

Frequently Asked Questions: Alginate Dressings

- [Introduction](#)
- [What are alginate dressings?](#)
- [How do alginate dressings work?](#)
- [What are the main indications for alginate dressings?](#)
- [Are there any side effects of alginate dressings?](#)
- [Is there any difference between brands?](#)
- [Is alginate an effective haemostat?](#)
- [Does zinc make a difference in haemostatic performance?](#)
- [What is the role of alginate dressings in split skin graft donor sites?](#)
- [Can alginates reduce post-operative donor site pain?](#)
- [Are alginates effective with full-thickness pressure ulcers?](#)
- [How useful are alginates for packing deep wounds?](#)
- [Does alginate packing affect scar results?](#)
- [What is the role of alginates in foot care?](#)

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Introduction

*The main frame of the Q&A below was originally drafted by Andrew Heenan in 1998 but Coreleader is pleased to contribute more information based on its findings from own research and study on Alginate, which has been used in various forms for more than sixty years and yet it remains a poorly understood and probably underused dressing. Compared to many modern dressings, the literature is sparse and inconclusive. As the author indicated in the article that "This article aims to provide answers to many of the questions which users might ask", it is *not* intended to be the final word, rather the opposite. These answers are written to be a starting point and no more. Like every article in World Wide Wounds, it can be amended or extended following readers' suggestions and additions." We are pleased to be part of it and able to help clarifying some misunderstandings.*

What are alginate dressings?

While British nurses are in favor of hydrocolloid film than alginate and complained about its fragility, which adds the difficulty in dressing change, American nurses use it only for its high fluid absorption. They are not aware of the key benefits behind this amazing dressing and hence, do not further probes the alginate dressing to fully develop its potential on the chronicle wound healing.

Alginate is a material derived from normal seaweed with high absorbability and biodegradability. They have been successfully applied to cleanse a wide variety of secreting lesions. The high absorption is achieved via strong hydrophilic gel formation. This limit wound secretions and minimizes bacterial contamination. Alginate fibres trapped in a wound are readily biodegraded [1].

Alginate dressings maintain a physiologically moist microenvironment that promotes healing and the formation of granulation tissue. Alginates can be rinsed away with saline irrigation, so removal of the dressing does not interfere with healing granulation tissue. This makes dressing change virtually painless. Alginate dressings are very useful for moderate to heavily exuding wounds [2].

Reference 1: Gilchrist T, Martin AM., Wound treatment with Sorbsan--an alginate fibre dressing; *Biomaterials* 1983 Oct;4(4):317-320

Reference 2: Motta GJ., Calcium alginate topical wound dressings: a new dimension in the cost-effective treatment for exuding dermal wounds and pressure sores; *Ostomy Wound Manage* 1989;25:52-56

How do alginate dressings work?

There have been few studies of the effect of alginate dressings on the processes of wound healing. The healing of cutaneous ulcers requires the development of a vascularized granular tissue bed, filling of large tissue defects by dermal regeneration, and the restoration of a continuous epidermal keratinocyte layer. These processes were modeled in vitro in one study, utilizing human dermal fibroblast, microvascular endothelial cell (HMEC), and keratinocyte culturing to examine the effect of calcium alginate on the proliferation and motility of cultured cells, and the formation of capillary-like structures by HMEC. In the study, the calcium alginate increased the proliferation of fibroblasts but decreased the proliferation of HMEC and keratinocytes. Hence, seems to us, the alginate keeps the wound from sealing up too fast and allow more time for tissue to fill up the cavity. In contrast, the calcium alginate decreased

fibroblast motility but had no effect on keratinocyte motility. There was no significant effect of calcium alginate on the formation of capillary-like structures by HMEC. The effects of calcium alginate on cell proliferation and migration may have been mediated by the released calcium ions. These results suggest that the calcium alginate may improve some cellular aspects of normal wound healing, but not others. It cuts short the healing process by around 50% as compared to the hydrocolloid film.

Reference 1: Doyle JW, Roth TP, Smith RM., *et al*; Effects of calcium alginate on cellular wound healing processes modeled in vitro. J Biomed Mater Res 1996 Dec;32(4):561-568

What are the main indications for alginate dressings?

Alginates have been shown to be useful in a variety of situation; sloughy wounds which also produce a degree of exudates may be treated with alginate dressings such as Algi-white, Sorbsan, Tegagen, Curasorb, melgisorb and Kaltostat (or other gel forming polysaccharide dressings). The gel is converted from alginate due to the mechanism of sodium-calcium ion exchange, which is kicked off once the alginates in contact with exudates. The gel is a moist covering layer over the slough, preventing it from drying out. In other words, alginate gel is only formed in the moist environment containing sodium.

To function correctly, alginates are not indicated for dry sloughy wounds or those covered with hard necrotic tissue. For shallow, heavily exuding wounds such as leg ulcers, fibrous sheet dressings made from alginate fibre may be used, while cavity wounds, traditionally packed with gauze soaked in saline, hypochlorite, or proflavine, are now more commonly dressed with alginate fibre in the form of ribbon or rope. For epithelizing wounds, alginates have an advantage over cellulose dressings in that they can be removed without causing pain or trauma if they are first well soaked with sodium chloride solution.

Calcium alginate can also serve as an agent for haemostasis. [2] It releases the calcium to the blood which is one of the 12 factors for coagulation in blood. It especially works well on massive capillary bleeding in an abrasion wound or venous hemorrhage. Some new indications were therefore developed, referencing to the paper of A.R. Groves and J.C. Lawrence. Algi-pad, a frozen dried alginate pad is made especially for the haemostasis after dialysis. On the other hand, a thicker Algi-white with B/W of 300 GSM is developed as the dressing exclusively for donor site to not only promote the granulation of fibroblast but also stanch the bleeding on the site.

An additional side benefit of Algi-white (high calcium alginate dressing) is the inhibition of microbial. During the ion exchange after calcium alginate meeting with the exudates or blood, the calcium released from the dressing turns the wound bed into an alkaline environment. The weak alkaline definitely is not in favor of microbial reproduction. Hence, we see the bacteria colony subsided gradually during a period of two weeks. Such efficacy is found with full calcium alginate dressing, namely Algi-white.

Reference 1: [Full Text]: Dr Stephen Thomas A structured approach to the selection of dressings, World Wide Wounds, 1997:

<http://www.worldwidewounds.com/1997/july/Thomas-Guide/Dress-Select.html>

Reference 2: Alginate dressing as a donor site haemostat by A.R. Groves and J.C. Lawrence, Annals of the Royal College of Surgeons of England (1986) vol. 68

Are there any side effects of alginate dressings?

Few studies mention side effects; certainly alginate use is characterised by convenience in application and removal, as confirmed by descriptive studies [1].

Foreign body reaction

One study considered two treatment protocols for the management of patients with non-infected cavity wounds, using data obtained from both the community and the out-patient clinic. Patients were treated with either a polyurethane foam hydrophilic dressing (Allevyn) or a calcium sodium alginate dressing (Kaltostat). Although alginate fibres were found to be incorporated in tissue, both dressing regimes were found to be easy to use, effective and acceptable to patients and clinicians [2].

However, there has been one report of a florid foreign body giant cell reaction seven months after the use of an alginate dressing to obtain haemostasis in an apicectomy cavity on an upper lateral incisor. The case suggests that alginate fibres left in situ may elicit a long-lasting and symptomatic adverse foreign body reaction. The authors suggest that alginates should be reserved for problematic haemorrhage and be removed from the tooth socket soon after haemostasis [3].

To date, this is the only published report concerning foreign body reaction to alginate. Patient with high allergy potential is suggested have thorough irrigation of the wound following alginate use; removal of debris, which might otherwise provide a focus for infection is good practice although alginate is biodegradable.

Reference 1: Torres de Castro OG, Galindo Carlos A, Torra i Bou JE., Pure calcium-sodium alginate dressing. Multicenter evaluation of chronic cutaneous lesions, Rev Enferm 1997 Sep;20(229):23-30

Reference 2: Berry DP, Bale S, Harding KG., Dressings for treating cavity wounds; J Wound Care 1996 Jan;5(1):10-17

Reference 3: Odell EW, Oades P, Lombardit. Symptomatic foreign body reaction to haemostatic alginate; Br J Oral Maxillofac Surg 1994 Jun;32(3):178-179

Is there any difference between brands?

Yes.

A study compared four different calcium alginate dressings (Algosteril, Comfeel Alginate, Kaltostat and Sorbsan) with respect to wound fluid retaining ability, adherence, dressing residues, epithelialisation and inflammatory cell infiltration using a standardised partial-thickness wound model in domestic pigs.

Wound fluid spread laterally onto surrounding normal skin by about 40% more with Sorbsan than with the other alginate dressings after 24h (P = 0.026). The corresponding figure after 66h was 20% (P = 0.030). Algosteril (mean 1.7 [sem 0.3]) adhered significantly (P = 0.014) more to the wounds than Comfeel Alginate (mean 0.2 [0.2]). Kaltostat (mean 1.8 [0.3]) left significantly (P = 0.038) more dressing residues on the wound surface at dressing removal than the Comfeel Alginate dressing (mean 0.8 [0.2]). Our understanding on the total absorption is associated with the base weight of dressings.

For the effect on epithelialization or dermal inflammation there was no statistically significant difference at significance level 5% among the four alginate dressings, as assessed by light microscopy. In summary, the four alginate dressings showed significant differences in important handling characteristics but did not differ significantly in their effect on epithelialization.

A recent study as shown below among more branded samples shows that material composition and the base weight of the product may affect the absorbability and the application convenience.

Product	Company	Composition	Fiber size	B/W (GSM)	Absorbability	Fluid absorption
Algisite M	Smith & Nephew	85% Cal alginate 15% CMC	10-16µm	160	10.34	1,654
Kaltostat	Convatec	Cal 20%+ Na 80% alginate	15-18µm	152	14.67	2,230
Tegaderm -Alginate	3M	Calcium alginate fibers	13-23µm	121	12.30	1,488

Melgisorb	Molnlycke	CMC w/ Alginate (High G)	14-16µm	143	12.29	1,757
SeaSorb Soft	Coloplast	CMC w/ Alginate (High M)	15-20µm	134	12.14	1,627
Algi-white	Coreleader	100% Cal Alginate (High G)	15-17µm	208	12.12	2,521

Reference 1: Agren MS., Four alginate dressings in the treatment of partial thickness wounds: a comparative experimental study; Br J Plast Surg 1996 Mar;49(2):129-134

Is alginate an effective haemostat?

While A.R. Grove reported the haemostatic effect of alginate, the value of alginates in this area has been challenged; a prospective, randomized clinical trial, comparing the effectiveness of calcium alginate swabs versus traditional cotton swabs on controlling blood loss after deciduous teeth extraction, included 101 healthy children aged 3-5 years. Teeth were extracted under general anesthesia, and blood loss was measured to compare the haemostasis efficacy between the two dressings. The number of teeth extracted ranged from 1-14; total blood loss ranged from 0.53-78.13 ml with a median of 12.9 ml. Calcium alginate swabs, used in 51 subjects, were not found to produce any clinical or statistical advantage over traditional cotton swabs [1].

However, a study on the haemostasis for 350 dialysis patients showed differently. Other than the subjective statement recorded from nurses as well as patients claiming less time required for hemostasis, we found that around 85% of the patients that formerly required more than 20 minutes for hemostasis, with the help of Algi-pad, the haemostasis time can be reduced to less than 5 minutes.

Reference 1: Henderson NJ, Crawford PJ, Reeves BC., A randomized trial of calcium alginate swabs to control blood loss in 3-5-year-old children. Br Dent J 1998 Feb 28;184(4):187-190

Reference 2: Alginate dressing as a donor site haemostat by A.R. Groves and J.C. Lawrence, Annals of the Royal College of Surgeons of England (1986) vol. 68

Does zinc make a difference in haemostatic performance?

Alginates act as calcium ion (Ca) donors as they contain mannuronic (M) or guluronic (G) groups with a high Ca content. A study compared the effects of calcium and zinc contained-alginate and non-alginate dressings on blood coagulation and platelet activation, determining which the best haemostat was.

The study showed that alginate materials activated coagulation more than non-alginate materials. The extent of coagulation activation was affected by the alginate M or G group composition. It was demonstrated that alginates containing zinc ions had the greatest potentiating effect on prothrombotic coagulation and platelet activation [1].

Reference 1: Segal HC, Hunt BJ, Gilding K., The effects of alginate and non-alginate wound dressings on blood coagulation and platelet activation. J Biomater Appl 1998 Jan;12(3):249-257

What is the role of alginate dressings in split skin graft donor sites?

Compared with paraffin gauze

In a prospective controlled trial, thirty patients were randomized to the calcium alginate group and 21 to the paraffin gauze group. The donor sites were assessed at 10 days post harvesting to determine if they were completely healed (100%) or not. Twenty one of the patients dressed with calcium alginate were completely healed on Day 10, while only seven in the paraffin gauze group were healed ($p < 0.05$). There were two infections in the study, both occurring in the alginate group while there was no difference in dressing slippage between the two groups.

Calcium alginate dressings provide a significant improvement in healing split skin graft donor sites [1]. As we have seen the calcium alginate staunch capillary bleeding fast and promote healing impressively, it is our belief that calcium alginate, such as Algi-white supreme (300 GSM) should be more aggressively used on the site. Please refer to our case study posted which was conducted by a burn center of a teaching hospital in Taipei.

Furthermore, a new dressing of Colla-algi (a non-woven dressing made of the mixture of collagen and alginate) proves even better than calcium alginate alone. A study was conducted at a military teaching hospital in Taipei proved that it healed the donor site faster than alginate dressing alone.

Compared with scarlet red

Twelve paired wounds were covered with either calcium alginate or scarlet red in seven patients with burns undergoing skin grafting. The rate of re-epithelialization was assessed by optical planimetry for the calcium alginate and by time for sloughing of the scarlet red. This comparison failed to demonstrate objectively any difference in the rate of wound healing between these dressings; however, calcium alginate did significantly reduce the pain severity and was favored by the nursing personnel because of its ease of care. Thus calcium alginate does appear to have clinical

advantages as a dressing for skin graft donor sites [2].

We asked a medical school to conduct a trial comparing Colla-algi (a mixture of collagen and alginate from Coreleader), Algi-white (a non-woven sheet), Aquacel (from ConvaTec) and Kaltostat (from ConvaTec) on split skin site in rodent model for four weeks. With only one piece of dressing covering a standard wound of 3x3 cm², healing promoted by Colla-algi proved to be about 100% faster than that of Algi-white. Algi-white is about 100% faster than that of Aquacel and 200% faster than that of Kaltostat. Please refer to our case study posted.

Reference 1: O'Donoghue JM, O'Sullivan ST, Beausang ES *et al.* Calcium alginate dressings promote healing of split skin graft donor sites; *Acta Chir Plast* 1997;39(2):53-55

Reference 2: Bettinger D, Gore D, Humphries Y Evaluation of calcium alginate for skin graft donor sites; *Burn Care Rehabil* 1995 Jan;16(1):59-61

Can alginates reduce post-operative donor site pain?

A prospective double blind controlled trial examined the differences in post-operation pain on split skin graft donor sites dressed with three differently-treated dressings; a dry calcium alginate dressing, a saline-moistened calcium alginate dressing and a bupivacaine hydrochloride (0.5%) moistened calcium alginate dressing. There was a significant reduction in post-operation pain in the bupivacaine hydrochloride (0.5%) moistened calcium alginate dressing group (group 3) at 24h and 48h when compared to the other two groups ($p < 0.04$). There was no difference in ease of removal of dressings or the quality of wound healing on Day 10 among the three groups. This study suggested a significant reduction in post-operation pain achieved by bupivacaine soaked calcium alginate, without reducing the beneficial effects of the calcium alginate on donor site healing [1].

Clinically, we applied the Algi-white 300 GSM on donor site. It holds the moisture well and hence, reduces the pain of patient with less secondary damage on wound during the dressing change, not to mention its better healing.

Reference 1: Butler PE, Eadie PA, Lawlor D, *et al.* Bupivacaine and Kaltostat reduces post-operative donor site pain; *Br J Plast Surg* 1993 Sep;46(6):523-524

Are alginates effective with full-thickness pressure ulcers?

A prospective, randomized, controlled trial of 92 patients with full-thickness pressure

ulcers set out to compare the efficacy of an alginate wound dressing with an established local treatment with dextranomer paste. During treatment, a minimal 40% reduction in wound area was obtained in 74% of the patients of the alginate group and in 42% of patients of the dextranomer group. The median time taken to achieve this goal was four weeks with alginate and more than eight weeks in the control group. Mean surface area reduction per week was 2.39 cm² (sd 3.54) and 0.27 cm² (sd 3.21) in the alginate and dextranomer groups respectively (p = 0.0001). This difference was still highly significant when the sub-groups of almost completely healed subjects at the end of the study were considered. This striking healing efficacy of an alginate dressing suggests it possesses pharmacological properties which require further investigation [1].

Reference 1: Sayag J, Meaume S, Bohbot S., Healing properties of calcium alginate dressings; J Wound Care 1996 Sep;5(8):357-362

How useful are alginates for packing deep wounds?

A controlled trial set out to compare calcium alginate with the more traditional saline-soaked gauze for packing abscess cavities, following incision and drainage. Patients were randomized to receive either calcium alginate (16 patients) or gauze dressing (18 patients). At the first dressing change the patient marked on a linear analogue scale, evaluating the pain level they experienced; the nurse noted similarity of the ease of dressing removal. Calcium alginate was significantly less painful (p<0.01) and also easier (P< 0.01) during dressing change than gauze dressings. If abscess cavities are packed after incision and drainage, calcium alginate appears to be an improvement on conventional dressings [1]. Reader are suggested to review our case study which testimonies the efficacy of promoting the wound healing.

Reference 1: Dawson C, Armstrong MW, Fulford SC, et al., Use of calcium alginate to pack abscess cavities: a controlled clinical trial; R Coll Surg Edinb 1992 Jun; 37(3):177-179

Does alginate packing affect scan results?

A study examined the appearances of four packing materials commonly used in otolaryngology surgery on CT and MR images. Bismuth-iodoform paraffin paste, aqueous betadine gauze, calcium sodium alginate, and triadocortyl cream were examined. CT attenuation values were measured using phantoms containing packing materials; MR characteristics were examined by packing the external auditory meatus of volunteers. Two illustrative case reports also are presented.

Bismuth-iodoform paraffin paste had a high CT attenuation (> 3000 Hounsfield units) resulting in severe image degradation attributable to streak artifact. Aqueous betadine gauze was of high attenuation (258 Hounsfield units; SD, 16.5) but did not cause image degradation. The attenuation value of calcium sodium alginate coincided with that of muscle, and the attenuation value of triadocortyl cream coincided with that of fat.

On MR image, calcium sodium alginate and bismuth & iodoform paraffin paste had imaging characteristics similar to muscle and aqueous betadine gauze had appearances similar to bone marrow. Triadocortyl cream had a high signal equal to that of fat on T1-weighted images but a lower signal similar to bone marrow on T2-weighted images.

The authors concluded that the presence of bismuth-iodoform paraffin paste can give rise to clinically important image degradation on CT image. More seriously, residual packing material - including alginate - may be misinterpreted as infection or tissue necrosis [1].

Reference 1: Hartley C, Ng KL, Jackson A., CT and MR appearance of otolaryngologic packing materials; AJNR Am J Neuroradiol 1995 Sep;16(8):1697-1702

What is the role of alginates in foot care?

Alginate dressings have been employed in foot care, for sinus drainage and in the treatment of fissures, hypergranulation tissue, interdigital maceration, heloma molle and other lesions for many years. Alginates have been used effectively in the treatment of diabetic and trophic foot ulcers.

Our case study reconfirms the efficacy of alginate dressing on pressure sore. After the debridement, we urge the patient to apply Algi-plaster, a plaster with alginate pad, right away. It supports healing well as shown in our case study. Hence, we suggest patient apply the alginate dressing as early as possible to avoid ulcer worsening. The only problem with early treatment is that the ulcer only turns in dark without dermis damage and hence, the alginate dressing fails to reach the tissue as we proposed.

Reference 1: Fraser R, Gilchrist T., Sorbsan calcium alginate fibre dressings in footcare; Biomaterials 1983 Jul;4(3):222-224