Improved care and reduced costs with advanced wound dressings

Bronwen Lafferty, Lisa Wood, Paul Davis

Abstract

Aims: To determine whether an advanced wound dressing technology can deliver measurable care benefits and reduce costs in a leg ulcer clinic. This pilot study was carried out as an industry/NHS collaboration. Methods: The existing caseload was assessed and tracked for 16 weeks under the clinic's existing 'standard care' regimens. After this run-in period, patients with static or deteriorating wounds were switched to treatment with advanced wound dressings (Oxyzyme™ for non-infected wounds and lodozyme™ for infected wounds). Wounds assessed as improving were continued with their current treatment. Progress was tracked for a further 20 weeks. Results: Of the 26 wounds being supervised, 11 leg ulcer wounds (nine patients) were treated with Oxyzyme or lodozyme. After 12 weeks, four of these (36%) had healed and the remaining seven (64%) were continuing to improve. After 20 weeks with Oxyzyme™ or lodozyme™, six wounds had healed and four continued to show improvement (the remaining wound was withdrawn at week 13). Conclusions: Although more expensive than 'standard' dressings, the modern dressings were more cost-effective in the long term. Conflict of interest: The study was supported by Archimed.

KEY WORDS

Advanced wound care
Oxyzyme™
lodozyme™
Caseload reduction audit
Chronic wounds

It is estimated that there are 200,000 people in the UK with a chronic wound, costing the NHS £2–3 billion per annum, which is approximately 3% of its budget (Posnett and Franks, 2007). Hospitalisation rate, number of procedures, emergency/elective ratio, mean length of patient stay, complication rates (infection, amputation, graft success rates), time to healing, frequency of dressing changes and cost of all dressing materials per dressing change are the key determinants of wound care costs (Hamilton, 2008).

White City Leg Ulcer Clinic provides care for a socio-economically deprived patient population in West London. Patients attending clinic at the time of this study typically presented with a range of underlying medical problems such as heart disease, diabetes, sickle cell anaemia and alcoholism. An audit of patients treated over the six months before this study showed a healing rate of 8% during that period (two of 26 wounds).

The purpose of this study was to assess whether a modern wound dressing technology, consistently and professionally applied, would be able to help reduce the burden of chronic wounds and reduce overall costs, even though the dressings were more expensive than standard products (Payne et al, 2009).

A new type of enzyme-containing hydrogel dressing technology has been developed (Archimed LLR Bedford, UK) — Oxyzyme™ and lodozyme™ wound dressings. They use glucose oxidase to generate iodine. (N.B. The enzyme is not present as a proteolytic aid to debridement, and does not come into direct contact with the wound.) Both dressings comprise two polysulphonate, sheet hydrogels applied one on top of the other; the larger wound contact gel contains glucose and the smaller gel, which is placed on top, contains a low level of the enzyme. When the dressing is placed over the wound, iodine is generated. In lodozyme, the peak level of iodine is 0.20% w/w, and in Oxyzyme it is <0.05% w/w. Lodozyme is suitable for use on infected wounds, whereas Oxyzyme is for non-infected wounds. They may be used on external, moderately exuding, non-exuding and dry wounds. As they generate iodine, they should not be used on patients with a known or suspected sensitivity or allergy to iodide or iodine, or patients with a thyroid disorder.

A multinational case study programme was conducted at 27 clinical centres in the UK, Germany and Sweden. Patients with intractable chronic wounds of various aetiologies were treated using Oxyzyme. Of the 100 completed case studies, nearly three-quarters resulted in healing or clinical improvement within six weeks (10% had proceeded to full healing during the study period and a further 63% exhibited clinical...
improvement). The average area of the wounds reduced from 15.7 cm² on entry, to 10.2 cm² during six weeks, a reduction of 35%. The majority of patients and clinicians were satisfied or very satisfied with their outcomes (Davis et al, 2009). Similar results have recently been obtained for lodozyme (Wood et al, 2010).

Method
The study dressings were Oxyzyme and lodozyme (Archimed LLP, Bedford, UK), both 10x10cm.

The study was conducted at the White City Leg Ulcer Clinic (London). All patients who attended the clinic were assessed by the clinic staff to determine the status and history of their wound and their treatment (i.e. wound type, location, duration, condition, number of clinic visits and previous four months' dressing and medication history). The wound status definitions were:

- **Deteriorating** – the general condition of the wound is deteriorating under current treatment
- **Static** – there is no significant change in the overall condition of the wound
- **Improving** – there was a reduction in wound area or improvement in the condition of the wound bed over the previous week.

At the initial assessment, 20 patients with 26 wounds were assessed. Thirty-one percent (8/26) of the wounds were assessed to be improving, 50% (13/26) were static and 19% (5/26) were deteriorating under their current treatment regimens. Of these 26 wounds, 17 (13 patients) were considered to be suitable for treatment using the study dressings. Three wounds exhibiting signs of local infection were dressed with lodozyme and the remaining 14 with Oxyzyme.

Before the initiation of the project, one patient with two wounds died and another patient with two wounds was hospitalised for non wound-related reasons. Hence, 13 wounds (11 patients) were included in the study.

A total of eight wounds which were improving continued on their current care regimen. One wound, an extended, multi-centred wound with sensitive, inflamed peri-wound region was not suitable for treatment with the study hydrogel dressing.

Progress of all wounds was assessed on a weekly basis for the first six weeks and at weeks 12, 16 and 20. The data collected included wound area (cm²), measured using the LUTM telemedicine system (Samal and Dodds, 2002). Data regarding wound bed tissue type (necrotic, sloughy, granulating or epithelialising), condition of surrounding skin, exudate level and colour and clinician assessment of overall status (improving, static, deteriorated, healed) were based on subjective clinician assessment against definitions provided by the trial manager. Patients scored their pain levels using a visual analogue scale (VAS), where 0 = the least pain and 10 = the most pain.

Results
Of the 13 wounds included in the study group, 11 (nine patients) completed the first 12 weeks of the project (Table 1). Of the two wounds that did not complete 12 weeks, one was withdrawn due to patient non-concordance issues, and another patient with one wound was admitted to hospital for non-wound-related reasons.

At the initial assessment, the average patient age was 64.2 years (range 26–83 years). All the patients treated within the clinic had some degree of venous insufficiency, as diagnosed by Doppler investigation. Of the 26 wounds, 19 were treated with some degree of compression therapy (ranging from class 2 hosiery to 3 or 4-layer compression bandaging). The level of compression applied was based on Doppler assessment and patient concordance. The ulcers being treated in the clinic had been present for 0.75–420 months (median value 32.5 months, mean 42.1 months).

Of the 11 wounds that completed the first 12 weeks of the project, there were seven wounds, on six male patients and four wounds on three female patients. The average age of the patients was 68 years (range 26–81 years). The ulcers had been present for 2–420 months (median value 21 months, mean 56 months). All the wounds were leg ulcers of venous or mixed aetiology. Nine of the wounds were managed under some degree of compression therapy before the start of the project. This remained unchanged throughout.

At the six-week review two wounds had healed and the total area of wounds had reduced by 52.2% from 75.3 to 36.0 cm². At the 12-week review, two more wounds had healed, resulting in a 36% (4/11) healing rate, and a total wound area reduction of 78.9%. After 20 weeks, two more wounds had healed, bringing the total to six out of 10 (one patient had withdrawn) (Tables 2 and 3). Total wound area reduction at 20 weeks was 88.4%.

The healing rate of six out of 10 wounds seen at 20 weeks with Oxyzyme/lodozyme treatment can be compared to the clinic's previous healing rate of 8% over six months (two wounds healed out of 26 treated). A chi-square test comparing the healing rate data for Oxyzyme/lodozyme versus the healing rate seen previously showed that the difference was more than would be expected by chance ($\chi^2=4.9347, df=1, p=0.0263$). While the inclusion of more than one wound per patient in the study could have affected the statistical outcome, statistical analysis showed that it had not influenced the results in this case.

Several of the case histories are included below.

Discussion
The total costs of care for the group of 11 wounds over their entire duration to date was estimated at circa £161,000 at current prices (Table 4), although over half of this figure was due to one 35-year-old wound. This estimate was based on a projection for the known lifetime of the wound based on the calculated cost of the previous four months' treatment. The four-month cost was calculated by counting the number and type of dressings used and recording clinician time taken. Published Drug Tariff prices for dressings and bandaging were used to cost the dressings and clinician.
Initial patient/wound status for wounds that subsequently completed 12 weeks of treatment with Oxyzyme™/lodozyme™

<table>
<thead>
<tr>
<th>No</th>
<th>Age of patient (years)</th>
<th>Sex</th>
<th>Age of wounds (months)</th>
<th>Initial wound area (cm²)</th>
<th>ABPI</th>
<th>Compression therapy (yes/no)</th>
<th>Previous dressings</th>
<th>Wound status before treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>78</td>
<td>M</td>
<td>420</td>
<td>6.1</td>
<td>1.1</td>
<td>yes</td>
<td>Biatain® Ibu (Coloplast), Aquacel® (Convatec), Acticoat® Absorbent (Smith &amp; Nephew), Tegaderm® Matrix (3M), Oxyzyme™</td>
<td>Static</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
<td>F</td>
<td>5</td>
<td>2.5</td>
<td>1</td>
<td>yes</td>
<td>Actiform Cool (Activa Healthcare), Tegaderm Matrix, Alleyn® (Smith &amp; Nephew), Iodoflex® (Smith &amp; Nephew)</td>
<td>Static</td>
</tr>
<tr>
<td>3</td>
<td>77</td>
<td>M</td>
<td>30</td>
<td>1</td>
<td>1.2</td>
<td>yes</td>
<td>Inadine® (Systagenix), Aquacel, Tegaderm Matrix</td>
<td>Static</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>M</td>
<td>21</td>
<td>30</td>
<td>1.1</td>
<td>yes</td>
<td>Inadine, Aquacel, Acticoform, Tiel® Xtra (Systagenix), Oxyzyme</td>
<td>Static</td>
</tr>
<tr>
<td>5</td>
<td>26</td>
<td>M</td>
<td>36</td>
<td>2.8</td>
<td>1.2</td>
<td>yes</td>
<td>Inadine, Tegaderm Matrix, Aquacel, Actiform Cool, Oxyzyme</td>
<td>Static</td>
</tr>
<tr>
<td>6</td>
<td>26</td>
<td>M</td>
<td>36</td>
<td>approx 5⁰</td>
<td>0.9</td>
<td>no</td>
<td>Inadine, Tegaderm Matrix, Aquacel, Actiform Cool, Oxyzyme</td>
<td>Deteriorating</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>M</td>
<td>2</td>
<td>approx 5⁰</td>
<td>0.9</td>
<td>no</td>
<td>Aquacel Ag, Aquacel</td>
<td>Deteriorating</td>
</tr>
<tr>
<td>8</td>
<td>80</td>
<td>F</td>
<td>35</td>
<td>16.1</td>
<td>1.2</td>
<td>yes</td>
<td>Inadine, Tegaderm Matrix, Aquacel, Acticoform Ag, Urgosorb® Silver (Urgo), Actiroll Cool</td>
<td>Static</td>
</tr>
<tr>
<td>9</td>
<td>81</td>
<td>M</td>
<td>17</td>
<td>5.3</td>
<td>0.7</td>
<td>no</td>
<td>Tegaderm Matrix, Aquacel, Ziploc® (Smith &amp; Nephew), Aquacel Ag</td>
<td>Static</td>
</tr>
<tr>
<td>10</td>
<td>77</td>
<td>F</td>
<td>4</td>
<td>1.5</td>
<td>0.9</td>
<td>yes</td>
<td>Acrucel</td>
<td>Static</td>
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<tr>
<td>11</td>
<td>77</td>
<td>F</td>
<td>4</td>
<td>2.5</td>
<td>1</td>
<td>yes</td>
<td>Inadine, Alleyn</td>
<td>Deteriorating</td>
</tr>
</tbody>
</table>

* estimated area (excoriated periwound due to dermatological condition)

The average treatment cost for the individual wounds with advanced dressings (Oxyzyme/lodozyme) was estimated as £85.40 per week per wound over the first six weeks of treatment (including clinician time at £36/hour and all cover dressings and compression systems, based on current prices in the Drug Tariff for England and Wales). Using the same method, the average treatment cost for the individual wounds under previous 'standard practice' was estimated as £76.80 per week per wound. This indicates that the cost per week of treatment with Oxyzyme/lodozyme compared to previous 'standard practice' was approximately 11% more expensive.

However, treatment with Oxyzyme/lodozyme resulted in faster healing than had been seen with 'standard practice'; six out of the 10 wounds that completed 20 weeks of treatment had healed.

Projected 52-week total costs for the 10 wounds that completed 20 weeks of treatment were calculated.

For previous 'standard practice', the projected 52-week cost was £39,091, assuming an average weekly treatment cost per wound of £76.80 and that the previous 8% healing rate over six months was maintained.

For Oxyzyme/lodozyme treatment, the projected 52-week cost was £16,055, assuming an average weekly treatment cost per wound of £85.40 and that the healing rate seen at 20 weeks was maintained.

Thus, the projected potential saving over 52 weeks derived from using Oxyzyme/lodozyme for this patient population was £23,036, a reduction of...
59% when compared to the 'standard practice' treatment cost. The projected comparative costs are shown in Figure 1.

During the study, the reduction in chronic wound caseload permitted re-allocation of clinician/nursing time to other priorities, such as routine Doppler assessments and initial patient examinations which, in turn, helped reduce the number of patients on the clinic waiting list. Previously there had been a four-week delay between patient referral and the first visit to the clinic. During the study this was reduced to three weeks, and the backlog of five patients waiting for assessment was cleared.

Conclusion
This pilot study compared the overall progress and status of wounds at a leg ulcer clinic under two care regimens: ‘Standard practice’ regimen, as implemented at the participating clinic during a four-month run-in period and Advanced wound care regimen using Oxyzyme/lodozyme.

There was a marked improvement in healing outcomes with the advanced wound care products, Oxyzyme and lodozyme. With ‘standard practice’, the observed rate of healing over six months was 8% (two wounds healed

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### Table 2
Wound areas for Oxyzyme®/lodozyme® group (cm²)

<table>
<thead>
<tr>
<th></th>
<th>Week 0</th>
<th>Week 6</th>
<th>Week 12</th>
<th>Week 16</th>
<th>Week 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound 1</td>
<td>6.1</td>
<td>4.8</td>
<td>4.3</td>
<td>2.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Wound 2</td>
<td>2.5</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8*</td>
<td>0.8*</td>
</tr>
<tr>
<td>Wound 3</td>
<td>30</td>
<td>16.9</td>
<td>6</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Wound 4</td>
<td>2.5</td>
<td>0.7</td>
<td>0.3</td>
<td>0.3</td>
<td>1.3**</td>
</tr>
<tr>
<td>Wound 5</td>
<td>2.8</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>1.3**</td>
</tr>
<tr>
<td>Wound 6</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wound 7</td>
<td>16.1</td>
<td>4.5</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Wound 8</td>
<td>5.3</td>
<td>4.0</td>
<td>4.0</td>
<td>3.6</td>
<td>3.1</td>
</tr>
<tr>
<td>Wound 9</td>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wound 10</td>
<td>2.5</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total area (%)</td>
<td>75.3 (100.0%)</td>
<td>36.0 (47.8%)</td>
<td>15.9 (21.1%)</td>
<td>9.6 (12.7%)</td>
<td>8.8 (11.6%)</td>
</tr>
<tr>
<td>% area reduction</td>
<td>0%</td>
<td>52.2%</td>
<td>78.9%</td>
<td>87.3%</td>
<td>88.4%</td>
</tr>
</tbody>
</table>

* Wound withdrawn at week 13 (last area measurement carried forward)
** Wound depth reduced although area increased. Wounds were considered by clinician as ‘improving’

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### Table 3
Outcomes of wounds treated with Oxyzyme®/lodozyme® wound dressings

<table>
<thead>
<tr>
<th></th>
<th>Week 0</th>
<th>Week 6</th>
<th>Week 12</th>
<th>Week 16</th>
<th>Week 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deteriorating</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Static</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Improving</td>
<td>0</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Healed</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>10*</td>
<td>10*</td>
</tr>
</tbody>
</table>

* One wound was withdrawn from the study at week 13 due to non-concordance issues. No dressing-related adverse events were reported
With Oxyzyme and lodozyme, it was 60% (six of 10) at 20 weeks, a statistically significant difference (p=0.0263). The projected potential 52-week saving resulting from use of Oxyzyme/lodozyme was £23,036, a reduction of 59% when compared to the ‘standard practice’ cost.

This study suggests that the systematic, professional application of a modern wound care technology in a wound clinic can substantially improve quality of care and reduce clinic caseload.

The methodology employed also permitted a detailed cost analysis to be performed, which showed that, although the modern dressings were more expensive in the short term (adding approximately 10% to previous ‘standard practice’ costs), they offered the potential for major savings in the long term, equivalent to up to 59% over the first year.

The authors strongly encourage other clinics to adopt this type of approach to reducing their chronic wound caseloads. If the results from this small pilot study could be replicated at other clinics across the UK, there could be significant improvements in patient care and substantial budgetary savings for the NHS.

**Limitations**

Future study design could be improved by increasing the number of patients treated, by following patients beyond 20 weeks and by reporting only one wound per patient.

**Case reports**

**Patient one**

Patient one was a 78-year-old male patient with a venous leg ulcer of 35 years’ duration. His ankle brachial pressure index (ABPI) measured 1.1. Previous treatments had included Biatain® Ibu, (Coloplast) Aquacel® Ag (ConvaTec), Aquacel® (ConvaTec), and Acticoat® Absorbent (Smith & Nephew).

On entry to the study, the wound consisted of 20% sloughy tissue and 80% unhealthy granulation tissue, and measured 6cm² (Figure 2).

After six weeks of treatment with the modern wound technology, the wound measured 4.8cm² and was 100% healthy tissue. At 12 weeks the wound had reduced by 28% (Figure 3), and by 20 weeks a 62% reduction was seen.

**Patient two**

This female patient of 63 years of age had had a venous leg ulcer for five months. Her ABPI was 1.0.
Patient three

Patient three was a 70-year-old male patient with a venous leg ulcer of 21 months' duration. His ABPI was 1.1.

Previous treatments had included Aquacel, Aquacel Ag, Inadine, Actiform Cool and Tielle® Xtra (Systagenix).

Oxyzyme was applied for one week before the start of the study. Compression bandages were worn.

On entry to the study, the wound consisted of 40% sloughy tissue, 40% granulation tissue and 20% hyper-granulating tissue, and measured 30cm² (Figure 6).

After six weeks of treatment the wound measured 16.9cm² and was 10% sloughy tissue and 90% granulation tissue. At 12 weeks the wound had reduced in size by 73%, and at 16 weeks by 92% (Figure 7). After 20 weeks of treatment the wound had healed.

Acknowledgements

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References


Key points
- This study examined the potential for improved clinical outcomes, cost savings and caseload reduction to be generated by systematic application of a new wound dressing technology.
- Oxzyme™ and Iodozyme™ were applied to 11 previously static or deteriorating leg ulcer wounds. A healing rate of 60% was observed at 20 weeks, compared to a rate of 8% seen previously in the same clinic over 26 weeks.
- The improved healing rate led to a reduction in chronic wound caseload which permitted re-allocation of clinician/nursing time to other priority activities.
- Significant full-year potential cost-savings were projected on the basis of the results from this trial.

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