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An observational study of the use of a polyhydrated ionogen impregnated dressing (DerMax®) in the treatment of wounds

Final report

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Study Number 29

The Study Team

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Summary

This clinical study was based on a series of case studies and is not strictly based on research principles. The overall aim was to demonstrate how DerMax® can be used in general, hard to heal wounds, in order to rebalance MMPs through normalization of the wound micro-environment. Healing in 'real life' wounds cannot be shown through randomised Controlled Trials, as the inclusion / exclusion criteria are so strict that it excludes the wound types that are currently causing difficulties with healing in the community.

In these case studies, there was an overall healing rate of 48% of those wounds treated with DerMax® and a predicted potential for a 72% healing rate.

Pain was experienced by those with already painful leg ulcers (3 = 13%). No other patient reported any pain. The 3 patients who experienced pain were discontinued from the study – all other patients and Health Care Professionals expressed satisfaction with DerMax® in application, removal and outcomes.

Background.

An acute wound in a patient with normal blood flow and good medical and nutritional condition should go on to heal if appropriate care is given. In chronic wounds however, healing is more difficult because the aetiology of the wound is harder to determine, and the measures to reverse the medical abnormalities are often complex (Attinger and Bulan 2001). This means that the word 'healing' is an emotive word and one that can lead to misunderstanding if wrongly applied to a chronic wound that is black and malodorous or oozing pus. This type of chronic wound is unlikely to heal without assistance and is known as a 'difficult' or intractable wound. There are many types of 'difficult' wounds such as necrotic pressure ulcers, leg ulcers, fistulas and sinuses.

Healthcare professionals use words like "frustrating," "expensive," and "time-consuming" to describe chronic wound care (Orsted et al. 2001). Often the

problem is not just the wound but also the "woundedness" of the individual with the wound (Orsted et al. 2001) or the pain, amount of discharge or malodour that is identified as the problem (Hampton and Collins, 2002). Healing a wound that has been present for an extended period of time is difficult and the patient's needs in chronic wound care often continue over months, years, or even a lifetime (Orsted et al. 2001).

Healing of a wound often relies on the provision of the optimum wound healing environment and this is achieved through the skill of the Health Care Professional selecting an appropriate dressing for the individual wound. As the education and knowledge of for Health Care Professionals is often poor in the area of tissue viability (Hampton and Collins, 2003), it is vital that new dressings are investigated for their healing in order to promote healing in recalcitrant wounds.

The history of wound healing dates back thousands of years before Christ to the Ancient Egyptians with detailed tomb and temple hieroglyphics depicting wound treatments of that era (Hess and Miller 1990). Through the historic milestones set forth by Hippocrates in 400 BC up to the time of Lister in the 1800s, the current theory of wound management and trends have evolved (Hess and Miller 1990) and a renaissance is now taking place in the field of wound healing with interest in wound healing at its highest (Falanga 1998). The relatively modern concept of wound-bed preparation draws together elements of current practice, including various methods of 'maintenance debridement' and the use of antibiotics and antiseptic agents, to speed up healing of chronic wounds (Romanelli and Mastronicola 2002).

The angiogenic process involves several cell types and mediators, which interact to establish a specific microenvironment suitable for the formation of new capillaries from pre-existing vessels (Naldini and Carraro 2005) and it is this process that occurs in the healing wound but is missing in the chronic static wound. Chronic wound healing process differs in many important respects from that seen in acute wounds (Mulder and Vande Berg 2002) and in chronic wounds, the orderly sequence of events seen in acute wounds

becomes disrupted or "stuck" at one or more of the different stages of wound healing (Schultz et al. 2003).

Matrix Metalloproteinases and wound healing

There is increasing evidence that Matrix MetalloProteinases (MMPs) from the gelatinases (MMP 2 – MMP 9) family and their tissue inhibitors (TIMPS) play an important role in the complexly orchestrated events that lead to wound healing.

Imbalance of MMPs in the wound microenvironment has been associated with poor wound healing leading to chronic wounds. Several studies of wound fluid have shown high levels of MMPs and low levels of TIMPs in chronic ulcers (especially MMP2 and MMP9). Acute surgical wounds with balanced MMP levels show low MMP2 and MMP9 and high TIMPs and heal expeditiously.

Therapeutic agents that could redress the imbalance of MMPs could restore the disturbed homeostasis in chronic wounds which would lead to wound healing. This concept has led to the discovery and development of DerMax®

DerMax®

DerMax® is synthesized from a botanical source, Red Oak Bark and based on metallic ions (including zinc, calcium, potassium and rubidium) in an acidic environment. This formula should redress the MMP imbalance in chronic wounds allowing them to heal.

Decreased levels of MMP2 and MMP9 are seen in tissue fibroblasts after a period of DerMax® treatment, these levels decrease even more as the wound heals.

DerMax® therapy should achieve wound closure in therapy resistant wounds by modulating the high levels MMPs which prevent timely wound healing.

Purpose of the Study

The purpose of this study was to evaluate the efficacy of DerMax®, Poly Hydrated Ionogens (PHI-5 impregnated dressing in achieving wound closure in four common types of hard to heal wounds found in patients in the community. The overall purpose is to provide information for Health Care Professionals and clinicians who daily nurse these common wounds. Therefore, a variety of wounds were assessed in this study in order to provide information for 'real life' wound treatment.

Methods

Wound healing prognosis is difficult to predict. However, Cukjati et al. (2001) arranged in order of decreasing prediction capability, prognostic factors as follows:

- Wound size
- Patient's age
- Elapsed time from wound appearance to the beginning of the treatment
- Width-to-length ratio
- Location and type of treatment.

Therefore, the proposal was designed using this prediction structure as a foundation for the evaluation.

The methods were not based on strict research procedures, and this was deliberate. There is a research programme underway in ten nursing homes in the Netherlands, using Randomised Controlled Trial methodology. This is the Gold Standard in research methodology and very strict exclusion criteria are applied. This makes it difficult to recruit patients and does not show the Health Care Professionals, using the dressings, how it could be applied in their day to day practice with commonly found variety of wounds. Therefore, this study was based on a series of case studies, each providing information on wound changes, pain and acceptability.

The chronic wounds that were included were greater than 3 months in a deteriorating or static phase and included:

- Venous leg ulcers
- Trauma wounds
- Pressure ulcers (less than grade 4)
- Diabetic wounds

Study aims

1. To gain real world learning of DerMax® to provide guidance to clinicians
2. Utilise results from the study (assuming positive) to market DerMax®
3. To assess patient and clinician satisfaction with use and application of DerMax®

Study objectives

To evaluate the effectiveness of DerMax® in non-healing, commonly found chronic wounds of longer duration than 3 months. These wounds are known as 'real life' wounds as they are commonly found, by practitioners, in every day practice. The gold standard RCTs are restrictive as they review one type of wound, generally of a certain size and age etc, and this does not assist practitioners in selecting a dressing for their most common, complex wounds. The parameters being measured being pain levels during wear time, rate of healing and ease of use.

The general study hypothesis is as follows: the treatment group using the DerMax® dressing as a primary dressing will experience improved healing and less pain. The study hypothesis will be measured by the Verbal Descriptor Pain Scale 1-10, the subjects' self- report and by the reported experience of using the dressing during the study and quantified evidence of healing.

Study questions will include:

1. During wear time, on application and removal, does the patient experience more or less pain, as measured by the 1-10 Verbal

Descriptor Pain Scale (Nagata et al 1996), than with previous treatments?

2. Is the dressing easy to handle, apply and remove?
3. Are patients generally more or less satisfied with the DerMax® dressing regime?
4. Does the wound show signs of healing?

Investigator/site

Principal investigator:
Sylvie Hampton. Tissue Viability Consultant. Eastbourne

Study design

A prospective, descriptive, evaluative, non-blinded clinical trial using a sample size of 23 recalcitrant wounds (non-healing wounds present for more than 3 months). The study duration was to be 6 weeks for each patient.
A simple evaluation (case study) is the chosen method of establishing market potential and clinical efficacy of DerMax®.

Large randomised controlled trials (RCTs) are the gold standard of research in wound care but most RCTs have a very strict criteria and the rules do not allow for assessing different wounds at different phases. One such trial (underway at present) is considered amongst the largest wound care study world wide. The elimination criteria are 'any wound with slough; wounds must be a certain size; any immobile patient' etc and this removes the potential for deciding how best a wound product is placed. By definition, a wound without slough is probably already healing and does not offer firm evidence of the healing potential of a dressing. Therefore, this evaluation is actually a series of case studies that demonstrate physical evidence of healing through the use of measurements and photographs on 23 chronic, intractable wounds including leg ulcers and pressure injuries.

Assessment included:

- Wound size established using planimetry measurement and Visitrak calculations
- Patient's age
- Elapsed time from wound appearance to the beginning of the treatment
- The experience of each Health Care Professional in caring for the individual wounds prior to treatment
- Width-to-length ratio
- Depth of the wound
- Location and type of treatment previously applied
- Photographic evidence

The selected patients were those with chronic, non-healing wounds. This meant that the large proportion of the wounds were in elderly and infirm patients. The overall view was one that suggested, if intractable wounds can rebalance MMPs and the micro-environment can be rebalanced healed in this type of patient, then healing in the younger able bodied would be greater.

First assessment was made by the research Health Care Professional and the subjects carefully selected to ensure that no arterial disease is present. Those with arterial disease were excluded from the study.

The patients were screened, consented and enrolled to the study by the research Health Care Professional. After granting informed consent, each patient was allocated a unique study reference number for identification. The frequency of dressing change and type of compression used was according to individual assessed need and local protocol. A case report form was administered on entry, weekly for 6 weeks and at the patient exit point from the study. Measurements and tracings were recorded weekly as well as photographs being taken.

- Photographs are very powerful evidence of wound healing rates and therefore, visits and photographs were undertaken (with the subject's permission) weekly by the evaluating team.

- Any wound care required during the interim period (between weekly visits by the evaluating team) were provided by a responsible primary Health Care Professional.
- DerMax® dressings were provided so that care was continuous.
- Pain was assessed on a recognised scale of 1-10 with 10 being the worst pain to possibly experience and 1 = no pain. The scale was 10cm in length and provided on laminated card.
- Each patient with a leg ulcer wound was assessed for venous/arterial insufficiency with Doppler ultrasound by the research Health Care Professional.
- Each wound was mapped using a wound map planimetry graph using an acetate sheet specifically designed for assessing wound size.
- Healing rates have been evaluated through the wound measurements.
- Secondary dressings were selected by the individual Health Care Professional and depended greatly on the type of wound. Wounds, such as sacral pressure ulcers, required adhesive secondary dressings. Wounds on heels and legs required bandages. Nevertheless, all secondary dressings had the ability to keep the wound moist and therefore, foam dressings (type not stipulated) were recommended in each case.

Subject selection

Patients who met the inclusion criteria were recruited from nursing homes, primary care trusts and personal referral.

Inclusion criteria:

1. Signed informed consent
2. Adult patients over the age of 18 years
3. Patients with non-healing wounds of > 3 months duration
4. Patients able to demonstrate understanding through verbalisation and performance, information about the study and the study dressing
5. Patients able to articulate information about their leg ulcer/pressure ulcer management

Exclusion criteria:

1. Patients who in the judgement of the Health Care Professional were not appropriate for the study
2. Patients who refused to take part in the evaluation
3. Patients with leg ulcers of non-venous origin (arterial)
4. Patients not undergoing compression therapy for venous leg ulceration
5. Patients with existing neurological disorders that would alter pain perception (i.e. Guillain-Barre syndrome, multiple sclerosis and myasthenia gravis)
6. Patients with pre-existing wound infection (confirmed by presence of cellulitis, positive wound swab) or other unrelated pain conditions
7. Patients with uncontrolled diabetes
8. Active alcohol and/or drug abusers
9. Patients currently taking immunosuppressants or any medication that would impair/influence wound healing. This may include steroids, antibiotics, specifically for treating a wound infection, radiation treatments and chemotherapy agents
10. Patients with a known sensitivity or allergy to the dressing
11. Moribund patients
12. Patients with arterial disease of the lower limbs

Patient assignment method

Prospective patients were assessed by the Health Care Professional for eligibility.

Informed consent was obtained prior to inclusion and assignment of a unique case study number

Study entry visit

Completed documentation including:

- Past and current medical history
- Analgesics in current use
- History of the management of the leg ulcer/pressure ulcer, including any previous dressings used.

- Current history of the leg ulcer/pressure ulcer
- Written, informed consent to the study and to photographs being taken
- Assessment of the skin surrounding the wound
- Current level of wound pain as measured by a 1-10 Visual Analogue Scale (VAS)

Weekly assessments

- Subjective data regarding current wound management
- Level of wound pain measured by the 1-10 VAS
- The patient's self-reported skin/wound assessment of the wound
- Assessment of the patient's level of acceptance of the treatment
- The Health Care Professional summarised his/her comments on the performance of the dressing

Clinical examinations

Clinical examinations were limited to the following:

- Subjective data regarding general wound pain, especially when the dressing is in place, being applied and removed. The 1-10 VAS pain scale was used to measure the level of wound pain.
- Objective skin and wound assessments

Patients could be discontinued from the study for any of the following reasons:

- Request of the patient
- Decision of the Health Care Professional
- The study treatment no longer considered to be the appropriate treatment
- Development of a serious wound infection
- Non-compliance to the protocol
- Any unanticipated adverse event directly related to the study dressing
- Concomitant illness/death requiring removal from the study.

Statistical analysis

Data was analysed anonymously by an independent statistician.

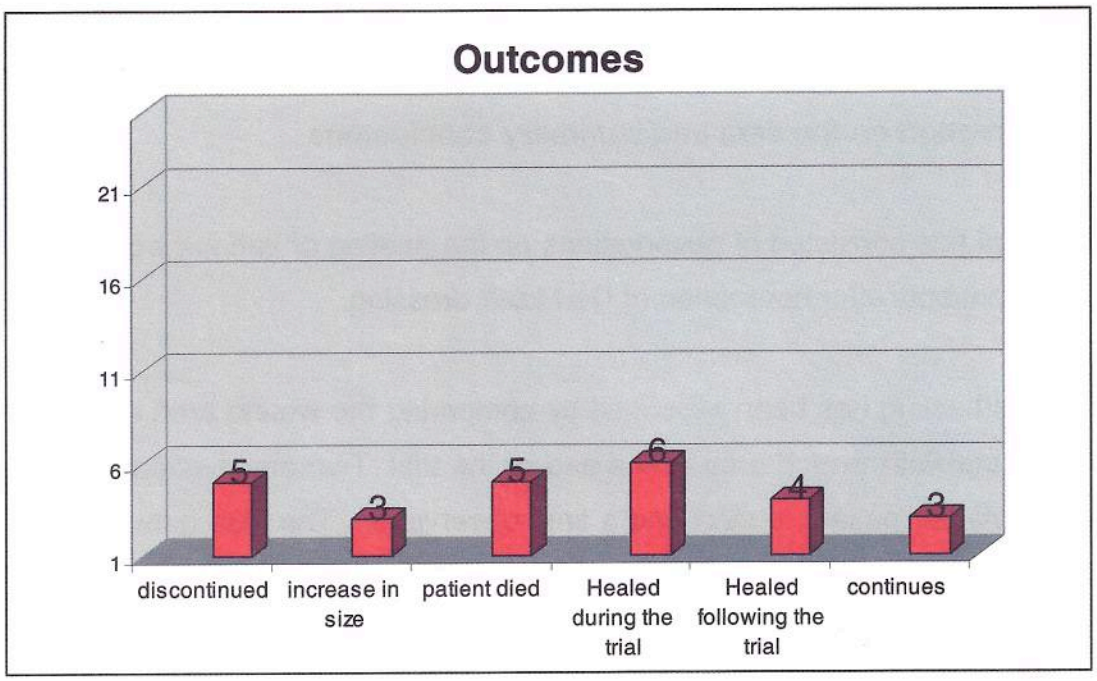
Results

Observation on the data and summary conclusions

The trial has consisted of observations on the healing of various wound types on 23 patients after application of DerMax® dressing.

Wound healing has been assessed by comparing the wound area at the start of the trial with wound area at the end of the trial. Two observations are thus available per patient, a start and a final observation. The time between these two observations varies considerably; from 1 to 100 days. The reason for this was to observe wounds to healing where possible. However, the differences in time interval does complicate any observed benefits from treatment.

During the trial, 5 patients died and a further 5 discontinued treatment. Eleven patients were classed as having healed during or after the trial. Three patients were classed as 'trial continues' which means that these patients wounds are not yet healed. Data were analysed with and without including those that died during the trial. One patient discontinued treatment due to pain on the first day. This patient was excluded from analyses. Nevertheless, it should be noted that many advanced dressings will cause pain in wounds that are already painful such as leg ulcers. The pain in leg ulcers associated with dressings that aid the healing process, are often balanced with the actual healing. In other words, the healing is important, and pain control is used with these other advanced dressings, if at all possible, to enable healing to occur.



A major problem with the data set is that there is no true control group. Unless it could be stated with absolute confidence that without any treatment or with a standard form of treatment that the wounds would not have shown any sign of healing or would have increased in size, critical interpretation of the data is not possible. Nevertheless, all of the wounds were in a static state prior to commencement of the trial and this supports the ability of DerMax® to provide a healing environment.

Also, it was a decision to undertake a series of case studies with photographic evidence of healing, (to ensure speed of data production and analysis) rather than undertake a strict RCT which would offer statistical significance and which would not provide information for Health Care Professionals requiring guidance in treatment of 'real life' recalcitrant wounds.

Four wound types were evaluated. In order for any conclusions to be reasonable, it must be assumed that any observed response is constant across all wound types. That most observed wounds were pressure ulcers means any conclusions reached are more applicable to this type. Nevertheless, most wounds identified by district Health Care Professionals would fall within these four categories.

- There was no relationship between change in wound area and time before assessment.
- Assessing % wound area change showed *significant* effects from treatment over time, although the data do suggest that some patients may show increased wound size and that this can be associated with pain.
- Using a paired sample test based on the starting and ending (after treatment) assessments for all patients, significant differences were found with wound size decreasing on average by -7.78 +/- 3.58 sq. cm. ($P<0.041$) or by -42.89% +/- 16.209 ($P<0.02$).
- When patients who died during the trial are excluded, the paired sample tests showed that wound size decreased by -9.87 sq cm +/- 3.67 ($P<0.02$) or by -64.88% +/- 8.66.... $P<0.01$.
- Recommendations on future protocol to investigate these effects are given.

Data analysis all patients

The data set comprises 23 wounds; each patient having a 'before treatment' and an 'after treatment' recording. Time to assessment was arbitrary.

Analyses based on absolute differences in wound size (sq cm).

Variance analysis based on sq cm differences

The data can be examined by treating the values as 'paired values' in which the first value is the initial wound size and the second value is the final wound size. If this is done the following is derived:

Mean difference in wound size = -7.78 +/- 3.58,
This provides a significance value of $P<0.041$ that the data are due to error.

Regression analysis of wound size reduction (sq cm) against time

Figure 1 illustrates the data for all patients; wound reduction in sq cm being plotted against time to assessment.

Analysis of the data shows no relationship between these parameters. The probability of the regression line being due to error is approximately 40%.

There is thus no evidence that wound healing, assessed as a reduction in sq cm of wound, increased with time.

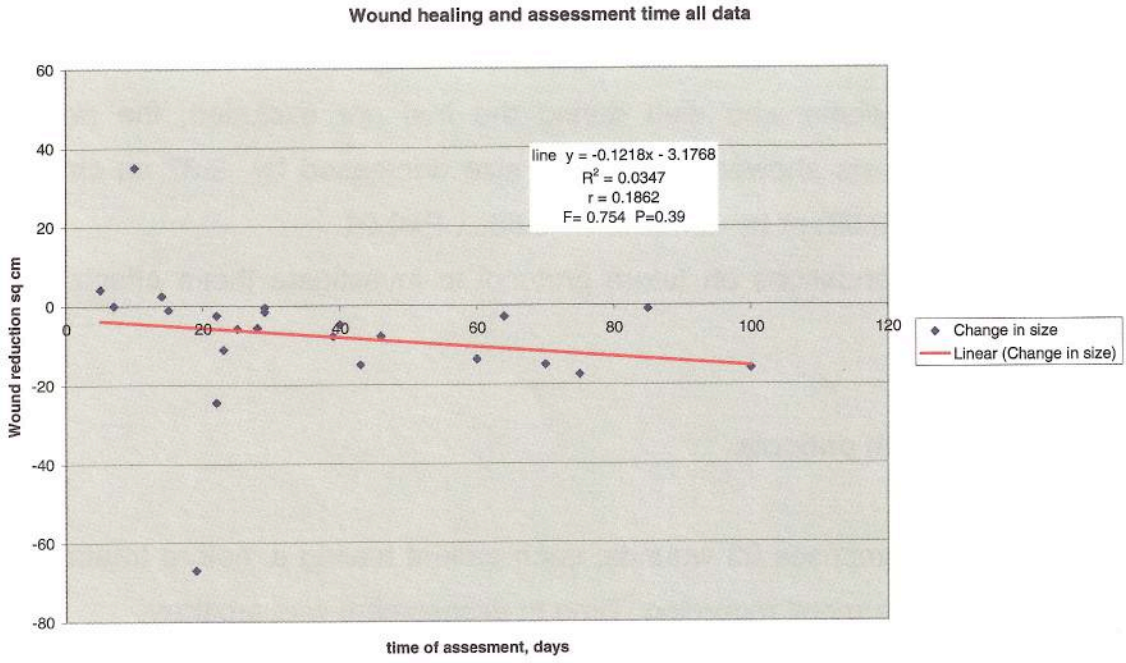


Figure 1. Relationship between wound healing and time of assessment, all patients.

Analyses based on % reduction in wound size

Using % wound size reduction as the assessment parameter removes variability due to initial wound size.

Variance analysis based on % wound size reduction

If data on % change are analysed as paired samples (based on % change = (difference/start size) * 100) then the mean difference in wound size becomes:

-42.89% +/- 16.209 , t = 2.625, P<0.02

This appears to give a far more positive result in that significance is achieved at P<0.02. However, see 'Comments' section.

Regression analysis of % wound size reduction against time

Figure 2 presents an analysis of % wound reduction, compared to the initial wound size, against time of assessment for all patients.

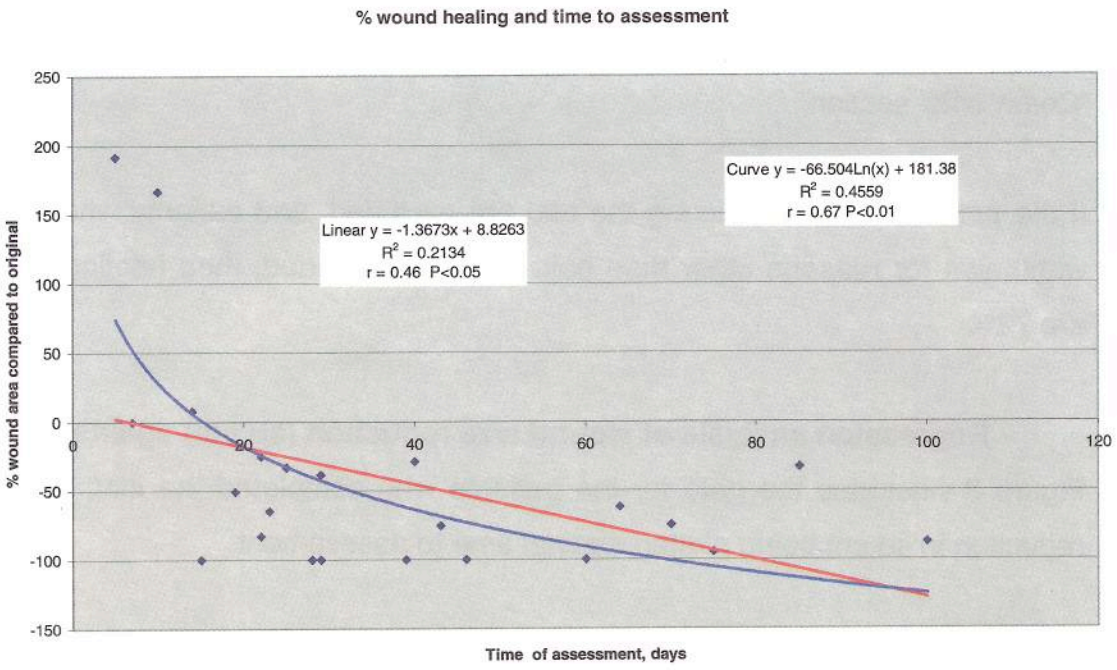


Figure 2. % wound area reduction compared to initial area influenced by time of assessment for all patients. Note that the line '-100%' indicates 'healed during trial'

Based on this analysis the data become more meaningful. A linear plot of the data points is possible and shows that the % wound reduction does appear to increase with time (P <0.05). However, a curvilinear plot is suggested, and gives a better fit with P < 0.01. But before getting carried away with this conclusion, please consider that the data also show that there is a reasonable likelihood of wound size increasing in the first few days after treatment; as shown by the +ve% values.

DATA ANALYSIS EXCLUDING PATIENTS WHO DIED DURING THE TRIAL

Analyses based on absolute differences in wound size (sq cm).

Variance analysis based on sq cm differences

Using paired samples as before:

Mean difference in wound size = -9.87 sq cm +/- 3.67, $P<0.02$.

There is thus evidence that absolute wound size did decrease. However, see 'Comments' section.

If the patients who died during the trial are excluded, and patients who were withdrawn for reasons other than pain are also excluded, then healing rates are 72%.

Regression analysis of wound size reduction (sq cm) against time

Figure 3 illustrates the data for the patients who completed the trial; wound reduction in sq cm being plotted against time to assessment.

Analysis of the data shows no relationship between these parameters. The probability of the regression line being due to error is approximately 83%.

There is thus no evidence that wound healing based on sq cm reduction increased with time.

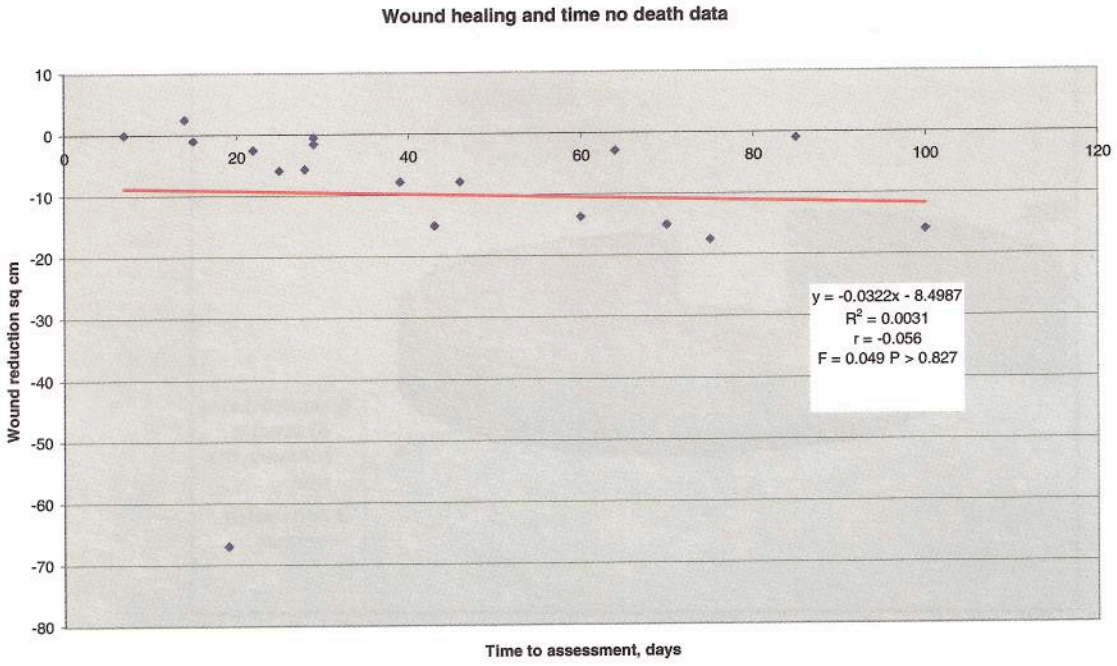
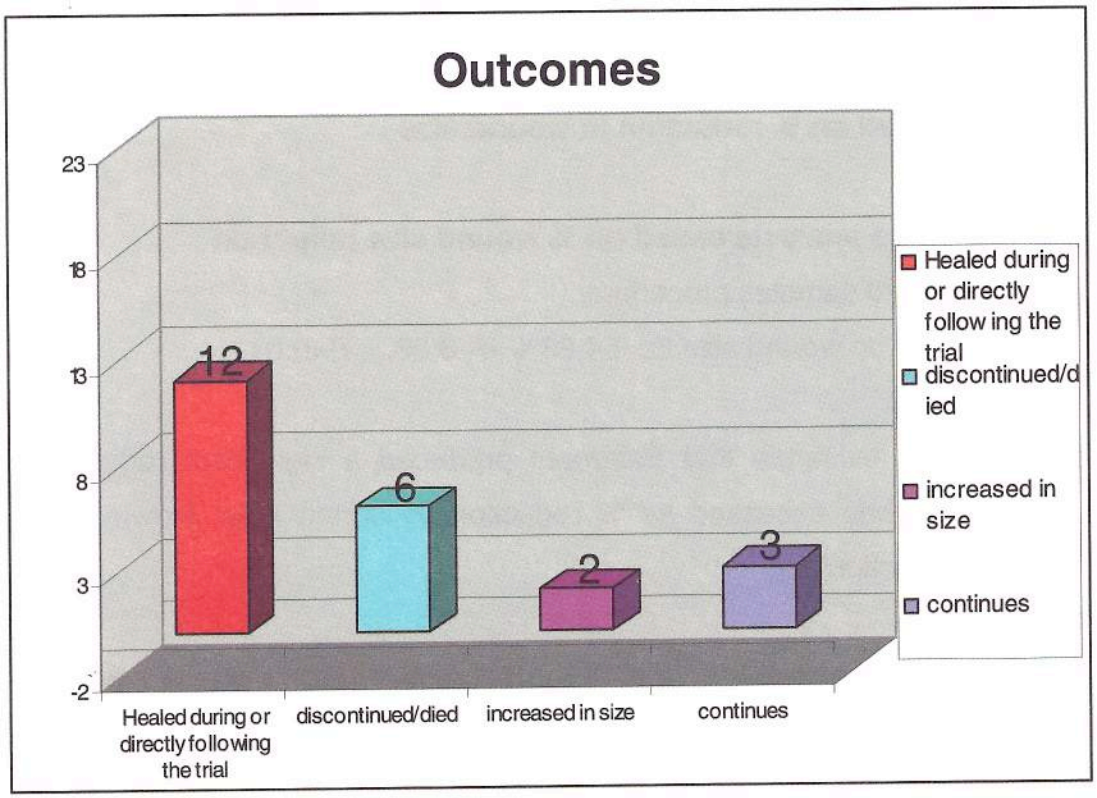
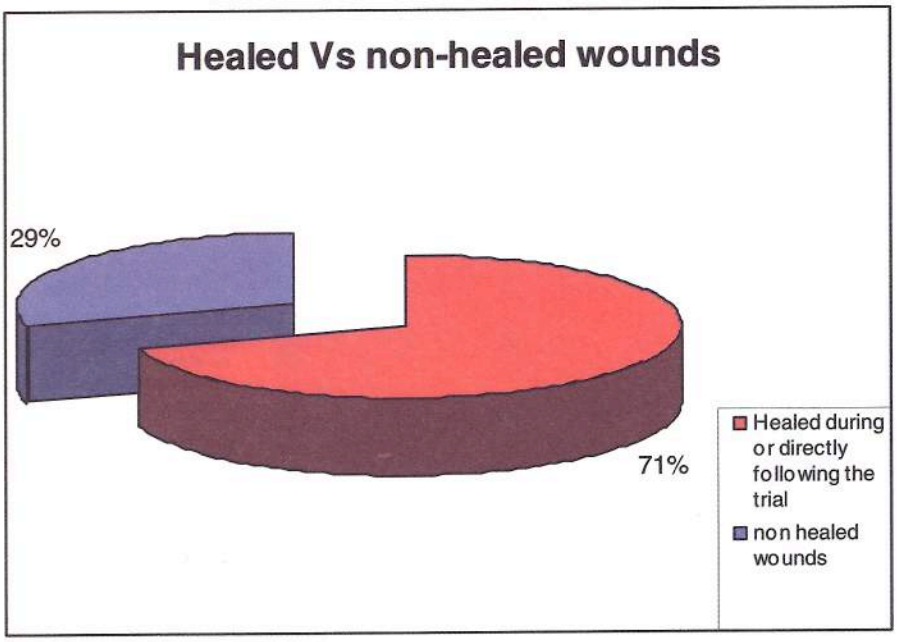


Figure 3. Relationship between wound healing and time of assessment, excluding patients who died during the trial.





Analyses based on % reduction in wound size

Variance analysis based on % wound size reduction

Using the paired samples procedure:

Mean % effect on wound size is: -64.88% +/- 8.66.... $P<0.01$

There is thus evidence that treatment produced a significant reduction in wound size when assessed as % reduction of wound area. However, see 'Comments section'.

Regression analysis of % wound size reduction against time

Figure 4 shows the analysis of % wound reduction against time, excluding patients that died during the trial.

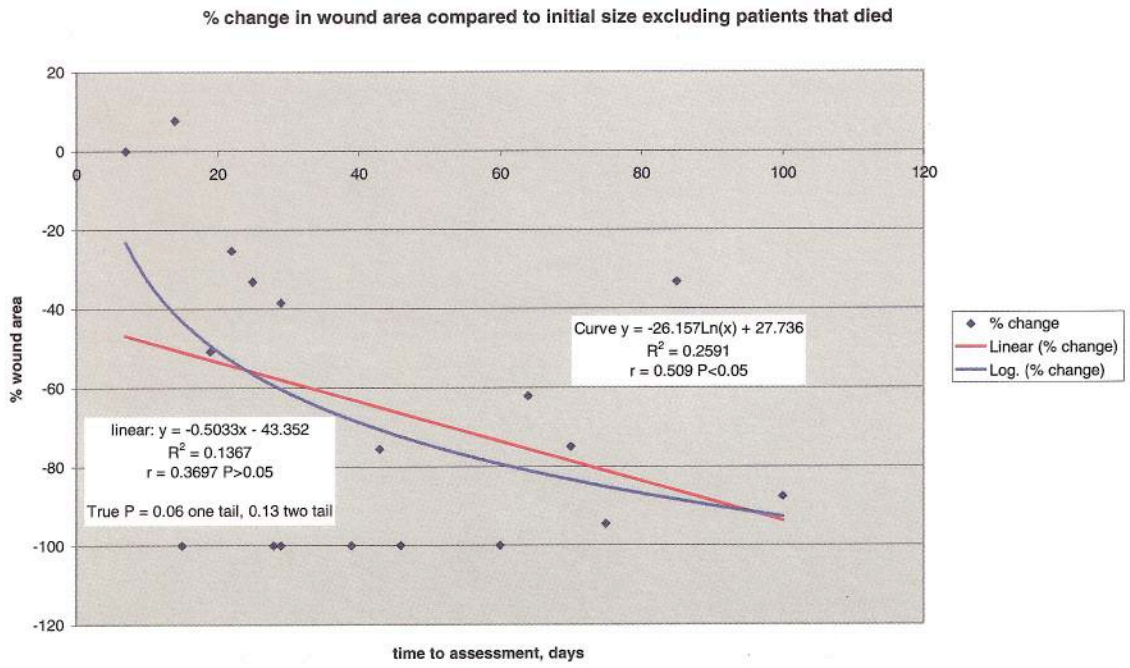


Figure 4. Analysis of % wound reduction against time, excluding patients that died during the trial. Note that the line '-100%' indicates 'healed during trial'.

The analysis again shows a positive effect with % wound reduction tending to increase with time. The curvilinear fit is the better fit. The linear plot is not significant at P=0.05. The true two tail probability for the linear plot is calculated as 0.13. The corresponding one tail probability is 0.06.

Visual assessment of the data for all patients.

Figures 5 and 6 present the data for all patients with some recorded observations inserted.

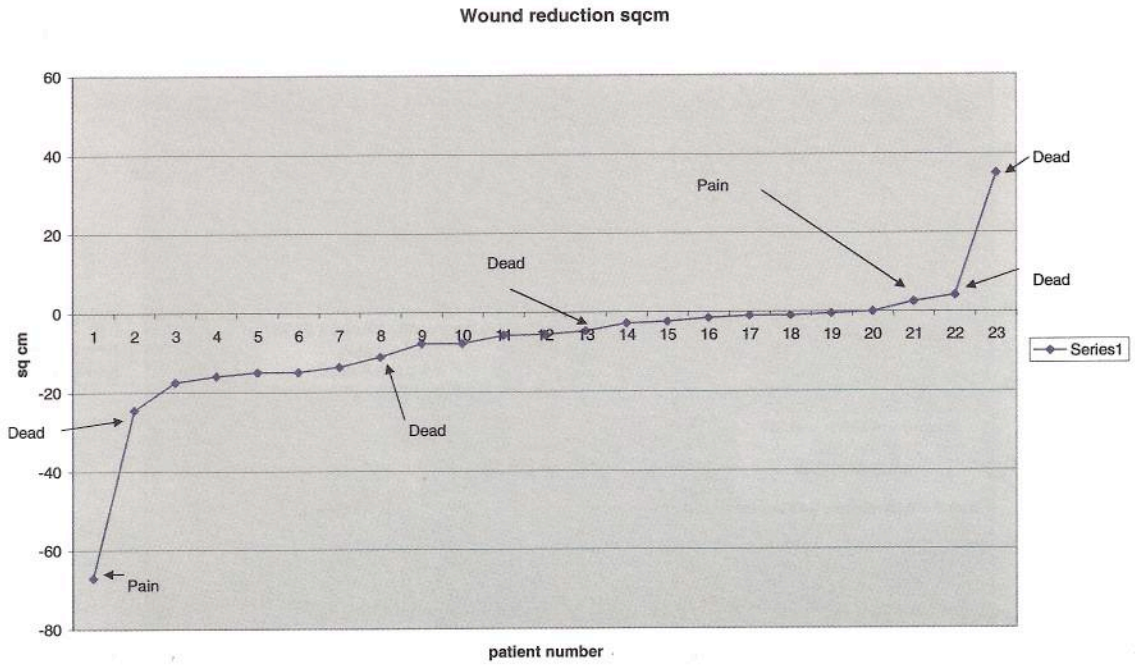


Figure 5. Wound reduction sq. cm for all patients, including some observed notes on some patients.

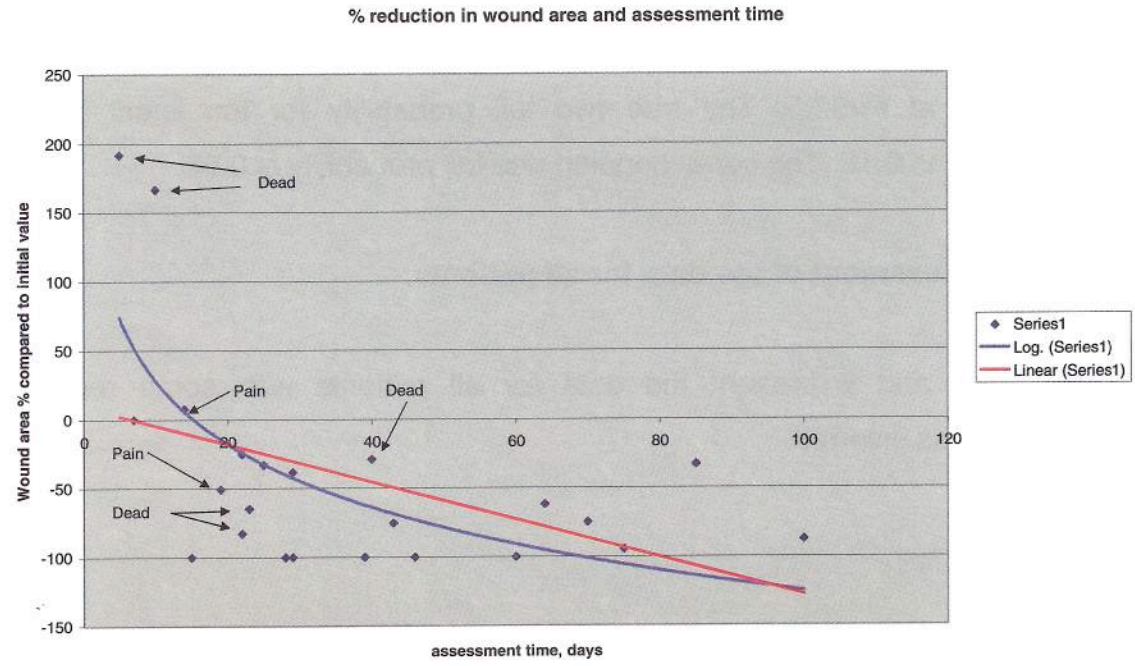


Figure 6. % wound reduction for all patients, including some observed notes on some patients. Note that the line '-100%' indicates 'healed'.

Figure 5 and 6 present a somewhat worrying picture for the data. Where no positive effect was noticed, the data set is dominated by patients who died or suffered pain which can be associated with treatment. Only one patient who showed an increased wound completed the trial, but it must be admitted that the sample size is small. Where no deleterious effect on the wound was noted, 3 patients are recorded as suffering pain or died. This accounts for approximately 17% of this patient class.

COMMENTS

The data set

Out of a data set of 23 wounds it is tempting to draw a conclusion that DerMax® was effective as 20 wounds showed a positive effect. However, it must be remembered that this is a very weak argument as there are no controls to illustrate what may have happened with no treatment.

Looked at on a purely mathematical basis, the application of DerMax® is not without risk. Some patients showed an increase in wound size as well as being associated with pain in some patients. Nevertheless, not one death was associated with the application and use of DerMax® as each cause of death was totally unrelated to the wound or treatment, but each was of natural causes.

The regression analyses in Figure 1 and 3 show that there is no relationship between wound healing, based on sq cm reduction in wound area, and time of assessment. While interesting, I wonder if this could be true;. It might be quite reasonable for patients to show different rates of healing (assuming DerMax® was effective in promoting healing).

Converting the data to a % reduction of wound area removed some of the patient and initial wound size variability. Analysis of all patient data and data excluding patients that died during the trial now shows clear effects, although the trend to an increase in wound size just after treatment is of some concern,

even (?) if it would not be expected. Before using the data I advise considering how the negative effects of treatment observed in the trial can be explained.

I urge caution when interpreting the analysis of the 'paired data' samples. The conditions for the test used are open to question. Although the samples appear to be paired for each patient (a before and an after recording), they are not as they are confounded by time. The 'before' data were gathered over a different time interval than the 'after' data.

Only if it can be categorically stated with 100% certainty that had the wounds not been treated with DerMax® they would have remained in a static condition i.e. neither improving or getting worse, can the conclusions presented be drawn. Evidence supporting this would be valuable. Nevertheless, the fact that these wounds were in a non-healing state for three months prior to application of DerMax® is a firm argument for stating that DerMax® positively affected the healing status in these wounds.

Comments made in the 'Methods' document

In the Methods document provided there is reference to an ongoing study providing evidence that a 55-77% increase in healing is identifiable. This intrigues me. By definition it can only be detected by comparison to another value. My comment on the use of the paired sample procedure in these analyses relates.

Detectable differences are greatly influenced by the number of observations (replicates) used to detect the effect. In turn the number of observations (replicates) influences the standard deviation for that sample. A standard deviation (SD) calculated from a trial with 100 data points is usually a more reliable indication of variability than a standard deviation derived from 10 data points which in turn is better than one generated by 5 points. The SD from 100 points should thus not be used in calculations based on a small sample number unless information is available to indicate that it reliably can be used.

The reliability of such 'cross data' assumptions increases as the number of values in the data sets increase, but reliability decreases markedly as the points decrease in number.

Pain

3 patients experienced pain. Each one reporting pain on VAS of 7, 7 and 10. It must be noted that each of these patients had leg ulcers and each wound was painful prior to application of DerMax® with average VAS level of 4. The pain was immediate, following application of DerMax® and lasted for up to 20 minutes following application. It should also be noted that each of these patients reported higher VAS pain during wear time of DerMax®. In each case, the study was discontinued at the request of the patient.

All other patients reported they had no pain when DerMax® was applied or during wear time.

Satisfaction with the dressing

The 3 patients with pain were unsatisfied with DerMax®. However, all other patients and Health Care Professionals expressed satisfaction with the dressing:

- Simple to apply
- Simple to remove
- Non painful removal
- Noticeable difference in healing status during the study period
- All would use DerMax® in the future

Discussion

This was a simple prospective, descriptive, evaluative, non-blinded clinical trial using a sample size of 23 recalcitrant wounds (non-healing wounds present for more than 3 months). The study duration was to be 6 weeks for each patient, but this was adapted as many patients showed excellent signs of healing and it was decided to continue with the trial in their cases. It would not have been ethical to have discontinued.

5 patients died during the trial. These deaths were completely unrelated to the trial and could not have been predicted at commencement of the study and did not affect the overall assessment of healing.

48% of the wounds either healed during the study or following the study. Given that these wounds were non-healing prior to the commencement, then 48% is a significant number healed and we can be confident that DerMax® had an affect on healing. From the data, it is not possible to say which types of wounds benefit most and which wounds do not respond as positively. Nevertheless, 3 wounds are continuing to heal following the trial and, once healed will give a final total of 53% healed. Given that 5 patients died and therefore can never heal, when these are taken out of the equation, (and given that the other 3 patients continuing to heal will finally reach closure) then a final healing percentage of 72% healed can be predicted for patients within this study.

A worrying aspect of DerMax® is its ability to cause increased pain in painful wounds. It is undoubtedly the content of citric acid that is causing this painful reaction.

It is unsurprising that it is painful in leg ulcers and not pressure ulcers due to the fact that leg ulcers are often superficial and have the nerve endings exposed. In pressure ulcers, the nerve endings are damaged or the tissue is dead and no longer contains nerve endings.

DerMax® is also less likely to cause pain in diabetic foot ulcers, as very many of these ulcers are caused because there is a lack of sensation due to neuropathy. Diabetic neuropathies are a family of nerve disorders caused by diabetes and people with diabetes can, over time, have damage to nerves throughout the body. Neuropathies lead to peripheral numbness and sometimes pain and weakness. Therefore, pain is unlikely to be an issue in the diabetic foot patient.

Apart from the 3 patients who experienced pain, the Health Care Professionals and patients found DerMax® to be easy to apply, simple to remove and required little input from them. Therefore, satisfaction on a scale of 1 (not satisfied) and 10 (completely satisfied) was 8. To increase satisfaction levels with DerMax®, it should not be applied to painful wounds (or potentially painful wounds) and should be incorporated into an adhesive dressing.

Cost-effectiveness

The cost-effectiveness of DerMax® is clouded by the fact that a secondary dressing is required in order to keep the wound moist. Nevertheless, a healed wound has an obvious cost saving, and a potential healing rate of 72% ensures that DerMax® is an advanced cost-effective method of treatment for recalcitrant wounds. This also means that in 72% of cases, cost savings are 100%. In all other cases, with 2 exceptions, dressing change times were reduced and this also ensured cost savings.

However, when considering dressing purchase, many GPs and purchasers may consider the immediate cost rather than the long term outcomes. In my professional experience, this is a common problem primarily created because the purchasers are not always business orientated and often can only see the immediate consequences. In order to reduce this potential problem, it is a recommendation of this study, that DerMax® should be considered as a complete dressing and that can only occur if it has the ability to maintain

moisture at the wound face, absorb fluid and remain in situ without secondary dressings or adhesive tapes (see recommendations for DerMax®).

The cost of Health Care Professional visits was a total of £22197 prior to the study over a 6 week period. During the study, the total cost was £14643. this is a cost reduction of £7554 during the six week period or a cost saving of 65.9%.

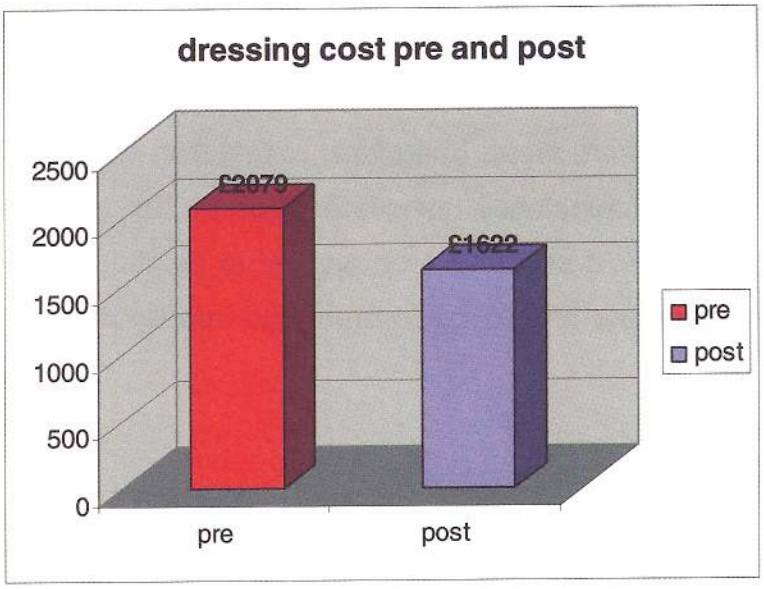


Chart 1

If the cost savings of dressings over the six week period of the study (chart 1) is linked to cost savings associated with Health Care Professional visits, then the cost savings become very significant at 67%. Chart 2 shows the cost for the six weeks prior to Dermax evaluation and for six weeks during use of Dermax.

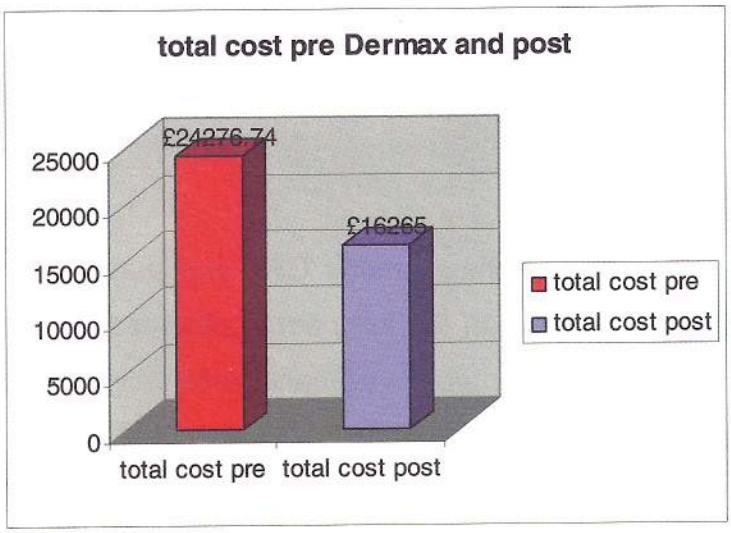


Chart 2

Chart 3 demonstrates the cost savings in Health Care Professional visits (time), cost of visits and cost of dressings during the six weeks of Dermax useage.

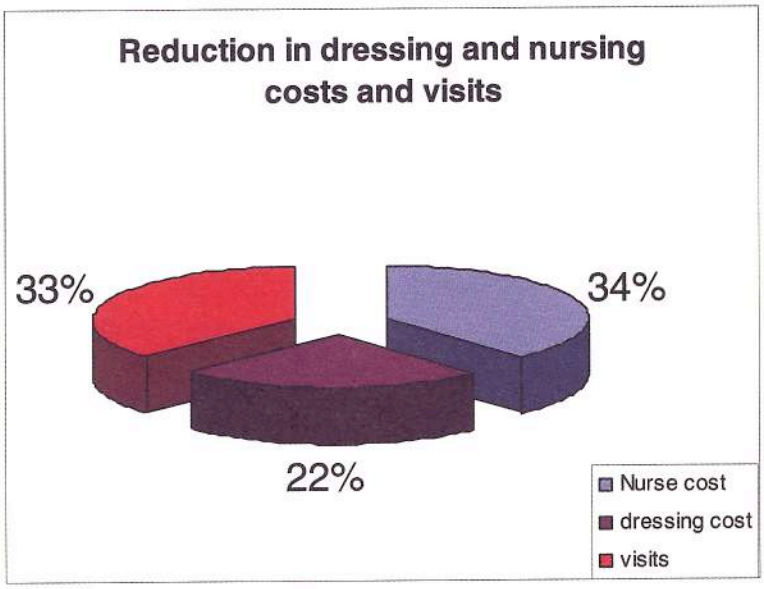


Chart 3

Conclusion

The overall outcome of this study presents a clear picture of a dressing that can offer positive benefits, in wounds that are currently not healing, by initiating the healing process. DerMax® should also be considered for wounds that are likely to heal in order to promote rapid healing.

There is evidence within this study that treatment produced a significant reduction in wound size when assessed as % reduction of wound area and that is an important consideration, given that all wounds are different sizes and depth. A larger study would be able to determine an average healing rate if the reduction (by %) of each wound is known. This could be used to establish an average and from that a prediction of healing time could be provided for each non-healing wound when DerMax® is applied.

All the patients on the trial, requiring DerMax, were supplied with enough dressings to follow through to healing at the end of the trial.

Recommendations for future studies

If this study is repeated, the following points should be taken into account in order to create a data set that allows more rigorous scrutiny.

- Use a trial that includes control treatments: a standard treatment or an untreated (this is already in progress in the Nursing Home Study in the Netherlands).
- Compare the outcomes found in the second study to compare healing rates with this study. This will provide support for these outcomes.
- Concentrate on one wound type. This, however, does not provide information for the 'real life' wounds that are treated every day by the Health Care Professionals who require that information. If different wound types are to be included, ensure adequate replicates for each type are included.

Recommendations for the future of DerMax®

- Many advanced dressings will cause pain in the same way that DerMax can cause pain in already painbful wounds. The companies responsible for these dressings never make recommendations re the potential to cause pain. Nevertheless, it may be valuable to recognise within Dermagenics literature, that pain is possible in already painful wounds.
- To enhance your product range, you may like to consider incorporating the contents into an absorbent second generation hydrogel such as Cool 2o (Manufacturer First Water - Ramsbury). This would provide Dermagenics with a complete dressing and would ensure further cost savings for the user.
- Consider an adhesive border

Insert PP. 32 - 71 PHOTOGRAPHIC REPORT SECTION

In Conclusion

This series of 'real life' case study photographs are important as they demonstrate healing (or non-healing) in a dramatic and accurate way that facts and figures cannot. Also, each of these wounds could be considered 'difficult to heal' as they were showing little signs of healing prior to the application of Dermax. Therefore, the pictures are the most important aspect of case studies and the statistics will offer support to the overall findings in shown in pictorial form.

The cost effectiveness of Dermax is without doubt. A 72% healing rate means that in 72% of cases, cost savings are 100%.

DerMax® has been well accepted by both the patients and the Health Care Professionals and the healing rates are shown to be excellent in all these extremely difficult to heal wounds.