

# Burns, Wounds and Scars Management by Telemedicine

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## Abstract

Concerns about the availability and access to health care have impelled the utilization of telemedicine specially during the past couple of years. The clinical application of telemedicine includes using available technology and electronic communication as a method of simplifying and facilitating patient care from the evaluation to reaching diagnosis and delivering management and treatment plan. Our aim is to explore the efficacy of telemedicine in the scope of burns, wound care, and scars management.

**Methods:** This is a literature review of published articles on PubMed and Google Scholar discussing the use of telemedicine in burns, wounds, and scars management. Articles were sorted based on their significance to plastic and reconstructive surgery, then reviewed to discuss their applications, benefits, and limitations of telemedicine in practice.

**Results:** A total of 216 articles were identified in the initial query. (126 articles for burn management, 24 articles for wound management, 66 articles in Tele-dermatology, only 7 articles of which focused on skin lesions and scars). Most of these articles described the benefit of telemedicine mostly showing progress in postoperative monitoring, increased access to patients in rural settings, while proving to be cost effective. These studies were conducted in 14 different countries where most of them took place in UK, USA, and China. No systematic or official models were observed.

**Conclusion:** Telemedicine is increasingly progressing in the efficiency of assessing burns, wounds, and scars on many levels especially with the help of rising technologies, still its use, in this regard, is limited to only 14 countries, where telemedicine was utilized mostly in burn management, while there was minimal use of telemedicine in scars management under plastic surgery. Moreover, there were no generalized or systematic implementations of models in the reviewed articles.

**Keywords:** Telemedicine; Telehealth; Plastic surgery; Burns and wounds; Scars management

## Introduction

Clinicians, health care researchers, and others have been investigating the use of advanced telecommunications, anticipating improvement of health care. At the intersection of many of these efforts is telemedicine. As defined here, telemedicine is the use of electronic information and communications technologies to provide and support health care when distance separates the participants [1]. The ascent of technology in communication along with the exceptional expansion in computing capacity and electronics made telemedicine possible [1]. Thus, exhibiting an increasing competence of postoperative care for surgical procedures, allowing care co-ordination while facilitating interprofessional collaboration across time and space as well as improving-the quality or accuracy of care provided. However, these benefits apply broadly not only to the practitioners but also to the patients, where progression in telehealth is of great significance to plastic surgeon due to the visual nature of their work [2,3]. Moreover, in this review we will focus on the benefits of telemedicine in plastic surgery (burns, wounds, and scars management) in which we will explore the use of existent models of telemedicine in different regions. In addition to analyzing the efficacy and limitations of these models to enhance the understanding and performance of telehealth worldwide.

## Methods

A structured literature review of English-language published articles on telemedicine was obtained using PubMed and Google Scholar discussing the use of telemedicine in burns, wounds, and scars management. Articles were sorted based on their significance to plastic and reconstructive surgery, then reviewed to discuss their applications, benefits, and limitations of telemedicine in practice

## Results

Various accessible reviews were comparing the efficiency and standards of Telemedicine uses in burns, wounds, and scars management over the years. Our article sheds light on the number of published studies discussing each topic (burns, wounds, or scars) to be able to compare the extent of telemedicine uses substantially around the world. On top of that, we explored the degree of expansion in terms of numbers of countries who are using telemedicine and whether they have established viable models encompassing telemedicine uses in plastic and reconstructive surgery.

### Telemedicine and burns

One article with the title 'A Systematic Review of the Use of Telemedicine in Plastic and Reconstructive Surgery and Dermatology' reviewed 23 articles, 5 of which were covering the use of telemedicine in burn management, which reported a (100%) benefit of telemedicine. This study included USA, Netherlands, Australia, UK, Taiwan France, Germany, Spain, Korea, and Thailand. However, only south Korea and Thailand published articles that evaluated the use of a possible model using phone apps to assess burns. A further article 'Telemedicine and burns: an overview', found 24 articles and 43 studies mainly discussing the value of telemedicine in managing burns concluded that it was times saving, cost effective, and has proven greater involvement in patient care. These articles were established in the following countries UK, USA, Australia, Armenia and Russia. None of these countries showed an implemented model of telemedicine that was routinely used as a measure of dealing with burns or burn management [3,4]. Furthermore, an article review with the title 'Fast resuscitation and care of the burn patients by telemedicine' analyzed 30 articles which took place in UK, Spain, USA, between 1993-2012 exploring the use of telemedicine in fast resuscitation of burn patients [5]. Correspondingly, patient satisfaction was measured in a study that included patients with burns of <15%TBSA, where 97% of 57 patients were satisfied with the use of Tele-burn care in UK [6]. In addition to a study by Wallace in 2012 about the evidence of telemedicine in burn care with a UK perspective investigated 24 clinical studies from Spain, UK, Australia, Germany, USA [6]. Similarly, positive results were observed in most of these articles.

### Telemedicine and wound care

Wound care was the focus of 24 articles [2] 4 of which included programmed phone applications, whereas the remaining studies used other modalities facilitating the implementation of telemedicine. Results showed efficacy and safety with conventional standard care of chronic wounds [7]. A different study in Switzerland developed an mHealth tool that suggested technical solutions taking a further step towards reliable and trustworthy digital health for home-based self-management of wounds [8]. Additionally, studies about chronic wound ulcers assessed outcomes in 182 chronic foot ulcer patients, conveyed that 79.8% healed in the Telemedicine group with high satisfaction levels compared to 76.1% in the standard care group. On the other hand, amputations were higher in patients receiving standard care than Tele-care [9,10].

### Telemedicine and scars management

A systemic review included mentioned above included 66 articles focused on telemedicine in dermatology, also demonstrated significant promise. 5 of these articles discussed the use of telemedicine in detecting, assessing and managing skin lesions including skin cancer [3]. Countries such as Austria, Australia Italy, USA, UK, Brazil contributed to these studies where various models were introduced for assessing and managing skin lesions. Evaluation of burn scars using the patient and observer scar assessment scale can be accurately performed via live videoconferencing especially in rural communities with less facilities and lower income [9]. Ultimately, a recent paper proposed a novel optical palpation device designed to evaluate tissue stiffness on a commercially available smartphone [10,11]. Finally, minimal published articles were found under scars management in Telemedicine.

## Discussion

The exponential expansion of mobile technology alongside its simplicity and evidence of its up-shooting accessibility has given rise to the escalated dependence towards these devices or applications on daily basis. Revolutionary uses of mobile devices and apps for the improvement of patient care and management has been researched over the years. Different phone applications demonstrated excellent sensitivity and specificity in detecting skin changes in the postoperative care. Considering the omnipresence of smartphone applications for medical uses in fields such as family medicine and dermatology it is likely that the ongoing technological progress will shadow the accurate, reliable, easy-to-use "apps" in plastic surgery. Consequently, the reviewed articles included detailed studies investigating the quality and clarity of different devices and applications in utilizing images and videos as a modality to evaluate and manage burns, wounds and skin lesion, where most data measuring results and patients' satisfaction showed great

functionality although the available technology can't replace the standard care of real time clinics, results showed that Telemedicine was able to minimize expenses, and unnecessary urgent referrals hence improving the quality of care provided to patients patient management, triage, and postoperative monitoring besides proving to be extremely time saving [12]. This evidence expressed the rising use of telemedicine distinctly in burns management compared to wound and scars management which could be explained by the fact that Burns are usually presented in a form of acute injuries that could be life threatening if management was delayed or miss diagnosed.

Nevertheless, the 126 articles discussing telemedicine in the use of burns weren't evident of any implementations of models that could facilitate the ease of tele-communication in handling burn patients. The importance of a generalized model with previously set standards can be evident in which it could simplify communication as well as comparison and diagnosis of these patients. Also, this will allow documentation which could clarify the limitations and improve the established methods and tools along with assisting in proposing an innovative instrument to utilize management and patient care. Wounds was the second most researched topic in our study, where 24 articles discussed the benefits and degree of telemedicine utilization in this field. Two of these articles proposed phone application models that could possibly be used in the future as a conventional tool to evaluate and manage wounds making home care possible while reaching an accurate diagnosis and potentially reaching safe outcomes. Limited numbers of relevant published article researched the use of telemedicine in scars management but since scars are a point of intersection between plastic surgery and dermatology, after analyzing articles discussing tele-dermatology, we found some articles discussing skin lesions including suspicious ones such as skin cancer. Accordingly, we found the assessment of telemedicine uses in scars management as insufficient to determine its extent and reliability in telemedicine. Nevertheless, the use of tele-dermatology is prospering and seems to be distinct from other telemedicine studies, whereas tele-dermatology has numerous studies and published articles that shows its progress. In the end, we recommend further analysis of the supporting data as well as establishing more studies concluding the successful implementation of telemedicine in plastic and reconstructive surgery while assessing standardized models of telemedicine and measuring whether these models could be applied internationally.

## Conclusion

Telemedicine is evidently highly utilized in burns and wounds but minimally in scars management. However, it shows potential

in increasing the efficiency of postoperative care for surgical procedures, improving patient care and management. In addition to, facilitating interprofessional participation across time and space, decreasing unnecessary referrals, and connecting patients located in different areas as well as improving the quality of care. Furthermore, data shows the restriction of telemedicine use in burns, wounds, and scars management to approximately 14 countries showing promising progress in apps uses. Nevertheless, the reviewed articles in our study showed no evidence of telemedicine application as a national validated model.

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