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Original Article

Return to work in patients with an ankle fracture and the influence of physiotherapy

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Abstract

Objective: The aim of this study is to assess the influence of physiotherapy on return to work (RTW) in patients with an ankle fracture.

Methods: A retrospective cohort study was conducted on patients 18 years and older with an ankle fracture submitted to conservative treatment or surgery in one of four regional hospitals in the Netherlands between 2017 and 2019. Patient and treatment characteristics were extracted from medical records. Questionnaires were sent to patients regarding information about RTW.

Results: One thousand eight hundred and four patients met the inclusion criteria, and 1163 patients replied to the questionnaire (64.5%). The patients were divided into two groups: those who received physiotherapy (n = 573) and those who did not (n = 582). Patients who had physiotherapy were more often older, female, had more inherently unstable and open fracture types, were submitted to surgery, treated using cast immobilization, experienced complications, and needed revision surgery more often. Physiotherapy was seen to be a significant negative associative factor for RTW (HR = 0.768).

Conclusion: Overall, 5% of all patients sustaining an ankle fracture did not RTW. Although partly explained by fracture characteristics, treatment type, and patient factors, physiotherapy appears to negatively affect time to RTW in patients with an ankle fracture.

Level of Evidence II; Prognostic study; Retrospective study.

Keywords: Ankle fractures; Physiotherapy; Return to work.

Introduction

After sustaining an ankle fracture, adults often experience a rapid initial recovery, but functional improvement declines over time. On average, it is suggested that no further improvement can be expected after 24 months[1]. Early rehabilitation is highly preferable when treating ankle fractures to improve functional outcomes[2].

Rehabilitation is often directed by a physiotherapist and is suggested to be beneficial in restoring mobility to impaired extremities. For instance, when patients with distal radius fractures are treated with physiotherapy, pain perception is decreased[3-6]. However, in terms of function, no clear benefit is seen[4,5]. Moreover, no clear benefit of physiotherapy is seen in patients with ankle distortion regarding functional recovery[7]. In line with these results, the effect of physiotherapy on functional outcomes after sustaining an ankle fracture is questioned[8].

Nevertheless, it is important to acknowledge that functionality is affected not only after sustaining an ankle fracture. Trauma patients face psychological but also social consequences, such as delayed return to work (RTW)[9,10]. It is well-established that several factors affect the ability to

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RTW following an ankle fracture, including the ability to bear weight[11-13]. To date, the exact influence of physiotherapy on RTW in patients with an ankle fracture remains unknown[14,15].

The primary aim of this study is to assess the influence of physiotherapy on RTW in patients with an ankle fracture.

Methods

Study design and eligibility criteria

A retrospective cohort study was conducted to assess the effect of physiotherapy on time to RTW. It was conducted in four regional teaching hospitals in the eastern Netherlands. Two hospitals are Level I trauma centres, and the others are Level II trauma. Ethical approval was obtained from local medical ethics committees. The study population was patients with an ankle fracture treated at one of the four participating hospitals between 1st August 2016 and 31st April 2020. Patients in this study had to be at least 18 years and older and master the Dutch language to answer the questionnaire. Patients submitted to conservative treatment and surgery were included. Patients who met the inclusion criteria and completed the questionnaire were included for analysis in this study. Patients with pilon fractures were excluded.

Study variables

Data was extracted from medical records of patients treated in one of the participating hospitals. Patient details, fracture characteristics, and treatment specifics were extracted from the records. All data was managed using the online Castor Electronic Data Capture software[16].

Patient data extracted from medical records were age, sex, date of the accident, American Society of Anaesthesiologists (ASA) classification as described by the anaesthesiologist in the pre-operative screening, and smoking as reported by the treating surgeon or anaesthesiologist[17].

The obtained fracture characteristics were the type of fractures classified by Danis-Weber and Lauge Hansen and whether or not it was a compound fracture (using Gustilo-Anderson classification)[18,19]. Fractures were analysed and classified by medical researchers. In case of uncertainties, three trauma surgeons were consulted.

The following treatment characteristics were extracted: conservative treatment or surgery, cast immobilization or functional treatment, and whether or not rehabilitation was directed by a physiotherapist. Complications such as superficial and deep infections, peripheral nerve damage, bleeding, malunion, nonunion, failure of osteosynthesis material, and if revision surgery was deemed necessary by the treating physician were assessed. Superficial wound infections were defined as treated with oral antibiotics only. Wound infections treated with intravenous antibiotics and/or surgical debridement were defined as deep infections. Peripheral nerve damage was defined as the loss of sensibility in the ankle or foot three months after surgery. If a blood transfusion was given or surgery was needed due to bleeding, it was considered post-operative bleeding. Malunion, nonunion, and failure of the osteosynthesis material were diagnosed by the treating physician.

Outcome measures

The primary outcome of this study was time to RTW in days. For conservative treatment, time to RTW was measured from the accident date. For surgery, it was measured from the date of surgery.

Return to work

Questionnaires were sent after record extraction to measure the time to RTW. They were emailed if an email address was available from the patients' records; otherwise, the questionnaire was sent by mail. A reminder was sent after two weeks if a patient did not respond to the email. Patients who did not respond to this reminder or the questionnaire sent by mail were called by phone. In total, patients were called no more than three times.

Questions about whether and when patients did RTW were asked. Patients could choose from three options: yes, no, and not applicable. For various reasons, patients who filled in 'no' could not RTW after injury. For RTW, not applicable was chosen when patients did not have a job before the injury and had already stopped working before the injury because of retirement or other illnesses. Smoking was also questioned in the questionnaire. The total years of smoking and number of cigarettes per day were asked to calculate the amount of packyears.

Statistical analysis

Descriptive statistics were used to describe the study population. Bivariable analysis was executed for main characteristics, including the Chi-square and Mann-Whitney U test. Number of patients who did not RTW was calculated among subgroups based on known factors that influence either returning to work or the need for physiotherapy. For further analysis regarding RTW, only patients who returned to work were considered. A univariable and multivariable Cox regression analysis was performed to evaluate the association of different variables on the time to RTW. In case of low numbers, subgroups were combined. Statistical analysis was performed using SPSS software version 29.0.0.0.

Results

Patients' characteristics

From 1st January 2017 to 31st December 2019, 1804 patients met the inclusion criteria, and 1163 patients completed the questionnaire (64.5%). The median follow-up time was 889 days (2.4 years) from the date of injury (for conservative treatment) or the date of surgery (for surgery).

Patients who completed the questionnaire were more often female (55.9% vs 62.9%), non-smoking (64.5% vs 73.3%),

had fewer comorbid diseases (ASA 1 and 2: 78.5% vs 86.9%), had more severe fractures types (Lauge Hansen pronation external rotation 4 (PE4) 7.0% vs 8.8%, supination external rotation 4 (SE4) 24.4% vs 29.0%), attended physiotherapy more often (42.9% vs 49.6%) and received more operative treatment (37.7% to 51.7%) (Table 1).

Table 1. Patients who completed the questionnaire vs patients who did not complete the questionnaire

			Questionnaire completed		Significance
			No (n = 640)	Yes (n = 1163)	
Age in years (median)			52.0 (32.0 to 71.0)	54.0 (40.0 to 65.0)	
					p = 0.950*
Sex	Male		282 (44.1%)	432 (37.1%)	
	Female		358 (55.9%)	731 (62.9%)	
					p = 0.004*
Smoking	No		231 (64.5%)	550 (73.3%)	
	Yes		127 (35.5%)	200 (26.7%)	
					p = 0.003*
ASA-classification	1		93 (33.3%)	228 (34.8%)	
	2		126 (45.2%)	341 (52.1%)	
	3		50 (17.9%)	78 (11.9%)	
	4		10 (3.6%)	8 (1.2%)	
					p = 0.005*
Weber- classification	Weber A		160 (25.7%)	314 (27.5%)	
	Weber B		384 (61.6%)	665 (58.3%)	
	Weber C		79 (12.7%)	162 (14.2%)	
					p = 0.378**
Lauge Hansen classification	SE	1	1 (0.2%)	0 (0.0%)	
		2	175 (27.5%)	273 (23.6%)	
		3	23 (3.6%)	22 (1.9%)	
		4	155 (24.4%)	335 (29.0%)	
	SA	1	111 (17.5%)	227 (19.6%)	
		2	40 (6.3%)	46 (4.0%)	
	PE	1	18 (2.8%)	30 (2.6%)	
		2	1 (0.2%)	5 (0.4%)	
		3	29 (4.6%)	51 (4.4%)	
		4	46 (7.0%)	102 (8.8%)	
	PA	1	9 (1.4%)	20 (2.5%)	
		2	0 (0.0%)	2 (0.2%)	
		3	7 (1.1%)	17 (1.5%)	
	Not classifiable		21 (3.3%)	21 (1.8%)	
					p < 0.013*
Gustilo-Anderson classification	Closed		621 (97.9%)	1135 (97.9%)	
	I		3 (0.5%)	9 (0.8%)	
	II		5 (0.8%)	7 (0.6%)	
	III		5 (0.8%)	8 (0.7%)	
					p = 0.235**
Surgery	No		397 (62.3%)	561 (48.3%)	
	Yes		240 (37.7%)	600 (51.7%)	
					p < 0.001*
Physiotherapy	No		360 (57.1%)	582 (50.4%)	
	Yes		271 (42.9%)	573 (49.6%)	
					p = 0.007*
Cast immobilization	No		89 (14.0%)	186 (16.0%)	
	Yes		547 (86.0%)	975 (84.0%)	
					p = 0.254**
Complication after surgery	No		598 (93.4%%)	1048 (90.1%)	
	Yes		42 (6.6%)	115 (9.9%)	
					p = 0.017*
Revision surgery	No		616 (98.2%)	1124 (97.3%)	
	Yes		11 (1.8%)	31 (2.7%)	
					p = 0.217**

* Mann-Whitney U test; ** Chi-squared test
ASA: American Society of Anaesthesiologists; SE: Supination external; SA: Lauge Hansen; PE: Pronation external.

The main reasons for not responding to the questionnaire were no interest in participating, an invalid phone number or (email-) address, and not answering the phone and/or email. Among the included patients, 1163 answered the questionnaire, and the patients were divided into two groups: patients treated with physiotherapy (n = 582) and patients not treated with physiotherapy (n = 573). There were eight missing values for the variable physiotherapy. For further analysis, only patients who completed the questionnaires were considered.

Baseline characteristics

Overall, patients were middle-aged (median 52.0 (IQR 35.0 to 64.0) vs 54.0 years (IQR 39.0 – 68.0)), and in both groups were more female patients (58.8% and 67.0%). In the physiotherapy group, more Weber B (48.2% vs 68.6%) and C (9.6% vs 19.2%) fracture types were seen, and fewer Weber A fracture types (42.4% vs 12.2%). Thereby, more inherently unstable fractures were noticed, such as SE4 (n = 248 vs n = 85) and PE4 (n = 73 vs n = 29). Lauge Hansen (SA1) was less frequently treated with physiotherapy (n = 188 vs n = 37) (Table 2). Consequently,

Table 2. Baseline characteristics between physiotherapy and no physiotherapy groups

			Rehabilitation		Significance
			No physiotherapy (n = 582)	Physiotherapy (n = 573)	
Age in years (median)			52.0 (35.0 to 64.0)	54.0 (39.0 to 68.0)	
					p = 0.001*
Sex	Male		240 (41.2%)	189 (33.0%)	
	Female		342 (58.8%)	384 (67.0%)	
					p = 0.004*
ASA-classification	1		81 (38.6%)	145 (32.7%)	
	2		101(48.1%)	240 (54.2%)	
	3		25 (11.9%)	53 (12.0%)	
	4		3 (1.4%)	5 (1.1%)	
					p = 0.472**
Weber-classification	Weber A		243 (42.2%)	68 (12.2%)	
	Weber B		277 (48.2%)	383 (68.6%)	
	Weber C		55 (9.6%)	107 (19.2%)	
					p < 0.001*
Lauge Hansen classification	SE	1	0 (0.0%)	0 (0.0%)	
		2	168 (29.1%)	103 (18.1%)	
		3	11 (1.9%)	11 (1.9%)	
		4	85 (14.7%)	248 (43.5%)	
	SA	1	188 (32.5%)	37 (6.5%)	
		2	26 (4.5%)	18 (3.2%)	
	PE	1	17 (2.9%)	13 (2.3%)	
		2	3 (0.5%)	2 (0.3%)	
		3	18 (3.1%)	33 (5.8%)	
		4	29 (5.0%)	73 (12.8%)	
	PA	1	14 (2.4%)	11 (1.9%)	
		2	1 (0.2%)	1 (0.2%)	
		3	5 (0.9%)	12 (2.1%)	
	Not classifiable		13 (2.3%)	8 (1.4%)	
					p < 0.001*
Gustilo-Anderson classification	Closed		578 (99.3%)	549 (95.8%)	
	I		3 (0.5%)	6 (1.1%)	
	II		0 (0.0%)	7 (1.2%)	
	III		1 (0.2%)	11 (1.9%)	
					p = 0.011*
Surgery	No		415 (71.4%)	143 (25.0%)	
	Yes		166 (28.6%)	430 (75.0%)	
					p < 0.001*
Cast immobilization	No		109 (18.7%)	77 (13.5%)	
	Yes		473 (81.3%)	495 (86.5%)	
					p = 0.015*
Complication	No		557 (95.7%)	483 (84.3%)	
	Yes		25 (4.3%)	90 (15.7%)	
					p < 0.001*
Revision surgery	No		574 (99.1%)	545 (95.4%)	
	Yes		5 (0.9%)	26 (4.6%)	
					p < 0.001*

* Mann-Whitney U test; ** Chi-squared test.
ASA: American Society of Anaesthesiologists; SE: Supination external; PE: Pronation external.

significant differences were seen in the number of operated patients ($p < 0.001$), the number of complications ($p = 0.015$) as well as patients who needed revision surgery ($p < 0.001$) in the physiotherapy group (Table 2). ASA- classification stages 3 and 4 were combined in the analysis due to the low number of patients. Concerning the Gustilo-Anderson classification, further analysis combined 3 A, B, and C as stage 3 or noted as open vs closed.

The median days between injury and completing the questionnaire (follow-up time) was 931 days (2.5 years) (IQR of 600 – 1210 days) for the no physiotherapy group compared to 847 days (2.3 years) (IQR of 551 – 1133.5 days) for the physiotherapy group, which was a significant difference between groups ($p = 0.024$).

Table 3. Comparison of patients who did not return to work between physiotherapy and no physiotherapy groups

		Rehabilitation		
		No physiotherapy	Physiotherapy	All patients
Age (years)	< 40	3 (2.0%)	13 (9.1%)	16 (5.4%)
	> 40	10 (2.3%)	32 (7.5%)	42 (4.9%)
Weber-classification	Weber A	4 (1.7%)	5 (7.5%)	9 (2.9%)
	Weber B	7 (2.6%)	29 (7.7%)	36 (5.5%)
	Weber C	2 (3.6%)	8 (7.7%)	10 (6.3%)
Surgery	Yes	8 (4.8%)	39 (9.1%)	47 (7.9%)
	No	5 (1.2%)	6 (4.3%)	11 (2.0%)

Primary outcome

Almost two-thirds (63.3%) of patients returned to work after sustaining an ankle fracture within the follow-up time. Others did not RTW after injury (5.0%), had already stopped working before the date of injury (31.0%), or did not answer the question (0.7%). When comparing patients who attended physiotherapy and patients who did not, it showed that patients who attended physiotherapy did more often not RTW after sustaining an ankle fracture in all subgroups (age, Weber classification, and operation) (Table 3). The highest percentages of patients who did not RTW were seen among those younger than 40 (9.1%) and those submitted to surgical treatment (9.1%).

Cox regression analysis

A Cox regression analysis was performed to demonstrate which factors are associated with time to RTW. In the univariable analysis, many variables were found to be significant. In the multivariable analysis, a significant association with time to RTW was seen within the variables operated (HR 0.612, 0.394 to 0.950), physiotherapy (HR 0.768, 0.607 to 0.972), cast immobilization (HR 0.660, 0.501 to 0.870) and complications (HR 0.694, 0.519 to 0.930) (Table 4).

Discussion

In our study, a total of 5% of all patients sustaining an ankle fracture were not able to RTW. In addition, several factors contribute to a prolonged time for RTW, such as cast

Table 4. Univariable and multivariable cox-regression analysis

		Univariable			Multivariable		
		HR (Exp B)	p-value	95% confidence interval for Exp B	HR (Exp B)	p-value	95% confidence interval for Exp B
Sex	Male	RC			RC		
	Female	0.929	0.339	0.798 to 1.081	0.898	0.341	0.720 to 1.121
Age	< 40 years	RC			RC		
	> 40 years	0.976	0.766	0.833 to 1.144	0.842	0.158	0.663 to 1.069
ASA-classification	1	RC			RC		
	2	1.054	0.617	0.859 to 1.292	1.087	0.461	0.871 to 1.356
	3 and 4	0.805	0.361	0.507 to 1.281	0.816	0.414	0.502 to 1.328
Gustilo-Anderson classification	Closed	RC			RC		
	Open	0.541	***0.030***	0.311 to 0.942	0.790	0.427	0.443 to 1.411
Weber classification	A	RC			RC		
	B	0.648	***<0.001***	0.543 to 0.773	1.309	0.175	0.887 to 1.933
	C	0.484	***<0.001***	0.378 to 0.620	1.043	0.844	0.685 to 1.588
Surgery		0.467	***< 0.001***	0.401 to 0.545	0.612	***0.029***	0.394 to 0.950
Physiotherapy		0.541	***< 0.001***	0.464 to 0.630	0.768	***0.028***	0.607 to 0.972
Cast immobilization		0.690	***< 0.001***	0.564 to 0.846	0.660	***0.003***	0.501 to 0.870
Complications		0.567	***< 0.001***	0.435 to 0.740	0.694	***0.014***	0.519 to 0.930

HR: Hazard ratio; RC: Reference category; ASA: American Society of Anaesthesiologists.

immobilization, surgery, or post-operative complications. Lastly, physiotherapy appears to have a negative impact on the time to RTW.

The finding of our study is in line with the study by Moseley et al.[15], in which physiotherapy was compared to advice only on functional outcome and RTW. This study showed no benefit of physiotherapy over advice only. Additionally, no significant difference was seen in time to RTW. However, a small difference was seen in time to RTW, whereas attending physiotherapy seems to have a longer time to RTW (median time: 23 days vs 32 days) compared to patients who only had advice[15]. So far, it is unclear what caused this prolonged time for RTW. It might be caused by the fact that more complex fractures more often attend physiotherapy, although multivariable regression analysis corrected Weber and Gustilo-Anderson's classification. Another interpretation might be that physiotherapists are intrinsically more cautious with active aftercare than medical specialists.

Apart from physiotherapy several other factors significantly influenced the time to RTW.

Firstly, patients submitted to surgery appear to be associated with a delay in returning to work. This aligns with a study on patients with distal radius fractures, where surgery led to a longer time from work than conservative treatment[20]. Surgical treatment might be considered a proxy for more complex fractures, whereas more complex fractures could lead to worse outcomes[21]. These worse functional outcomes could explain a delay in returning to work[22]. Second, cast immobilization appeared to be a significant factor. Studies show that active exercise accelerates daily activities, functional outcomes, and RTW compared to immobilization[12]. Therefore, cast immobilization can lead to a delay in RTW. Thereby, cast immobilization could lead to ankle stiffness and affect functional outcomes[6,23].

Lastly, complications following surgical treatment also cause a prolonged time to RTW. Complications lead to impaired functional scores[24]. Consequently, this could explain why lower functional outcomes are associated with a decreased RTW[22].

In our study, 5% could not RTW after sustaining an ankle fracture. Other studies in the Netherlands, the USA, and Australia showed higher unemployment rates of 8% to 15.7% in patients after sustaining an ankle fracture[9,25]. An explanation for the higher unemployment rate of these studies could be due to differences in sample sizes and differences in social support and health care systems among these countries.

Our study has several limitations. First, the questionnaire response rate was 64.5%, and some significant differences were seen in patients who completed the questionnaire and patients who did not, which could potentially lead to selection bias. Another limitation is that the exact content and frequencies of physiotherapy treatment were unknown. It is reasonable to think that both aspects influence functional outcomes. Thereby, it is known that many factors influence functional outcomes and RTW. It is possible that some of these influencing factors were not accounted for in our analysis. For example, the kind of work performed, the content of the physiotherapy, or psychological aspects of rehabilitation (i.e. kinesiophobia) since there is a growing amount of evidence suggesting a relation between psychological factors and clinical outcome after trauma[13,26-28].

The strengths of this study include that this study is a multicentred study; therefore, the study population size is large enough to show a significant difference and have a good representation. Lastly, the median follow-up time was 2.4 years, which allowed patients to recover from an ankle fracture and a high possibility of RTW.

Conclusion

Our study showed that 5.0% of all patients sustaining an ankle fracture did not RTW. Although partly explained by fracture characteristics, treatment type, and patient factors, physiotherapy appears to negatively affect time to RTW in patients with an ankle fracture. Further research should be performed to assess the impact of the type of labour (i.e. manual and/or heavy labour) on RTW, the exact content of physiotherapy, and the role of a physiotherapist in the context of kinesiophobia.

Authors' contributions: Each author personally and significantly contributed towards the development of this article: RVV *(https://orcid.org/0000-0002-9546-9279) Interpreted the results of the study, participated in the reviewing process, interpreted the results of the study, participated in the reviewing process; DPJS *(https://orcid.org/0000-0002-4895-9806) Conceived and planned the activities that led to the study, wrote the paper, participated in the reviewing process, interpreted the results of the study, participated in the reviewing process; MJRE *(https://orcid.org/0000-0001-8035-8157) Conceived and planned the activities that led to the study, wrote the paper, participated in the reviewing process; AFPG *(https://orcid.org/0000-0001-5743-4000) Conceived and planned the activities that led to the study, wrote the paper, participated in the reviewing process, interpreted the results of the study, participated in the reviewing process; DLTG *(XXX) Conceived and planned the activities that led to the study, wrote the paper, participated in the reviewing process; MB *(XXX) Conceived and planned the activities that led to the study, wrote the paper, participated in the reviewing process; SDN *(https://orcid.org/0000-0003-0180-0731) Interpreted the results of the study, participated in the reviewing process, interpreted the results of the study, participated in the reviewing process. All authors read and approved the final manuscript.*ORCID (Open Researcher and Contributor ID).

References

1. Beckenkamp PR, Lin CW, Chagpar S, Herbert RD, van der Ploeg HP, Moseley AM. Prognosis of physical function following ankle fracture: a systematic review with meta-analysis. J Orthop Sports Phys Ther. 2014;44(11):841-51, B2.
2. Lesic A, Tomic S, Cobeljic G, Milicevic M, Djukic V, Slavkovic N, et al. [Modern aspects of the ankle fracture treatment]. Acta Chir Iugosl. 2005;52(2):23-8.
3. Taylor NF, Dodd KJ, Shields N, Bruder A. Therapeutic exercise in physiotherapy practice is beneficial: a summary of systematic reviews 2002-2005. Aust J Physiother. 2007;53(1):7-16.
4. Handoll HH, Elliott J. Rehabilitation for distal radial fractures in adults. Cochrane Database Syst Rev. 2015(9):CD003324.
5. Kay S, McMahon M, Stiller K. An advice and exercise program has some benefits over natural recovery after distal radius fracture: a randomised trial. Aust J Physiother. 2008;54(4):253-9.
6. Lin CW, Donkers NA, Refshauge KM, Beckenkamp PR, Khera K, Moseley AM. Rehabilitation for ankle fractures in adults. Cochrane Database Syst Rev. 2012;11:CD005595.
7. Brison RJ, Day AG, Pelland L, Pickett W, Johnson AP, Aiken A, et al. Effect of early supervised physiotherapy on recovery from acute ankle sprain: randomised controlled trial. BMJ. 2016;355:i5650.
8. Van Vehmendahl R, Nelen SD, El Hankouri M, Edwards MJR, Pull Ter Gunne AF, Smeeing DPJ. Effectiveness of Postoperative Physiotherapy Compared to Postoperative Instructions by Treating Specialist Only in Patients With an Ankle Fracture: A Systematic Review. Foot Ankle Orthop. 2023;8(2):24730114231173680.
9. van der Sluis CK, Eisma WH, Groothoff JW, ten Duis HJ. Long-term physical, psychological and social consequences of a fracture of the ankle. Injury. 1998;29(4):277-80.
10. McPhail SM, Dunstan J, Canning J, Haines TP. Life impact of ankle fractures: qualitative analysis of patient and clinician experiences. BMC Musculoskelet Disord. 2012;13:224.
11. Vioreanu M, Dudeney S, Hurson B, Kelly E, O'Rourke K, Quinlan W. Early mobilization in a removable cast compared with immobilization in a cast after operative treatment of ankle fractures: a prospective randomized study. Foot Ankle Int. 2007;28(1):13-9.
12. Smeeing DP, Houwert RM, Briet JP, Kelder JC, Segers MJ, Verleisdonk EJ, et al. Weight-bearing and mobilization in the postoperative care of ankle fractures: a systematic review and meta-analysis of randomized controlled trials and cohort studies. PLoS One. 2015;10(2):e0118320.
13. Cancelliere C, Donovan J, Stochkendahl MJ, Biscardi M, Ammendolia C, Myburgh C, et al. Factors affecting return to work after injury or illness: best evidence synthesis of systematic reviews. Chiropr Man Therap. 2016;24(1):32.
14. Keene DJ, Costa ML, Peckham N, Tutton E, Barber VS, Dutton SJ, et al. Progressive exercise versus best practice advice for adults aged 50 years or over after ankle fracture: the AFTER pilot randomised controlled trial. BMJ Open. 2022;12(11):e059235.
15. Moseley AM, Beckenkamp PR, Haas M, Herbert RD, Lin CW, Team E. Rehabilitation After Immobilization for Ankle Fracture: The EXACT Randomized Clinical Trial. JAMA. 2015;314(13):1376-85.
16. Castor EDC. Castor Electronic Data Capture 2019 [27 Aug. 2019]. Available from: https://castoredc.com.
17. Doyle DJ, Goyal A, Garmon EH. American Society of Anesthesiologists Classification. StatPearls. Treasure Island (FL)2022.
18. Fonseca LLD, Nunes IG, Nogueira RR, Martins GEV, Mesencio AC, Kobata SI. Reproducibility of the Lauge-Hansen, Danis-Weber, and AO classifications for ankle fractures. Rev Bras Ortop. 2018;53(1):101-6.
19. Kim PH, Leopold SS. In brief: Gustilo-Anderson classification. [corrected]. Clin Orthop Relat Res. 2012;470(11):3270-4.
20. Palola V, Hevonkorpi TP, Ponkilainen VT, Launonen AP, Mattila VM. Sick leave length and the costs of operatively and conservatively treated distal radius fractures in the working age population: a retrospective cohort study. BMC Musculoskelet Disord. 2023;24(1):842.
21. Saini UD, Mandeep SD, Cheema U, Rajnish KR. Open Fractures of the Ankle: Management Options and Factors influencing Outcomes. J Foot Ankle Surg (Asia- Pacific). 2017;4(2):69-76.
22. Johnson JD, Chachula LA, Bickley RJ, Anderson CD, Ryan PM. Return to Duty Following Open Reduction and Internal Fixation of Unstable Ankle Fractures in the Active Duty Population. Mil Med. 2019;184(5-6):e381-e4.
23. Nash CE, Mickan SM, Del Mar CB, Glasziou PP. Resting injured limbs delays recovery: a systematic review. J Fam Pract. 2004;53(9):706-12.
24. Korim MT, Payne R, Bhatia M. A case-control study of surgical site infection following operative fixation of fractures of the ankle in a large U.K. trauma unit. Bone Joint J. 2014;96-B(5):636-40.
25. Thakore RV, Hooe BS, Considine P, Sathiyakumar V, Onuoha G 2nd, Hinson JK, et al. Ankle fractures and employment: a life-changing event for patients. Disabil Rehabil. 2015;37(5):417-22.
26. Adiyeke L, Aydogmus S, Sabuncuoglu M, Bilgin E, Duymus TM. Effects of psychological factors on the clinical outcomes of fifth metacarpal neck fractures and their relation to injury etiology. Ulus Travma Acil Cerrahi Derg. 2019;25(4):403-9.
27. Huang L, Zhang C, Xu J, Wang W, Yu M, Jiang F, et al. Function of a Psychological Nursing Intervention on Depression, Anxiety, and Quality of Life in Older Adult Patients With Osteoporotic Fracture. Worldviews Evid Based Nurs. 2021;18(4):290-8.
28. Li Q, Wang Y, Shen X. Effect of Psychological Support Therapy on Psychological State, Pain, and Quality of Life of Elderly Patients With Femoral Neck Fracture. Front Surg. 2022;9:865238.