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Review Article

ALGINATE: A NATURAL POLYMER IN WOUND MANAGMENT

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Abstract

The wound management is one of the complex natural procedure; a single continuous process with no clear divisions between the various stages of healing is there. Wound healing is a cellular and biochemical process, involving essentially an inflammatory reaction that leads to successful healing. The references had shown that not the dressings which heal wounds, but the careful selection of appropriate dressings that provide the optimal wound-healing environment for the individual wound. The present review shows the alginate; a natural polymer in promoting optimal wound healing.

Key words: Wound management, Alginate, Natural polymer, Polymer, Alginate dressings.

INTRODUCTION

Alginate is natural polymer produced from alginic acid, which occurs naturally in brown seaweed found on the west coast of Ireland and in the Outer Hebrides, Europe and the USA. It is a combination of mannuronic and guluronic acid molecules and alginate dressings vary in their proportions of these molecules, depending mainly on the origin and species of seaweed and which part of the plant is used in the manufacture.

Alginate dressing is mostly composed of calcium and sodium alginate fibers, which have been entangled to form a strong cohesive product (Thomas S., 2000). This produces a highly absorbent, non-adherent dressing that transmits oxygen and moisture vapour (Choucair M. and Phillips T., 1998). According to Thomas during manufacture, a solution of sodium alginate is extruded under pressure through a fine orifice into a bath containing calcium ions. This results in ion exchange, leading to the formation of insoluble calcium alginate fibers. When the dressing is applied to a wound, significant proportions of the calcium ions are replaced by sodium ions from the wound which leads to selling of fibers to form a gel kike mass that fills the wound and increase the rate of healing. Thomas has also proved that although there are differences between brands of alginates, it is generally assumed that these are of little relevance to the dressing's performance clinically or at cellular level. It is also possible to manufacture the alginate dressing where some calcium within alginate replaced with sodium which can accelerate the gelling process and overall healing process (calcium-sodium alginates), (Qin Y. and Gilding D. K., 1996). The most two important properties of alginate is

- Interactive, i.e. they produce an environment above the wound, which allows optimal healing and
- Bioactive, i.e. they intervene in the healing process by promoting optimal conditions for wound healing.

Physiological Effects and Bacterial Biding

As dressings themselves do not heal wounds but the nature of optimal environment what they provide is important for wound healing. Alginate dressing having most of all that kind of properties to work as wound healing dressing like it can keep wound moist, keeps wound warm, non-adherent to wound, absorbent, have a the potential to absorb and remove bacteria, free of contaminants and non-toxic.

Blair *et al* (1998) found that the alginate dressing Kaltostat was significantly better at arresting hemorrhage than the control dressings (collagen, oxidized cellulose, or gauze). Schmidt (1986) suggested that calcium alginate might activate or stimulate the wound-healing process as it appeared to promote the growth of mouse fibroblasts. These findings were confirmed by Doyle *et al* (1996) who suggested that calcium alginate had an effect on cell proliferation and migration that was believed to have been mediated by the release of calcium ions into the wound bed. Sayag *et al* (1996) compared an alginate dressing with dextranomer paste in a randomized controlled trial of 92 patients with full-thickness pressure ulcers. He found a minimum 40% reduction in wound size in the alginate group within four weeks, whereas the dextranomer group took eight weeks to achieve similar reductions in size. Sayag *et al* (1996) concluded that: 'The striking healing efficacy of an alginate dressing suggests it possesses pharmacological properties which require further investigation'.

It was first recognized by Lawrence the importance of 'containing' bacteria in dressings, he was very closely followed by Dehaut and Maingualt, who recognized the ability of the alginate dressing Algosteril to bind and retain bacteria within it. When the dressing is removed, the bacteria are also removed and disposed of. It was foundation of good clinical practice for wound healing that to prevent progression from colonization to infection. (Wysocki A. B., 2002).

Calcium Alginate and Zinc in Haemostasis

Most of all alginate dressings have high calcium content which when come in contact with wound exudates containing sodium ions, it partially converted to soluble sodium alginate which in tern is useful for the treatment of wounds that bleed easily, as the calcium ions released into the wound assist in the clotting cascade (Jarvis P. M. *et al*, 1987 and Collins F. *et al*), promoting haemostasis (Morgan D., 1997 and Sirimanna K. S., 1989). Segal *et al* (1998) showed that the extent of coagulation activation varied with the proportions of mannuronic and guluronic residues in the alginate dressing and that alginates containing zinc ions had the greatest potentiating effect on prothrombotic coagulation

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and platelet activation. So overall calcium and zinc in alginate is helpful for working alginate dressing in wound healing.

Alginate Dressing and Associated Pain at Time of Removal

Selection of appropriate dressing not only depends on healing but we have also taken in consideration the pain associated with removal of dressing. Lalau *et al* (2002) confirmed the findings of Bettinger *et al* (1995) and Heenan (1998) that alginates were easy to remove and caused less pain and he described the removal of alginate dressings as virtually painless, particularly when they were well soaked with sodium chloride solution (Vanstraelen P., 1992). Lalau *et al* (2002) compared alginates with paraffin gauze dressings in the treatment of diabetic foot ulcers and found that pain on dressing removal was lower in the alginate group ($p = 0.047$) and that fewer dressing changes were required ($p = 0.07$). The authors concluded that the alginate was more appropriate for topical treatment of diabetic foot lesions.

Although alginate dressings generally become moistened within the wound, they should not be used in very dry wounds because a burning sensation may be experienced as fluid is 'drawn' from the wound bed as a result of the hydrophilic effect. If a wound is dry as a result of arterial insufficiency, alginates could potentially draw fluid from an area that has very little fluid within the tissues, causing damage. At the same time, there is a potential for dried-out alginate to increase pressure on the wound bed and this can lead to compromised healing in the diabetic foot.

Alginates dressing contain rich part of mannuronic acid from a soft and flexible gel that is dissolved with saline and easily washed out of the wound. Where as alginates that are rich in guluronic acid, however, tend to form a firmer gel (Morgan D., 1997), which is removed from the wound intact and should be soaked well with saline before removal. Alginate dressing can easily remove from the wound with saline; regardless of the type of alginate used in preparation.

Alginate Dressing and Sinus

This dressings can also used in sinus wounds due to its good absorbency power, where they are very effective in absorbing fluid and helping to reduce the collection of pus in the 'bulb' at the base of the sinus. Even though care should always be taken when 'plugging' any sinus with a dressing, as the dressing may dry out which may lead to adverse effect like blocking the exit of fluid and thereby increasing the collection of pus in the sinus base, which could potentially increase the size of the sinus. This is particularly relevant in the diabetic foot, which often has tracking wounds and which alginates may not be appropriate for.

Some of the example of alginate dressing include: Tegagen Kaltostat Algisite, Algisite M, Algosteril, Curasorb, Melgisorb, SeaSorb, Sorbalgon, Sorbsan.

CONCLUSION

However it is necessary understand wound healing process and how available dressing can enhance that process to get appropriate use of dressings. Although wound dressings are constantly progressing to new levels, still alginates will be going to remain an important component of wound care with several useful applications like haemostat.

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