



Review Article

Wound Healing With Medicinal Plants

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ABSTRACT

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Medicinal plants have an important role in the healthcare system and are a major source of raw material for development of traditional or conventional medicines. Wound Healing is a natural process by which the body itself overcomes the damage to the tissue but the rate of healing is slow. Healing is a complex dynamic process that results in the restoration of anatomic continuity and function. Improvement in the healing process can be accomplished by decreasing the time required and avoiding the microbial infection for wound healing. Several medicinal plants and herbs have been reported for wound healing worldwide. The various phytoconstituent are responsible for the wound healing activity. Various constituents like tannins, flavonoids, alkaloids, and glycoside possess the healing potential. Traditionally in ayurveda various herbs, fats, oils, and minerals have been used as wound healing agent. Herbal extract promotes blood clotting, fights against infections, and accelerates the healing process of wounds. The wound healing activity of many medicinal plants is due to their properties like astringent, antioxidant, antimicrobial, anti-inflammatory. This review highlights all the plants which are scientifically proven for the use in treatment of wounds and wound care. It also covers the list of the plants and its part of plant used traditionally for wound care.

1. Introduction

Wound is a cellular and anatomic disruption of tissue with or without microbial infection and is produced due to any accident, cuts, burns, diabetic wound[1]. Wound healing is a process of restoring normal structure function of damaged tissue[2]. There are many herbs traditionally known for wound healing activity. Traditional medicines are also known as indigenous or folk medicine comprises the knowledge that has been developed over generations within various societies before the ear of modern medicine.

Practices Known as traditional medicines include Herbal, Ayurveda, Siddha, Unani, Iranian, Islamic and other medical knowledge and practices all over the globe. India has a rich tradition of plant based knowledge on healthcare[3]. The herbal plants which possess the potential of wound healing have properties such as antioxidant, antimicrobial, anti-inflammatory. These agents act by stimulating fibroblast proliferation, induce keratinocytes proliferation, increase collagen formation[4]. In recent years many attempts have been made to formulate a herbal formulation by extracting the active constituents from plants or by taking whole extract.

A polyherbal gel containing *Terminalia arjuna*, *Centella asiatica*, *Curcuma longa* which possess wound healing, anti-inflammatory, antioxidant and antibacterial activities. An anti acne formulation consisting of a fraction of tannins and flavonoids fractionated from *Terminalia arjuna* has been formulated into a cream formulation. The anti acne cream was found to have activity against propionibacterium acnes and staphylococcus epidermidis[5,6].

1.1 Wound

The protective functions of the skin are compromised by injury, wound leads defect or break in the skin, resulting from either mechanical or thermal damage, or a result of the presence of underlying medical or physiological condition. Wounds are described as acute if they heal rapidly with minimum scarring and chronic if they take longer than 8-12 weeks to heal. Simple mechanical injuries caused by for example, surgery, accidents and fires require specialist nursing care[7].

1.2 Classification of Wound

Wounds can be classified in number of ways, depending on healing time they can be acute or chronic

Acute wounds

Acute wound is defined as the traumatic loss of normal structure and function to recently uninjured tissue. Acute wound healing is the highly regulated process of cellular, humoral, and molecular events activated at the time of injury and resulting in a time-dependent but predictable and orderly pattern of tissue repair[8].

Chronic wounds

Chronic wounds are defined as wounds that have failed to proceed through an orderly and timely process to produce

anatomic and functional integrity, or preceded through the repair process without establishing a sustained anatomic and functional result[9].

Depending on disruption of skin layers they can be:

Superficial wounds

Involve injury into the epidermis alone.

Partial thickness wounds

Involve injury to the epidermis and the deeper dermal layers, including the blood vessels, sweat gland and hair follicle.

Full thickness Wounds

Occur when the underlying subcutaneous fat or deeper tissues are also damaged[10].

1.3 Process of wound healing

Process of wound healing may be considered as a dynamic process in which cellular and matrix components act together to re-establish the integrity of damaged tissue and replace lost tissue. Regardless of the source or the extent of tissue damage, under normal conditions the wound healing process occurs in predictable fashion in four stages: inflammation, migration, proliferation and maturation (remodeling). Wound Healing is considered to complete when the skin surface has reformed and has regained its tensile strength[10].

1.4 Stages of wound healing

Hemostasis and coagulation

In wound healing the platelets act as utility workers sealing off the damaged blood vessels. The blood vessels themselves constrict in response to injury, but this spasm ultimately relaxes. The platelets secrete vasoconstriction substances to this process but their prime role is to form a stable clot sealing the damaged vessel[10,11].

Inflammation

Inflammation is the body's response to injury and involves both cellular and vascular responses. The release of histamine and a number of other cell mediated factors into wound results

in vasodilation, increased capillary permeation and stimulation of pain receptors. The release of protein rich exudate containing phagocytes and other materials from the blood capillaries onto wound surfaces engulf the debris of dead cells and bacteria[11].

Migration

Growth factors in the wound exudates promote the growth and migration of epithelial cells, fibroblasts and keratinocytes to the injured area to replace damaged and lost tissue. These cells regenerate from the margins, rapidly growing over the wound

under the dried scab. the epithelial thickening and basal cell proliferation[11,12].

Proliferation

The proliferation Phase involves the development of new tissue and occurs simultaneously or just after the migration phase, lasting from 5 to 20 days. Granulation tissue is formed by infiltration of blood capillaries and lymphatic vessels into the wound and by the supporting collagen network synthesized by fibroblast. This process is known as granulation[12].

Maturation

The final phase of wound healing (also called the remodeling phase) involves the diminution of the vasculature and enlargement of collagen fibers, which increase the tensile strength of the repair. The timescale for wound repair is from about 3 weeks to 2 years commonly the tensile strength of the final scar recovers to 70-90% of that pre injured tissue[13].

1.4 Commonly used Medicinal Plants

Calendula

calendula officinalis, or pot marigold, Calendula is a common garden plant belonging to the family compositae . It is native to southern Europe, it grows upto 60cm in height and produces large yellow or orange flowers. The parts of plant having medicinal use are flowers. Flowers have been used to treat a number of clinical conditions, specifically, the treatment of dermatological disorders. The clinical effects of calendula are due to number of chemical constituents. The main compounds within calendula are the triterpenoids, which are claimed to have anti-inflammatory and wound healing potential. calendula may facilitate wound healing by increasing both wound angiogenesis and collagen, nucleoprotein, and glycoprotein metabolism leading to improvements in both local circulation and granulation tissue formation[14].

Curcumin

Curcuma longa is a popular Indian spice that has been used for centuries in herbal medicines for the treatment of a variety of ailments such as rheumatism, diabetic ulcers, anorexia, cough and sinusitis. It is commonly called as turmeric. It is also called Indian saffron. The main constituent curcuminoid present in turmeric and responsible for its yellow color. curcumin has shown to possess significant anti-inflammatory, anti-oxidant, anti-carcinogenic, anti-mutagenic, anti-coagulant and anti-infective effects. Curcumin has also been shown to have significant wound healing properties. It acts on various stages of natural wound healing process to healing. Wound healing properties of curcumin also provides ability to enhance granulation tissue formation, collagen deposition, tissue remodeling and wound contraction[15].

Arjuna bark

Terminalia arjuna is a deciduous tree of the combretaceae family. The plant is found in India, Sri Lanka, Burma, and Mauritius. The bark of tree and fruit are the parts of plant

responsibility for its medicinal activity. *Terminalia arjuna* can be used in the treatment of wound healing, to treat inflammation, coronary artery disease, heart failure and hypercholesterolemia. It can be used in treatment of dermatological where it is used in fractures, Inflammation, wounds and ulcers. The chemical constituent present in *Terminalia arjuna* are flavonoids, tannins, triterpenoid saponins, gallic acid, ellagic acid, phytosterols. *Terminalia arjuna* consisting mainly of tannins was proved to reveal a greatest enhancement in the tensile strength and fastest rate of epithelization[16].

Neem

Azadirachta indica is a tree in the mahogany family Meliaceae. *Azadirachta*, is native to India, Burma, Bangladesh, Sri Lanka, Malaysia grown in tropical and semi-tropical regions. It is a fast-growing tree that can reach height of 15-20m. All parts of Neem tree used as antihelmintic, anti-fungal, anti-diabetic, anti-bacterial. Neem tree is used in many medicinal treatments like skin disease, cough, asthma, and ulcer. Alcoholic extract of neem is useful in eczema, ringworm, and scabies. Neem leaf extract and oil from seeds and bark has proven anti-microbial effect. This keeps any wound or lesion

free from secondary infections by microorganism clinical studies have also revealed that neem inhibits inflammation[17].

Hadjod

It *Cissus quadrangularis* which is commonly known as Hadjod and Edible Stemmed Vine. It belongs to family Vitaceae. It is an annual or perennial herb, entire leaves, buff colored with greenish ting and requires warm tropical . It has

many medicinal properties, used to reduce body weight, antihelmintic, muscular pains, asthma, broken bones, antiulcer, antihemorrhoid, antimicrobial. The chemical constituents of *cissus quadrangularis* flavonoids, triterpenoids, vitamin C, stilbene derivatives. The *cissus quadrangularis* contains high amount of carotene A, anabolic steroidal substance and calciumis found to contain vitamins and steroids, which are found to have specific effect on bone fracture healing[18].

Tulsi

Ocimum sanctum is widely distributed plant throughout India and different parts of world. It is commonly called as Tulsi. It belongs to family labiatae. It possesses anti-inflammatory, analgesic, immune-stimulatory, free radical scavenging and antimicrobial activity . The free radical scavenging activity of Plant is responsible for wound healing potential. The chemical constituents of *Ocimum sanctum* are cirsilineol, circimaritin, isothymusin, apigenin and rosameric acid, eugenol. The aqueous extract of leaves of ocimum sanctum has wound healing activity[19].

Bael

It consists of unripe or ripe fruits of Plants as Aegel marmelos belonging to family Rutaceae. It is commonly called as Bael fruits, Indian bael. It is indigenous to India and found in Maynmar and Sri Lanka. The chemical constitute of drug is marmelosin which is furococurin. It also contains carbohydrates, Protein, Volatile oil and tannins. The pulp of fruit also contains vitamin C and vitamine A. It is used as digestive, appetizer and also has wound healing potential. It is also used in treatment of diarrhea and dysentery[20].

1.5 Medicinal plants with wound healing property

Table No. 1: List of plants with wound healing activity

Sr. No.	Plant Name	Biological Source	Family	Part of Plant	Reference
1.	Amla	<i>Phyllanthus embilica</i>	Euphorbiaceae	Fruits	[21]
2.	Aleppo Oak	<i>Quercus Infectoria</i>	Fagaceae	Galls	[22]
3.	Aloe	<i>Aloe barbadensis</i>	Liliaceae	Leaves	[23]
4.	Aritana	<i>Bryophllum pinnatum</i>	Crassulaceae	Leaves	[24]
5.	Apamarga	<i>Achrynthus aspera</i>	Amaranthaceae	Leaves	[25]
6.	Bach	<i>Acorus calamus</i>	Araceae	Leaves	[26]
7.	Brahmi	<i>Centella asiatica</i>	Umbellifrae	Flowers	[27]
8.	Bael	<i>Aegle marmelos</i>	Rutaceae	Roots	[28]
9.	Brazilian Pepper	<i>Schinus tereninthifolius</i>	Anacardiaceae	Leaves	[29]
10.	Cumin	<i>Cuminum cyminum</i>	Umbelliferae	Leaves and seeds	[30]
11.	Chaturangi	<i>Lanata camara</i>	Verbanaceae	Leaves	[31]
12.	Eucalyptus	<i>Eucalyptus globules</i>	Myrtacee	Oil	[32]
13.	Figwort	<i>Scrophielaria nodosa scrophulariaceae</i>	Achillea millefolium Asteraceae	Seeds and pods	[33]
14.	Leopardis bane	<i>Arnica Montana</i>	Asteraceae	Flowers	[34]
15.	Liquorice	<i>Glycyrrhiza glabra</i>	Leguminosae	Bark, root	[35]
16.	Myrobalan	<i>Terminalia berilica</i>	Combretoreceae	Leaves, fruit	[36]
17.	Ndende	<i>Entoda Africana</i>	Fabaceae	Leaves	[37]
18.	Neem	<i>Azardica Indica</i>	Meliaceae	Leaves	[38]
19.	Nagarmotha	<i>Cyperus rotundus</i>	Cyperacea	Tubers	[39]
20.	Palas	<i>Butea monosperma</i>	Fabaceae	Bark	[40]
21.	Pepper elder	<i>Peperomia pellucid</i>	Piperaceae	Leaves	[41]
22.	St. John Wort	<i>Hypericum mosorence</i>	Hypericaceae	Leaves	[42]
23.	Turmeric	<i>Curcuma Longa</i>	Zingiberaceae	Rhizomes	[43]

2. Conclusion

The natural plants in this review are those with wound healing potentials. Plants are potent healers they promote the repair mechanism in the natural way. This review covers all the herbal plants with wound healing potential for Wound Care. It covers the plant with description of plant and also its pharmacological activity also the list of medicinal plant with the wound healing activity. So, with the help of traditional knowledge and by using a scientific approach we can extract and isolate active constitute from the plant source and develop a formulation having wound healing potential.

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