1991** and it is consisting of 23-items divided into 3 sub-scales to measure the effect of foot pathology on function; foot pain in different situations [9-items], disability/difficulty in performing different functional activities as a result of foot problems [9-items] and activity restriction/limitations in activities as a result of foot problems [5-items]. Scoring each item is rated from 0 to 10 Likert scale. 0 = no pain/disability and 10 = worst pain imaginable/sever disability for each item. Total FFI score equals the total of the answered items (maximum of 230) multiplied by (100) [total score/230×100= total FFI score %]. It was adopted by the researchers to measure foot function for patients with plantar fasciitis.

American Orthopedic Foot and Ankle Society Scale (AOFAS)

It was developed by **Kitaoka et al., 1994**. The AOFAS is a 9-item questionnaire divided into 3 subscales (100 points): level of pain [40 points] consists of 1 item / question [maximum score is 40 points = no pain], function [50 points] consists of 7-item [maximum score is 50 points = full function], and foot alignment [10 points] consists of 1-item [maximum score is 10 points = good alignment]. It is used for measuring functional recovery after different foot and ankle problems. Scores ranged from 0 - 100 points; (0) indicates the worst and (100) shows no symptoms or impairments. It was adopted by the researchers to measure functional recovery for patients with plantar fasciitis.

Exercises adherence logbook

It was developed by the researchers to ensure adherence of patients to the exercises rehabilitation program. It consisted of exercises page for each week over 12-week of follow up.

Exercises Rehabilitation Program (Handout)

It was developed by the researchers in Arabic language after reviewing different national and international literature. It was reviewed and revised by special experts (one expert from medical-surgical nursing staff, one expert from the orthopedic and trauma staff and one expert from rheumatology, rehabilitation and physical medicine). It consists of the following:

- Plantar fascia stretching (10 repetition, for 10 seconds, three times per day).
- Achilles tendon stretching (10 repetition, for 10 seconds, 3 times per day).

- Roll plantar fascia with frozen water bottle (10 minutes, 3 times per day).

Methods

Ethical considerations

Permission was obtained from Faculty of Nursing and Assiut University Hospitals to carry out this study. Oral agreement was obtained from patients with plantar fasciitis for voluntary participation in this study. Confidentiality and anonymity were assured by coding of patients' data. All patients were informed with the nature and purpose of the study and also they informed that they have the right to refuse participation in this study and can withdraw at any time.

Validity and reliability

It was established by a panel of three experts (one expert from medical-surgical nursing staff, one expert from the orthopedic and trauma staff and one expert from rheumatology, rehabilitation and physical medicine) who reviewed the tools of the study for relevance, clarity, understanding and applicability. Correlation coefficient was used to test reliability [0.87].

Pilot study

It was conducted on (10%) of the studied sample in the orthopedic department and orthopedic outpatients clinic at Assiut University Hospitals to test applicability, feasibility, and clarity of the study tools. No changes were done to the tools of the study, so the (10%) of the studied sample was included in the study.

Sixty-four out of seventy-two patients were invited to participate (64/72) met the eligibility criteria of the study and gave informed consent to participate. Patients assigned randomly into 2 equal groups as odd number (intervention group) and double number (control group).

All studied patients were assessed for the first time in the orthopedic department and orthopedic outpatients clinic. All studied patients received routine 3 weeks non steroid anti-inflammatory drugs and instructed about activity modifications (recommended rest period for 2 weeks during acute phase and measures to relieve pain and inflammation as ice pack three times per day for 2 weeks).

In addition to routine management, the intervention group was adhered to the 12-week exercises rehabilitation program from the first day of assessment. The researchers explained and trained the patients with plantar fasciitis to perform and adhere to the 12-week exercises rehabilitation program in order to reduce their pain and improve functional recovery and foot function. Each patient in the intervention group was interviewed individually for one session (1 hour) to explain the content of the 12-week exercises rehabilitation program and train them to do it. A handout with the recommended exercises (type of exercises, frequency and duration) was given to each patient in the intervention group. The intervention group patients were instructed to perform the recommended exercises every day, three times a day for 12-week.

The researchers ensured commitment of the patients of the intervention group to implement the 12-

week exercises rehabilitation program by exercises adherence logbook and by continuous follow up by telephone and attendance of patients to orthopedic outpatients clinic to complete their follow up period (12-week).

The 12-week exercises rehabilitation program aimed to reduce pain and improve functional recovery and foot function. So, patients with plantar fasciitis were encouraged to perform and adhere early to the 12-week exercises rehabilitation program in order to improve their conditions. The 12-week exercises rehabilitation program; plantar fascia stretching, Achilles tendon stretching and roll plantar fascia with frozen water bottle was explained to patients with plantar fasciitis with illustrated photos (Handout of 12-week exercises rehabilitation program for patients with plantar fasciitis)

Patients with plantar fasciitis were followed up in orthopedic outpatients clinic and by telephone to follow their

Results

Table (1): Non statistical significant differences were found between both groups as regarding demographic data. The mean ages of patients with plantar fasciitis in intervention and control groups were 44.72 ± 5.60 , and 41.89 ± 7.52 years, respectively. More than half of patients in intervention 17 (53.12%) and control 21 (65.62%) groups were males and officer [20 (62.5%) and 17 (53.12%) respectively]. Non statistical significant differences were found between both groups as regarding baseline medical data. More than half of patients in both groups

progression and ensure continuity of the 12-week exercises rehabilitation program. The 12-week exercises rehabilitation program was done by patients of the intervention group at home. Exercises was done every day, three times a day for 12-week.

The design of the 12-week exercises adherence logbook enabled patients of the intervention group to rate their weekly notes/commitment to exercises. Self-reported commitment to exercises was reported to the researchers weekly for 12-week by telephone or attendance of patients to orthopedic outpatients clinic.

Statistical analysis

Statistical analysis for the study data were analyzed using SPSS software (version 20.0). Frequency, chi-square test, an independent sample t- test were used. Statistical difference was considered significant when p .value <0.05.

(59.37%) not having co-morbidities. More than half of patients in intervention 20 (62.5%) and control 24 (75%) groups having pain in the right leg. All patients experienced pain for more than 1 month, in the morning and after prolong standing or walking. The mean weight of patients in intervention and control groups were 68.4 ± 12.5 , and 69.4 ± 9.7 kilogram, respectively. The mean body mass index of patients in intervention and control groups were 27.0 ± 3.0 , and 28.0 ± 2.0 kilogram, respectively.

Table (2): There was non statistical significant difference between the total numeric pain rating scale scores either for the pain at morning or for the pain at worst in both groups at baseline

assessment (p.value > 0.05). Regarding the baseline assessment using the FFI, there was non significant difference between the total FFI score in both groups (p.value > 0.05). Regarding the baseline assessment using the AOFAS, there was non significant difference between the total AOFAS score in both groups (p.value > 0.05).

Table (3): The intervention group had statistical significant improvement regarding the mean numeric pain rating scale score during follow up (p.value 0.001). For morning pain, statistical significant difference was found between the intervention and control groups at second and third months of follow up (p.value < 0.05). For worst pain, statistical significant difference was found between the intervention and control groups at second month (p.value < 0.05) and third month (p.value < 0.01) of follow. The mean numeric pain rating scale score regarding worst pain for intervention group at the second and third months 3.52 ± 2.55 , 2.73 ± 2.16 respectively compared to mean numeric pain rating scale score for control group 6.34 ± 2.47 , 6.34 ± 2.47 respectively.

Table (4): Both intervention and control groups had statistical significant improvement regarding the mean FFI score during follow up (p.value < 0.001, < 0.05 respectively). Statistical significant difference was found between the intervention and control groups at second month (p. value < 0.01) and third month (p. value < 0.001) of follow up. The mean FFI for intervention group at the second and third months 14.21 ± 0.98 , 3.74 ± 0.91 respectively compared to mean FFI score for control group 37.04 ± 8.49 , 29.16 ± 4.76 respectively.

Table (5): Both intervention and control groups had statistical significant improvement regarding the mean AOFAS score during follow up (p.value < 0.01, < 0.05 respectively). Statistical significant difference was found between the intervention and control groups at second month (p.value < 0.05) and third month (p.value < 0.01) of follow up. The mean AOFAS for intervention group at the second and third months 82.54 ± 9.33 , 93.42 ± 8.64 respectively compared to mean AOFAS score for control group 69.91 ± 8.76 , 72.86 ± 9.85 respectively.

Table (1): Demographic characteristics and baseline data of the studied groups.

Variables	Intervention group (n=32)		Control group (n=32)		p. value
	No.	%	No.	%	
Age (years) (18-53)					
Mean ± SD	44.72 ± 5.60		41.89 ± 7.52		0.281
Sex					
Male	17	53.12	21	65.62	0.538
Female	15	46.87	11	34.37	
Level of education					
Read and write	5	15.62	2	6.25	0.743
Middle school	8	25	11	34.37	
High school	12	37.5	5	15.62	
University	7	21.87	14	43.75	
Occupation					
Officer	20	62.5	17	53.12	0.172
Machinery work	8	25	9	28.12	
Not working	4	12.5	6	18.75	
Co-morbidities					
None	19	59.37	19	59.37	0.183
Diabetes mellitus	11	34.37	4	12.5	
Hypertension	2	6.25	9	28.12	
Duration of pain					
More than 1 month	32	100	32	100	
Affected side					
Left knee	12	37.5	8	25	0.729
Right Knee	20	62.5	24	75	
Characters of pain					
In the morning	32	100	32	100	0.394
During running	9	28.12	5	15.62	
After prolong standing or walking	32	100	32	100	
After prolong sitting	18	56.25	21	65.62	

Non significance p > 0.05

Table (2): Baseline data of the studied groups in terms of numeric pain rating scale, foot functional index and American orthopedic foot and ankle society scale scores.

Parameters	Intervention group (n=32)	Control group (n=32)	p.value
	Mean ± SD	Mean ± SD	
Numeric pain rating scale (Pain intensity)			
Pain at morning	6.75±2.43	6.13±2.29	0.192
Pain at worst	7.85±2.20	7.36±2.21	0.540
FFI	64.8±13.2	62.9±14.8	0.462
AOFAS	49.87±8.69	47.95±9.43	0.976

Non significance p > 0.05

Table (3): Outcomes of the studied groups at 1 month, 2 months and 3 months in terms of numeric pain rating scale.

Parameters	One month follow up Mean ± SD	Two months follow up Mean ± SD	Three months follow up Mean ± SD	p.value
Pain at morning				
Intervention group	4.75±2.62	3.98±2.24	1.52±2.12	0.001**
Control group	5.82±2.54	5.70±2.51	3.19±1.25	0.076
p.value	0.774	0.04*	0.01*	
Pain at worst				
Intervention group	6.08±2.27	3.52±2.55	2.73±2.16	0.001**
Control group	7.09±2.31	6.34±2.47	6.34±2.47	0.062
p.value	0.689	0.03*	0.001**	

Non significance $p > 0.0$

**Significance $p < 0.01$

*Significance $p < 0.05$

***Highly significance $p < 0.001$

Table (4): Outcomes of the studied groups at 1 month, 2 months and 3 months in terms of foot functional index scores.

Parameters	One month follow up Mean ± SD	Two months follow up Mean ± SD	Three months follow up Mean ± SD	p.value
FFI				
Intervention group	44.94±5.71	14.21± 0.98	3.74 ±0.91	0.0001***
Control group	50.86±3.89	37.04±8.49	29.16±4.76	0.01*
p.value	0.929	0.001**	0.0001***	

Non significance $p > 0.0$

**Significance $p < 0.01$

*Significance $p < 0.05$

***Highly significance $p < 0.001$

Table (5): Outcomes of the studied groups at 1 month, 2 months and 3 months in terms of American orthopedic foot and ankle society scale scores.

Parameters	One month follow up Mean ± SD	Two months follow up Mean ± SD	Three months follow up Mean ± SD	p.value
AOFAS				
Intervention group	62.79 ± 9.21	82.54 ± 9.33	93.42 ± 8.64	0.001**
Control group	58.64 ± 7.98	69.91 ± 8.76	72.86 ± 9.85	0.01*
p.value	0.692	0.02*	0.001**	

Non significance $p > 0.0$

**Significance $p < 0.01$

*Significance $p < 0.05$

***Highly significance $p < 0.001$

Discussion

Plantar fasciitis is a common problem in the orthopedic department. Despite this, there has been a remarkable little advancement in the understanding and management of this condition. There is no standard treatment protocol for plantar fasciitis. A variety of management options are available to patients. The nonoperative management leads to complete resolution of pain in 90% of patients with plantar fasciitis but can take 3 to 6 months (Latt et al., 2020). So, this study conducted in an attempt to find recommended exercises rehabilitation program for those patients.

The comparison of the baseline data of the patients in the intervention and control groups revealed that they were similar. All patients were adult and having morning and worst heel pain. In the first measurement before starting the 12-week exercises rehabilitation program for patients with plantar fasciitis, the mean scores obtained from the numeric pain rating scale in both groups were close to each other, and no significant statistical difference between them. It was determined high scores of numeric pain rating scale of patients in both groups indicating severe pain intensity.

In this regard, a study of Latt et al., 2020 reported that plantar fasciitis is the most common cause of heel pain in adults, affecting young active patients and older patients with more sedentary lifestyle. It results from excessive

overload of the plantar fascia due to overuse or excessive loading as in obese (body mass index >30) and individuals stand for prolonged time.

Similar studies mentioned that assessment data for patients with plantar fasciitis indicate high level of heel pain that worse in the morning (Çil et al., 2019; Mohamed, 2015; Moyné-Bressand et al., 2018; Thong-On et al., 2019).

In the first measurement before starting the 12-week exercises rehabilitation program for patients with plantar fasciitis, the mean scores obtained from the FFI in both groups were close to each other, and no significant statistical difference between them. It was determined high scores of FFI of patients in both groups indicating impaired foot function.

Similar studies stated that assessment data for patients with plantar fasciitis mentioned that patients with plantar fasciitis had impaired foot function; high scores of FFI and high level of pain (Çil et al., 2019; Mohamed, 2015).

In the first measurement before starting the 12-week exercises rehabilitation program for patients with plantar fasciitis, the mean scores of the AOFAS in both groups were close to each other, and no significant statistical difference between them. It was determined low scores of AOFAS of patients in both groups indicating impaired functional recovery.

Similar studies stated that assessment data for patients with plantar fasciitis indicate low scores of AOFAS and high level of pain. This pain had negative impact on patients functional level and ability to perform daily living activities and thus patients had poor quality of life; low scores of AOFAS (Cil' et al., 2019; Mohamed, 2015).

The results of the current study clarified that the intervention group showed significant improvements in pain, functional recovery and foot function (total numeric pain rating scale, AOFAS and FFI scores) in terms of intermediate (2 months) and final measurements (3 months) after application of the 12-week exercises rehabilitation program.

From the researchers point of view, this may be due to the effect of the 12-week exercises rehabilitation program for patients with plantar fasciitis which applied in the intervention group; reduced their pain and improved their functional recovery and foot function. The 12-week exercises rehabilitation program for patients with plantar fasciitis was effective in enhancing rapid recovery and thus improving patients outcomes.

In this study, significant improvement was found between intervention and control groups regarding pain intensity. The intervention group showed greater reduction in pain intensity than the control group. Morning pain and worst pain reduced in the intervention group with significant improvement regarding numeric pain rating scale.

This study results supported by the study results of **Thong-On et al., 2019** who conducted exercise programs; strengthening and stretching which significantly improved pain and gait function for patients with plantar fasciitis compared to assessment data. The morning pain and the worst pain reduced in both groups and significant improvement was observed as regard visual analogue scale (VAS) score. The foot muscles play important role in maintaining foot arches while walking. They concluded that the strengthening and stretching exercises for foot muscles have better improvements in pain and gait function.

In this study, patients of the intervention group showed greater improvements in FFI scores (foot function) and AOFAS scores (functional recovery) than the control group during follow up period.

From the researchers point of view, this may have been as a result of the major benefits of the 12-week exercises rehabilitation program for patients with plantar fasciitis. Also, the improvements in the intervention group may have occurred as a result of increased dorsiflexion of ankle range of motion and plantar flexors through stretching and strengthening exercises for Achilles tendon and calf muscles. In addition to the continuous follow up of the intervention group by the researchers to be sured from adherence of the patients to perform the 12-week exercises at regular time according to the recommendations in the handout given to them.

The researchers point of view was supported by the study of **Rathleff et al., 2015** who concluded that stretching and strengthening exercises for patients with plantar fasciitis showed change in the total FFI scores from baseline to greater improvements at the third month of follow up.

Other supported results were those of **Khan et al. 2014** who reported that patients with plantar fasciitis managed with tissue-specific plantar fascia stretching protocol have better outcomes regarding pain intensity and FFI. Also, study of **Jha et al., 2013** mentioned that stretching of the plantar fascia can lead to improvement of symptoms in patients with plantar fasciitis with improving FFI scores and worst and morning pain.

Also, the researchers point of view was supported by the study of **Mohamed, 2015** who stated that stretching of the Achilles tendon can significantly reduce pain and disability for patients with plantar fasciitis, as regard VAS and AOFAS scores compared to assessment data. This method of management provides inexpensive, effective, and straightforward treatment protocol for treating plantar fasciitis. In addition, compliance may affected the results if patients with plantar fasciitis did not perform their exercises regularly.

Rehabilitation nurses play an important role in meeting the needs of every patient, supporting their function and helping them to identify measures for

performing daily activities. They identify the needs of every patient and provide them with necessary care and education and this have a positive impact on patients' physical function, quality of life and motivation. Also, they have an important and effective role in patients' compliance to the treatment regimen; exercises rehabilitation program (**Kwon and Lee, 2017**).

Conclusion

The findings of this study concluded that the 12-week exercises rehabilitation program of the plantar fasciitis was significantly reduced pain, disability and improved foot function and functional recovery. It provides inexpensive, effective and straightforward treatment protocol for patients with plantar fasciitis. In addition, adherence to the 12-week exercises rehabilitation program of the plantar fasciitis is the main point of the success of the 12-week exercises rehabilitation program in managing pain and disability. So, this study concluded that rehabilitation nurses have an important and effective role in managing patients with plantar fasciitis through continuous education, training and monitoring and this continuous role have a positive effects on patients' adherence to the 12-week exercises rehabilitation program and improving their outcomes.

Recommendation

Distributing the handout of the 12-week exercises rehabilitation program (plantar fascia stretching, Achilles tendon stretching and roll plantar fascia with frozen water bottle for patients with plantar fasciitis) is of great value in improving outcomes for patients with plantar fasciitis, reminding them of the rehabilitation guide and reduce both the possibility of recurrence and the progression to chronicity.

References

- Agyekum E. K., and Ma K., (2015):** Heel pain: A systematic review. Chinese Journal of Traumatology, Vol.18, No. 3, P.p 164-169.
- Becker B. A., and Childress M. A., (2018):** Common foot problems: over-the-counter treatments and home care. American family physician, Vol.98, No.5, P.p 298-303.
- Beeson P., (2014):** Plantar fasciopathy: revisiting the risk factors. Foot and ankle surgery, Vol. 20, No.3, P.p 160-165.
- Budiman-Mak E., Conrad K. J., and Roach K. E., (1991):** The Foot Function Index: a measure of foot pain and disability. Journal of clinical epidemiology, Vol. 44, No.6, P.p 561-570.
- Camicia M., Black T., Farrell J., Waites K., Wirt S., and Lutz B., (2014):** The essential role of the rehabilitation nurse in facilitating care transitions: a white paper by the association of rehabilitation nurses. Rehabilitation Nursing Journal, Vol. 39, No.1, P.p 3-15.
- Chang R., Rodrigues P. A., Van Emmerik R. E., and Hamill J., (2014):** Multi-segment foot kinematics and ground reaction forces during gait of individuals with plantar fasciitis. Journal of biomechanics, Vol. 47, No.11, P.p 2571-2577.
- Çil E. T., Şaylı U., and Subaşı F., (2019):** Outpatient vs home management protocol results for plantar fasciitis. Foot & ankle international, Vol. 40, No.11, P.p 1295-1303.
- Çol B. K., and Purut H. P., (2018):** Nursing in Rehabilitation Process. Psychology Research, Vol. 8, No. 4, P.p 168-172.
- Hotta T., Nishiguchi S., Fukutani N., Tashiro Y., Adachi D., Morino S., and Aoyama T., (2015):** The association between plantar heel pain and running surfaces in competitive long-distance male runners. The Journal of sports medicine and physical fitness, Vol. 56, No.9, P.p 1021-1025.
- Jha R. K., Uprety S., and Shah L. L., (2013):** Functional outcome in patients with chronic plantar fasciitis treated with plantar fascia stretching vs tendoachilles stretching exercises. Journal of Institute of Medicine Nepal, Vol. 35, No.1, P.p 32-38.
- Khan M., Ali S. S., and Soomro, R. R., (2014):** Role of Tissue Specific Plantar Fascia Stretching Exercises Versus Myofascial Released Technique in Chronic Plantar Fasciitis. Journal of Basic and Applied Sciences, Vol. 10, P.p 91-95.
- Kitaoka H.B., Alexander I.J., and Adelaar R.S., (1994):** Clinical rating systems for the ankle-hindfoot,

- midfoot, hallux, and lesser toes. *Foot Ankle Int*, Vol. 15, P.p 349–53.
- Kukreja T., Agarwal T., Singh A., and Bhugra H., (2017):** Comparative study for the treatment of plantar fasciitis by corticosteroids versus platelet rich plasma. *Medical Journal of Dr. DY Patil University*, Vol. 10, No. 3, p. 252.
- Kwon H. K., and Lee S. J., (2017):** The effect of a movie-based nursing intervention program on rehabilitation motivation and depression in stroke patients. *Journal Korean Academy of Nursing*, Vol. 47, No.3, P.p 345-356.
- Latt L. D., Jaffe D. E., Tang Y., and Taljanovic M. S., (2020):** Evaluation and treatment of chronic plantar fasciitis. *Foot & Ankle Orthopaedics*, Vol.5, No.1, 2473011419896763.
- Ling Y., and Wang S., (2018):** Effects of platelet-rich plasma in the treatment of plantar fasciitis: A meta-analysis of randomized controlled trials. *Medicine*, Vol.97, No.37, P.p 1-9.
- Martin R. L., Davenport T. E., Reischl S. F., McPoil T. G., Matheson J. W., Wukich D. K., and Godges J. J., (2014):** Heel pain—plantar fasciitis: *Journal of Orthopaedic & Sports Physical Therapy*, Vol. 44, No.11, A1-A33.
- McCaffery M., and Beebe A., (1989):** The numeric pain rating scale instructions. In *Pain: Clinic Manual for Nursing Practice*. Mosby, St. Louis.
- Mohamed H. A., (2015):** Effectiveness of Achilles tendon stretching for the treatment of chronic plantar fasciitis. *The Egyptian Orthopaedic Journal*, Vol. 50, No.4, p. 215.
- Moyne-Bressand S., Dhieux C., Dousset E., and Decherchi P., (2018):** Effectiveness of foot biomechanical orthoses to relieve patients suffering from plantar fasciitis: is the reduction of pain related to change in neural strategy?. *BioMed research international*, 2018.
- Rathleff M.S., Molgaard C.M., Fredberg U., Kaalund S., Andersen K.B., and Jensen T.T.,(2015):** High-load strength training improves outcome in patients with plantar fasciitis: a randomized controlled trial with 12-month follow-up. *Scand J Med Sci Sports*, Vol. 25, e292-300
- Thompson J. V., Saini S. S., Reb C. W., and Daniel J. N., (2014):** Diagnosis and management of plantar fasciitis. *The Journal of the American Osteopathic Association*, Vol. 114, No.12, P.p 900-901.
- Thong-On S., Bovonsunthonchai S., Vachalathiti R., Intiravoranont W., Suwannarat S., and Smith R., (2019):** Effects of strengthening and stretching exercises on the temporospatial gait parameters in patients with plantar fasciitis: A randomized controlled trial. *Annals of rehabilitation medicine*, Vol. 43, No.6, p. 662.