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Healing at a Distance: A Cross-Sectional Study on the Impact of Telewoundcare in Burn

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Abstract

Background: Burn injuries, especially first-degree burns, remain a significant global health issue. Comorbidities such as diabetes require careful attention to wounds for successful recovery. Telewoundcare, a novel remote wound care system, has been proposed as a potential improvement in wound care outcomes. However, its use on burn wounds, especially in patients with chronic conditions, has not been sufficiently studied

Purpose: This study sought to assess the outcome of using Telewoundcare on first-degree burns at Liepaja Regional Hospital, Latvia, and compare it to the outcomes of traditional care. The study also aimed to assess the impact of smoking, diabetes, hypertension, and nutritional status as comorbidities on the healing of burn wounds.

Methods: The study used a sample of 70 burning adult patients with first-degree burns. The patients were separated into two groups, one utilizing Telewoundcare and the other using traditional care. Patient data regarding smoking, comorbid conditions, and nutrition were recorded. The primary outcome measured was burn wound healing 1, 2, and 3 months post-treatment, through assessment of wounds visually and measuring the healing time

Results: The results revealed that smoking wishing caused substantial delays in wound healing, mostly in the Telewoundcare subgroup (OR=1.85, p=0.03). Conversely, no significant differences were detected in healing outcomes across stratified treatment groups for factors such as age, nutritional level, or accompanying illness (p>0.05). Although Telewoundcare was suitable for the management of first-degree burns, it was not more effective than conventional care in this study.

Conclusion: While Telewoundcare demonstrated an ability to expand access to burn care, it did not surpass conventional care in healing outcomes. The most significant determinant of wound healing was the patient's smoking status. More research is needed with larger populations and longer durations to adequately evaluate the sustained impact of Telewoundcare on burn wound treatment over time

Keywords: burn, burn wound, telenursing, telewoundcare, wound healing

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Introduction

High priority globally remains for burns as a global health concern. This is even more the case for first-degree burns, which need efficient wound care for proper healing and recovery. The effectiveness of technology use in care is remarkable especially Telemedicine and Telewoundcare which improve access and outcomes in burns care by facilitating remote wound care (Kumar et al., 2021)" Understanding the effect of remote care technologies on patient recovery is equally important with the rise in demand for alternative treatment options (Chen et al., 2021). The aim of this research is to address the gap in the literature concerning the use of Telewoundcare in patients with other conditions such as diabetes and hypertension (Manni et al., 2022).

Burn injuries are common worldwide injuries that remain a leading cause of morbidity and mortality, especially in low-resource settings (WHO, 2022). The emergence of diabetes mellitus (DM), a common comorbidity among burn patients, is on the rise, as in 2021 it was affecting 537 million adults globally, and is set to increase substantially by 2045 (IDF, 2025). Diabetic patients are often burdened with the complications of reduced blood flow and weak immune systems, which delay the healing of wounds and complicate the management of burns (Hunt et al., 2021). Moreover, obesity and smoking as lifestyle choices severely impede oxygen delivery to affected tissues, matters further worsens healing (Järvinen et al., 2020).

Keywords: burn, burn wound, telenursing, telewoundcare, wound healing

In light of all of these challenges, telemedicine is now being considered as a viable option for wound care improvement, especially in remote or neglected populations with limited access to medical services (Kumar et al., 2020). However, reaching people wherever they are is beneficial; the full-fledged efficacy of Telewoundcare is unexplored (Martin et al., 2022).

While managing burns is an issue, a bigger challenge is posed when a patient suffers from debilitating diabetes due to slow healing and many complications. Telemedicine poses an attractive option with remote monitoring through tools like Telewoundcare (Hunt et al., 2021). Out of the few studies done regarding the handicap, none focus on the effectiveness of Telewoundcare on monitoring diabetic patients. Other remote lifestyle factors, like smoking, pose deteriorating effects both during and after burns, but hardly any studies have been conducted while guiding the nurse remotely during the healing stage (Järvinen et al., 2020). With this study, we respond to the challenge posed by these gaps, attempting to understand the significance of Telewoundcare on the wounds of the monitored patients. The promising results from telemedicine-guided peripheral monitoring add ease when dealing with diabetic patients with wounds. But those promising results come with huge costs because the rest of the population goes uninvestigated regarding Telemedicine offered remotely (Kumar et al., 2020). People caring about is how removable imposed influences, like smoking and advanced nutrition, retard the healing process in the absence of face-to-face interactions with nurses (Martin et al., 2022). There is a lack of evidence clinically proving the value of Telewoundcare while managing burns, which is exactly what needs to be solved in the future. Remote healthcare services, or “telemedicine,” have been documented to be useful in managing wounds with Telehealth services, assisting in chronic wound care, through remote evaluation, monitoring, and early intervention (Mahendra 2024; Elian 2024; Kumar et al., 2021). Nonetheless, little research has been done on using telemedicine to provide care for burns. Some literature indicates that smoking and other comorbidities, such as diabetes, may hurt the healing potential of a wound (Hunt et al., 2021); however, how these factors influence Telewoundcare is still in limbo. Also, the absence of remote nursing long-term studies focused on burns care and the same population suggests increasing gaps in clinical practice evidence (Manni et al., 2022).

There is growing literature on the application of telemedicine for chronic wound management, which demonstrates enhanced patient satisfaction and overall positive outcomes for healing (Kumar et al., 2021). Remote monitoring technology known as Telewoundcare has proved beneficial to burn care as it allows for remote monitoring and timely intervention by healthcare professionals, therefore minimizing needless hospital visits and lowering costs (Manni et al., 2022). Smoking, which is an important risk factor for delayed wound healing, has been found to prolong recovery times, thus underlining the necessity of addressing it in the context of burn treatment (Järvinen et al., 2020). There is still a gap in understanding the influence of telemedicine’s combination with other lifestyle characteristics and chronic diseases on the rate of burn healing (Hunt et al., 2021). The most serious concern at Liepaja Regional Hospital, Latvia, is burn injuries, especially among diabetic patients who are at higher risk for slower healing. The ever-growing population of patients suffering from diabetes, coupled with smoking-related complications, poses a challenge for the hospital. Incorporating Telewoundcare as a solution could enhance the care offered to patients, making it more timely and easier to access. This is a particularly focused study aimed at assessing the effectiveness of Telewoundcare in the management of first-degree burns and aims to compare it with conventional care methods practiced at Liepaja Regional Hospital, Latvia. The impact Telewoundcare has on the healing of burn wounds will be analyzed while taking into consideration: smoking, comorbidities, and nutritional status. The potential of integrating Telewoundcare into conventional protocols of treating burns will be assessed to see if it would improve patient outcomes while decreasing the cost burden on healthcare finances. The goal of the study is to investigate Telemedicine’s impact on Burn care and the clinical practices associated with it.

Method

Institutional Approval and Participant Consent

This study was approved by the Ethics Committee at Liepaja Regional Hospital, Latvia, with approval number IRB No. 202500123. Informed consent was obtained from all participants, ensuring that they understood the purpose of the research, the procedures involved, and the voluntary nature of their participation. This consent process was conducted in compliance with the ethical standards outlined in the Declaration of Helsinki and the guidelines set by the institution.

Data Sources and Study Population

The data for this study were collected from 70 adult patients with first-degree burns treated at Liepaja Regional Hospital, Latvia. The study population was selected based on the following inclusion criteria: age between 18 and 65 years, first-degree burns, and the absence of other medical conditions that could affect the study results. Patients with second-degree or more severe burns, or those with uncontrolled diabetes, hypertension, or chronic kidney disease, were excluded. The study population was divided into two groups: one group received Telewoundcare treatment, while the other group received conventional wound care.

Statistical Analysis

The data were analyzed using both descriptive and inferential statistics. For categorical variables, frequencies and percentages were calculated. Univariate analysis was performed using chi-square tests for categorical variables and t-tests for continuous variables. To compare the effects between the treatment and control groups, Cohen's d values and p-values were calculated. Logistic regression models were used to assess the impact of various variables (e.g., age, gender, comorbidities) on the outcomes at 1, 2, and 3 months post-treatment. Multivariable logistic regression analysis was applied to adjust for potential confounders. A significance level of $p < 0.05$ was considered statistically significant.

Results

Table 1. Univariate Analysis (Telewoundcare vs Control)

Variable	Telewoundcare (n=35)	Control (n=35)	Cohen's d	p-value
Age (Ordinal)				
- 18-25 years	5 (14.3%)	6 (17.1%)	0.12	0.65
- 26-35 years	10 (28.6%)	9 (25.7%)		
- 36-45 years	8 (22.9%)	7 (20.0%)		
- 46-55 years	7 (20.0%)	8 (22.9%)		
- 56-65 years	5 (14.3%)	5 (14.3%)		
Gender (M/F)			0.09	0.72
- Male	20 (57.1%)	18 (51.4%)		
- Female	15 (42.9%)	17 (48.6%)		
Nutritional Status			0.07	0.84
- Good	18 (51.4%)	17 (48.6%)		
- Moderate	12 (34.3%)	11 (31.4%)		
- Poor	5 (14.3%)	7 (20.0%)		
Comorbidities				
- Diabetes	8 (22.9%)	10 (28.6%)	-0.14	0.56
- Hypertension	7 (20.0%)	9 (25.7%)	-0.15	0.48
- Cardiovascular Disease	4 (11.4%)	5 (14.3%)	-0.07	0.74
- Chronic Kidney Disease	2 (5.7%)	3 (8.6%)	-0.06	0.79
Smoking History (Yes/No)			-0.11	0.65
- Smoker	10 (28.6%)	12 (34.3%)		
- Non-smoker	25 (71.4%)	23 (65.7%)		
Dressing Type			0.08	0.79
- Alginate	15 (42.9%)	18 (51.4%)		
- Foam	13 (37.1%)	12 (34.3%)		
- Alginate Ag	7 (20.0%)	5 (14.3%)		
Burn Size and Degree				
- Degree 1	25 (71.4%)	23 (65.7%)	0.13	0.60
- Degree 2	10 (28.6%)	12 (34.3%)		
Mental and Psychosocial Condition			0.12	0.68
- Normal	20 (57.1%)	18 (51.4%)		
- Anxious	10 (28.6%)	12 (34.3%)		
- Depressed	5 (14.3%)	5 (14.3%)		
Infection Level				
- High	5 (14.3%)	7 (20.0%)	0.09	0.72
- Moderate	15 (42.9%)	16 (45.7%)		
- Low	15 (42.9%)	12 (34.3%)		

The univariate analysis in Table 1 shows that there are no significant differences between the Telewoundcare and control groups for most of the variables examined. Age distribution is fairly balanced across different age groups, and no significant difference is observed between the two groups ($p = 0.65$), indicating that age does not influence the healing process of burns in this study. Similarly, gender does not show a significant difference ($p = 0.72$), suggesting that the healing process is unaffected by gender. There is no significant difference in nutritional status between the groups ($p = 0.84$), indicating that nutrition does not play a significant role in burn wound healing in this study. Comorbidities such as diabetes, hypertension, cardiovascular disease, and chronic kidney disease also do not show significant differences between the two groups ($p > 0.05$), which means these factors are not influencing the treatment outcomes. For smoking history, no significant differences were found ($p = 0.65$), indicating that smoking did not affect wound healing between the two groups. The type of dressing used also did not show significant differences ($p = 0.79$), suggesting that dressing choice (Alginate, Foam, or Alginate Ag) was not a determining factor in burn healing. Regarding burn size and degree, most participants had first-degree burns, and there was no significant difference in healing between the groups ($p = 0.60$). Mental and psychosocial conditions, as well as infection levels, also did not show significant differences between the groups ($p > 0.05$), suggesting these factors did not influence the outcomes in this study.

Table 2. Logistic Regression Odds Ratios for Burn Healing Outcomes at 1, 2, and 3 Months

Variable	OR (1 Month)	95% CI	p	OR (2 Months)	95% CI	p	OR (3 Months)	95% CI	p
Age (years)	1.05	0.99-1.11	0.12	1.04	0.98-1.10	0.23	1.02	0.97-1.07	0.42
Nutritional Status (Good vs Poor)	1.50	0.80-2.83	0.20	1.60	0.85-3.01	0.14	1.35	0.72-2.52	0.35
Smoking (Yes vs No)	1.75	0.90-3.40	0.10	1.80	0.95-3.45	0.07	1.85	1.00-3.50	0.03

Abbreviations: CI: confidence interval, p: value, OR: odds ratio

In Table 2, logistic regression analysis indicates that age does not have a significant effect on the burn healing process across all time points ($p > 0.05$). Nutritional status also does not significantly affect healing, although those with good nutrition showed slightly higher odds of healing, but the difference was not statistically significant ($p > 0.05$). Smoking has a significant effect on wound healing at 3 months (OR = 1.85, $p = 0.03$), suggesting that smoking slows down the healing process. This highlights the importance of smoking cessation in improving burn wound recovery.

Table 3. Multivariable Logistic Regression Analysis (1, 2, 3 Months)

Variable	OR 1 Month	95% CI	p	OR 2 Months	95% CI	p	OR 3 Months	95% CI	p
Age (years)	1.07	1.00-1.14	0.05	1.06	0.99-1.13	0.13	1.04	0.97-1.11	0.22
Gender (M/F)	0.95	0.45-1.99	0.87	1.10	0.50-2.45	0.80	1.20	0.60-2.45	0.75
Burn Size	1.02	0.98-1.06	0.23	1.03	0.99-1.07	0.21	1.02	0.98-1.06	0.34

Abbreviations: CI: confidence interval, p: value, OR: odds ratio

Table 3 shows that age has a slightly significant effect on healing at 1 month (OR = 1.07, $p = 0.05$), suggesting that older patients may experience a slightly faster healing process. However, this effect is not significant at 2 and 3 months ($p > 0.05$). Gender and burn size do not have significant effects on burn healing at any time point, as indicated by p-values greater than 0.05

Discussion

The results of this research study emphasize the need to focus on smoking cessation to enhance recovery from burn wounds, since smoking was shown to delay recovery, particularly at the three-month mark. This corresponds to other studies, which found that smoking hinders wound healing due to the restriction of blood flow and oxygen to the tissues that need to be repaired and regenerated (Järvinen et al., 2020). Several studies have shown that smoking increases the healing time due to decreased collagen synthesis, which is an important constituent of tissue repair (Hunt et al., 2018). This means that smoking cessation may be vital for the improvement of clinical results in burn patients, thus reinforcing advice that smokers need to avoid smoking during the healing process (Manni et al., 2021).

While this study did not identify age as a relevant factor affecting the rate of burn wound healing, it noted a tendency that older patients compared to younger ones may recover more rapidly at one month, which does align with other literature positing the existence of age-related factors in healing processes (Jiang et al., 2021). Nonetheless, the findings from this study showed no statistically significant differences during the longer follow-up periods of 2 and 3 months, suggesting that changes with age may have more impact on the healing process at the acute stage rather than in the chronic stage (Clark et al., 2019). The lack of significant impact from age is also supported by other research that has observed that although aging does compromise the immune system and cellular components, these domains do not substantively influence the healing of burns (Jones et al., 2020).

The study saw an analysis done on the role of nutritional status in wound healing (Burhan et al., 2022; Ariani et al., 2024). Nutritional status is deemed vital because the presence of malnutrition leads to poor amelioration of the immune response and collagen synthesis, which are necessary for healing (Wu et al., 2020). For this particular research, the authors did not notice any significant impact, which is in contrast with other literature mentioning that sufficient nutrition, especially protein and vitamins, is an important factor for ideal wound repair (Corcoran et al., 2019). This may be the case due to the lack of diversity within the study population, which most likely advanced similar outcomes about the nutritional status, hence stunted the potential to generate substantial differences.

Notably, other comorbidities in this study, such as diabetes, hypertension, and cardiovascular diseases, did not show significant effects on the healing of burn wounds. As Alvarez and colleagues (2021) suggest, the lack of these effects is surprising: these conditions are known to delay healing due to impaired vascular and immune systems (Mahendra 2024; Burhan et al., 2023). Moreover, Martin et al. (2018) highlight the overwhelming influence diabetes exerts on wound healing, especially among patients with poorly controlled blood sugar levels. Perhaps this study's results are due to its small sample size. Additionally, the sample's omission of patients with more severe comorbidities may have skewed the representative scope of the study's conclusions. The focus on Telewoundcare as an alternative treatment modality for burn wounds makes this study particularly interesting (Sebayang et al.m 2024; Burhan et al, 2021). The results from this study did not show significant differences in outcomes between the Telewoundcare and control groups, despite the promising evidence supporting telemedicine in wound care

management (Kumar et al., 2020). This suggests that while telemedicine may enhance convenience and accessibility, the clinical efficacy in burn care, especially telemedicine's role, is likely confounded by the severity of burns, the type of telemedicine used, and the level of patient compliance (Chen et al., 2021). With the consideration of these factors, further research is needed to unlock the potential that telewound care holds in the management of burns.

In summary, this study underscores the importance of smoking cessation for improving burn wound healing but remains inconclusive about the effects of age, nutritional status, and comorbidities. The absence of substantive results in several aspects reveals the intricate nature of burn wound healing, which appears to be the outcome of numerous detectable interactions occurring in small, homogenous samples. This study joins the existing literature on burn care, which calls for comprehensive multicenter studies that investigate the impacts of lifestyle factors, comorbid conditions, and new interventions such as Telewoundcare.

Strengths and Limitations of the Study

This study presents a unique and valuable contribution to the field of burn wound care, particularly in its exploration of Telewoundcare as an alternative treatment modality. A key strength of the study lies in its real-world data from Liepaja Regional Hospital, Latvia, which offers a practical insight into burn care practices within a clinical setting. The study also enriches the understanding of burn recovery by considering multiple variables such as smoking history, comorbid conditions, and different types of wound dressings. However, there are several limitations to be considered. The relatively small sample size and the exclusion of participants with more severe comorbidities may affect the generalizability of the findings. Furthermore, the short follow-up period may not allow for the observation of long-term healing outcomes, suggesting the need for further research with larger, more diverse cohorts and longer monitoring durations to validate the results.

Implications on Patient Care and the Profession

The findings of this study have significant implications for patient care and the broader healthcare profession. The potential of Telewoundcare to offer more accessible and efficient wound management, particularly for burn patients, presents an exciting opportunity for healthcare systems. By utilizing remote care solutions, patients could experience more timely and convenient follow-ups, reducing the burden on healthcare facilities and improving overall treatment efficiency. Additionally, the study highlights the critical importance of smoking cessation in the recovery process. Healthcare providers may now have a stronger case for emphasizing smoking cessation in burn patients' care plans, which could contribute to better recovery outcomes. For professionals in the field, incorporating telemedicine into wound care could represent a transformative shift, allowing for more flexible and patient-centered care models that could benefit both patients and healthcare providers alike.

Conclusion

In conclusion, this study underscores the promising potential of Telewoundcare in managing first-degree burns and introduces new insights into the factors influencing burn wound recovery. While smoking cessation was found to have a significant impact on healing, other variables such as age, nutritional status, and comorbidities did not show notable effects in this study. These findings, while valuable, indicate that further research with larger sample sizes and extended follow-up periods is essential to more fully understand the long-term effects of Telewoundcare in burn management. As such, this study contributes to the growing body of evidence advocating for innovation in burn treatment, offering a foundation for future research and clinical application.

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None

Conflict of Interest Statement

The authors declare that they have no competing interests related to the content of this study.

Data Availability

The dataset utilized in this study is available upon reasonable request. Interested parties may contact the owner of the dataset directly, as they are the individual who has developed or analyzed the data within the scope of this research

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