CHAPTER 6

Efficacy of Polymer-Based Wound Dressings in Chronic Wounds

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1. INTRODUCTION

Wound care is a global health burden. Chronic wounds are common in the elderly population [1–3]. In the United States, it is estimated that 3% of the population with chronic wounds are older than 65 years and most of them suffer from open wounds. Over 2% of the total population of the United States has also been estimated to be affected by chronic wounds. In 2016, a report from Wales estimated a 6% cases of chronic wounds with a 5.5% cost to the National Health Service. Globally the United States and Europe are the biggest wound-dressing markets. The annual cost for wound care in 2014 was reported to be an average of $2.8 billion [3]. It has been estimated that this amount will increase to $3.5 billion in 2021 [3]. The market research report in 2018 indicates that the global wound-closure products market will increase by more than $15 billion in 2022 (Internet source: Advanced Wound Care Market Outlook and Forecasts). It is estimated that by 2024, the wound care market targeting surgical wounds and chronic wounds such as ulcers will exceed $22 billion due to factors such as the advancement of technology [3] (Internet source: Advanced Wound Care Market Outlook and Forecasts).

Factors that contributes to a wound becoming chronic are infections, poor circulation, age, alcohol, poor nutrition, obesity, diseases such as diabetes, cancer, HIV/AIDS, and some medications (antiinflammatory drugs, chemotherapy) [4]. The use of wound dressings that is not suitable for the wound type also contributes to a wound becoming chronic [5]. An ideal wound dressings should have features such as good capability to remove excess wound exudates, biodegradable, permeable to gaseous exchange, easy to use, affordable, protect the wound from infections, provide mechanical protection, affordable, biocompatible, reduce surface necrosis of the wound, does not cause trauma to the wound on removal, keeps the wound environment moist and dry and does not cause allergic reactions [6]. Wounds can be classified as acute and chronic. Acute wounds represent an injury to the skin that heals by the normal phases of wound repair whereas chronic wounds need longer time to heal [7].

The healing process of wound is complex and complicated. Different strategies are used for the management of wounds depending on the nature of wounds. Wound occurs on the skin as a result of damage which can be physical or thermal. The skin is referred to the largest organ in the human body with an area of 2 m^2 [8, 9]. The skin is made up of three important layers known as the dermis, epidermis, and hypodermis. The skin is very important in protecting the internal organs from ultraviolet (UV) radiation and invasion of microorganisms. It is also useful in regulating body temperature [10] and for the detection process of the sensory and immune system of the body [11].

Factor to be considered when selecting a wound dressing for the treatment of a wound are the location, type, depth, amount of exudates, wound adhesion, and infections. Wound dressings are prepared from a combination of biopolymers, synthetic polymers, and antibiotics. Biopolymers used for the preparation of wound dressings are either animal or plant origin. The biopolymers obtained from animals exhibit high porosity, biocompatibility, and biodegradability with good water uptake. Biopolymers such as collagen exhibit good hemostatic property and are useful for controlling bleeding wounds. Furthermore, the hemostatic mechanism of collagen-based wound dressings showed that platelets and hemocytes can adhere to the surface of the wound dressings followed by proliferation [12]. However, animal-based biopolymers are limited by their poor mechanical properties and their capability to transmit diseases to humans. Plant-based biopolymers used in the development of wound dressings are nontoxic in nature, biocompatible with good antimicrobial activity [10]. The present of hydrophilic functionalities in the plant-based biopolymers enhance the water

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