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ARTICLE

# A retrospective analysis of Drawtex hydroconductive dressing compared with standard silver sulphadiazine mixed with a hydrogel, in an adult provincial tertiary burn centre in the Western Cape Province, South Africa

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**Background.** The standard of care for slough and exudative burn wounds in our unit is a combination of Intrasite gel and Flamazine.
**Objective.** To analyse our standard of care method in comparison with Drawtex hydroconductive dressings.
**Methods.** A retrospective record review was done of a 3-month period in 2016 during which we had a large amount of the hydroconductive dressing available. The inclusion criteria were the use of Drawtex on the wounds of patients who were not operated on within 48 hours of dressing application, where there was another wound of the same depth on an opposite limb, on which a control dressing was used. The exclusion criteria were skin-grafted areas and patients who had had operations within 48 hours.
**Results.** There were 100 patients with acute burn wounds admitted in the period from February to April 2016. A limited quantity of Drawtex had been donated. The total number of patients with complete clinical documentation available was 39. Of these, 36 met the inclusion criteria, with 48 wounds treated. Eleven patients had wounds that could be assessed with controls, but only 8 had adequate follow-up data for study. Of the eligible 36 patients, 28 were treated with Drawtex without the use of control areas. Eight patients were found who had good control areas for comparison. Drawtex was clearly better than control areas by such a large margin that during the application period in 2016, the control treatment areas were abandoned for Drawtex, hence the low number of controls. Drawtex was also found to be less expensive when a cost comparison was done.
**Conclusion.** The study found that Drawtex delivered better results than the control method, and was more cost-effective than our standard operating procedure. Therefore, we recommend Drawtex for burns with moderate to highly exuding wounds with slough.

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Burn injuries are a major public health concern globally and also in South Africa (SA), owing to their devastating consequences, which can be life-threatening.[1,2] More than 19 500 fire-related deaths are reported in SA each year.[1] It is estimated that burn injuries affect 3.2% of South Africans each year, with 14% of burns being classified as moderate to severe.[2] Adult burns are mostly due to assaults, accounting for 37% of burn injuries, followed by accidental burns (20%) and fires in rural settlements (15%).[2] The management of burn wounds is a priority right from the beginning of treatment, with a special emphasis on wound closure: after resuscitation and treatment for inhalation injury, the treatment and closure of the burn wound becomes the priority.[3] Applying dressings to the wound creates a physical barrier that provides protection against contamination while providing a healing environment.[4] It is important to select the best dressing for the type of wound treated, as inappropriate dressings can have an impact on the healing process.[3] Wound healing can be delayed as a result of excessive exudate, bacterial biofilm and inflammatory cytokines produced by burn injuries.[3]

Some local factors influencing dressing selection are the type of wound, the location of the wound, the moistness of the wound, the presence or absence of infection, tissue oedema and the vascularity of the wound bed. According to Couch,[5] wound infection and the amount of moisture present, among other factors, determine dressing selection. Dressings should have particular characteristics that aid in wound healing, such as being impermeable to bacteria, and the ability to absorb excess exudate and allow the flow of air while maintaining a moist environment.[5] Dressings differ based on wound-healing properties, and can be classified as alginates, hydrofibres, carboxymethylcelluloses, polyurethane foams and, recently, hydroconductive dressings.[5]

The skin is the largest organ in the human body, with key functions essential for survival.[6] The primary function of the skin is to provide protection from the external environment, and therefore injury to the skin resulting in a wound can be difficult to heal, as it is a complex process.[6]

Wound healing can be influenced by a variety of factors. Some factors that prevent wound healing are an increase in wound moistness, biofilm and slough.[7] An increase in exudate has also been linked to poor healing outcomes.[8] The factors that prevent wound healing can co-occur and have a compounding effect on the healing process.[7] Comorbidities can also result in delayed wound healing.[5]

Wound-bed preparation includes tissue management, control of infection and inflammation, ensuring moisture balance and advancing

epithelial growth to enhance wound healing.[7] Drawtex can be used for wound-bed preparation as it is the only dressing that removes devitalised tissue, corrects moisture imbalance and removes the biofilm.[7]

Although some research has been conducted, the extent of the wound-healing capabilities of Drawtex has not fully been explained.[4,5] Understanding the wound-healing benefits of Drawtex hydroconductive dressings could allow appropriate treatment protocols to be developed that would aid in patient recovery. Based on the current literature available, the efficacy of Drawtex hydroconductive dressings has not been described in a tertiary burn unit specialising in adult burn care, such as the one at Tygerberg Hospital. A proper understanding of the efficacy thereof will contribute to effective protocol development and treatment.

## Methods

Ethics approval was obtained from the Health Research Ethics Committee at Stellenbosch University (ref. no. N 17/04/045). A retrospective record review was done for the use of Drawtex in our adult burn unit in the 3-month period from February to April 2016.

### Inclusion criteria

During the period of Drawtex use in 2016, patients were selected by the main author. Our burn unit treats burns in adult patients aged ≥14 years. The inclusion criteria were the use of Drawtex on the wounds of patients who were not operated on within 48 hours of applying the dressing, where there was another wound of the same depth on an opposite limb, on which a control dressing was used. The exclusion criteria were skin-grafted areas and patients who had had operations within 48 hours.

### Data collection

Demographic data such as age and sex were collected, and clinical wound analysis data such as the percentage of total body surface area affected, burn mechanism, area affected, treatment days and types of wound changes (initial application v. later).

### Wound assessment and treatment

For wound assessment, the following 10 parameters were assessed in the notes of selected patients (these were intentionally recorded on data sheets by the main author for the purpose of the anticipated retrospective data analysis): slough, biofilm, exudate, epithelium, moistness, infection, wound size, colour, odour and whether a swab test was needed. We used a wound assessment scale to grade the severity of the wound from 0 to 3 (Table 1).

The wound dressing regime was to use either Drawtex with a crepe or Kling bandage, or, in the control areas, the standard operating procedure (SOP), which was Intrasite gel mixed with silver sulphadiazine (SSD; Bactrazine), covered with Telfa and wrapped in Kling bandages. The Drawtex change time was every 2 days, and the SOP every day. The dressing regime comparison is shown in Table 2.

All wounds were cleaned and disinfected with the same regime, to eliminate bias: water, chlorhexidine and alcohol solution. For multidrug-resistant *Staphylococcus aureus* we used chlorhexidine soap or a 1% acetic acid solution soaked in gauze, with adequate pain control.

For highly exudating wounds with slough, this SOP has been used for the past 4 years for partial (second-degree) and full-thickness (third-degree) wounds. The frequency of hydroconductive dressing change was 24 - 48 hours, depending on wound exudation/severity.

### Photographic analysis

Patients who had good photographic records were used for comparison. The protocol in the unit for the photos was: an iPhone (Apple Inc., USA) camera of 10 megapixels used; photograph taken 30 cm from the wound; and a ruler in the photograph for size assessment. All photographs were taken by the main author.

### Statistical analysis

The McNemar $\chi^2$ test was chosen for comparison of parameters. Means, standard deviations, ranges and 95% confidence intervals were planned. Other statistical analysis was done via Statistical Package for Social Sciences version 23 (IBM Corp., USA). A two-tailed $p$-value <0.05 was considered statistically significant.

## Results

There were 100 patients with acute burn wounds admitted in the period from February to April 2016. A limited quantity of Drawtex had been donated. The total number of patients with complete clinical documentation available was 39. Of these, 36 met the inclusion criteria, with 48 wounds treated. Eleven patients had wounds that could be assessed with controls, but only 8 had adequate follow-up data for study. Of the eligible 36 patients, 28 were treated with Drawtex without the use of control areas. Eight patients were found who had good control areas for comparison. These results are shown in Table 3.

**Table 1. The wound assessment scale used to grade the severity of the burn wounds**

| Scale value | Description |
|---|---|
| 0 | None |
| 1 | Mild |
| 2 | Moderate |
| 3 | Severe |

**Table 2. Wound dressing regime comparison**

| Drawtex group | Control group (burn unit SOP) |
|---|---|
| Primary dressing: Drawtex | Primary dressing: Intrasite and Bactrazine |
| No secondary dressing, only bandages | Secondary dressing: Telfa followed by bandages |
| Frequency of change: every 48 hours | Frequency of change: every 24 hours |

SOP = standard operating procedure.

**Table 3. Study participant selection**

| Description | Patients, *n* |
|---|---|
| Total admitted to burn unit | 100 |
| Total with records available | 39 |
| Selected | 36 |
| Drawtex patient sample | 36 |
| Control patient sample | 8 |
| Total number of areas to be treated in 36 patients | 48 |
| Drawtex areas to be treated out of 48 areas | 40 |
| Control areas to be treated out of 48 areas | 8 |

The average age of the patients was 33 years, ranging from 17 to 78, and the male:female ratio was 28:8. The minimum total body surface area burn percentage was <1%, the maximum 55%, and the average 23%. The most common mechanism of injury was flame burns (80%), while hot fluids accounted for 12%, electrical burns 5%, and chemical burns 2%. The areas most commonly treated were arms (56%), legs (29%) and abdomen and chest (21%). The back was the least commonly treated area (10%). The average length of treatment was 2.6 days (Table 4).

The results of the assessment parameters compared between Drawtex and the SOP in the unit were as follows: slough removal was 82% improved with Drawtex, while slough increased by 6% with the SOP; there was 100% less biofilm with Drawtex, and 200% more with the SOP; epithelialisation was 129% improved with Drawtex, compared with 17% with the control; exudate was 79% lower with Drawtex, compared with 21% higher with the control; infection was 100% less with Drawtex, and in the control 50% more; and there was 67% less moistness with Drawtex, compared with 21% more in the control. These results are shown in Table 5. The examples of the photographic comparison of Drawtex v. controls are shown in Figs 1 - 6.

Using the 10 wound-assessment parameters, the wounds were given a score of 1 per parameter present, and the totals added. If the wound improved, the total score fell. The overall scores for Drawtex decreased at every evaluation, compared with the SOP scores, which in fact increased (Table 6).

The total scores for each wound parameter assessed were compared between Drawtex and the control dressings, and showed a clear advantage to Drawtex. Table 7 shows the overall parameter changes for all 40 wounds treated using Drawtex.

When comparing wound colour, the differences between the following colour ranges were assessed: green; red; yellow; yellow and red; yellow and green; and yellow, red and black. Drawtex clearly outperformed the control in improved wound-bed colour. Five of those treated with Drawtex had an increase in red (healthy) wound tissue, while none in the control group did. The amount of yellow (slough) tissue was significantly reduced

**Table 4. Demographic and clinical data of Drawtex group (*N*=36)**

| Characteristic | Value |
|---|---|
| Age, mean (range), years | 33 (17 - 78) |
| Sex, *n* (%) | |
| Male | 28 (78) |
| Female | 8 (22) |
| TBSA, mean (range), % | 23 (<1 - 55) |
| Burn mechanism, *n* (%) | |
| Boiling water | 5 (12) |
| Flame | 28 (80) |
| Electrical | 2 (5) |
| Chemical | 1 (2) |
| Burn area, *n* (%) | |
| Arms | 27 (56) |
| Legs | 14 (29) |
| Back | 5 (10) |
| Abdomen/chest | 10 (21) |
| Head | 7 (15) |
| Treatment days, *n*, mean (range) | 2.6 (1 - 6) |

TBSA = total body surface area.


*Fig. 1. Before pictures of wounds on different limbs in the same patient, showing the intended Drawtex and control sides. This information was recorded in the patient's notes (only available image).*

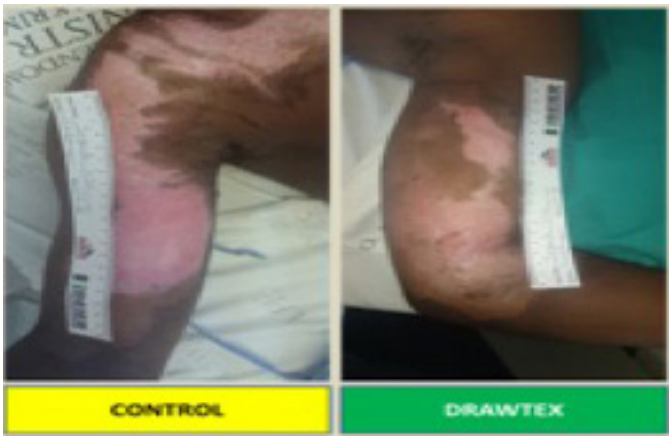


*Fig. 2. This picture shows the result after 3 days in the Drawtex v. control treated areas in the same patient. In the control area, there seems to be some slower healing in the pink area over the medial biceps, compared with the Drawtex area, where all areas appear a light brown colour (only available image).*

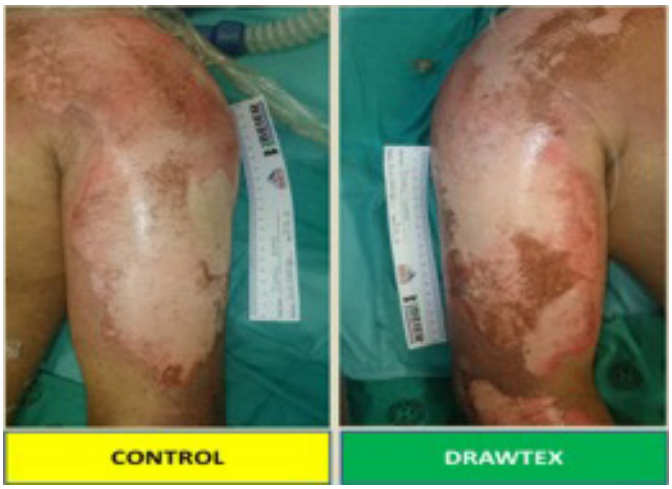


*Fig. 3. The first wound comparison, before the dressing application for wounds of more or less similar depths on opposite sides of the upper arms, in the same patient (only available image).*

by 67% in the Drawtex group, while in the control group, slough increased by 50% (Table 8).

The cost-effectiveness of Drawtex was calculated by a cost comparison of the control v. Drawtex in relation to the clinical results of the study. The total cost of Drawtex after 48 hours of treatment (once with Drawtex, and twice for the control) was ZAR102.83, slightly cheaper than the control dressing's cost of ZAR111.35. The results of the cost analysis are shown in Table 9 below.

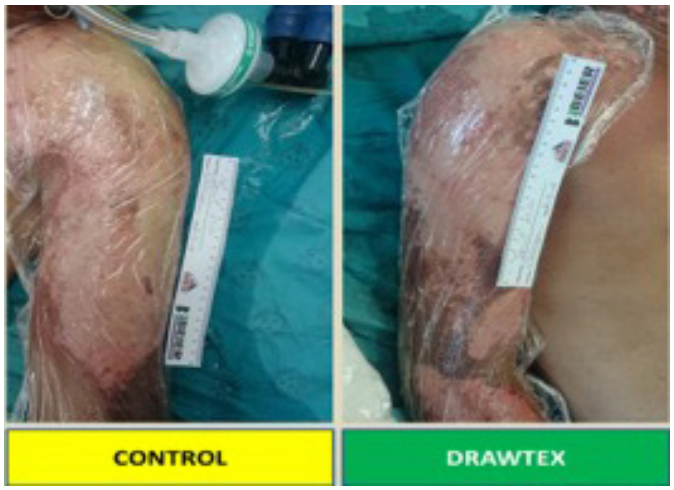


*Fig. 4. The patient is shown 3 days later, when the difference between the two sides can be compared. It appears that there is less yellow on the Drawtex arm than the control (only available image).*


*Fig. 5. This patient is shown with wounds on both arms on day 1 before applying treatment (only available image).*

## Discussion

In terms of the choice of the control to compare Drawtex with, one would prefer to compare apples with apples. Drawtex is certainly very different to the combination of a hydrogel and antiseptic agent with absorbent secondary dressings.[9] The main reason for our comparison of different classes of dressing was that the SOP in our unit for sloughy burn wounds was Intrasite and SSD, and it seemed that Drawtex could potentially fulfil the same role of exudate control and slough removal. Despite Drawtex not containing an antibacterial agent, it has been reported that bacteria are removed from the wound surface by its electrostatic action.[4] Thus even though the mechanisms of action of the dressings are different, and they are in different categories of wound dressings, there was a possibility that Drawtex could compete with our SOP for sloughy exudative wounds.

The results may have been affected by the difference in the frequency of dressing changes between Drawtex and the control. The control area was washed and cleaned every day, and new dressings applied, in comparison with Drawtex, which was left on for 2 days. By regular cleaning in the daily SOP regimen, the bacterial load may have been more effectively removed than by changing the Drawtex every second day. In this respect, one might have expected the control area to demonstrate better results in terms of biofilm appearance, infection and odour, to name a few assessed parameters. However, the results showed a clear advantage in favour of Drawtex. We believe that the adsorption of slough to Drawtex, and secondary mechanical removal, greatly assists with bacterial bioburden clearance.

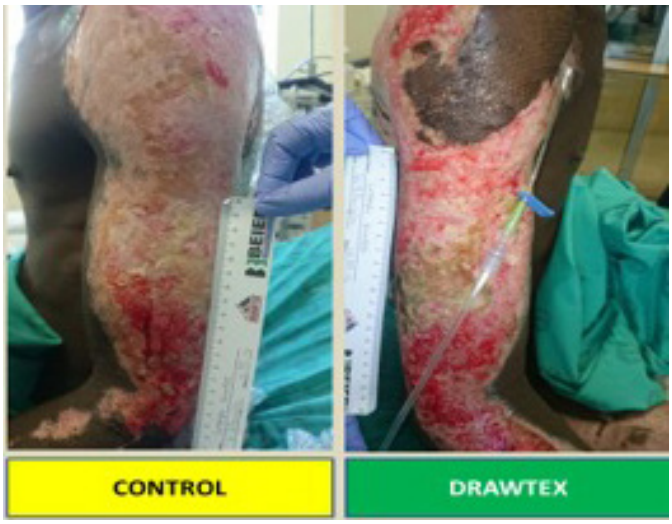


*Fig. 6. After 3 days, the wound with Drawtex appeared cleaner, redder and with less yellow slough (only available image).*

**Table 5. Wound assessment comparison by parameters**

| | Drawtex, *n*=8 | | | Control, *n*=8 | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Initial** | **Follow-up** | **Change, %** | **Initial** | **Follow-up** | **Change, %** |
| Slough | 17 | 3 | –82 | 16 | 17 | 6 |
| Biofilm | 2 | 0 | –100 | 2 | 6 | 200 |
| Epithelium | 7 | 16 | 129 | 6 | 7 | 17 |
| Exudate | 14 | 3 | –79 | 14 | 17 | 21 |
| Infection | 2 | 0 | –100 | 2 | 3 | 50 |
| Moistness | 15 | 5 | –67 | 15 | 18 | 21 |

During the period of comparison of Drawtex and the control (February to April 2016), the control was eventually abandoned, because the results of treatment with Drawtex were better every time, to the extent that the main investigator felt that it was unethical to continue to use the control.

**Table 6. Total wound assessment scores by patient and group**

| Patient number, group | Initial | Follow-up | Difference |
|---|---|---|---|
| 1 | | | |
| Drawtex | 7 | 2 | 5 |
| Control | 5 | 6 | –1 |
| 2 | | | |
| Drawtex | 7 | 3 | 4 |
| Control | 7 | 10 | –3 |
| 3 | | | |
| Drawtex | 9 | 4 | 5 |
| Control | 9 | 10 | –1 |
| 4 | | | |
| Drawtex | 8 | 5 | 3 |
| Control | 8 | 10 | –2 |
| 5 | | | |
| Drawtex | 9 | 3 | 6 |
| Control | 9 | 7 | 2 |
| 6 | | | |
| Drawtex | 5 | 3 | 2 |
| Control | 5 | 12 | –7 |
| 7 | | | |
| Drawtex | 7 | 3 | 4 |
| Control | 7 | 6 | 1 |
| 8 | | | |
| Drawtex | 5 | 4 | 1 |
| Control | 5 | 7 | –2 |

**Table 7. Overall parameter measurement results using Drawtex (*n*=40 wounds)**

| Variable | Initial | Follow-up | Change, % |
|---|---|---|---|
| Slough | 69 | 27 | –61 |
| Biofilm | 11 | 3 | –73 |
| Epithelium | 35 | 68 | 94 |
| Exudate | 62 | 25 | –60 |
| Infection | 11 | 0 | –100 |
| Moistness | 59 | 28 | –53 |

The later analysis of the results confirmed the clinical impression, and that abandoning the comparison tests had been the right decision. The numbers in the study are small, but the better results were clear enough to convince us to abandon the comparison and change our SOP to the use of Drawtex for sloughy and exudative wounds. From the wound assessment data, it appears that fresh burns with slough had the greater benefit from the use of Drawtex.

A clean, fresh burn of superficial to mid-partial thickness is most successfully treated using a skin substitute, of which there are many available. Even though the SOP also removed slough, this process took much longer than with Drawtex. One could make an argument for the presence of more pseudo-slough in the burns treated with the Intrasite and Bactrazine, but the clinical evidence in the photographs is very convincing in showing that pseudo-slough did not play a role.

A study by Smith *et al.*[10] compared Drawtex with a control standard burn fluffed-gauze dressing. At the first dressing change, the hydroconductive Drawtex dressing had increased 85.6% in weight, compared with 61.3% for the standard burn dressing control, which was not statistically significant. At the second dressing change, after 24 hours, the difference was statistically significant, at 59.7% in the hydroconductive dressing and 32% in the control.[10] The hydroconductive dressing removed a statistically significant greater amount of oedema fluid from the burn wounds, which is consistent with our results.

Initially this was planned to be a prospective study, but there were too many delays in getting ethics approval, and we could not let the stock of Drawtex that had been donated go to waste in our resource-limited environment. It was decided to use the dressings, and afterwards apply for ethical approval for a retrospective data write-up. Because the inclusion and exclusion criteria, assessment parameters and methods were already decided, it was simple to use the dressing in the same standardised way it would have been used in the prospective controlled study.

We would have loved to use a photographic digital analyser for more detailed assessment of the photographs. Other advanced technology assessments may also have helped to augment the results. The objectivity of the interpretation of the results could also have been enhanced by the involvement and evaluation of other wound experts.

When it comes to wound assessment, a single experienced eye offers much greater value than multiple inexperienced eyes. The patient selection, and the way in which the Drawtex was used, with controls of similar depth in the same patients, on opposite limbs, does eliminate many variables that could otherwise have created doubt about or bias in the results. In a randomised controlled study by Reynolds *et al.*,[11] the researchers showed that having non-wound-expert nurses evaluate the results led to huge differences among nurses' evaluations, and showed an

**Table 8. Changes in colour in Drawtex v. control group**

| | Drawtex, *n*=8 | | | Control, *n*=8 | | |
|---|---|---|---|---|---|---|
| Wound colour | Initial | Follow-up | Change, % | Initial | Follow-up | Change, % |
| Green | 1 | 0 | –100 | 1 | 0 | –100 |
| Red | 2 | 5 | 150 | 0 | 0 | 0 |
| Yellow | 3 | 1 | –67 | 4 | 6 | 50 |
| Yellow and red | 1 | 3 | 200 | 3 | 2 | –33 |
| Yellow and green | 1 | 0 | –100 | 0 | 0 | 0 |
| Yellow, red and black | 1 | 0 | –100 | 0 | 0 | 0 |

**Table 9. Cost-effectiveness of Drawtex v. other dressings**

| Treatment regimen | Size/volume | Medium wound application 10 - 20 cm | Total cost (24 hours), ZAR | Total cost (48-hour treatment), ZAR | Cost comparison, ZAR |
|---|---|---|---|---|---|
| Drawtex | 20 | 20 × 20 × 1 | n/a | 102.828 | 102.828 |
| Other | | | | | |
| Intrasite | 25 g | 0.5 | 17.9 | 35.82 | |
| Melolin | 10 × 10 cm | 3 | 7.44 | 2.48 | |
| Telfa | 0 | 3 | 0 | 0 | |
| Bactrazine | 50 g | 0.5 | 21.9 | 43.77 | |
| Bandage | 0 | 1 | 0 | 0 | |
| Gauze swab | 0 | 4 | 14.64 | 29.28 | 111.35 |

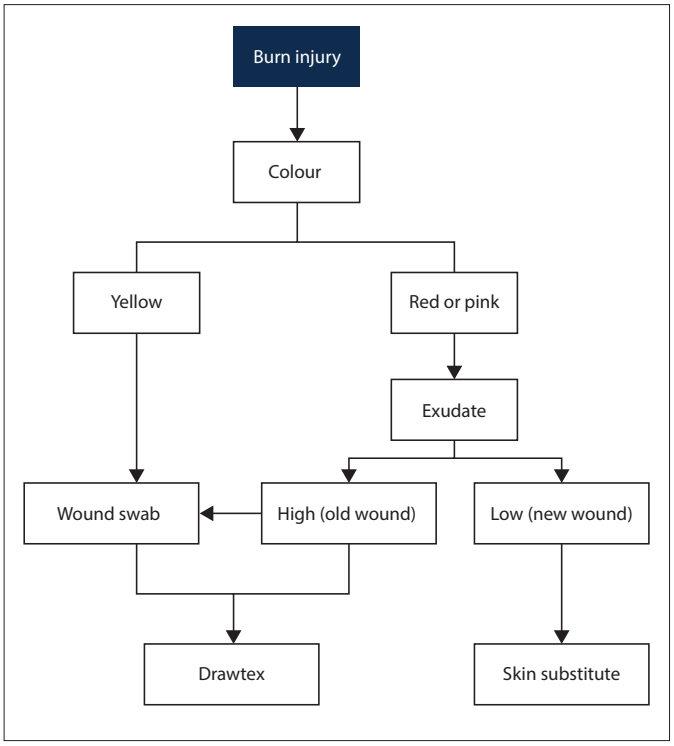


*Fig. 7. Proposed algorithm for the use of Drawtex in burn wounds.*

advantage for Drawtex by 12.7% non-blinded, but 6.6% blinded in favour of routine dressings. In our cases, the comparison was clearly in favour of Drawtex, to the extent that clinically, all staff in the unit could agree that the Drawtex results were clearly better. This was also confirmed by the later retrospective data analysis. In addition to achieving better results with Drawtex, it was also cheaper than the SOP, and therefore more cost-effective.

Based on these results, we propose an algorithm for the decision-making process to use Drawtex in burn wounds (Fig. 7).

## Conclusion

The efficacy of Drawtex hydroconductive dressings, based on an understanding of the current literature, has not previously been described in a tertiary adult burn unit in a resource-limited environment. This study found that Drawtex delivered better results than the control, our SOP, and was more cost-effective. Therefore we recommend Drawtex for burns with moderate to highly exuding wounds with slough. The proposed algorithm can assist the clinician in finding the appropriate circumstances for the use of Drawtex.

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**Author contributions.** EK: data collection; HDP: data analysis; WGK: data collection and analysis.

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**Conflicts of interest.** None.

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