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The use of Biobrane[®] by burn units in the United Kingdom: A national study

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ABSTRACT

Biobrane[®] is a biosynthetic wound dressing, first used by Woodruff in 1979, which has many of the ideal properties of a dressing as outlined by Pruitt and Levine [Pruitt Jr BA, Levine NS. Characteristics and uses of biologic dressings and skin substitutes. *Arch Surg* 1984;119(3):312–22]. It is becoming increasingly popular in the management of superficial and moderate depth partial thickness burns and a range of other conditions. When used appropriately, it has been shown to reduce pain levels, healing time, inpatient stay and nursing requirements when compared to traditional dressings. We present the results of a national study concerning the use of Biobrane[®] in the United Kingdom, highlight variations in practice, discuss the pertinent issues, make suitable recommendations and highlight the versatility of Biobrane[®] as a wound dressing.

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1. Introduction

Biobrane[®] is a biosynthetic wound dressing, first used by Woodruff in 1979, which has many of the ideal properties of a dressing as outlined by Pruitt and Levine [1]. It is composed of a thin (6 µm) semi-permeable flexible silicone membrane bonded to a layer of nylon fabric mesh (360 µm thick). The nylon mesh is covered with a monomolecular layer of type I collagen that provides a hydrophilic coating for fibrin ingrowth and the initial adherence. Small pores are present in the structure to allow for drainage of exudates and also provide permeability to topical antibiotics [2]. More recently Biobrane L[®] has been introduced, with less adherent properties, aimed for use on donor sites. Biobrane L[®] contains a nylon fabric woven from monofilament threads (as opposed to tri-filament threads seen in standard Biobrane[®]).

Biobrane[®] is becoming increasingly popular worldwide in the management of superficial and moderate depth partial thickness burns. When used appropriately, it has been shown to reduce pain levels, healing time, inpatient stay and nursing

requirements when compared to traditional dressings [2–5]. To our knowledge there has been no study published concerning the extent of use of biobrane or current practices in the UK. We investigated such practices using a simple questionnaire, and discuss the versatility of Biobrane[®] as a wound dressing.

2. Method

A telephone questionnaire survey (see Table 1) of all regional burns units in the United Kingdom was conducted between October and November 2005 to investigate the current extent of use of Biobrane, and to investigate current practice. The names, addresses and phone numbers of the units were obtained from the National Burns Bed bureau. The Burns unit was contacted via hospital switchboard. Data was collected from 32 units. Adult and Paediatric Burns Units were considered separate units, even if they were on the same site ($n = 32$). Accurate information was obtained from the Burns

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Table 1 – Questionnaire

1. Do you use Biobrane[®] in your unit for the treatment of partial thickness burns?
2. Do you use Biobrane[®] to dress donor sites?
3. Do you use Biobrane[®] for temporary coverage of excised full thickness burns?
4. What age of patient would you consider using Biobrane[®] on?
5. What burn location would you NOT consider using Biobrane[®] on?
6. Do you use a general anaesthetic when applying Biobrane[®]?
7. When would you apply the Biobrane[®]?
8. What age of burn would you apply Biobrane[®] to?
9. What agent do you use to prepare the site?
10. What method of attachment do you use?
11. Do you use antibiotic cover with Biobrane[®]?
12. What is the average inpatient stay?
13. What is your post-application of Biobrane[®] regime?
14. Do you have a protocol for the use of Biobrane[®]?

Sister. The response rate was 100%. No incomplete datasets were included.

3. Results

The majority of burns units in the United Kingdom use biobrane in the treatment of partial thickness burns (see Fig. 1). Eight units (25%) used Biobrane[®] to dress donor sites and 12 (33%) used Biobrane[®] to temporarily cover excised full thickness burns before definitive grafting. All 22 units using Biobrane[®] would use it on patients of any age. Two adult burns units would only use Biobrane[®] on hand burns. Three children's burns units said they would not use Biobrane[®] on facial burns. One unit would not use Biobrane[®] on buttock burns. Nineteen of the 22 units applied Biobrane[®] in theatre under a general anaesthetic. Three units applied Biobrane[®] to adult burns on the ward with analgesia. The timing of application was dependent on the time of admission and on theatre and staff availability, ideally before 9 p.m. on the day of admission. In the majority of cases (13 units) this was normally the following morning, after consultant review. There were differences in the age of partial thickness burn that units would consider dressing with biobrane (see Fig. 2). Nine units used betadine to prepare the partial thickness burn site before application of Biobrane[®], three units used betadine followed by saline and eight units used only saline. One unit used betadine followed by chlorhexidine, and one unit used

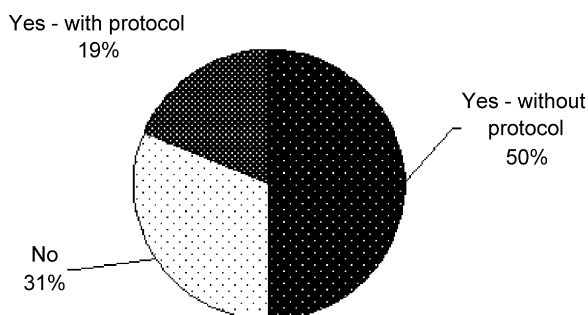


Fig. 1 – The extent of use of biobrane by burns units in the United Kingdom.

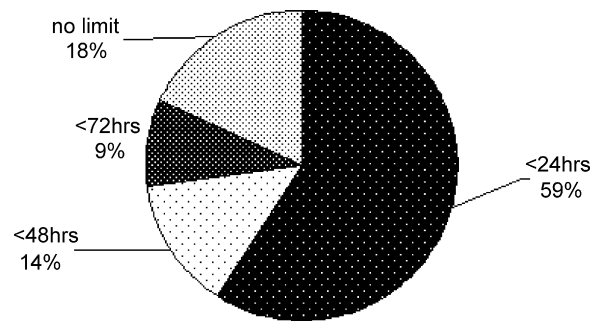


Fig. 2 – Age of partial thickness burn injury thought suitable for biobrane application.

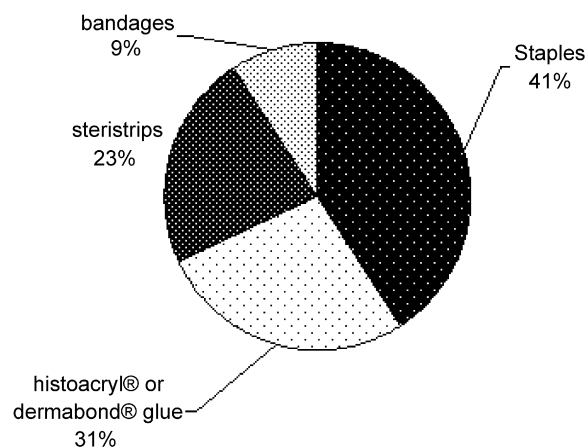


Fig. 3 – Method of attachment to the burn/donor site.

tap water and baby soap. Four main methods were used in the attachment of biobrane (see Fig. 3). Nine of the 22 units routinely prescribed antibiotics at the time of biobrane application. The average length of inpatient stay was dependent on general condition of the patient, social situation and size of the burn, but in general the majority of units sent patients home within 24 h in well, uncomplicated patients, with a handful of units keeping patients in for at least 48 h (until the first dressing check).

Twelve units used a betadine soaked dressing over the biobrane, and 10 units used plain gauze dressings. Six units checked the biobrane every 24 h, and 16 units checked every 48 h. Dressing checks continued until the biobrane had separated completely from the wound. If there was any indication that the burn could have become infected, harbouring pus or excessive ooze, the dressing was removed, wound bed cleansed, and conventional dressings restarted. Six units had protocols in place outlining the use of biobrane.

4. Discussion

There is a great deal of literature available supporting the successful use of Biobrane[®] in the management of partial thickness burns, particularly in paediatric patients [6–10]. This is reflected with the majority of burns units in the United Kingdom using biobrane to treat injuries of this nature.

Respondents would apply Biobrane[®] to wounds, which were clinically superficial thickness, but not deep dermal wounds, due to the increased chance of infection and significantly delayed healing (see Fig. 1). Of the 10 units who did not use Biobrane[®], four used Mepitel[®] or Aquacel Ag[®], one used Transcyte[®], and the remaining five used jelonet. At least one of the units using jelonet were interested in introducing the use of Biobrane[®].

All 22 units using Biobrane[®] would consider using it on patients of any age. Literature supporting its use in adult patients is available [11,12], but its use in this population is less widespread, particularly in smaller burn areas, with adults tolerating traditional dressing changes much more readily. Biobrane[®] seems to be most useful in large burns [13] and burns involving joints [14] and the hand [15,16]. It is of interest that two adult burns units would only use Biobrane[®] on hand burns. Three children's burns units said they would not use Biobrane[®] on facial burns. This approach seems sensible considering the problems of mesh imprinting that have been reported with the use of E-Z Derm dressing for facial burns [17], with the use of Mepitel[®] in similar situations [18] and the appearance of punctuate scarring following the use of porous Biobrane[®] which has been recently reported in this journal [19]. The use of non-porous dressings has been suggested in certain circumstances to avoid this problem [20].

The use of Biobrane[®] to manage donor sites has been advocated by several authors, both in burned [21], and non-burned patients [22–25]. In our study, eight units (25%) used Biobrane[®] to dress donor sites and 12 (33%) used Biobrane[®] to temporarily cover excised full thickness burns before definitive grafting. Although alternative membranes are not used in the treatment of superficial thickness burns in our experience, xenograft of porcine origin and cadaveric allografts are often used for the temporary coverage of large excised full thickness burns where insufficient autograft is immediately available for cropping or as a 'sandwich graft' in combination with 3:1 meshed allograft in an attempt to obtain early definitive wound closure.

Nineteen of the 22 units applied Biobrane[®] in theatre under a general anaesthetic with three units applying Biobrane[®] to adult burns on the ward with analgesia. Children have a low tolerance and high anticipation of pain, and exhibit poor co-operation [26], so these findings are of no surprise.

The timing of application was dependent on the time of admission and on theatre and staff availability, ideally before 9 p.m. on the day of admission. In the majority of cases (13 units) this was normally the following morning, after consultant review.

It was previously advocated to apply Biobrane[®] within 24 h of injury to reduce the risk of bacterial colonization [27], and studies have shown that the application of Biobrane[®] within 48 h of superficial burns provides for shorter hospitalizations and faster healing times in children of all ages without increased risk of infection [5]. There is no definitive evidence however that precludes the application of Biobrane[®] to older burns, however due to the predilection of burn wounds to undergo colonization early in their natural history, this mitigates towards early application of occlusive dressings. In our study there were differences in the age of partial thickness burn that units would consider dressing with

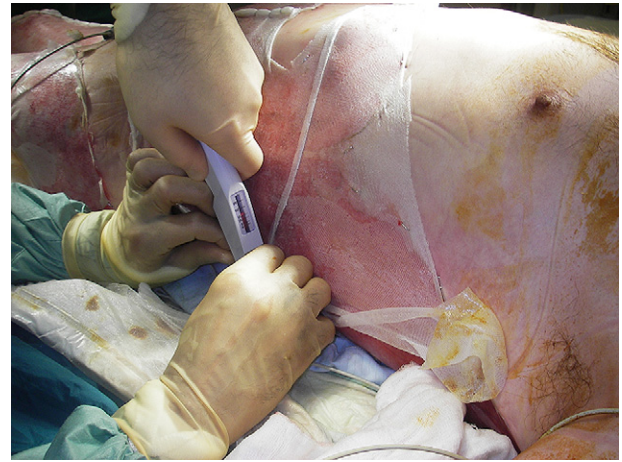


Fig. 4 – Avoidance of stapling directly into the skin as much as possible—stapling a ‘hem’ by attaching the Biobrane[®] to itself.

biobrane (see Fig. 2), with 73% of units only applying Biobrane[®] to injuries occurring within 48 h, and the remaining 27% placing it on older injuries.

In our study, four main methods were used in the attachment of biobrane (see Fig. 3). The consensus conference convened in 1994 in Texas generated guidelines for the application and use of Biobrane[®] [28–30]. Recommendations included that Biobrane[®] should be applied under tension and the edges secured with adhesive tapes or steristrips. This method provides a straightforward but time consuming method of attachment. Wound exudates or body fluids such as sweat, however, often causes the adhesive tapes to lose adherence resulting in loss of position [31]. A viable alternative is the use of staples. These provide rapid and secure attachment, with the disadvantage of staple removal causing further distress, particularly in the paediatric population. The discomfort can be to some extent reduced by avoid stapling directly into the skin as much as possible, and only stapling a ‘hem’ by attaching the Biobrane[®] to itself (see Fig. 4). Obviously this is less important if another general anaesthetic is planned for staple removal. Butyl-2-cyanoacrylate glue (Histoacryl[®]) is our attachment of choice [31], by stretching the Biobrane[®] into position (Fig. 5) and dropping the glue onto fenestrations in the silicon layer. The glue spreads out by capillary action on the undersurface of the mesh and results in rapid stabilisation of the border. This method allows fixation of Biobrane[®] to either dry or moist surfaces and allows application by a single operator. Unlike adhesive tape, where adverse reactions have been reported [32,33], complications of Histoacryl[®] attachment are virtually non-existent and there have been no reports of clinically significant histotoxicity [34–36]. In fact, it has been reported that Histoacryl[®] has a serendipitous bacteriostatic activity against gram positive microorganisms [37]. The chemical bond degenerates spontaneously over 7–10 days and separates spontaneously as underlying epidermis is renewed.

Various modifications of application have been published to overcome coverage of difficult areas, for example use of the Biobrane[®] glove to dress the foot [38] and the Biobrane[®] ‘jacket’ to dress the torso [27].



Fig. 5 – Stretching of Biobrane® over the wound bed, applied under tension, with the dull side down, removing wrinkles carefully.

Nine of the 22 units routinely prescribed antibiotics at the time of biobrane application. Burns undoubtedly compromise the immune status of any individual, by virtue of their barrier-destroying properties, and pose a challenging problem especially in very young children. Children are more prone to bacterial super-infections, especially those patients below the age of 5 years. These infections are largely due to staphylococcus aureus (SA) and group A beta haemolytic streptococcus (GABHS) [39,40]. It was suggested for example that children with current or recent varicella zoster infection should be a relative contraindication to the application of Biobrane® [9]. There has been a reluctance to use Biobrane® by some individuals due to a perceived increase in infection rates [41], with the literature reporting rates of between 5 and 6% [42]. Other views dispute the concern with regards to infection rates, and believe Biobrane® improves wound healing with no increased infective risk [5]. On the plus side, is the transparency of Biobrane® allowing the immediate identification of infection [10]. Biobrane® is marketed on the premise that the highly purified peptides from porcine dermal collagen bonded to a nylon and silicone semi permeable membrane, minimises bacterial proliferation by minimising dead space. In the immunocompetent patient, at least one randomised trial has shown that there were fewer infections when Biobrane® was compared with 1% silver sulphadiazine [6]. Clinical results show that Biobrane® is effective in controlling bacterial growth in wounds initially containing $<10^5$ bacteria per gram of tissue when good adherence is achieved [43].

If there is any indication that the burn has become infected, harbouring pus or excessive ooze, the dressing should be removed, wound bed cleansed, and conventional dressings restarted. We do not advocate the routine prescription of antibiotics if the Biobrane® is used to cover clean partial thickness burns which are less than 48 h old.

It is of interest that only six units had protocols in the place for the outlining the use of Biobrane®, further highlighting the variations in practice.

Table 2 – Suggested guidelines

Appropriate conditions for use
Clean, well vascularised wound bed, devoid of eschar
Anaesthesia
General anaesthetic for children, oral analgesia/nitrous oxide for adults
Agent to prepare site
Betadine followed by thorough cleansing with saline
Method of application (see Fig. 5)
'Stretched' over the wound bed, applied under tension, with the dull side down, removing wrinkles carefully
Method of attachment
Tissue glue Histoacryl®/Dermabond®, or stapling separate sheets to each other in a 'hem' (skin sparing)
Outer dressing
An absorptive dressing such as gauze
Follow up
Initial check at 24 h, then checks at 48 hourly until removal
In cases of infection—remove all biobrane, thorough cleansing and use of traditional dressings

4.1. Our recommendations (see Table 2)

4.1.1. Religious and ethical issues

In a recent study of religious leaders [44], the vast majority (77%) said that patients should be informed of the constituents of the biological products and consent obtained. In the case of the porcine content of Biobrane®, this could have consequences for consenting particularly the Muslim community. Ignoring religious sensitivities and neglecting consent in the usage of Biobrane® could have serious implications including litigation. It is very worrying that none of the healthcare professionals questioned in the same survey knew the constituents of biological dressings correctly [44].

4.1.2. Adverse effects of Biobrane®

Adverse affects following the use of Biobrane® are uncommon, however surgeons should be aware of the possibility of contact dermatitis [45]. In the first description of such a case, the patient developed a bullous skin reaction directly related to a second exposure to Biobrane®, 18 days after the initial application, and the bullous reaction developed within 48 h of repeat exposure. Sensitivity was confirmed by patch testing. Hypersensitivity to Biobrane® was reported the following year [46]. Punctate scarring coinciding with the position of the pores in the Biobrane® dressing has recently been described in this journal in two cases of paediatric partial thickness burns [1].

4.1.3. Alternative uses of Biobrane® in reconstructive and burn surgery units

Of interest to the plastic and reconstructive surgeon is the use of Biobrane® in axillary reconstruction following surgical excision for hidradenitis suppurativa [47]. This method provided a single stage procedure, with no donor site morbidity and exhibited the ability to use Biobrane® in colonised tissues. The limitations included a longer healing time and increased cost of dressing. Biobrane® has also been successfully used following laser resurfacing of the face

[48,49]. Studies showed that Biobrane[®] adhered well to the skin post procedure, was well tolerated, minimised pain and drainage, decreased erythema, reduced healing time and simplified nursing care. Similarly, Biobrane[®] has been used as a dressing following mechanical dermabrasion [48,50,51]. This study showed Biobrane[®] reduced erythema and healing time by up to 50% when compared to air-exposed wounds. It was also associated with a lower incidence of milia formation. The use of Biobrane[®] has been reported in the successful treatment of serious skin conditions such as toxic epidermal necrolysis [52-55] and paraneoplastic pemphigus [56]. Biobrane[®] was applied to the extensive areas of erosion to assist in pain management and to provide a temporary barrier function. Standard dressings such as silver sulfadiazine were too messy and caused discomfort with frequent changing.

The treatment of serious skin conditions such as TEN and pemphigus with Biobrane[®] is an area that warrants further evaluation with large randomised controlled trials as it may contribute to the overall treatment and comfort cares of these patients.

Chronic wounds such as large venous ulcers have also been successfully managed using Biobrane[®] [57]. Several case reports concerning the use of Biobrane[®] are present in contemporary literature. The skin substitute has been used in the treatment of a life threatening oesophageal fistula by covering an expandable metallic stent [58] and in the management of subcutaneous colostomy perforation [59] where the Biobrane[®] served as a temporary dressing, providing good stability, and supported the application of a stoma appliance. Biobrane[®] has also been used in the successful management of a sternotomy wound which could not be closed immediately due to massive intra-operative oedema formation [60]. To protect the mediastinum from infection, Biobrane[®] was applied to the surgical wound and a moist gauze dressing over it. When the dressing was removed 4 days later, the wound was pink, granulating, free from infection, and suitable for closure.

This manuscript highlights the variations in practice with regards to the use of Biobrane[®] in the United Kingdom and discusses relevant issues. We believe that Biobrane[®] is a highly versatile tool which should be in the armamentarium of all reconstructive and burns surgeons.

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