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INVESTIGATION OF THE RELATIONSHIP BETWEEN PAIN, FUNCTIONALITY AND QUALITY OF LIFE IN PATIENTS AFTER METATARSAL FRACTURES

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ABTRACT

Metatarsal fracture is a common problem in the foot. After fracture patients may have problems such as pain and loss of function. The aim of this study is to examine the relationship between pain, functionality and quality of life in patients after metatarsal fracture. The study included 14 patients with a mean age of 40.71±13.58 years, whose primary fracture healing completed after metatarsal fractures. Visual Analogue Scale (VAS) for pain severity, Nottingham Health Profile (NHP) Questionnaire for quality of life and Foot Function Index (FFI) for foot functions were used in the evaluations, the relationships between them were examined with Spearman correlation analysis. According to VAS, the most pain was in activity (VAS activity: 5,01±2,02cm), the least pain was at rest (VAS rest: 1,22±0,35cm) in patients. In NHP the most pain (49,10±29,67 points) and the least social isolation (5,71±11,78 points) sub-parameters were affected. In FFI, more influence was observed in the disability subscale (44,75±24,89 points). Very strong relationship between FFI pain, NHP sleep and NHP total score (TS); very strong relationship between FFI disability and NHP pain, physical mobility (PM) and NHP TS; very strong relationship between FFI TS and NHP pain, PM and NHP TS was found ($p<0,05$). In conclusion we think that determination of the relationships between pain, functionality and quality of life in patients after metatarsal fractures will guide the planning of the physical therapy and rehabilitation program and establishing of long and short-term goals.

KEYWORDS: Metatarsal Fracture, Pain, Quality of life, Physiotherapy.

INTRODUCTION

Foot fractures are most common foot injuries that primary care physicians often encounter. Metatarsals and toes are most commonly affected in the foot.[1] Metatarsal fractures constitute approximately 5-6% of fractures evaluated in primary care and represent a large amount of all foot injuries.[2,3,4,5,6] Acute metatarsal fractures occur at a rate of 35% among foot fractures and 5% among all skeletal fractures.[7,8] Metatarsal fractures commonly can be the reason of chronic foot pain that is seen in adults and children.[8] In adults, metatarsal fractures are usually encountered between 2nd and 5th decades of life and also elderly women who have osteoporosis and patients who have diabetes mellitus about more than 25 years carry greater risk for metatarsal fractures.[6,9] Having diabetes mellitus, obesity and female gender are related with negative outcomes of metatarsal fractures.[6]

Fifth metatarsal fractures are most common in adults and children over the age of five.[1,6] This is followed by the third metatarsal fractures. [1] First metatarsal fractures, which constitute 1.5% of metatarsal fractures, are the least common due to its large anatomical structure and relative stability. [8] In adults one third of metatarsal fractures occur in the distal part or shaft of the metatarsals.[9]

Metatarsal fractures can occur with various conditions.[7] The severity of the metatarsals injury can vary from a simple isolated metatarsal fracture to a comminuted fracture which can affect the joint, with more serious soft tissue damage and a crush injury that causes severe soft

tissue involvement.[6] These fractures, ranging from crush injury to extensive damage in the soft tissue and bone component, can cause significant discomfort for the patient.[7] It is often a reason for pain and disability if there is malunion in the fracture.[4]

Metatarsal fractures can be caused by both direct and indirect traumas.[6,7] Most of these fractures are caused by a simple foot trauma due to a fall or by an object which is falling on the foot from above.[9] Direct trauma in the form of a heavy object falling on the foot is commonly seen in industrial workers. Indirect trauma may occur from rotation of the leg and hind foot while the forefoot is fixed.[4] The responsible injury mechanism of metatarsal fractures is frequently related with falling while standing or rotation injury with the forefoot fixed.[8] Although mostly low-energy traumas cause of metatarsal fractures, also high-energy crush injuries can occur.[7]

Stress fractures are frequently seen in metatarsal area in the human skeleton.[4] They are caused from microtrauma as a result of repetitive forces and can be seen in athletes, dancers, and soldiers.[4,6] The proximal end of the second, third, and fifth metatarsals are the most common sites of stress fractures. Patients who have metatarsal fractures complain of pain while walking or the inability to bear weight on the foot.[4] Mostly there is swollen, bruise in the foot and tenderness on palpation. Depending on etiology and amount of metatarsals affected patient can complain of mild pain on walking and inability to weight bear.[6] Major deformities are just seen in more complex and severe injury patterns, including additional toe dislocations and serial fractures.[4,6] Metatarsal fractures vary from simple manageable fractures to more complex fractures that need to surgical intervention.[2] Classification of metatarsal fractures is made according to patient history, anatomical region and radiological findings. According to these classifications and activity level of patient, treatment may be select conservative or surgical.[10] Metatarsal fractures mostly can be treated well by conservatively with or without cast.[5] Approximately 80% of metatarsal fractures are either non-displaced or minimally displaced, in which case they are frequently suitable for conservative treatment.[1] All metatarsal fractures which are closed non-displaced can generally be treated non-operatively including stress fractures.[4,6]

In the treatment of non-displaced metatarsal fractures, many different non-operative treatment methods have been described. Generally, for 3-5 weeks immobilization of metatarsals and not to loading is recommended.[4] While metatarsal fractures mostly can be treated only with immobilization, few of these fractures need to operative stabilization. Generally it is accepted that twisting injury or direct trauma must be the reason of the majority of these fractures.[11] Elite athletes can be treated surgically for reduce immobility time. Displacement in the sagittal plane may cause of changing weight distribution under the metatarsal heads that can be reason of mechanical metatarsalgia, painful callosities and neuroma formation, because of this it needs surgery. The selection of treatment should be specific for the fracture and patient. Displaced metatarsal fractures affect the weight-bearing complex of the foot so this can cause metatarsalgia because of the excessive pressure on the metatarsal heads.[6] In general, the main aim of treatment is to correct the placement of all metatarsals and to maintain the normal weight-bearing distribution and transverse and longitudinal arches of the forefoot.[8]

In the literature there is little attention to the metatarsal fractures, in spite of its disability risk and incidence.[5] Studies on the evaluation of pain and functional disabilities in patients after metatarsal fractures, are insufficient in the literature.[12] Restoring pain-free standing, balance and walking functions of patients after both surgical and conservative treatment of metatarsal fractures is important to improve the patient's functionality and level of independence. For this reason, determination the level of influence that may occur due to fracture and pain in such functions of the patient during the return to daily life and work will guide the planning of physical therapy and rehabilitation in accordance with the expectations and needs of the patient. The aim of this study is to examine the relationship between pain, functionality and quality of life in patients who have completed conservative treatment after metatarsal fracture. Thus, it will be possible to determine on which parameters the long-term and short-term goals of the rehabilitation plan to be determined for these patients will create responses that can affect each other. For example, the possible relationship of sub-parameters such as physical mobility, energy level, sleep, social isolation with pain will facilitate the estimation of the effects of a goal for pain reduction on these parameters and the determination of goals in terms of social participation.

MATERIALS AND METHODS

The study was carried out at Hacettepe University, Physical Therapy and Rehabilitation Faculty. Ethics committee approval of the study was obtained from Hacettepe University Clinical Research Ethics Committee with registration number KA-180122.

Inclusion criteria for the study

- Having been treated conservatively (with cast or splint) after metatarsal fracture
- Having been completed primary fracture healing (at least 4 weeks)
- Between the ages of 18-60 years

Exclusion criteria from the study

- Having undergone any surgery that may affect lower extremity functions in the last 1 year
- Having any neurological problem

- Having any peripheral nerve injury of the lower extremity
- Having hearing, vision and speech disabilities that will prevent communication
- Having any inflammatory disease
- Having neuropathy
- Having any vascular (arterial or venous) problems
- Having any other injuries or fractures involving the lower extremity in the last 1 year other than metatarsal fracture

Demographic information such as age, height, weight, educational status, main complaint, history, previous surgical operation and trauma information of the patients were recorded.

Visual Analogue Scale (VAS) was used to evaluate the pain severity of the patients. There is a 10 cm line in the VAS evaluation. The starting point (0) on this line means that the pain is not felt at all (no pain). The VAS method indicates that the severity of pain increases as one moves away from the starting point. The number 10 is the value at which unbearable pain is felt.[13] The patients were asked to mark the degree of pain they felt at rest, during activity and at night on this line. The distance of the marked point to the starting point was measured in centimeters and recorded. This value was determined as the pain intensity of the patients. The Nottingham Health Profile Questionnaire (NHP) was used to assess the patients' quality of life. This scale is a general quality of life scale developed to measure the health status of the individual in terms of physical and emotional social aspects as she/he perceives herself/himself. The first part of the scale, which consists of two parts, is mostly used and consists of 38 items that evaluate quality of life in 6 areas (pain, energy level, sleep, emotional reactions, physical mobility and social isolation status). The questions are answered as "Yes" or "No". Scores in each section are added together and 0 points indicate good health and 100 points indicate poor health. The Turkish Validity and Reliability study of the questionnaire was conducted by Küçükdeveci et al (2000) .[14] Foot Function Index (FFI) scale was used to determine the effect on the foot functions of the patients. The foot function index was developed to measure the effects of foot pathologies on disability, pain and activity limitation, and the form can be filled in by the individuals themselves. The foot function index is a 23-item scale with 3 subgroups (pain, disability, and activity limitation). The pain subscale includes nine items and measures the level of foot pain in various conditions. The disability subscale consists of nine items and the degree of difficulty in relation to foot problems during different functional activities is determined. There are five items in the activity limitation subscale, and activity limitations due to foot problems are evaluated. Patients score all items in this scale with VAS, taking into account their foot condition in the previous week. In order to calculate the subscales and the total score, the score of each item is added, divided by the sum of the maximum scores that can be obtained from the items, and multiplied by 100. Higher scores indicate more pain, disability, and activity limitation. If patients cannot perform some activities, these items are not considered valid and calculations can be made by subtracting them from the total score, if possible.[15,16]

Statistical analysis

Demographic and clinical characteristics of the participants were defined as mean (X) and standard deviation (SD) according to the type of variable. Spearman correlation coefficient was used to evaluate the relationship between variables. Significance level was determined as $p<0.05$. The correlation coefficient was expressed as r and $0.201 < p < 0.400$ weak correlation; $0.401 < p < 0.600$ moderate correlation; $0.601 < p < 0.800$ strong correlation; $0.801 < p < 0.999$ very strong correlation; It was determined as 1,000 full correlation.[17]

RESULTS

Our study, which was planned to analyze the relationship between pain, foot functions and quality of life in patients who completed conservative treatment after metatarsal fractures, included a total of 14 sedentary patients (10 women and 4 men) with a mean age of 40.71 ± 13.58 years (min:23, max:60 years) were included. Dominant extremity is right side in all patients; the affected foot was determined as the right side in 6 patients and the left side in 8 patients. In our study, it was observed that the non-dominant extremities of the patients were mostly affected. 11 of the patients had 5th metatarsal, 2 of them had 4th metatarsal and 1 of them had 3rd metatarsal fracture. When their educational status was examined, it was seen that most of the patients were university graduates (1 patients primary school, 2 patients high school, 11 patients university). In addition, other data on the demographic characteristics of the patients are shown in Table 1.

Table 1: Demographic data.

	X	SD
Age (year)	40,71	13,58
Height (m)	1,66	0,10
Weight (kg)	74,00	13,77
Body Mass Index (kg/m^2)	26,76	4,53

X: Mean, SD: Standart Deviation, m: Meter, kg: Kilogram

In our study, it was determined that the patients felt the most pain during activity and had the least pain at rest. The VAS results used to evaluate the pain severity of the patients are shown in Table 2.

Table 2: Results of pain intensity in patients according to VAS.

Pain intensity (VAS)	X	SD
Rest (cm)	1,22	0,35
Activity (cm)	5,01	2,02
Night (cm)	2,55	2,89

X: Mean, SD: Standart Deviation, VAS: Visual Analog Scale, cm: Centimeter

According to the results of the Nottigham Health Profile Questionnaire used to evaluate the quality of life, it was observed that the most affected parameters were pain, energy level and physical mobility, respectively. The least affected was determined as the social isolation parameter. NHP results are shown in Table 3.

Table 3: Results of Nottingham Health Profile (NHP) questionnaire in patients.

Nottingham Health Profile Questionnaire (point)	X	SD
Energy level	45,23	39,05
Pain	49,10	29,67
Emotional reactions	22,22	6,98
Sleep	32,85	31,71
Social isolation	5,71	11,78
Physical mobility	42,85	23,95
Total	39,06	23,02

X: Mean, SD: Standart Deviation

In the Foot Function Index (FFI) sub-scales, which are used to evaluate foot functions, it was observed that the disability and pain scales were more affected. FFI results are shown in Table 4.

Table 4: Results of Foot Function Index (FFI) in patients.

Foot Function Index (point)	X	SD
Pain	41,52	23,57
Disability	44,75	24,89
Activity limitation	28,42	20,78
Total	39,86	21,30

X: Mean, SD: Standart Deviation

The evaluation results of the relationships between Visual Analog Scale (VAS), Foot Function Index (FFI) subscales and the Nottigham Health Profile (NHP) Questionnaire sub-parameters are shown in Table 5, Table 6 and Table 7.

Table 5: Relationships between VAS and Foot Function Index (FFI) sub-scales.

Correlation test (r)		VAS		
		Rest	**Activity**	**Night**
FFI	**Pain**	0,430**	0,684***	0,530**
	Disability	0,571**	0,750***	0,642***
	Activity limitation	0,150	0,405**	0,375*
	Total	0,495**	0,725***	0,601***

r: correlation coefficient, VAS: Visual Analog Scale, FFI: Foot Function Index
**Weak correlation, **Moderate correlation, ***Strong correlation, ****Very strong correlation, p<0.05*

Table 6: Relationships between VAS and Nottingham Health Profile (NHP) sub-parameters.

Correlation test (r)		VAS		
		Rest	**Activity**	**Night**
NHP	**Energy level**	-0,019	0,476**	0,428**
	Pain	0,596**	0,648***	0,782***
	Emotional reactions	0,158	0,565**	0,199
	Sleep	0,248*	0,576**	0,538**
	Social isolation	-0,122	0,176	-0,005
	Physical mobility	0,432**	0,627***	0,643***
	Total	0,358*	0,691***	0,604***

r: Correlation coefficient, NHP: Nottingham Health Profile, VAS: Visual Analog Scale
**Weak correlation, **Moderate correlation, ***Strong correlation, ****Very strong correlation, p<0.05*

Table 7: Relationships between Foot Function Index (FFI) subscales and Nottingham Health Profile (NHP) sub-parameters.

Correlation test (r)		FFI			
		Pain	Disability	Activity Limitation	Total
NHP	Energy Level	0,726***	0,627***	0,527**	0,731***
	Pain	0,797***	0,876****	0,596**	0,889****
	Emotional reactions	0,559**	0,531**	0,430**	0,602***
	Sleep	0,861****	0,684***	0,416**	0,798***
	Social isolation	0,042	0,177	0,515**	0,224*
	Physical mobility	0,728***	0,903****	0,687***	0,886****
	Total	0,839****	0,856****	0,633***	0,917****

r: Correlation coefficient, NHP: Nottingham Health Profile, FFI: Foot Function Index
**Weak correlation, **Moderate correlation, ***Strong correlation, ****Very strong correlation, $p<0.05$*

DISCUSSION

With this study, it was aimed to determine the current functional loss in patients with metatarsal fractures and the need for rehabilitation. In our study, possible relationships between pain levels, quality of life and foot functions of patients following conservative treatment of patients with metatarsal fractures were evaluated.

According to the VAS used to determine the pain intensity of the patients, it was determined that there was a strong relationship between the pain intensity especially during activity and the Foot Function Index pain, disability and total score. We think that the pain that can occur during loading on the foot in the activities such as walking or going up and down stairs affects the foot functions negatively. In addition, a strong correlation was observed between night pain and FFI disability and total score in our study. In the literature, there are limited number of similar studies conducted in patients after metatarsal fractures. Although studies are mostly focused on fracture treatment and fracture healing process, studies showing functional results are few. Bigsby et al. in a study with fifth metatarsal fractures, investigated the functional results and the effect of fracture type on results in individuals. In the study, Foot Function Index (FFI) scale and Short Form 36 version 2 (SF36v2) questionnaire were administered to patients with conservatively treated fifth metatarsal fractures at the 1st, 4th and 12th months and no difference was found between FFI results according to gender and fracture type. In addition, pain was also evaluated in the same group and there was no significant difference in pain according to fracture type at final follow-up. As a result of the study, it was reported that 25-33% of the patients had pain in the first year, while the pain and foot functions improved following the injury.[12] Most of the patients in our study had fifth metatarsal fracture and the pain level of the patients was especially lower at rest; it has been determined that pain is at a higher rate during activity and at night, although it is not very severe. We believe that functionality and quality of life can be improved more effectively and faster as a result of reducing the pain level with the implementation of physical therapy and rehabilitation program for the problems associated with pain complaints that may be observed in the long-term in patients. This situation can be revealed more clearly with the treatment results of studies to be conducted on this subject.

In our study, it was determined that there was a strong relationship between pain, physical mobility and total score which are sub-parameters of the Nottingham Health Profile questionnaire and activity and night pain levels of patients according to VAS. After the fracture, an increase in pain can be observed, especially in situations where weight is placed on the foot, such as walking, climbing stairs. In a study by Coşkun et al., it was aimed to investigate the relationship between hallux valgus deformity and the position of the hindfoot joints, quality of life, pain and related functional status in women with bilateral hallux valgus. As a result of the study, it was stated that the increase in the hallux valgus angle and the pathomechanical changes in the hind foot were associated with an increase in pain and thus a decrease in the functional status and quality of life.[18] Pain due to foot problems can negatively affect the daily life of patients by reducing not only physical functions but also health-related quality of life. For this reason, it is expected that the applications to reduce pain will improve these parameters and affect the individual positively.

In our study, the mean body mass index scores of the patients were found to be slightly above the normal limit. In a systematic review examining the relationship between body mass index and foot disorders, it was reported that there is a strong relationship between chronic plantar heel pain and nonspecific foot pain and body mass index.[19] In our study, the weight average being slightly above the normal limits may cause more load on the joints and bone structures in activities such as walking or standing which may cause an increase in pain. According to these results, the pain that can be observed in the post-fracture period in patients may cause functional disabilities and difficulties in movement. We think that this may adversely affect the quality of life and daily activities of patients.

Very strong relationship between the FFI pain parameter and NHP sleep and total score; very strong relationship

between FFI disability parameter and NHP pain, physical mobility and total score; very strong relationship between FFI total score and NHP pain, physical mobility and total score were found. In addition, in the same scales strong relationship between FFI pain parameter and NHP energy level, pain and physical mobility scores; strong relationship between the FFI disability parameter and NHP energy level and sleep scores; strong relationship between FFI activity limitation parameter and NHP physical mobility and total score; strong relationship between FFI total score and NHP energy level, emotional reactions and sleep scores was found. Functional losses and pain may be occur in patients as a result of trauma and fracture. In addition after the immobilization process foot functions of the patients can be negatively affected also the level of independence, activity level, physical and psychological state of the patients. For this reason, we think that a physical therapy and rehabilitation program that stimulates fracture and soft tissue healing and aims to increase physical functions by reducing pain is important in the treatment of these patients. In the study of Pfeifer et al., it was stated that the rehabilitation program played an important role in the healing of the fracture and long-term functional outcomes in foot and ankle fractures treated surgically or conservatively.[20] In our study, it was revealed that the pain parameter has a critical importance in the functionality and quality of life of these patients. For example, the relationship between sub-parameters such as physical mobilty, energy level, sleep, social isolation and pain suggests that a goal to reduce pain will also have positive effects on these parameters and will facilitate the determination of goals in terms of social participation.

CONCLUSION

It is important to determine the possible relationships in pain severity level, health-related quality of life and functionality parameters in patients after metatarsal fracture in terms of revealing the clinical level. Thus, it will be possible to determine on which parameters the long and short-term goals of the physical therapy and rehabilitation plan to be determined for these patients will create responses that can affect each other. Although the small number of patient in our study is a limitation, we think that this study may raise awareness about problems after metatarsal fracture and needing individualized physical therapy and rehabilitation programme.

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Conflict of Interest

The authors declare no competing interest.

REFERENCES

1. Bica D, Sprouse RA, Armen J. Diagnosis and management of common foot fractures. American Family Physician, 2016; 93(3): 183-191.
2. Haltch RL, Alsobrook JA, Clungston JR. Diagnosis and Management of Metatarsal Fractures. Amarican Family Physician, 2007; 76(6): 817-26
3. Bowes J, Buckley R. Fifth metatarsal fracture and current treatment. World Journal of Orthopedics, 2016; 7(12): 793-800.
4. Rammelt S, Heineck J, Zwipp H. Metatarsal fractures. Injury, 2004; 35(2): 77-86.
5. Cakır H, Van Vliet-Koppert ST, Van Lieshout EMM, De Vries MR, Van Der Elst M, Schepers T. Demographics and outcome of metatarsal fractures. Archives of Orthopaedic and Trauma Surgery, 2011; 131(2): 241-5.
6. Moore NFE. Metatarsal fracture management. Orthopaedics and trauma, 2018; 32: 428-436.
7. Buddecke DE, Polk MA, Barp EA. Metatarsal fractures. Clinics Podiatric Medicine and Surgery, 2010; 27(4): 601-24.
8. Boutefnouchet T, Budair B, Backshayesh P, Ali SA. Metatarsal fractures: a review and current concepts. Trauma, 2014; 16(3): 147-163.
9. Kozacı N, Ay MO, Avcı M, Beydilli İ, Turhan S, Dönertaş E, Ararat E. The comparison of radiography and point-of-care ultrasonography in the diagnosis and management of metatarsal-fractures. Injury, Int. J. Care Injured, 2017; 48(2): 542-547.
10. Zwister EW, Breederveld RS. Fractures of fifth metatarsal; diagnosis and treatment. Injury, Int. J. Care Injured, 2010; 41(6): 555-62.
11. Singer G, Cichocki M, Schalamon J, Eberl R, & Höllwarth ME. A study of metatarsal fractures in children. The journal of bone and joint surgery, 2008; 90(4): 772-6.
12. Bigsby E, Halliday R, Middleton RG, Case R, Harries W. Functional outcome of fifth metatarsal fracture. Injury, Int. J. Care Injured, 2014; 45(12): 2009-12.
13. Hawker GA, Mıan S, Kendzerska T, French M. Measures of Adult Pain. Arthritis Care & Research, 2011; 63(11): 240-52.
14. Küçükdeveci AA, McKenna SP, Kutlay S, Gürsel Y, Whalley D, Arasıl T. The development of psychometric assessment of the Turkish version of the Nottingham Health Profile. International Journal of Rehabilitation Research, 2000; 23(1): 31-8.
15. Yalıman A, Şen Eİ, Eskiyurt N, Budiman-Mak E. Turkish translation and adaptation of Foot Function Index in patients with plantar fasciitis. Türk Fiziksel Tıp ve Rehabilitasyon Dergisi, 2014; 60(3): 212-22.
16. Anaforoğlu-Külünkoğlu B, Fırat N, Yıldız NT, Alkan A. Reliability and validity of the Turkish version of the Foot Function Index in patients with foot disorders. Turkish Journal of Medical Sciences, 2018; 48(3): 476-483.

17. Spor AR. Sağlık ve Eğitim Bilimlerinden Örneklerle Uygulamalı İstatistik ve Güvenirlik-Geçerlik. Ankara: Detay Yayıncılık, 2016.
18. Coşkun G, Talu B, Bek N., Yiğiter Bayramlar K. Effects of halluks valgus deformity on rear foot position, pain, function, and quality of life of women.The Journal of Physical Therapy Science, 2016; 28: 781-787.
19. Butterworth PA, Landorf KB, Smith SE, Menz HB. The association between body mass index and musculoskeletal foot disorders: a systematic review. Obesity Reviews, 2012; 13(7): 630-42.
20. Pfeifer CG, Grechenig S, Frankewycz B, Ernstberger A, Nerlich M, Krutsch W. Analysis of 213 currentlyh used rehabilitation protocols in foot and ankle fractures. Injury, Int. J. Care Injured, 2015; 46(4): 51-57.