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Assessment of Quality of Life and Range of Motion of Lower Extremity in Chronic Burn Patients

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ABSTRACT

Background: A burn is defined as a wound caused by an exogenous agent leading to coagulative necrosis of tissue. The burn injury represents an assault on all aspects of patients, from physical to psychological. Contractures are problematic scar formations, causing a limited range of motion (ROM) of a joint. They can be disfiguring, severely limit joint function, and may have a substantial impact on quality of life (QoL). The study aimed to assess the quality of life and to assess the range of motion to check how a range of motion impacts the quality of life in post-burn patients. **Methods:** A descriptive cross-sectional study was performed using demographic data, a Health questionnaire (EQ-5D-5L), and a manual tool goniometer for a range of motion to find out how quality of life is affected among the post-burn patients of involved lower extremity in the Burn Center, PIMS Islamabad. The study participants were post-burn patients aged between 15 and 45 years. Data collection tools used were a health questionnaire (EQ-5D-5L) and a goniometer for assessing the range of motion of the affected part. Data collected was analyzed via SPSS version 26 in terms of descriptive analysis using frequency tables, pie charts, and clustered bar charts. **Results:** The study at Burn Center PIMS examined the causes, severity, and impact of burns on patients' quality of life (QOL). Flame burns were the most common, and second-degree burns were predominant, with most cases being minor. Burns typically involved ≤10% total burn surface area (TBSA), with limbs frequently affected. The EQ-5D-5L scale revealed significant issues in mobility, self-care, usual activities, pain, and anxiety, with burn severity having a significant negative correlation with QOL ($\beta = -0.561$, $R^2 = 0.314$, $p = 0.000$). Most participants rated their health as "Best" or "Better." Range of motion (ROM) analysis showed significant limitations in hip joint movements, particularly in flexion, external rotation, and abduction, underscoring the need for targeted rehabilitation strategies. **Conclusion:** The study concludes that burn injuries are significantly adversely associated with patients' quality of life, with higher burn severity associated with greater challenges in mobility, self-care, usual activities, pain, and anxiety. The findings emphasize the importance of comprehensive burn care that addresses both physical and psychological aspects, including targeted rehabilitation to improve range

of motion and overall recovery. These insights underscore the need for holistic approaches to burn management to enhance patients' long-term outcomes and well-being.

Keywords: Quality of Life, Prevalence, Range of Motion, Contractures, Lower Extremity, Health Status Burn, Disability

INTRODUCTION

Burns are one of the most serious health issues that can potentially be fatal. Burn injuries are a trauma that is often overlooked yet can happen to anybody, anywhere, at any time. Although friction, cold, heat, radiation, chemicals, and electric sources can all result in injuries, heat from hot liquids, solids, or flames is the main cause of burn injuries [1]. While energy transfer causes tissue destruction in all burn injuries, distinct causes might result in different physiological and pathological reactions [2, 3]. Burn patients are a heterogeneous population with a wide range in age, burn damage mechanism, wound site and depth, and comorbidity [4].

Therefore, their outcome significantly varies, with different natures of impact on the entire life of victim's life, and occasionally it may cause permanent impairment. Approximately 6 million burn victims worldwide seek medical care annually. However, most of them are treated in outpatient clinics [5]. If a patient survives, they may experience severe consequences such as burn scar contractures. Burns, particularly those to the face and neck, pose significant challenges for the burn team and need to be treated by the rehabilitation team with great care and attention to detail to prevent contractures [6]. Contractures are frequently characterized as the excessive or inadequate extensibility of scar tissue replacing skin, which may decrease the range of motion (ROM) of a joint [7, 8].

Additionally, they may be irritating, unpleasant, or disfiguring. Therefore, contractures may restrict a joint's capacity to function in daily tasks, which may lead to impairment and a reduction in quality of life (QoL). For individuals healing from burn injuries, contractures are a substantial source of disability [9]. Post-burn contractures typically harm a person's quality of life and ability to carry out daily activities due to contractures, which reduce joint range of motion and may also cause joint disability, incapacity, distortion, and cosmetic and mental damage [10, 11]. In previous studies, individuals with serious burns who had significant burn extent (burn degree) and total body surface area (%TBSA) reported a lower quality of life. Burn scar contracture has been treated and prevented in numerous research, but measuring ROM has received less attention [7, 12].

Therefore, the present study will focus on assessing the affected body part in addition to the patient's QOL. The next important part of this study will be based on awareness among patients about rehabilitation, as burn rehabilitation therapy must include physical therapy that covers several physiotherapy treatment techniques, including exercise therapy, cardiovascular training, joint mobilization, posture, and splint modification [13, 14]. The goal of physical therapy is for patients to regain complete independence and return to their prior careers. Burns (especially those on the face and neck) present a specific challenge to the burn team, and the rehabilitation team must treat them with great caution and awareness to prevent contractures. This study will be used to determine the quality of life in post-burn patients and to assess ROM. This study will also help in enhancing patient awareness about rehabilitation after burn injuries and how physiotherapy contributes to its role in burn victims.

MATERIALS AND METHODS

This study was a cross-sectional descriptive design conducted at the Burn Center PIMS, Islamabad, over six months. The study population consisted of chronic burn patients with lower extreme involvement at the center. The sample size was calculated using an online calculator (calculator.net) with a confidence level of 95%, a 5% margin of error, and an 80% population proportion. The calculated sample size was 174, and with a response rate of 86.2% from community outreach, the final collected sample was 150 participants. A probability of a convenient sampling technique was employed for this research. The measurable outcome variables included assessing the quality of life of post-burn injury patients and the range of motion (ROM) assessment of the involved part. The sampling procedure involved randomized, convenient sampling. Inclusion criteria for the study were male and female participants aged 15 to 45 with second and third-degree burns, a total body surface area (TBSA) of 1-40%, and burns that occurred more than one month before the study. Exclusion criteria included pregnancy, comorbidities such as diabetes and hypertension, acute burn injuries, and first-degree burns.

The ethical approval for the study was obtained in writing from the Head of the Department at the Bashir Institute of Health Sciences, Barakahu, Islamabad, as well as the Research Head and Institutional Review Committee (IRC) / Ethical Review Board (ERB) of the institute. A written request for data collection approval was also obtained from Dr. Tariq, the head of the Burn Center. A meeting with Dr. Alishba, head of the ERB, was held on November 20, 2023, where the study synopsis was presented, and permission was granted. Data collection took place at the Burn Care Center, PIMS Hospital, Islamabad. Participants were recruited after providing their consent, and only those with chronic burn injuries were invited to participate. ROMs were assessed using a goniometer, and the EuroQol-5D-5L questionnaire was administered in face-to-face interviews with each participant.

DATA COLLECTION PROCEDURE

Data collection at the Burn Centre, PIMS, Islamabad, involved 150 chronic burn patients recruited via randomized, convenient sampling after ethical approvals. Eligible participants provided informed consent, and data on range of motion (ROM) using a goniometer and quality of life via the EuroQol-5D-5L questionnaire were collected through face-to-face interviews.

STATISTICAL ANALYSIS

Data analysis was performed using SPSS version 26 to evaluate statistical values. Frequency distribution analysis, descriptive statistical analysis, one-way ANOVA, and pair sample t-test were performed to analyse the data.

RESULTS

In the current study, a total of 150 participants were included, about the sample size. The age group (15-45) outlined in the research was further classified as follows (15-25), (26-35), and (36-45). Out of the total sample size of 150,52 participants were in the age group (15-25),48 participants were in the age group (26-35) and 50 participants were in the age group (36-45) as shown in fig.4.1. The total number of participants according to the inclusion criteria concerning gender is shown in table 1, Total male and female patients were 79 and 71 respectively.

Table 1: Demographic Variables

		F	%
Age	15 to 25 Years	52	34.67%
	26 to 35 Years	48	32.00%
	36 to 45 Years	50	33.33%
Gender	Male	79	52.67%
	Female	71	47.33%

According to the data collected, the causes of burns in patients at Burn Center PIMS were reported as shown in Figure 1; out of 150 participants, the majority (67) were reported with flame burn, following scald (34), chemical (20), electrical (16) and contact burn (13) differentiates between burns of the second and third degrees, classifying them as minor, moderate, or severe according to the proportion of the injured body surface area.

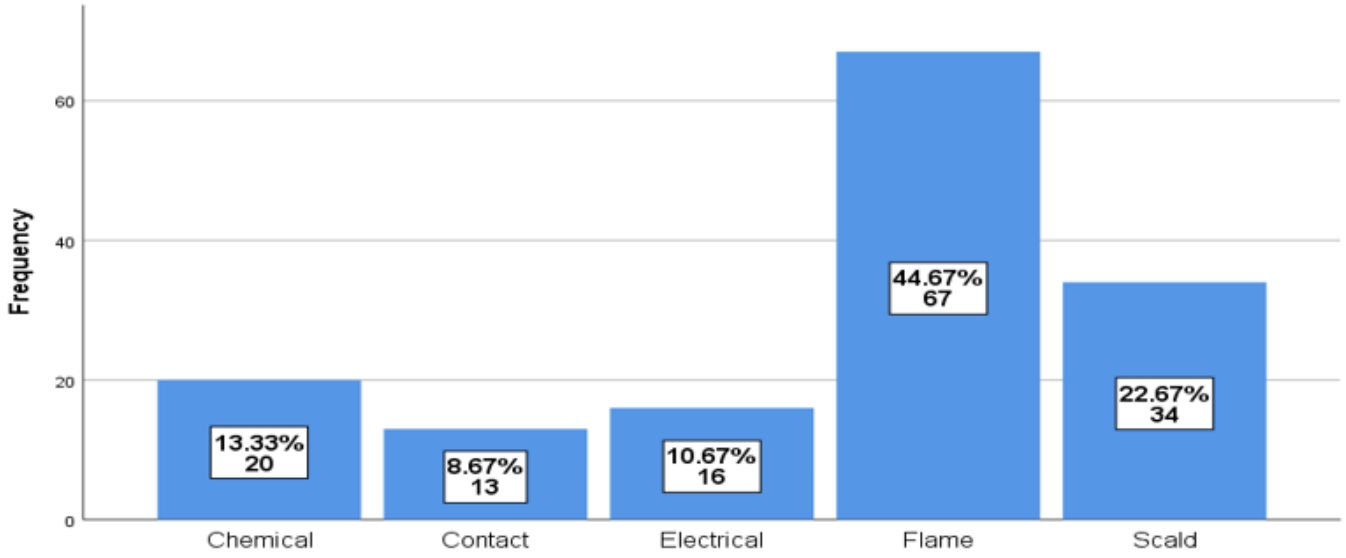

Figure 1: Causes of Reported Burn

Table 2: Assessment of Severity of Burn in Patients

	Minor Burn	Moderate Burn	Severe Burn	Total	P-value
Second Degree Burn	99	15	1	115	
3rd Degree Burn	17	12	6	35	0.000
Total	116	27	7	150	

Second degree minor burn= TBSA ≤15%, Second degree moderate burn=TBSA=15-30%, Second degree severe burn=TBSA>30%, 3rd degree minor burn=TBSA≤2%, 3rd degree moderate burn=TBSA=2-10%, 3rd degree severe burn=TBSA>10%

Based on the statistics, it can be inferred that 84.0% of cases have an onset time of less than or equal to three months. This represents a considerable majority of instances. Conversely, just 4.0% of cases have an onset time of more than a year, making them comparatively uncommon. 12.0% of cases fall into the intermediate category, which has an onset time between four and twelve months, as shown in Table 3.

Table 3*: Frequency and* Percentage of Time Since Burn Injury

Onset time	Frequency	Percent
>1 year	6	4
≤3 month	126	84
4-12 month	18	12
Total	150	100

Table 4. shows the number of participants and their percentage distribution according to their site of injury, degree of burn, and total burn surface area.

Table 4: *Frequency and* Percentage of Patients According to Site of Burn Injury

Parameters	Frequency (N)	Percentage (%)
		Site of injury

Both foot	3	2
Both legs	4	2.7
Both legs and foot	1	0.7
Both limbs	17	11.3
Both limbs and perineum	6	4
Both thighs	6	4
Both thighs and legs	5	3.3
Both thighs and perineum	3	2
Left foot	9	6
Left leg	15	10
Left leg and foot	3	2
Left limb	5	3.3
Left thigh	8	5.3
Left thigh and leg	6	4
Right and left leg	1	0.7
Right foot	12	8
Right leg	17	11.3
Right leg and foot	3	2
Right limb	5	3.3
Right limb and perineum	2	1.3
Right thigh	8	5.3
Right thigh and leg	10	6.7
Right thigh, leg, and foot	1	0.7
Total	150	100

Table 5: Frequency Distribution Analysis of Patients According to Total Burn Surface Area

TBSA	F	%
1%-10%	95	63.3
11%-20%	30	20
21%-30%	18	12
31%-40%	7	4.7
Total	150	100

Table 6 presents a comprehensive summary of the various dimensions of health perception among the surveyed population. Each dimension displays the distribution of responses, showing the frequency of no difficulties, moderate problems, and severe problems.

Table 6: *Participants'* Response to EQ-5d Scoring.

	EQ-5D Problems		
Dimensions	No problem	Moderate problem	Severe problem
Mobility	8 (5.3%)	133 (88.7%)	9 (6%)
Self-care	71 (47.3%)	74 (49.3%)	5 (3.3%)
Usual activities	22 (14.7%)	120 (80%)	8 (5.3%)
Pain/discomfort	20 (13.3%)	128 (85.3%)	2 (1.3%)

Depression/anxiety	73 (48.7%)	77 (51.3%)	----

The data given in Table 7 shows the prevalence of problems or difficulties in mobility, self-care, usual activities, pain, and emotional well-being in post-burn patients. Most patients reported moderate levels of issues in most dimensions, with lower percentages indicating severe problems.

Table 7: Quality of Life

		Frequency	Percent
Mobility	1 No problem	8	5.3
	2-3 moderate problem	133	88.7
	4-5 severe problem	9	6
Self-Care	1 No problem	71	47.3
	2-3 moderate problem	74	49.3
	4-5 severe problem	5	3.3
Usual Activities	1 No problem	22	14.7
	2-3 moderate problem	120	80
	4-5 severe problem	8	5.3
Pain /Discomfort	1 No pain	20	13.3
	2-3 moderate pain	128	85.3
	4-5 severe pain	2	1.3
Anxiety/Depression	1 No Depression	73	48.7
	2-3 moderate depression	77	51.3

We apply an ANOVA test to find out the significance of the association of age, gender, and marital status with quality of life. Tab.4.6 explains the factors that can contribute to changes in quality of life. According to statistics, the factors age, gender, and marital status show that their effect on QOL is insignificant with a p-value of 0.065, 0.130, and 0.130 and an F value of 2.78, 2.31, and 2.31.

Table 8: Control Factors of Quality of Life

	Quality of life				
	Sum of Squares	df	Mean Square	F	Sig.
Age	0.530	2	0.265	2.780	0.065
Gender	0.224	1	0.224	2.315	0.130
Marital status	0.224	1	0.224	2.315	0.130

The results of the current study are shown in Table 9, which explains how the impact burns on the quality of life of a person. According to the table, the degree of burn is negatively associated with quality of life with a beta value of -0.561 and R square of 0. 314. Statistically, it is accepted, as shown in the table, that the value is -8.237 and the p-value is .000. According to the coefficient of variance, it can be stated that a one-degree rise in the burn can decrease 31.4% of QOL. So, according to the data collected, QOL in terms of mobility, self-care, usual activities, anxiety, and discomfort is impaired.

Table 9: Impact of burn on quality of life

	B	Std. Error	R^2	T	Sig
Burn	-.561	.099	.314	-8.237	.000

a. Dependent Variable: Quality of life

The overall health status of chronic burn patients was assessed using a health questionnaire scale (EQ-5D-5L), in which they were asked to label their health status on a scale ranging from 0 to 100. Results show none of the respondents gave their quality of life the rating: worst, fair, or excellent. A moderate degree of perceived health and quality of life is indicated by 11.3% of respondents who fall into the "Good" category. With 37.3% of respondents falling into the "Better" group, the biggest percentage of respondents appear to believe that their health is above average.51.3% of respondents, or most of them, are in the "Best" group, as shown in tab 4.8.

Table 10: Quality of life

Health status	Scoring range	Frequency	Percentage
Worst	0	0	0
Fair	1-25	0	0
Good	26-50	17	11.3
Better	51-75	56	37.3
Best	76-99	77	51.3
Excellent	100	0	0
Total		150	100.0

Table 11 shows that the normal range for hip joint flexion and extension are 120-125 and 15-30; the cutoff limit selected for this test was 120 and 15, and their mean values were 108.8 and 16.99, respectively. According to the analysis, the average difference in ROM for hip joint flexion and extension was about 11.12 and 1.99, respectively. The T- value of 10.6 indicated the significance of this result outcome. On the contrary, a t value of 1.97 shows insignificant result outcomes for hip joint extension. So, the hip joint flexion ROM limitation was more prevalent than an extension. Similarly, hip joint external rotation with a mean difference of 1.567 was more limited than hip joint internal rotation. Hip abduction range of motion is typically 30 to 50 degrees. A significant difference is indicated by the t-test value of 4.44. With a mean difference of 2.433 degrees, the observed group appears to have a wider range. Hip adduction range of motion is typically 20–30 degrees. A significant difference is indicated by the t-test value of 4.12. With a mean difference of 1.333 degrees, the observed group appears to have a wider range.

Table 4.9: Impact on Range of Motion

Movements	Normal ROM	T-Test Value	t	df	p-value	Mean	Mean Difference	95% CI	
								Lower	Upper
Hip Joint Flexion	120 - 125	120	10.6	149	0.000	108.88	-11.120	-13.1	-9.06
Hip Joint Extension	15-30	15	1.97	149	0.051	16.99	1.993	-0.01	3.99
Hip Joint Internal Rotation	25-40	25	4.50	149	0.000	27.950	2.953	1.66	4.25

Hip External Rotation	Joint	40-50	40	-3.07	149	0.003	38.43	-1.567	-2.57	-0.56
Hip Abduction	Joint	30-50	30	4.44	149	0.000	32.43	2.433	1.35	3.51
Hip Adduction	Joint	20-30	20	4.12	149	0.000	21.33	1.333	0.69	1.97
Knee Flexion	Joint	130-140	130	-11.9	149	0.000	113.62	-16.380	-19.09	-13.67
Knee Extension	Joint	140-0	0	37.0	149	0.000	90.07	90.067	85.27	94.87
Ankle Planter Flexion	Joint	50-60	50	-9.05	149	0.000	43.80	-6.200	-7.55	-4.85
Ankle Joint Dorsi Flexion		15-20	15	-3.32	149	0.001	14.07	-0.933	-1.49	-0.38
Subtalar Inversion	Joint	30-40	30	-4.88	149	0.000	27.60	-2.400	-3.37	-1.43
Subtalar Eversion	Joint	15-20	15	-1.17	149	0.241	14.70	-0.300	-0.80	0.20

The knee joint flexion and extension also indicate that there is a statistically significant difference. There is a 16.38-degree decrease in knee joint flexion and a 90.067-degree rise in knee joint extension. Likewise, hip joint knee joint flexion is more limited than extension. The ankle joint movements, i.e., ankle plantar flexion, dorsiflexion, and subtalar joint inversion, show a highly significant difference with a t value of -9.05, -3.32, and -4.88 as compared to subtalar eversion that shows no significant difference with a t value of -1.17.

DISCUSSION

According to the current study, quality of life is negatively correlated with the extent of burning. This study also depicted that QOL is impacted by 31.4% for every degree of burn. Current results were obtained through the health questionnaire EQ-5D-5L, which includes five dimensions, i.e., mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, and a health scale ranging from score 0 to 100 depicting zero as the worst health state and 100 as the excellent health status of the individual. The first validation study from Pakistan was carried out by Faiza Shahid, Mohammad Ismail, and Salman Khan to evaluate the quality of life of patients who had suffered burns [4, 15]. The current study, in collaboration with a prior study, stresses burn severity as a major factor negatively affecting the QOL in burn survivors; both studies identify burn extent and depth as critical factors. Although the earlier study applied the EQ-5D-3L questionnaire and revealed that age, gender, and socioeconomic status significantly affected QOL, the present study used the EQ-5D-5L tool to obtain a more detailed picture of the health-related dimensions, including mobility, self-care, and anxiety/depression. The current study extends the previous research by providing quantitative data on the degree of burn by which QOL is diminished, providing specific information that adds to the overall conclusions of the earlier studies. However, the current study has excluded demographic factors that were included in the earlier study. These two studies are complementary as they fill each other's gaps in understanding and designing interventions for burn survivors [4, 15]. This study involved 240 OPD patients and was carried out at the Burn Centre PIMS Islamabad. Its conclusions suggest that burn damage harms several EQ-5D dimensions. The sample's average age was 17.08 years. Scald was the most common cause of burns, followed by flame. Most children (46%) with burns from fire and scalds were between the ages of 3 and 10. Male burns were observed to be electric (84.2%) and contact (78.3%), while female burns were high (56%) and significantly sustained flame and scald burns. Eighty-seven percent of the individuals were evaluated in the first year following their burn, and they indicated moderate to severe problems in all five health dimensions on the EQ-5D instrument. The EQ-5D scores for

health aspects are negatively impacted by the depth and duration of TBSA burn as well as the post-burn period. The current study also reveals that the degree of burn shows a negative impact on the quality of life of patients. T.C.C. Hendriks conducted a prospective cohort study with a one-year follow-up [16]. The purpose of this research was to evaluate the course of burn scar contractures and their effects on quality of life, disability, and joint function in a low-income nation. The result of this study shows that burn scar contractures were very common [16, 17]. The function of the joints with burn scar contracture was often impaired. Individuals with contractures reported far higher levels of impairment and a worse quality of life. Thirty-six patients with 124 affected joints were enrolled. There was an 83% follow-up rate. At 12 months, 26/104 joints (25%) showed a limited range of motion in comparison to normal ranges. At discharge, the limited functional range of motion was noted in 55/115 joints (48%) and had dropped to 22/98 joints (22%) by the 12-month mark [18]. Patient delay and the proportion of TBSA deep burns were significant predictors of the development of joint contractures. Our study also reveals that the time of onset of burn injury and TBSA% impacted joint scar contractures. Although some of the movements were limited, patient delay and degree of burn, along with no rehabilitation, were the main reason. The current study also reveals important demographic characteristics of burn injuries, the extent of the burns, and the effects on QOL, mobility and health perception of the participants. In comparison to other literature, the study outcomes are in line with the study done by Tibebu et al. (2021), where burn severity TBSA and depth of the burn significantly influenced the poor QOL of burn survivors. In the same way, Patterson et al. (2023) established that deeper burns and larger TBSA had a significant psychological effect on pediatric patients and their caregivers, in concordance with this study that focused on second and third-degree burns as major causes of functional and psychological difficulties [18, 19]. However, unlike Parvizi et al. (2023) 's previous reviews pointed out other factors such as marital status, appearance satisfaction, and family support as other factors that could affect life satisfaction, the current study showed that burn severity had a strong negative correlation with QOL ($\beta = -0.561$). Furthermore, Tehranineshat et al. (2020) found that resilience and self-efficacy were protective factors of QOL, and these were not assessed in the current study [20, 21]. This implies a possibility of a lack of sufficient knowledge on the psychological resilience of burn survivors and, therefore, the need to adopt a more holistic, biophysical, and psychosocial approach to burn injury treatment and rehabilitation.

LIMITATIONS AND RECOMMENDATIONS

The multiple limitations and future recommendations of this study include the sample being small, which increases the possibility of an error, and the study was conducted at a restricted location, the Burn Center at PIMS Islamabad. Further, sample split by gender differences was not considered in the study to delineate the variance of ROM, and the effect of gender on QOL of the burned patients was also not investigated. It should be stipulated that future researchers could aim at the influence revealed based on gender differences in QOL, exploring the impact of the illness on female patients' lives as well as on their marital lives and societal perception of their physical appearance. Any subsequent studies might also assess the degree of social isolation that single women with burn injuries experience, as well as whether they have virtually no chances of getting married and what their perception of QOL is. One area worthy of future research includes the effect that burns have on the QOL of lactating mothers who have caregiver responsibilities. In the end, the authors could explore the factors explaining the differences in ROM between burned patients to have better insights into such differences.

CONCLUSION

The current study found that mild, moderate, and severe second and third-degree burns were present in target populations, impacting the quality of life by increasing anxiety and depression and restricting the mobility and self-care of individuals. It also impairs a person's usual activities. The burn is negatively associated with quality of life. The burn decreases the quality of life of individuals by up to 31.4% by affecting mobility, self-care, and usual activities and enhancing anxiety and depression. The burn restricts the flexion, dorsiflexion, plantar flexions, and subtalar inversion range of motions of the hip/knee and ankle joints, respectively. However, a limited effect was noticed on hip extension, internal rotation, abduction, adduction, knee extension, and subtalar eversion. The current study does not investigate the differential reasons for variation in the range of motion in Burned patients.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

AUTHOR CONTRIBUTION

Taimoor ul Hassan Javed conceptualized the study, reviewed the literature, performed data analysis, and drafted the manuscript. Haseeb Muhammad Khan contributed to the study design, data collection, and critical review of the manuscript. Aneesa Ehsan Butt assisted in data extraction and statistical analysis. Sawaira contributed to results interpretation and manuscript refinement, while Muhammad Usman provided support in data analysis and critical review for intellectual content.

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