Over the past 30 years a plethora of advanced wound dressings have been introduced. Hydrocolloid dressings have led this woundcare revolution and helped clinicians recognise the importance of moist wound healing. Today, hydrocolloid use has become routine and the dressing evolution has led to the development of other dressing technologies.

THE EVOLUTION OF WOUND CARE

Wounds are not a 21st century problem. They have been a constant challenge throughout the history of mankind. Today we have the ability to treat a whole range of different wounds and potentially save lives.

Historically, many materials have been used in the treatment of wounds, ranging from grease-soaked bandages to what can best be described as sophisticated cloth. The treatment of wounds has traditionally been the remit of surgeons or doctors, but over the past century that remit has expanded to include nurses. Modern medicine sees a more multidisciplinary approach to care as the treatment of wounds has developed from an art to a clinical specialty.

Wound care has evolved primarily as a result of the evolution of other clinical areas (such as endocrinology and the treatment of diabetes), and treatment options have become more advanced.

The evolution began with the more sophisticated 'cloths' (gauzes) where clinicians and scientists worked together to eliminate the limitations and clinical complications of existing treatments. One of the most significant scientific discoveries to impact on the evolution of wound treatments was that of George Winter in the early 1960s. His discovery was counter to the established wisdom of the time. Traditional practice was to use gauze to 'soak up' the wound fluid, allowing wounds to dry out, scab over and ultimately heal. Winter discovered that the opposite was true in that keeping the wound moist led to faster and better quality healing [1].

As a result of Winter's findings, researchers and clinicians alike began to rethink clinical practice [2]. New dressings were developed based on plastics, with the first being film dressings in the 1970s, which primarily utilised polyurethane technology [3]. However, the adoption of film dressings was limited initially for two main reasons. First, changing clinical practice, especially practice that has been established for centuries, does not happen overnight. Achieving change is complex and requires a concerted effort to show clinicians that changing practice has benefits both for the patient and the clinician.
Second, the companies marketing the film dressings also had established businesses in the traditional dressings arena, so were in effect competing against themselves while also seeking to market a new technology and persuade clinicians to adopt it.

During the 1980s, however, clinical practice was beginning to change, albeit very slowly. Although the benefits of healing in a moist environment had been published worldwide, the use of woven gauze as a wound contact material still prevailed in many countries [4].

HISTORY OF HYDROCOLLOID DRESSINGS

With the increasing use of film dressings, clinicians began to see limitations and this created an opening for an alternative. The most significant development, however, was the evolution of hydrocolloid technology from its use in stoma care to its use in wound care. A clinician treating stoma patients noticed that the edges of the stoma looked healthier and began to heal when under hydrocolloid wafers. This led to the development of hydrocolloid dressings for wound care and the moist wound healing revolution really began.

Revolution may seem to be a strange and strong statement; however, the introduction of hydrocolloids to the treatment of wounds drove both the clinical and technological adoption of the findings of Winter some 20 years after his discovery of the importance of moist wound healing [4].

This revolution was also spurred on in the 1980s by a more aggressive approach to the marketing of hydrocolloids than to that of previous dressings.

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A hydrocolloid is defined as a dressing typically consisting of an absorbent layer of gel on a semi-permeable film or foam that promotes rehydration and debridement of wounds, including infected wounds [5].

Hydrocolloids comprise an adhesive rubber matrix containing a gel-forming colloidal suspension such as sodium carboxymethylcellulose or gelatin, containing fluid-absorbing particles [6,7]. Although originally derived from stoma products, hydrocolloid dressings were tailored to be more appropriate for wound care. The adhesive wafers were backed by polyurethane films to make them easier to handle and to impart the moisture-retentive properties offered by the film dressings (and in this way to deliver the principles of Winter's findings). Clinically, however, hydrocolloid dressings overcame the principal weakness of the film dressings by being able to absorb fluid in highly exuding wounds.

There was a significant marketing campaign to achieve the acceptance and adoption of hydrocolloids [8]. This was primarily led by ConvaTec with DuoDERM and closely followed by Coloplast with
Comfeel. Creative marketing was required to educate clinicians about both hydrocolloid dressings and the principles of moist wound healing. This type of marketing approach was familiar in the pharmaceutical market but not in wound care.

The first hydrocolloid dressing to be launched in the UK was Granuflex (ConvaTec) in 1982, which was subsequently introduced in the US in 1983 as DuoDERM (known as Varihesive in some markets). This first formulation produced a viscous mobile gel in the presence of exudate. By the 1990s new formulations were introduced to provide alternatives for different clinical situations. Numerous products have followed such as Comfeel (Coloplast), Tegasorb (3M) and Restore (Hollister), with many generic versions also now in existence [7]. About 45 hydrocolloids are now available. All of these products are broadly similar in appearance and are used for the same range of clinical indications, despite some difference in their structure and composition.

**Technical development**

Hydrocolloid dressings thus broadened the choice of dressings available for clinicians [2,3,5]. They were shown to have a number of beneficial properties, namely:

- Fluid management [9]
- Ability to create a moist wound environment [12]
- Facilitation of autolytic debridement [6,13].

The effect of these occlusive dressings on the biological processes of wound healing has been researched extensively through a variety of *in vitro*, animal and human studies. In the moist wound environment created by hydrocolloid dressings, cells are kept viable, enabling them to release growth factors and cytokines that contribute to the healing process [14].

The moist, hypoxic environment created by hydrocolloid dressings is believed to:

- Accentuate angiogenesis [15,16]
- Increase the number of dermal fibroblasts, thus promoting granulation tissue formation [17,18]
- Increase collagen synthesis [19].

Several researchers have shown that wound fluid contains constituents that can impact on wound healing both positively and negatively [18-23]. From this research, it is evident that there are a number of biological reasons for the use of dressings that maintain a moist environment and keep the wound fluid in contact with the wound surface, as proposed by Winter [1].

In a recent review of hydrocolloids Thomas [7] stated: "The evidence that modern dressings are able to provide a better environment than gauze can be attributed to researchers of the last three decades. However, history reports that even in 1797, Thomas Baynton [24] applied occlusive adhesive tape to
venous ulcers, finding that, in comparison with those dressed with conventional gauze, healing was faster. So perhaps Winter was not the first to observe this phenomenon, but the first to explain it.

Scientific evidence

Hydrocolloid dressings are among the most widely researched woundcare technologies. Much of this research has centred around their mechanism of action. By default this has led to the expansion of the scientific knowledge around wounds and their healing processes.

Hydrocolloid dressings have been shown to not only provide a moist environment but to influence healing by creating an environment where the biological process of healing occurs in a more ordered fashion [22].

In one laboratory study, the absorbency and fluid-handling characteristics and other physical properties of 12 hydrocolloid dressings were compared [25]. The results of this study clearly demonstrate that although most of the dressings examined were similar in appearance, they differed markedly in performance. Considerable variation exists in their ability to absorb a test solution or transmit moisture vapour, which may have important implications for their ability to cope with exudate production in vivo. The article discusses the potential implications of these observed differences for the clinical use of the products [25].

The introduction of a classification or grading system for hydrocolloid dressings, based on their ability to cope with fluid production, would provide potential users with useful information to facilitate the selection process. Such a classification system should also take account of the conformability and ease of use of the products concerned.

Hydrocolloid dressings are available in a variety of shapes, sizes and presentations. The continued development of hydrocolloid technology has provided a number of new technologies and products in other formats such as gels, foams and fibres. In addition, there are a number of combination products available, such as Alione (Coloplast), CombiDerm (ConvaTec) and Versiva (Convatec), which contain hydrocolloid particles [26].

CLINICAL USE, PERFORMANCE AND APPLICATION

Indications for use
Hydrocolloid dressings are indicated for low to moderately exuding wounds. Thin versions are generally used on wounds that are dry or produce very low levels of exudate.

**Action at the wound/dressing interface**

On contact with wound exudate, a hydrocolloid dressing forms a hydrophilic gel that absorbs the wound fluid and facilitates autolytic debridement of the wound. Patients and less experienced practitioners may think that this is a purulent discharge, but experience will inform them that this is a normal phenomenon. The resultant gel is easily removed and has no deleterious effect on the wound bed.

**Characteristics of hydrocolloid dressings**

Hydrocolloid dressings are waterproof and generally impermeable to bacteria and viruses. Thin and bordered products, or those with a profiled edge, are less likely than the thicker hydrocolloid wafers to roll or ruck at the edges. Different shapes and sizes of dressings are produced for specific anatomical areas.

**Application of the dressings**

Hydrocolloid dressings should be gently warmed between the hands before use to improve adhesion and, where possible, the patient’s weight should be kept off the dressing for a minimum of 20 minutes to allow it to adhere to the skin. This will maximise the wear time. It is usual to allow a margin of 2cm around the wound edges to achieve a secure fixation. Due to the viscous nature of the gel formed by some of the dressings, the effects of gravity should be taken into consideration when placing the dressing on certain areas of the body such as the lower legs, to prevent premature leakage. This can be achieved by increasing the overlap margin at the base of the ulcer to provide a larger surface area for absorption.

Individual manufacturers' labelling and application instructions should be consulted before using any hydrocolloid dressing to ensure correct application and use. Hydrocolloid paste is useful on wet, excoriated areas such as peri-stomal or peri-anal wounds and may also be used under flat sheets in cavity wounds to increase absorbency.

**Clinical evidence**

Studies too numerous to cite have established that hydrocolloid dressings are more effective than 'traditional' dressings, such as gauze. Despite this, and the relative reduction in cost over the decades, many health professionals continue to use obsolete materials and methods.
A recent article by Jones et al [4] traces the history of gauze and problems associated with its usage against the introduction of the hydrocolloid. The authors discuss why this revolutionary dressing material did not herald an immediate change of practice away from gauze. Even more than 40 years after the initial work of Winter, gauze is still relatively widely used, with many practitioners remaining unconvinced that they should abandon it. Jones et al suggest that problems with the processes that underpin personal and organisational change may contribute to this reluctance [4].

Hydrocolloid dressings have been the most widely studied category of dressings. They have been shown to:

- Provide a better healing environment, faster healing and less pain when compared to gauze [27-30]
- Reduce nursing time significantly, providing cost savings [31]
- Provide these benefits in leg ulcers [29]; donor sites [32]; acute wounds [33]; burns [34]; diabetic foot ulcers [35,36]; pressure ulcers [37]; and many other wound types [38].

Recent systematic reviews [39, 40] provide compelling evidence that a variety of moisture-retentive products will provide benefits over gauze in relation to healing, pain and infection [4].

During the 1980s fears were expressed that occlusive dressings, including both film dressings [2] and hydrocolloids, would facilitate the multiplication of bacteria in wounds. During the following decade several researchers established that, in fact, hydrocolloid dressings provide an external barrier to bacterial and viral invasion [8,10,41,42], and that bacteria are as numerous under gauze dressings as under hydrocolloids [43], and yet this subject is still debated.

A number of clinical studies, in many different wound aetiologies, have shown no increase in infection rates or a reduced incidence with occlusive dressings [44-46]. Other studies [47,48] have also reported that hydrocolloids provide an optimal environment for the functioning of the normal defence mechanisms vital for the control of invading organisms.

**THE FUTURE OF HYDROCOLLOIDS**

After more than 25 years, hydrocolloids remain one of the most widely used technologies for the treatment of acute and chronic wounds. Many of today’s newer technologies (such as hydrofibre dressings) are variants of the original hydrocolloids. The level of sophistication of hydrocolloids has increased with clinical need and to address the limitations of the original dressings in differing clinical situations.

From their initial introduction, hydrocolloids were, and still are, designed to be left in place for several days. On removal, they have been found not to stick to wounds, and to cause less trauma than gauze to
the newly formed tissues [29,44,49]. They have also been reported to provide local pain relief to the wound area, which is thought to be due to protection of the nerve endings [50,51].

Newer formulations of carboxymethylcellulose dressings used as packing material have been shown to have numerous positive benefits for the patient, resulting in less pain on application and removal and decreased use of analgesia [52, 53].

Where can this technology go in the future? The creativity of clinicians, scientists and technologists have to date produced a range of sophisticated dressing materials for a variety of clinical situations [54]. The future application of hydrocolloids will continue and evolve to meet new clinical challenges and situations. While hydrocolloids may not be optimal for all wounds, they are highly effective in many. The future of hydrocolloid technology is bright if we embrace the multi-variant nature of this technology, which provides many dressings for different categories of wounds. It has played the most significant part in moist wound healing since Winter's original findings.

It has been a long revolution, but clinical practice has improved significantly as a result, with many patients having improved quality of life and clinical outcomes. Much remains to be done as at best only 50% of all wounds are treated appropriately. As caregivers, we all have a part to play in the wider adoption of modern dressing technologies in order to achieve better patient outcomes [55]. The revolution has begun but the battle is not won.

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