

# Chapter 11

## Mobile Telemedicine Systems for Remote Patient's Chronic Wound Monitoring

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### ABSTRACT

*Telemedicine can be defined as the delivery of health care and sharing of medical information at a distance using telecommunication platforms. This chapter describes the implementation of a mobile telemedicine system for patient's chronic wound (CW) monitoring using a smartphone. The system proved to be quick and reliable for providing health care at door step. The tele-wound technology network (TWTN) framework in telemedicine systems using smartphones for remote wound monitoring has been proposed. This framework is effective for both rural as well as urban people; it gives good performance in terms of wound monitoring and advanced diagnosis. The main objective of this work is to design and develop a TWTN system model that can acquire, process and monitor CW related problems with using a low cost smartphone to increase the overall performance of the system. Specifically, the TWTN system is developed for biomedical information like CW processing to monitor important patient information inexpensively and accurately.*

### INTRODUCTION

Management of chronic wounds (CWs) is becoming a big challenge in medical health care globally. The skin is often referred as “the largest organ of the human body” as it stretches throughout the body parts. The skin is a first line of cover against infection, forms an insulating shield and also protects the body

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against extremes of temperature, damaging sunlight, and harmful chemicals. As it forms the exterior of the human body, the skin is prone to be damaged by external and internal factors that lead to the formation of wounds. A wound is defined as a break in the skin due to an injury or damage, usually occurs when the integrity of the underlying tissue is compromised.

## **Chronic Wounds: Causes and Concerns**

Elderly people (over 60 years) are more prone to suffering due to chronic wounds. The non-healing wounds can persist for years, causing pain to patients and placing them at risk for secondary infections and loss of limb. All types of wounds may become chronic due to various conditions that stop or slow the wound healing process. These may include any of the following:

- **Poor Blood Supply or Ischemia:** The various conditions that may lead to tissue ischemia are low blood pressure, blocked or narrowed vessels, and various systemic diseases of the blood, heart, kidney, and lung.
- **Infections:** It may happen when large number of microorganisms gets into the wound by various foreign particles such as glass or metal. Devitalized necrotic tissue in the wound and underlying systemic disease such as diabetes can increase the risk of infection.
- **Immune Suppression:** The immune system helps in healing by reducing infection. Poor nutrition, radiation treatment, medical drugs used over a long period such as steroids and disease such as cancer and diabetes weakens the immune system. Emotional stress may also lower the immunity by increasing the cortisol levels (Snyder, 2005).
- **Tissue Swelling:** Tissue swelling decreases the blood flow in the wound area by increasing the pressure. Repeated physical trauma initiates the inflammatory process and leads to chronic wound formation. Swelling can also happen with conditions such as heart failure or blood vessel disease that cause decreased blood flow to the wound region.
- **Age:** Old age is also a contributing factor in the formation of chronic wounds (Mustoe, 2004). Aging skin of the older people is damaged more easily. Also an older cell does not proliferate as fast and lacks an adequate response to stress in terms of gene up-regulation of stress-related proteins.
- **Malignancy:** Cancerous tissue can proliferate until the blood supply to the cells stops and tissue lead to the formation of an ulcer. Cancer may also develop as a result of an ulcer such as squamous cell carcinoma; probably repetitive tissue damage that stimulates cell proliferation may be the cause (Trent, 2007).

Patients are affected in many ways by various problems caused by the CWs such as pain, restricted mobility, economic burden and psychological stress all leads to the reduced quality of life. Pain varies with the type of wound as in diabetic ulcer there is no or diminished pain sensation, while in arterial ulcer there is a constant pain and in pressure ulcer intermittent pain is felt by the patient. Pain also varies from one patient to another. Wounds causing severe pain may reduce the quality of life by restricting the mobility of the patient that leads to the loss of earning. As CWs take long time to heal, therefore, combined with pain and inability to move the limb adversely affect the psychological state and behavior of the patient. A CW not only affects the individual, but the entire family gets suffered due to the enormous cost of wound care. Also it should be noted that without intensive medical care and treatment a wound

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