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BREAKTHROUGHS IN THE MANAGEMENT OF WOUND WITH SPECIAL REFERENCE TO SHASHTHI UPKRAMA

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ABSTRACT

In Ayurveda *Sushruta* has explained 60 treatment modalities called *Shashthi Upkrama* for wound management, that can be corelated with modern techniques of wound management. *Shashthi Upkrama* plays vital role in case of different types of wound management. Management of wound is one of the important clinical challenges faced by clinicians. Nowadays, disease like Diabetes, peripheral vascular disorders, malnutrition, immunosuppression are increasing as it interferes wound management resulting in increased prevalence of non-healing wounds. Traditional approach of wound management is sometimes not significantly effective in non-healing wounds hence we must look for upgraded modalities such as advanced dressings, Negative pressure wound therapy, skin substitutes, Hyperbaric oxygen therapy for better results. **Objectives:** (1) To review "*Shashthi Upkrama*" in Ayurveda. (2) To study newer techniques of wound management. **Methodology:** Data collected from *Sushruta Samhita*, modern books and articles from web database. Basic principles mentioned in *Shashthi Upkrama* are relevant to modern modalities of wound management. Traditional techniques for wound management are still being used along with well-developed techniques. The foundation of basic principles of wound management was laid down by *Sushruta* long ago, which are valid techniques used for wound care today. While dealing with the wound, *Sushruta* has mentioned detailed stepwise methods for wound care. Newer techniques are still in development but the basic principle of wound management remains same i.e. *Shodhana* (wound cleaning) which is essential before *Ropana* (Healing).

KEYWORDS: *Shashthi upkrama*, Negative pressure wound therapy.

INTRODUCTION

In *Ayurveda* the concept of wound broadly explained in *Bruhatrayis* viz. *Charaka Samhita, Sushruta Samhita* and *Ashtang Hridaya*. Out of these *Bruhatrayis,* in *Sushruta Samhita Sushruta* has given detailed explanation about *Vrana* (Wound). *Sushruta* explained classification and management of *vrana* (wound) in details. He described two types of wound *shuddha vrana* (acute) and *Dushta vrana* (chronic/infected wound) and there are 60 different treatment modalities called *Shashtiupkrama* described for management of acute and chronic wound. These techniques broadly classified as *Vrana Shodhana* (wound cleaning) and *Vrana Ropana* (wound healing).[1]

Nowadays the wound management has become a challenge for clinicians because the diseases in which healing process grossly compromises are increased in numbers. Hence there is need of new wound management techniques for getting better results while treating the patients of wound.

In modern science many different treatment options and modalities are present and many new advanced techniques are developing day by day. Some advances like advanced dressing techniques, negative pressure wound therapy, skin substitutes, Hyperbaric Oxygen Therapy as an adjunct in wound healing.

Negative pressure wound therapy devices are relatively new in wound management, and their attestations are continually expanding for wound management that previously had very few options for wound management. Advanced wound dressing products can help alter the wound environment to optimize healing conditions. With the advent of biosynthetics and tissue engineering, skin substitutes are being created that not only provide effective temporary coverage of wounds, but are also changing the standard of wound management. By treating the wound with growth factors and biologic substances, we can help to harmonize the wound healing process itself. And finally, hyperbaric oxygen treatment can provide additional assistance to the above wound healing modalities, especially in chronic wounds which are not responding to other treatment modalities.

Negative pressure wound therapy

The use of Negative Pressure Wound Therapy (NPWT), most commonly provided with the Vacuum Assisted Closure system (VAC) by using a sealed open-pore sponge. To achieve the application of negative pressure at the surface of the wound a polyurethane (PU) or

polyvinyl-alcohol (PVA) foam is cut to fit the wound cavity exactly. Acute wounds are now more frequently being treated with NPWT closure. In patients with significant comorbidities or other serious injuries, NPWT can be used in large soft-tissue injuries, infected wounds, and wounds with damage tissue.[2]

Mechanism of NPWT

The primary mechanisms of action include

1. Macrodeformation of the wound when, depending on the deformability of the surrounding tissues, the wound edges are brought closer together by the suction distributed through the foam sponge. This reduces the space required to be healed by primary closure or secondary granulation.
2. Microdeformation of the wound surface at the microscopic level. Finite element computer models have shown that NPWT produces 5-20% strain across the healing tissues, that promotes cell division and proliferation, growth factor production and angiogenesis.[3]
3. Extraction of oedematous fluid and exudate from the extracellular space, removing inflammatory mediators and cytokines whose prolonged effect can hinder the ability of the microcirculation to support damaged tissue. This can lead to further tissue necrosis frequently seen at further debridement.
4. A warm and moist environment that prevents desiccation of the wound and enhances formation of granulation tissue [4]

Indications

1. Surgical wound like the open abdomen, cardiac wound infection, skin graft fixation,
2. Chronic wound like pressure ulcers, complex diabetic wound, vascular ulcers.[5]

Contraindications

There are no absolute contraindications to NPWT. However, this method should not be use to slough and necrotic tissue.[6]

Device application

NPWT device is applied on the wound in a standard manner. Once the dressing is applied a standard pressure of 125mmhg is applied in a continuous mode.

Dressing should change on every 3rd day, but this time may vary depending on wound and dressing type.

Once the wound bed is filled with granulation tissue and wound bed preparation has been achieved NPWT may be stopped. The prepared wound is allowed to close with secondary intention.

Dressings

Ayurvedic perspective

Raskriya: An intelligent surgeon should purify an ulcer with raised flesh and which is dry and is attended with scanty secretion with an application of medicated mustered oil. An indurated ulcer, refusing to be purified with medicated oil should be purified with decoction of the drugs from *salsaradi* group in the manner of *raskriya.* A decoction of the said drugs duly prepared should be saturated with and after throw of *Haritala, manashila, kasisa* and *saurashtra* earth and well compounded together. The preparation should also be mix with *matulunga* and with honey. The medicine thus prepared should be applied to the ulcer every 3rd or 4th day.

Kalka

A *kalka* or levigated paste of *sisam* and honey should be applied for the purpose of ulcer situated in muscular part from which all putrid flesh has been sloughed of and which exhibited clear cavity. This paste of *sisam* tends to allay the deranged *vayu* though its sweet test and heat making potency, subdues the derange *pitta* though its astringent, sweet and bitter test and also prove beneficial even in case of deranged *kapha* with same properties.[7]

Advanced dressings

Plain gauze is most commonly used for wound dressing in hospitals till now. But new advances in dressing material provide us huge benefits while treating wounds. With the help of advanced products, we can achieve ideal moist, warm, protected wound healing environment. The advances in dressings includes Hydrocolloids, Alginates, Foams, Hydrogels, Hydrofibers.

Mrudukrma (softening)

In respect of indurated and fleshless ulcers mark by a deranged condition of *vayu* softening measure like repeated application of lotions and plasters composed of sweet and demulcent substances mixed with salt in tepid or lukewarm state. Bloodletting, sprinkling (*seka)* and application of clarified butter or oil prepared with the *vayu* subduing drugs should also be applied.[8]

Hydrocolloids

There are two layers in hydrocolloids dressings. The inner layer of hydrocolloid adhesive which has particles that absorbs exudate to form a hydrated gel over the wound which create a moist environment that promotes wound healing and protect the new tissues while the outer layer which is made up of film, foam or both forms a seal to protect the wound from bacterial contamination and other foreign debris. The hydrocolloids dressing is not the choice of dressing in wound with copious amount of drainage. Hence the hydrocolloids dressing is useful in wound with minimal drainage.[9]

Alginates

Alginate dressings are prepared by either ionic cross-linking of its solution with calcium, magnesium, barium, lead, cadmium, cobalt, zinc, nickel, manganese, strontium ions, etc., to form a gel, or it can be further processed to form freeze-dried porous sheets in form of foams or fibrous dressings. Alginate dressings can absorb wound fluid in the dry form and form gels that can provide a dry wound with a physiologically moist environment and minimize bacterial infections, thereby promoting rapid re-epithelialization and granulation tissue formation. Alginate-based dressings exist in different forms, such as hydrogels, films, foams, nanofibers, and in topical formulations.

Foams

The foam dressings normally contain hydrophilic (water absorbant) polyurethane foam plot to absorb exudate from wound which maintains moist wound surface. There are a variety of versions and some include additional absorbent materials, like viscose and acrylate fibres, or particles of superabsorbent polyacrylate, which are silicone-coated for non-traumatic removal.[10]

Hydrogel

Hydrogel is a water-swollen, and cross-linked polymeric network produced by the simple reaction of one or more monomers. It consists of a starch polymer and up to 96% water. They can absorb wound exudate or rehydrate a wound because they have high porosity and a soft consistency hence, they can be used for dressings and to help tissue regeneration. These materials are ideal for wound dressings, because they can protect the injured tissues make the patients more comfortable as they provide a cooling effect, and their non-adhesive nature protect the wound tissue.[11]

Hydrofibers

Hydrofiber dressings made from sodium CMC (carboxymethyl cellulose) and interact with exudates to form a gel. They maintain a moist environment and allow autolytic debridement. In 1997, Convatec Ltd. launched the brand name Aquacel® which composed of 100% CMC fibers. Hydrofibers are structurally similar to alginates and have many of the same properties. They are comfortable, easy to remove, and are persuadable to heavily exudating or infected wounds. Hydrofibers have been proven to be effective in reduction of bioburden levels due to their highly absorptive character. They have also been combined with silver in Aquacel Ag®. These dressings may be left in place for up to 3–7 days or until saturated. Because of same physical properties in Alginates and Hydrofibers they will have similar range of indications. Like pressure ulcers, lower limb ulcers, surgical wounds.[12]

Skin substitutes

Ayurvedic perspective

***Patradan* (Application of leaves on an ulcers)**

Leaves posses of proper medicinal virtues taking into consideration the particular *dosha* and season of the year should be tied over an ulcer of non-shifting or non-changing character and not affecting a large depth of flesh and which refuses to be healed up owing to its extreme dryness. An ulcer of the deranged vayu should be tied over with the leaves of the *eranda, bhurja, putika* or *haridra* plants as well as with those of the *upodika* and *gambhari.*[13]

Biosynthetic skin substitutes and cultured autologous engineered skin, are available to provide temporary or permanent coverage, with the advantages of availability in large quantities and negligible risk of infection or immunological issues.

Tissue engineered skin

Biobrane

Biobrane™ was first introduced in 1979 for the treatment of burn wounds and donor sites. Biobrane™ is a biosynthetic semipermeable membrane map out to temporarily perform the functions of lost epidermis until reepithelialization of wound. It is bilaminate material, consisting of a woven nonbiodegradable nylon mesh, the outer surface of which has a silastic coating which is a mechanical barrier to vapor loss and bacterial ingress. Peptides are bonded to all exposed nylon and silicone surfaces. These peptides are derived from porcine type I collagen. The material bonds firmly to the adequately prepared bed of a superficial partial thickness to middermal burn injury until spontaneous detachment by reepithelialization. It is

a lightweight material and is packaged and stored as dry sheets or gloves and has a long shelf-life.

Transcyte

Transcyte is a synthetic temporary wound coverage product which is made up of newborn human fibroblast cells cultured on a porcine-coated collagen nylon. It has a semipermeable silicone membrane. It is used for coverage of excised burns prior to autografting or partial thickness burns which do not require grafting.[14] It is typically applied with surgical wrap or adhesive and peels away as the burn wound heals. Prior to cell growth, this nylon mesh is coated with porcine dermal collagen and bonded to a polymer membrane (silicone). After application this membrane provides a transparent synthetic epidermis. As fibroblasts proliferate within the nylon mesh, they secrete human dermal collagen, growth factors and matrix proteins. Following freezing, no cellular metabolic activity remains; however, the tissue matrix and bound growth factors are left intact.[15]

Transcyte provide temporary protective barrier.

Apligraft

Apligraf is a composite bi-layer product made by combination of bovine type I collagen gel and living neonatal fibroblasts as the dermal component, with a cornified epidermal layer composed of neonatal keratinocytes. It is available and ready to use and has a shelf life of 5 days. It is approved by the US FDA for chronic venous ulcers of more than 1 month's duration and diabetic lower extremity ulcers of more than 3 weeks' duration.

Dermagraft

Dermagraft is a sterile, cryopreserved, human fibroblast–derived dermal substitute produced by the culture of neonatal dermal fibroblasts onto a bioresorbable polyglactin mesh frame. During the manufacturing process, the human fibroblasts proliferate to fill the interstices of this scaffold and secrete collagen, other extracellular matrix proteins, growth factors, and cytokines, creating a three-dimensional human-derived dermal substitute containing metabolically active, living cells.[16] Dermagraft contains only human dermal fibroblasts and their secreted products and is devoid of other cell types also found in skin *e.g.*, macrophages, lymphocytes, endothelial cells, or keratinocytes. The fibroblasts are from a qualified cell bank and have been extensively screened for infectious agents. The polyglactin mesh which supports the fibroblasts has been tested and approved for use in humans.[17]

Indications: Diabetic foot ulcers, venous leg ulcers.

Integra

Integra is a semi biologic, bilaminar dermal regeneration template which is composed of a silicone protective sheet overlying a matrix composed of type 1 bovine collagen and chondroitin-6-sulfate a glycosaminoglycans derived from shark cartilage under a temporary silicone epidermal sheet.[18,19] Pore size (70-200 μm) is designed to allow migration of body's own endothelial cells and fibroblasts. Indicated in full-thickness burns, reconstruction of nonburn-related complex tissue defects, to cover hand wounds associated with exposed bone, joints, and/or tendons from nonburn trauma or cancer resection.[20]

Hyperbaric oxygen therapy

Among advanced techniques for wounds management, hyperbaric oxygen therapy (HBOT) has the unique ability to ameliorate tissue hypoxia, reduce pathologic inflammation, and mitigate ischemia reperfusion injury. In HBOT, a patient enters in a hyperbaric chamber that fits either a single or multiple individual and is exposed to 100% oxygen while the atmospheric pressure is increased.[21] This is provided in either a monoplace or multiplace chamber typically compressed with oxygen or a compressed with air where oxygen is delivered by either a hood or mask. The benefits of treatment are the result of both primary and secondary effects. Primary effects are the result of increased pressure and hyperoxia. Indeed, PaO_2 can increase from less than 200 mmHg at atmosphere absolute (ATA) room air to more than 2,000 mmHg at 3 ATA. This also translates into significant increases in tissue oxygen partial pressure.[22]

The while secondary effects are the result of a controlled oxidative stress. HBOT produces reactive oxygen species (ROS) and reactive nitrogen species, which function as signaling molecules in different pathways, including those involved in wound healing. The result is an cluster of secondary effects which include improved leukocyte function, amelioration of ischemia–reperfusion injury, and neovascularization as a result of increased local growth factors and release of autologous progenitor stem cells.

RESULT

As above literature gives the detail information of *Shashthi upkrama* in management of wound, specially in case of non-healing ulcers *sushruta* explained different types of *shodhana* and *ropana upkramas*. Nowadays, different methods are well developed in the

management of wound such as negative pressure wound therapy, hyperbaric oxygen therapy etc. but Achrya Sushruta already explained its basic principle in the form of sixty different *upkramas* which known as *Shashthi upkramas.*

DISCUSSION

Every type of technique has its own different mechanism of action such as in case of negative pressure wound therapy which promotes cell division and proliferation, growth factor production and angiogenesis, extraction of oedematous fluid and exudate from the extracellular space, removing inflammatory mediator. In hydrocolloids it absorbs exudate to form a hydrated gel over the wound which create a moist environment that promotes wound healing Reviewing above all literature data we emphasised that the basic *siddhanta of shashthi upkramas* are still developing in different forms to overcome non healing ulcers.

CONCLUSION

In Ayurveda Acharya's mentioned various types of wound management as *Shashti Upkrama. Sushruta* is the main pioneer of *Shashti upkrama* in which he has mentioned *upkramas* for wound management along with *Vaikrutapaham* (plastic surgery) its complication like discolouration, deformity.

In this present era various treatment methodologies are available for wound management in which basic principles of *Sushruta's Vrana Chikitsa* are being used in various modern techniques of wound management. Along with this so many researches are still going on in context of wound management by accepting *Shashti Upakrama* which plays a vital role in the management of *vrana* (wound).

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