



Can a Self-care Educational Mobile Application Improve the Quality of Life of Victims With Hand Burns? A Randomized Controlled Trial

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Abstract

Objectives: Hand burns are among the most destructive types of burns, imposing significant limitations on the performance and occupation of individuals. Accordingly, this injury induces many negative effects on the quality of life (QOL) of patients. Therefore, the goal of the present study was to assess the effect of a self-care educational mobile application on the QOL of victim patients with hand burns.

Materials and Methods: The present randomized controlled trial included 60 burn victims admitted to the Burn Center of Imam Reza hospital, Mashhad, Iran. The intervention group used the hand burn self-care application upon their admission up to 2 months after their hospital discharge while the controls only received the ordinary training presented in the burn center. All patients completed the Burn-Specific Health Scale-Brief (BSHS-B) questionnaire before and 2 months after the intervention. Finally, data were analyzed using an independent *t* test, along with chi-square and Mann-Whitney U tests in SPSS 21.

Results: Two months after using the hand burn self-care application, the total mean score for the QOL of burn victims increased from 80.4 ± 17.9 to 182.5 ± 15.6 and 74.8 ± 15.3 to 122.4 ± 19.7 in the intervention and control groups, respectively ($P < 0.001$).

Conclusions: According to our results, using the self-care burn mobile application can improve the QOL of burn victims. Consequently, the use of this tool can be proposed as part of the treatment and rehabilitation procedures for these patients.

Keywords: Hand burns, Self-care application, Quality of life

Introduction

Burn injuries are considered as the most destructive and disturbing kind of injuries (1,2). Although hand burn affects less than 3% of the total body surface area (TBSA), it is classified as a severe injury. In addition, hands are affected in more than 80% of patients experiencing severe burns (3).

According to some studies (4-6), hand burns are not usually fatal although they can lead to functional limitations and disabilities. In other words, they affect patients' ability to play their routine roles thus create numerous physical and mental issues and reduce their quality of life (QOL).

Nowadays, the promotion of health and QOL is an integral part of socio-economic development, the achievement of which requires the adoption of educational approaches and enhancement of self-care knowledge (7). Therefore, the healthcare team, especially nurses, must focus on different aspects of the QOL in a patient's recovery period since it can lead to early diagnosis (8-10). One of the information and communication technology-based teaching methods is the use of mobile educational

applications which are effective tools given that they have widespread use and availability and have revolutionized the field of education (11). Various types of mobile healthcare applications allow their users to have online access to medical professionals and valid information (12). Moreover, the findings of previous studies have shown that the patient's follow-up after discharge through smartphones, along with sending the images of the burned area provides medical professionals with the required information to evaluate and manage burn wounds (13, 14). However, several problems impede satisfactory in-person training in the hospitals of Iran, including the multitude of patients and the lack of adequate staff, time, and motivation to educate patients, as well as the lack of equipment in burn departments and centers (2, 15). All these reasons underscore the necessity of providing a self-care mobile app for burn victims to enhance their QOL. Accordingly, the present study was conducted to fulfill this objective.

Materials and Methods

Our randomized controlled clinical trial included burn

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victims who referred to the only burn management center in the Northeast of Iran, located in Imam Reza hospital, Mashhad, Iran, during 2019.

The inclusion criteria were deep second- or third-degree hand thermal burns with the TBSA of <25%, access to mobile phones with android OS, the ability of patients or their companions to use mobile phones and applications, and internet access. Other criteria included the lack of hearing impairment (complete hearing loss in spite of using hearing aids) or visual impairment (inability to read the newspaper within 30 cm with glasses), no history of psychoactive drug use in the past 6 months, no history of mental disorders, and individuals within the age range of 18-65 years. Finally, the lack of some medical disorders (e.g., diabetes mellitus, skin allergies, multiple sclerosis, malignancy, mental illness, and hand movement disorders), as well as the lack of disfigurement and impairment in hands and fingers were among other considered criteria. On the other hand, patients who were dead during the study or did not refer to the hospital for visiting the physician or changing their wound dressings were excluded from the study. The selected patients were randomly assigned to intervention or control groups using the consecutive sampling technique in SPSS software, version 21.

Given that no other study was available on the quality assessment of life after conducting the self-care educational mobile application in burn patients, the original sample size was estimated according to the total score and different aspects of the QOL with a pilot study including 10 subjects in each group. Finally, the sample size was calculated based on the highest estimated number for these variables using the formula of comparing two group means, considering a 95% confidence level and 80% power based on the interpersonal relationship aspect in the QOL questionnaire. In addition, 50% was added to the estimate in order to enhance the confidence level and predict the possible losses. Therefore, 40 patients were included in each group.

Pre-intervention Phase

During the preparation phase, the burn patient self-care training content of the application was produced based on patients' educational needs and according to the latest clinical guidelines with the assistance of medical, surgical, and physiotherapy specialists. The application included various sections such as wound and skin graft care, non-surgical management of burn wounds, infection prevention and control, rehabilitation and physiotherapy of hand burn injuries, massage therapy, pain control, proper wound dressing, and the use of splint tutorials.

Further, this mobile application included four parts of educational content, a list of medical professionals, chats with medical personnel, and daily assessment. Patients could easily have access to videos and other educational content and chat with healthcare providers. In addition,

they could send their pictures from the burned area to the healthcare team via the chat and messaging section. A web-based version of the content management system was also provided for the central computer of the burn center in order to answer patients' questions and update the educational content (i.e., pamphlets, posters, and videos). Furthermore, patients' medical records were included in the content management system. The recorded information entailed patient status, surgery type, and burned area images from admission to complete recovery. The educational content of this application was mostly designed in the form of instructional videos so that illiterate patients could easily use the content.

The Burn-Specific Health Scale-Brief (BSHS-B) questionnaire was also completed by all victims before the intervention. The mentioned questionnaire contained 40 items about the body image and emotional dimensions, as well as skin sensitivity to heat, hand function, caring guidelines about burned surfaces, communication/occupation, sexual performance, and ability to fulfill simple activities. The answers were chosen on a 5-point Likert-type scale (1 = Very much, 2 = Much, 3 = Moderate, 4 = A little, 5 = Not at all). Therefore, each item had a minimum of one point and a maximum of five points. Moreover, the BSHS-B questionnaire covered three domains of QOL, namely, physical (18 items), psychological (11 items), and social (11 items) dimensions. Additionally, the content validity and reliability of this questionnaire were reported as 0.95 and 0.94, respectively (16). In our study, the Cronbach's alpha coefficient of 0.89 supported the reliability of the above-mentioned questionnaire.

Intervention Phase

Both groups received the usual self-care training during and after admission, which included educational pamphlets and in-person training provided by nurses. However, patients in the intervention group also received a training session lasting 60-90 minutes to be introduced to the application and learn how to use it. Subsequently, the application was installed on their mobile phones or those of their family members, and then a personalized username and password was chosen by the patient. Accordingly, patients used the application with the aid of the researcher and their companions during their hospitalization or when they were in the severe hand burn phase. The severe phase is ascribed to the condition in which 90% of the wound is closed by dressing or surgery, which is expected to last for an average of 10-14 days. After the discharge, patients used the application by their healthy hands or fingers. However, patients were helped by their relatives or friends in case both hands were burned.

After completing the training session for the intervention group, the application was utilized by patients for 2 months after their discharge. To ensure that the patient used the application correctly, a daily evaluation section was included in the application, which consisted of several

questions so that the patient had to answer them on a daily basis. Their responses were attached to their medical records in the web-based content management system and were accessible for the researcher and healthcare providers. The researcher was also able to contact patients via telephone and the internet. In addition, patients were referred to the burn clinic if they needed to visit a physician. The control group received routine self-care training during and after admission, which included educational pamphlets and in-person training presented by nurses.

Post-intervention Phase

All victims completed BSHS-B questionnaire again when referring for a wound dressing change or visiting the doctor in the hospital. Further, patients were reminded of their appointments 2 days earlier.

Data Analysis

SPSS software (version 21) was used for data analysis using descriptive (i.e., mean, standard deviation, and frequency), as well as inferential (i.e., the Mann-Whitney U test, chi-square test, and independent *t* test) statistics.

Results

Out of 80 participated patients, 20 cases were ruled out from the intervention and control groups due to non-referral to the burn center after 2 months, not using the hand burn self-care application, deterioration of the health condition, and hospitalization in the intensive care unit. Therefore, the final analysis was performed on 30 subjects in each group (i.e., 60 cases in total). The demographic variables of patients are listed in Table 1.

The analysis of data related to burn accidents showed that the type of burn was thermal in all patients. In addition, the mean percentages of TBSA in the intervention and control groups demonstrated no significant differences. Furthermore, the deepest burns in both groups were deep second- and third-degree injuries. Moreover, the most frequent sites of burn wounds in the intervention group were the hand and the upper limb. In the control group, the hand and the lower limb were the most frequently affected areas (Table 2).

Based on the results of BSHS-B, the mean scores of all health-related quality of life (HRQOL) dimensions improved after using the hand burn self-care application. Additionally, the total mean score of the QOL in patients of the intervention and control groups was statistically significant ($P < 0.001$). In the post-intervention phase, the total score of the QOL increased by 102.1 ± 20.1 and 47.6 ± 19.5 in the intervention and control groups, respectively ($P < 0.001$, Table 3).

Discussion

According to our results, all dimensions of the QOL improved in the intervention group two months after

implementing the intervention and an educational program through a hand burn self-care mobile application. Although the mean scores of all dimensions increased in both intervention and control groups, more significant improvement was reported in the intervention group as compared to the control group. This progress could be related to knowledge enhancement that plays an important role in enhancing patient motivation for performing

Table 1. Frequency Distribution of the Basic and Demographic Variables of Hand Burn Patients in Both Groups

Variable	Group		Test Results
	Intervention n=30	Control n=30	
Age (y), mean \pm SD	38.2 \pm 11.7	43.6 \pm 12.6	$P=0.088$, Independent <i>t</i> test
Gender, No. (%)			$P=0.080$, Chi-square
Male	25 (83.3)	19 (63.3)	
Female	5 (16.7)	11 (36.7)	
Marital status, No. (%)			$P=0.166$, Chi-square
Single	7 (23.3)	3 (10.0)	
Married	23 (76.7)	27 (90.0)	
Job, No. (%)			$P=0.106$, Exact chi-square
Clerk	2 (6.7)	0 (0.0)	
Self-employment	22 (73.3)	19 (63.3)	
Retired	4 (13.3)	3 (10.0)	
Unemployed	2 (6.7)	8 (26.7)	
Education, No. (%)			$P=0.066$, Mann-Whitney U
Elementary school	3 (10.0)	7 (23.3)	
Middle school	11 (36.7)	13 (43.3)	
High school	11 (36.7)	8 (26.7)	
Higher education	5 (16.7)	2 (6.7)	

Note. SD: Standard deviation.

Table 2. Data Distribution of Burn Victims in Both Groups

Variable	Group		Test Results
	Intervention n (%) = 30	Control n (%) = 30	
Total body surface area percentage	16.9 \pm 5.7	19.6 \pm 5.1	$P = 0.099$, Mann-Whitney U
Burn cause			$P = 0.166$, Chi-square
Flame	27 (90.0)	23 (76.7)	
Water or steam	3 (10.0)	7 (23.3)	
Depth of burn wound			$P = 0.567$, Chi-square
Deep second-degree burns	9 (30.0)	12 (40.0)	
Third-degree	4 (13.3)	2 (6.7)	
Deep second- and third-degree burns	17 (56.7)	16 (53.3)	
Burned area			$P = 0.087$, Chi-square
Hand	9 (30.0)	8 (26.7)	
Hand and upper limb	11 (36.7)	4 (13.3)	
Hand and lower limb	6 (20.0)	8 (26.7)	
Hand and chest	2 (6.7)	2 (6.7)	
Hand and back	1 (3.3)	0 (0.0)	
Hand, back, and face	1 (3.3)	1 (3.3)	
Hand and upper and lower limbs	0 (0.0)	5 (16.7)	
Hand, chest, and back	0 (0.0)	2 (6.7)	

Table 3. Comparison of QOL and its Dimensions Between Pre- and Post-intervention Phases

		Intervention (n=30)	Control (n=30)	Intergroup Test	
		Mean ± SD	Mean ± SD	Results	
Total score of QOL	Pre-intervention	80.4±17.9	74.8±15.3	<i>P</i> =0.200	
	Post-intervention	182.5±15.6	122.4±19.7	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001	<i>P</i> <0.001		
Physical ability	Pre-intervention	4.1 ± 1.4	3.8±1.3	<i>P</i> =0.253	
	Post-intervention	13.2 ± 1.9	8.4±2.1	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Hand function	Pre-intervention	6.3±2.0	6.1±2.0	<i>P</i> =0.608	
	Post-intervention	22.4±3.0	12.6±3.0	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Emotional dimension	Pre-intervention	18.8±6.7	18.9±7.7	<i>P</i> =0.972	
	Post-intervention	32.9±3.8	25.3±5.0	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Body image	Pre-intervention	8.0±3.5	8.4±3.2	<i>P</i> =0.768	
	Post-intervention	18.2±2.9	12.2±3.4	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Skin sensitivity to heat	Pre-intervention	6.7±2.3	6.5±2.1	<i>P</i> =0.807	
	Post-intervention	21.3±0.7	15.5±4.3	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Adherence to diet therapy	Pre-intervention	9.6±2.9	8.7±3.2	<i>P</i> =0.216	
	Post-intervention	22.6±2.7	13.1±3.2	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Sexual performance	Pre-intervention	7.9±4.6	6.0±4.0	<i>P</i> =0.077	
	Post-intervention	14.8±0.8	10.6±4.1	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Interpersonal relationship	Pre-intervention	14.0 ± 5.3	11.7±5.1	<i>P</i> =0.097	
	Post-intervention	19.8±0.8	15.7±4.1	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.003**		
Job status	Pre-intervention	4.9±1.6	4.8±1.6	<i>P</i> =0.477	
	Post-intervention	17.3±2.9	8.9±3.0	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		
Physical, psychological, and social aspects	Physical dimension	Pre-intervention	26.7±5.6	25.1±6.2	<i>P</i> =0.239
		Post-intervention	79.6±7.8	49.7±9.9	<i>P</i> <0.001*
		Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**	
	Psychological dimension	Pre-intervention	26.8±9.5	27.3±9.6	<i>P</i> =0.840
		Post-intervention	51.1±6.5	37.5±7.3	<i>P</i> <0.001*
		Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**	
Social dimension	Pre-intervention	26.9±8.0	22.4±8.2	<i>P</i> =0.038	
	Post-intervention	51.9±3.5	35.2±6.9	<i>P</i> <0.001*	
	Intra-group tests	<i>P</i> <0.001**	<i>P</i> <0.001**		

Note. SD: Standard deviation; QOL; Quality of life *Independent t-test; **Paired sample t-test. *P*<0.05 (significant).

self-care behaviors and continuing communication with medical professionals through an interactive application system. Accordingly, it can help the patients to improve their lifestyle and QOL.

In the same vein, Abrams et al developed a bio-psycho-social training program for patients after discharge in order to collect information on pain, anxiety, back pain, itching, medication adherence, social participation, self-efficacy, and return to work (17), the results of which are consistent with those of the present study.

Similarly, Mohaddes Ardebili et al showed that the mean score of the QOL (in all dimensions) of the intervention group, subjected to self-care education via multimedia, was higher than that of the controls (18). The reason for the consistency of our results with those of the above-

mentioned study might be the effect of using videos and multimedia for self-care education after patient discharge in both studies.

In another study, Li et al investigated the impact of rehabilitation interventions on the general health status of burn patients. Based on their report, the intervention group had significantly higher mean scores in terms of comprehensive health, physical functions, mental functions, social functions, and general health compared to the control group (19). In line with our results, the mean score of the QOL was significantly higher in the intervention group one month and three months after using a burn rehabilitation program (20). One of the reasons explaining this consistency could be the positive impact of rehabilitation education on burn patients since

education reinforces a sense of responsibility regarding rehabilitation. Such kind of education can improve treatment adherence in patients and enable them to diagnose and manage the symptoms of the disease and thus seek healthcare immediately after confronting new conditions. In addition, patients with adequate awareness and training regarding self-care skills are more concerned about their health compared to less-informed patients. Accordingly, they perform all the necessary measures for maintaining their health (21).

The results of another study revealed that oral QOL training could significantly improve the QOL of burn patients after two months (22). These findings corroborate with those of the current study although the QOL scores of the control group increased over time in our study.

Physical exercise education has a positive effect on burn patients by improving physical health and the QOL in these victims (22). According to Radwan et al, the implementation of rehabilitation programs improves the physical, social, and psychological performance of burn patients after the burn accident. This is due to the fact that regaining physical health and recovery from burn wounds through proper self-care can improve patients' QOL (23). The mentioned results are in line with the findings of our present study, showing that the improved physical health and healing of burn wounds through proper self-care could progress patients' QOL.

Further, the self-care mobile app designed in our study enabled patient follow-up through the messaging system that was embedded in the software. More precisely, it enabled patients to ask their questions regarding self-care and receive counseling from medical professionals (e.g., surgeons, nurses, physiotherapists, and nutrition consultants) at any time. Heydarikhat et al also examined the health status of burn patients after a 90-day follow-up and showed that the execution of the follow-up program, including visits at home, telephone follow-up, and patient referral to specialists or health centers, increased the QOL of the intervention group. Accordingly, the patients in the intervention group acquired a significantly higher score for the QOL 90 days after discharge compared to the control group (24).

Our application also provided the opportunity to transfer images and exchange the required information for the evaluation and management of burn-related wounds, thus creating a mutual relationship between patients and medical professionals. According to the literature, adding a feature facilitating sending burn images (e.g., via WhatsApp) to the routine telephone follow-up can prevent the unnecessary visit and reception of 66 out of 100 patients to burn centers. Therefore, distant counseling through mobile phones reduces the costs of in-person counseling and avoids non-essential patient referrals to burn centers (25). Furthermore, the findings of another study demonstrated that adding a photo-sharing feature to the telephone consultation process led to the improvement

of decision-making and triage processes (26).

Therefore, given that the burn center of Imam Reza hospital in Mashhad now accommodates burn patients from several neighboring provinces and even countries, the use of such self-care systems can facilitate patient education and follow-ups and provide distant monitoring. Thus, the clinical usage of these results may include all patients with hand burns for improving their QOL.

Limitations of the Study

The limitations of this study included a short follow-up period, the lack of the evaluation of patients with higher degrees of burn injuries due to the longer duration of their treatment, and problems for installing or loading the app.

Thus, it is recommended that future studies investigate the effect of self-care application within a longer intervention period (i.e., 12 to 24 months). Future studies are also suggested to examine the effect of this application on patients with > 25% TBSA burns, as well as the effect of self-care burn software on stress, anxiety, and depression in burn patients.

Conclusions

According to our findings, the use of hand burn self-care training applications could induce positive effects on the QOL of burn victims. Therefore, this application can be considered as a complementary method for in-person training and follow-ups. Moreover, the development of such applications could have a significant effect on the prevention of functional disabilities and impairments induced by burn injuries through improving the self-care process in these patients.

Authors' Contributions

RF conceptualized and conducted the study. All authors contributed to the design and collection of data. In addition, RF and SRM analyzed the data, and then all authors interpreted the findings. Further, RF and NK organized the first draft of the paper. Eventually, all authors read the draft version and approved the final manuscript.

Conflict of Interests

Authors have no conflict of interests.

Ethical Issues

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences (code: IR.MUMS.NURSE.REC.1397.048) and registered in Iranian Registry of Clinical Trials (identifier: IRCT20181020041386N1; <https://www.irct.ir/trial/34636>). All participants signed the written consent from.

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References

- Zuo KJ, Medina A, Tredget EE. Important developments in burn care. *Plast Reconstr Surg*. 2017;139(1):120e-138e. doi:10.1097/prs.0000000000002908
- Froutan R, Khankeh HR, Fallahi M, Ahmadi F, Norouzi K. Pre-hospital burn mission as a unique experience: a qualitative study. *Burns*. 2014;40(8):1805-1812. doi:10.1016/j.burns.2014.04.010
- Gabel CP, Melloh M, Michener LA, Burkett B. Clinimetric evaluation of measurement tools used in hand therapy to assess activity and participation. *J Hand Ther*. 2010;23(1):83-84. doi:10.1016/j.jht.2009.09.003
- Omar MT, Hegazy FA, Mokashi SP. Influences of purposeful activity versus rote exercise on improving pain and hand function in pediatric burn. *Burns*. 2012;38(2):261-268. doi:10.1016/j.burns.2011.08.004
- Lin SY, Chang JK, Chen PC, Mao HF. Hand function measures for burn patients: a literature review. *Burns*. 2013;39(1):16-23. doi:10.1016/j.burns.2012.08.020
- Abd Elalem SM, Shehata O, Shattla SI. The effect of self-care nursing intervention model on self-esteem and quality of life among burn patients. *Clin Nurs Stud*. 2018;6(2):79-90. doi:10.5430/cns.v6n2p79
- Heravi Karimovi M, Pourdehqan M, Jadid Milani M, Foroutan SK, Aieen F. Study of the effects of group counseling on quality of sexual life of patients with breast cancer under chemotherapy at Imam Khomeini hospital. *Journal of Mazandaran University of Medical Sciences*. 2006;16(54):43-51. [Persian].
- Meirte J, van Loey NE, Maertens K, Moortgat P, Hubens G, Van Daele U. Classification of quality of life subscales within the ICF framework in burn research: identifying overlaps and gaps. *Burns*. 2014;40(7):1353-1359. doi:10.1016/j.burns.2014.01.015
- Echevarría-Guanilo ME, Martins CL, Cantarelli KJ, Gonçalves N, Rossi LA. Visibilidade das cicatrizes de queimaduras percebida pelos pacientes durante o primeiro ano de reabilitação. *Revista Brasileira de Queimaduras*. 2012;11(3):120-124.
- Kool MB, Geenen R, Egberts MR, Wanders H, Van Loey NE. Patients' perspectives on quality of life after burn. *Burns*. 2017;43(4):747-756. doi:10.1016/j.burns.2016.11.016
- Anderson K, Burford O, Emmerton L. Mobile health apps to facilitate self-care: a qualitative study of user experiences. *PLoS One*. 2016;11(5):e0156164. doi:10.1371/journal.pone.0156164
- Fukuoka Y, Kamitani E, Dracup K, Jong SS. New insights into compliance with a mobile phone diary and pedometer use in sedentary women. *J Phys Act Health*. 2011;8(3):398-403. doi:10.1123/jpah.8.3.398
- Wallace DL, Jones SM, Milroy C, Pickford MA. Telemedicine for acute plastic surgical trauma and burns. *J Plast Reconstr Aesthet Surg*. 2008;61(1):31-36. doi:10.1016/j.bjps.2006.03.045
- Hasselberg M, Wallis L, Blessing P, Laflamme L. A smartphone-based consultation system for acute burns - methodological challenges related to follow-up of the system. *Glob Health Action*. 2017;10(suppl 3):1328168. doi:10.1080/16549716.2017.1328168
- Aliyari S, Jafari M, Zareian A, Dadgari F. Design and implementation of educating the patients admitted to the intensive cardiac care unit program: a preliminary study [Persian]. *Military Caring Sciences*. 2015;2(3):173-180. doi:10.18869/acadpub.mcs.2.3.173
- Pishnamazi Z, Kiani Asiabar A, Heravi Karimavi M, Zaeri F, Norooz Zadeh R. Quality of life in burn patients. *Payesh*. 2011;11(1):103-110. [Persian].
- Abrams TE, Lloyd AA, Elzey LE, Hickerson WL. The bridge: a mobile application for burn patients. *Burns*. 2019;45(3):699-704. doi:10.1016/j.burns.2018.09.028
- Mohaddes Ardebili F, Najafi Ghezeljeh T, Bozorgnejad M, Zarei M, Ghorbani H, Manafi F. Effect of multimedia self-care education on quality of life in burn patients. *World J Plast Surg*. 2017;6(3):292-297.
- Li L, Dai JX, Xu L, et al. The effect of a rehabilitation nursing intervention model on improving the comprehensive health status of patients with hand burns. *Burns*. 2017;43(4):877-885. doi:10.1016/j.burns.2016.11.003
- Elsherbiny OE, El Fahar MH, Weheida SM, Shebl AM, Shrief WI. Effect of burn rehabilitation program on improving quality of life (QoL) for hand burns patients: a randomized controlled study. *Eur J Plast Surg*. 2018;41(4):451-458. doi:10.1007/s00238-017-1379-7
- Brunner LS, Smeltzer S, Suddarth D. *Brunner & Suddarth's Textbook of Medical-Surgical Nursing*. Vol. 1. Lippincott Williams & Wilkins, 2010:1114-2240.
- Zhang LJ, Cao J, Feng P, et al. Influencing factors of the quality of life in Chinese burn patients: Investigation with adapted Chinese version of the BSHS-B. *Burns*. 2014;40(4):731-736. doi:10.1016/j.burns.2013.09.011
- Radwan M, Samir S, Aty OA, Attia S. Effect of a rehabilitation program on the knowledge, physical and psychosocial functions of patients with burns. *J Am Sci*. 2011;7:427-434.
- Heydarikhayat N, Ashktorab T, Rohani C, Zayeri F. Effect of post-hospital discharge follow-up on health status in patients with burn injuries: a randomized clinical trial. *Int J Community Based Nurs Midwifery*. 2018;6(4):293-304.
- den Hollander D, Mars M. Smart phones make smart referrals: the use of mobile phone technology in burn care - a retrospective case series. *Burns*. 2017;43(1):190-194. doi:10.1016/j.burns.2016.07.015
- Wallace DL, Hussain A, Khan N, Wilson YT. A systematic review of the evidence for telemedicine in burn care: with a UK perspective. *Burns*. 2012;38(4):465-480. doi:10.1016/j.burns.2011.09.024

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