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A clinical observation evaluation of bioactive soluble beta-glucan gel compared with standard care

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Objective: Clinicians across all health-care settings are challenged daily by wounds that are slow or static in healing due to time constraints, reduced resources and the negative impact upon the patient's quality of life (QoL). Community settings are particularly challenging due to the varied environments, patient social, psychological and financial constraints, and multi-clinician wound care monitoring. The aim of this clinical evaluation is to clinically evaluate bioactive soluble beta-glucan gel (BSBG) on those wounds that have stalled at four weeks as an adjunct to normal standards of care.
Method: A clinical observational evaluation was undertaken within a large community setting, reviewing patients who self-presented with stalled healing/chronic wounds, and the effects upon adding a BSBG gel twice a week for eight weeks as part of their set standard care. Formulary cleansing and dressing products were continued and results monitored by a designated clinician. All data was collected as part of the patient's normal wound review routine in relation to primary outcome of wound reduction with secondary outcomes relating to pain reduction, slough and necrosis reduction, exudate reduction and adverse events.
Results: At six months, analysis of data demonstrated >2-times a higher rate of healing in chronic wounds with eight weeks' initial treatment and >4-times a higher rate of healing over six months in those patients with ulceration (PU, VLU, DFU). A reduction of per patient care cost saving was achieved across the treatment group compared with the standard care retrospective group.
Conclusion: The administration of a wound healing gel within a moderate size cohort of patients presenting with chronic wounds resulted in improved wound reduction and significant cost savings.
Declaration of interest: Biotec Pharmacon provided supplies of Woulgan Biogel and the author received an honorarium.

beta-glucan • chronic wounds • cost-effectiveness improved • macrophages • patient experience • wound healing

Within the health-care arena there is great improvement in wound management concepts, the accessibility of new and innovative devices, dressing products and increased numbers of wound care specialists which are changing our clinical practice approach to patient care.[1,2] There is also an increased focus with regards to relevant wound care education and training programmes, promotion of patient self-care initiatives and improved formulary processes.[3] Despite this, we continue to be faced on a daily basis with challenging wounds that are either slow-to-heal or which have become static and therefore chronic in nature.

According to While,[1] there is clearly an ongoing need to research, explore and evaluate new wound care products and devices to improve wound healing within the whole wound care arena. Advanced wound care therapies, such as recombinant growth factors, enzymes and artificial skin tissues are, according to Skjaeveland and Engstad,[4] expensive, only used by senior specialists in wound care, and are therefore not generic or easily accessible across the whole spectrum of health professionals.

Aim

This paper will assess the effects of a new product, bioactive soluble beta-glucan gel (BSBG, Woulgan), used within non-infected, slow-to-heal or static wounds, which purports to expedite wound healing

Wound healing

The challenges posed by chronic wounds are widely recognised, in regards to the negative impact upon patient quality of life (QoL) and overall health-care costs.[5] Ineffective wound assessment, diagnosis and management are factors which are, in part, attributed to wound chronicity according to Grothier.[6] Guest et al[7] suggest that approximately 2.2 million chronic wounds are managed annually within the NHS with a related cost of £4.5–5.1 billion per annum.

Wound healing, as a normal biological continuum, is facilitated through highly complex and precise regulated phases: haemostasis, inflammation, proliferation and remodelling.[8] Those wounds that are deemed 'static' or 'chronic' are those that have not progressed as expected over a 2–4 week period despite following normal standards of care.[9,10] Factors which can contribute to wound chronicity include hypoxia, infection, age, chronic illness and comorbidities, stress, diabetes, obesity, smoking, alcohol consumption, smoking and poor dietary intake.[11] Chronic wounds have varied aetiologies but tend to fall into well-established categories: venous leg ulcers (VLUs), pressure

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Table 1. The role of macrophages in the different wound-healing phases (adapted from Cutting, 2017)[19]

Phase	Cells involved	Function and activity
Haemostasis	Platelets	Clotting
Inflammation	Macrophages Neutrophils	Tissue macrophages ● Alarms and attracts neutrophils to wound bed ● Phagocytose debris ● Produce cytokines and growth factors
Proliferation	Macrophages Fibroblasts Myofibroblasts Keratinocytes	Macrophages ● Produce signal molecules for angiogenesis ● Activate fibroblasts to collagen production ● Attract and activate myofibroblasts for wound contraction ● Produce growth factors for cell proliferation
Remodelling	Fibroblasts Macrophages Fibrocytes	● Fibrocytes are 'clones' of macrophages and fibroblasts, aiding collagen-tissue modulation

ulcers (PUs), diabetic foot ulcers (DFUs) and arterial ulcers, although chronicity can also be attributed to those wounds within trauma, surgical and burn groups.[12] In the management of chronic wounds, King et al.[13] emphasise the key importance of identifying and addressing the underlying aetiology so that appropriate interventions can be delivered.

Bioactive soluble beta-glucan gel

BSBG is a wound healing product containing an ancillary medicinal substance—soluble beta-glucan (SBG). The active element of the product is the component SBG which activates macrophage functions within the wound tissues, alongside the ability to stimulate the immune system and activate white blood cells.[14] Macrophages are key players in wound healing, providing signalling molecules important for healing and orchestrating the wound-healing process.[15] Macrophages boost host defences, promote and resolve inflammation, remove dead cells, and support cell proliferation and tissue restoration after a wound occurs.[16] Across the phases of wound healing, the presence of active macrophages is therefore essential (Table 1).

The gel formulation offers hydrogel properties, at least 80% water content, ensures a moist wound healing environment which facilitates both hydration of necrotic tissue and supports autolysis.[13] It demonstrates a soothing and atraumatic application to the wound bed and facilitates contraction of the tissues within the wound healing process. The BSBG promotes wound healing, prevents excessive protease activity and activating macrophages to produce signal molecules and growth factors resulting in cell proliferation, angiogenesis and wound contraction.[4] In summary, enhanced cell proliferation and angiogenesis can be demonstrated through macrophages activation following BSBG applications

The product has a manufacturer's recommended initiation therapy time of four weeks alongside standard care when normal responses are not satisfactory. Directions for use (according to manufacturer's product instruction):

- Carry out full wound assessment which includes patient medical history, pharmacology history, wound assessment including previous treatment regimens
- Wound cleansing according to local policy/ guidelines/ practice
- Debride if appropriate
- Protect the wound edges, if applicable
- Cover the surface of the wound bed with a thin layer of BSBG
- Apply secondary dressing of choice and fixate (avoid superabsorbent dressings)
- Apply compression or offloading devices/dressings
- Apply BSBG at every dressing change—whether twice a week or once a week, for example, in leg compression
- Reassess after four weeks of BSBG treatment alongside holistic patient care or sooner as patient wound status and local guidelines dictate
- If no improvements in relation to cleaner wound bed, improved healthier wound tissue, reduction in wound size and wound depth, consider discontinuing product
- If improvements continue for a further four week period then stop and maintain usual standard of care
- If the wound healing stalls or plateaus start the above process again with a further four-week regimen
- If the wound deteriorates, patient develops any sensitivities to the product or any clinical concerns, discontinue the product and reassess
- NB—an increase in inflammation can be expected and should not be confused with infection markers, exudate levels may increase in the initial stages and to alter secondary dressings accordingly.

Precautions with product use include those wounds that are deemed clinically infected, positive wound swab via microbiology, but can be used with antimicrobial therapies and the effect of the product can be impaired if the patient is being managed with systemic steroid therapy or immune suppressive medication.

As a product to be used as an adjunct to standard care, BSBG is simple to use, requires little training, has no adverse effects to date, is accessible on local and National Formularies and is currently being used by wound experts, clinicians and patients.[18] However, it is not a replacement for or to be used as a delaying tactic when specialist referral is required to tissue viability, revascularisation, diabetes management, plastics and general surgery.

Evidence overview

There is a steady growth of level one evidence and data

outcomes emerging in regards to the benefits of using BSBG within chronic wounds. The work on diabetic foot ulcers (DFUs) by Zykova et al.[18] highlight positive outcomes in regards to wound healing in a detailed randomised, double blind, comparator-controlled clinical trial. The study revealed that 56% of wounds in the treatment group demonstrated full wound closure by week 12 compared with the control cohort of 37% within the same timeframe. Although not a randomised controlled trial, this retrospective comparative clinical evaluation has demonstrated equitable healing rates over a higher number of cohorts who received the BSBG gel which is encouraging.

Aim

The aim of this clinical observational evaluation was to record wound progress in a moderate sized cohort of participants with slow-to-heal or static chronic wounds who self-presented to their own General Practitioner (GP)surgery. The primary outcome assessed the ability of the BSBG gel to restart the wound healing process (measured as wound reduced surface area) and cost-effectiveness. Secondary outcomes related to pain reduction, slough and necrosis reduction, exudate reduction, and adverse events were also assessed.

Method

This evaluation was conducted in a community care setting in patients with wounds that had either become static, healing <40% in four weeks, or that were chronic, that is of >8 weeks duration. Inclusion and exclusion criteria was applied to all identified patients (Table 3). We recruited patients consecutively in July 2017, with data collection completed by February 2018. There were no drop outs from the study and all patients were included within the initial stages of the evaluation. This enabled six months' data collection from onset of treatment. Retrospective data of a similar cohort of patients using the same standard treatment identified from patient notes from the same care environment, meeting the same criteria, from exactly one year previous to the study timeframe to provide a 'picture' of traditional standard care outcomes.

The recruited cohort(s) were all verbally and electronically documented consented patients/carers who self-presented from 31 July 2017, aged ≥5 years, for all comorbidities, as per local policy. The recruitment target was 150 patients for each cohort. Each patient was given a coded number for ease of reference which would continue throughout all stages of the evaluation to ensure anonymity of patient identifiable data. Each patient in the BSBG cohort had a four-week data pre-day 0, received eight weeks' adjunct therapy, unless healed or stopped due to adverse events or withdrawal, and a total of six months' of follow-up data was collected. The control cohort was selected using an equivalent method, 150 consecutive patients with <40% wound healing over the previous four weeks within the matched period the previous year, and data collected for 12 weeks, and then up to 24 weeks, for a total of 30 weeks' of data for each patient including the four-week run-in period. Ethical approval was not required in clinical evaluation processes where standards of care were not affected and the patient's verbal/documented consent was obtained.

Patients received standard care and twice-weekly applications of BSBG for eight weeks or until healed under normal standard care environment and treatment, and once weekly in those patients who underwent 2- and 4-layer compression with weekly changes. Patients were continued on their pre-existing dressing regimen to minimise the possible influence of changes in dressing regimen. Changes in wound dressings required over the course of treatment were allowed as per standard wound care protocols (including an increase in dressing frequency should the wound require more frequent changes).

The primary endpoint was rate of wound healing, defined as the results of a Cox proportional hazards regression of time-to-wound healing, with data censored for loss of follow-up and remaining unhealed at 12 weeks, and controlling for known healing covariates such as patient age, wound persistency, baseline wound size, and wound type including separation of leg ulcers into a separate category for wounds with ischaemia in the affected limb (arterial leg ulcers). A total of six months' follow-up data has been achieved and secondary endpoints of pain level reduction and cost savings are touched upon in this paper.

Pain scores were monitored using the McGill Pain Questionnaire, which is part of normal practice, at each dressing change, post-dressing change, and patient satisfaction scores were on a Likert scale of 1–5 with '1' being the lowest level of satisfaction with the treatment and '5' being highest level of satisfaction with treatment.

Secondary outcomes such as slough and necrosis reduction, exudate reduction, the cost of nursing, cost

Table 2. Inclusion and exclusion criteria

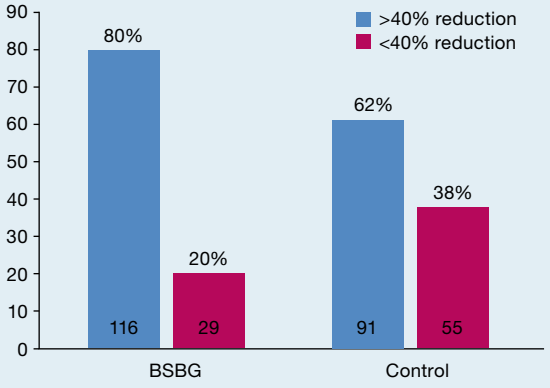
Inclusion criteria	Exclusion criteria
● Age five years and above	● Under five years of age
● No presence of infected tissue	● Diagnosis of infected wound
● No administration of antibiotic therapy	● Receiving antibiotic therapy for wound
● Wounds that have <40% wound reduction over a four-week period	● Wounds that have reduction in size over a four-week period
● Wounds deemed chronic, being present >8 weeks	● Wounds not deemed chronic, being present <8 weeks
● Patients/carers who can follow written/verbal information	● Patients/carers who cannot follow written/verbal information
● Patients/carers who give verbal consent	● Patient/carer declined verbal consent

Table 3. Baseline characteristics and wound aetiology

	BSBG group (n=150)	Standard care alone (n=150)	p-value
Age (years)			
Mean (range)	57 (7–98)	52 (6–96)	0.05
Gender			
Male, n (%)	71 (47%)	73 (49%)	
Female, n (%)	79 (53%)	77 (51%)	
Wound duration (months)			
Mean (range)	2.5 (1–6)	2.3 (1–6)	0.13
Median	1.8	2.1	
Wound size (cm^2)			
Mean (range)	31.4 (0.98–895)	23.9 (0.39–236)	0.27
Median	12.6	14.1	
Slough coverage			
Mean (range) %	10.9% (0–80%)	3.1% (0–60%)	<0.001
Wounds with slough (%)	70 (47%)	28 (19%)	
Wound pain (10cm VAS)			
Mean (range)	4.4 (0–10)	2.4 (0–10)	<0.001
Median	4	2	
Wounds with any pain (%)	126 (84%)	108 (72%)	
Wound aetiology			0.85*
Trauma	37	47	
Pressure ulcer	30	26	
Venous leg ulcer	21	23	
Diabetic foot ulcer	18	21	
Burn	15	11	
Postoperative	13	10	
Donor site	9	7	
Arterial leg ulcers	7	5	
	150	150	
Notable events up to week 12 (up to week 24)			Not tested
Deaths	4 (4)	11 (11)	–
Amputations	0 (0)	1 (1)	–
Patient weeks with infection	0 (0)	8 (8)	–
Loss of follow-up	2 (2)	0 (2)	–
Recurrences	0 (1)	0 (0)	–

Statistics are two-tailed t-tests unless specified; *Chi-squared test; BSBG—bioactive soluble beta-glucan gel; VAS—visual analogue score

Fig 2. Healing response rate by week four



BSBG—bioactive soluble beta-glucan gel

of dressings and other wound related consumables, costs of adjunct wound related procedures (i.e. surgical debridement, amputation) are not discussed in this paper.

Statistical analysis

To identify differences between groups, Chi-squared tests were used for group level (nominal) data and unpaired two-tailed t-test for numeric (parametric) values. Statistical significance was defined as $p<0.05$. No adjustment to required p-values were made for multiple statistical analysis. The primary outcome was defined as the results of a Cox proportional hazards regression of time-to-wound healing, with data censored for loss of follow-up and remaining unhealed at 12 weeks, while controlling for known healing covariates such as patient age, wound persistency, baseline wound size, healing trajectory (improving versus not improving wound size) and wound type (ulcer versus non-ulcer type wound). A planned analysis to 24 weeks is reported in this paper, providing a rich source of patient outcomes beyond the treatment phase.

Results

A total of 300 patients were included in this evaluation: 150 patients in the BSBG group (47% male, 53% female, mean age: 57 years) and 150 patients in the retrospective control group (49% male, 51% female, mean age: 52 years). Patients included during the observation window included a diversity of wound aetiologies with a mixture of long established wounds and increasingly over the recruitment period, wounds that had become chronic. The most common wound types were trauma (n=84), PU (n=56) and VLU (n=44). Patients were followed first for 12 weeks, and then for a further 12 weeks, for a total of 24 weeks, however, six patients in the BSBG group were lost during the follow-up period, and one patient had a wound recurrence three months after healing. On the control group, there were 13 patients who had a limb

Table 4. Cox proportional hazard regression results

	12 weeks			24 weeks		
	ß	95% CI	p	ß	95% CI	p
Group (relative rate with BSBG)	2.54	(1.89 to 3.42)	<0.001*	3.15	(2.37 to 4.20)	<0.001
Static or improving (if improving)	1.20	(1.03 to 1.40)	0.021	1.23	(1.06 to 1.43)	0.007
Persistency (per additional month)	0.779	(0.68-0.89)	<0.001	0.86	(0.77 to 0.96)	0.008
Age of patient (per additional year)	0.989	(0.98 to 1.00)	0.002	0.991	(0.99 to 1.00)	0.006
Size of wound (per additional cm^2)	0.986	(0.98 to 0.99)	<0.001	0.987	(0.98 to 0.99)	<0.001
Wound type (if ulcer type)	0.528	(0.43 to 0.65)	<0.001	0.490	(0.41 to 0.59)	<0.001

*Primary end-point (effect of 8 weeks BSBG treatment over 12 weeks); CI—confidence interval; BSBG—bioactive soluble beta-glucan gel

amputated or were lost by week 12 (six and 14 respectively over the extended 24-week follow-up). There were no recurrences in the control group. Chi-squared tests and t-tests identified no significant differences between the groups in the baseline characteristics of age, gender, wound type distribution, baseline wound size or pre-baseline wound duration. Wounds had been present for an average of 2.5 months (median: 1.8 months) in the BSBG group (maximum: six months), compared with 2.3 months (median: 2.1 months) in the control group (maximum: six months) (p=0.13). The average baseline wound size was larger in the BSBG group (31.4cm^2, range: 0.98–895cm^2) compared with the control group (23.9cm^2, range: 0.39–236cm^2), but this difference was not statistically significant (p=0.27). Median wound size was similar at 12.6cm^2 and 14.1cm^2, respectively (Table 4). However, both baseline pain scores and percentage slough coverage were significantly higher in the BSBG group than in the control group. Mean pain scores were 4.2 (median: 2) in the BSBG group and 2.4 (median: 2) in the control group (p<0.001), with 18 more wounds reported as resulting in pain in the BSBG group at baseline group compared with the control group. Mean slough coverage, defined as percent sloughy tissue, was 10.9% at baseline in the BSBG group and 3.1% in the control group (p<0.001), with 41 more wounds recorded with any slough at baseline in the control group (Table 4).

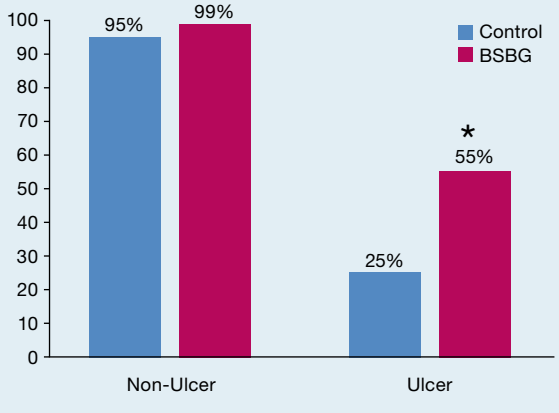
Wound healing

By 12 weeks, the primary end-point, 116/144 (81%) wounds had completely healed in the BSBG group versus 91/138 (66%) in the control group. Furthermore, there was a sustained difference in the rate of healing over the 24-week follow-up period, with 138/144 (96%) and 102/136 (75%) healing in the BSBG and control groups respectively. These percentages were for patients that completed follow-up and excluded patients who died, had amputation, or were lost to follow-up (Fig 1). Proportional hazards regression for time-to-healing over the first 12 weeks, controlling for baseline wound size, wound duration, patient age, healing trajectory, and ulcer wound type, showed a significant effect of BSBG group (p<0.001), with 2.54 (greater) weekly chance of healing, 95% confidence interval (CI): 1.89 to 3.42), with significant healing rate observed for patient age, baseline wound size, wound duration and ulcer type (Table 2). At 24 weeks data collection wound reduction was sustained with no deterioration, the increased probability of healing was sustained with a 3.15 (greater) weekly chance of healing (95% CI 2.37 to 4.20), despite BSBG only being administered over the first eight weeks (Table 5). The healing benefits were observed quickly, with a substantially higher proportion of wounds restored to normal healing rates, >40% wound size reduction over four weeks, in the BSBG group (80%) versus controls (62%). A significantly greater (p=0.02) mean wound size reduction from baseline was identified from two weeks after initiation with BSBG, with a mean reduction of –51% versus –38% in the control group (Fig 3).

Wound type subgroup analysis: ulcers

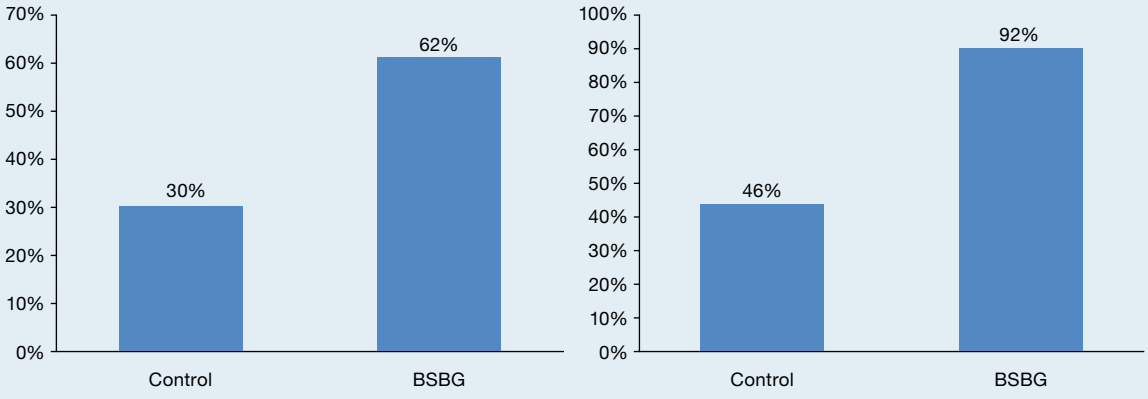
Fig 2. When grouping wounds into ulcer and non-ulcer, a clear difference is observed for ulcer type wounds as a group

Healing response by ulcer type: ≥40% wound size reduction at 4 weeks



*p<0.001; BSBG—bioactive soluble beta-glucan gel

Fig 3. When evaluating outcomes for ulcer type (arterial leg ulcers, venous leg ulcers, diabetic foot ulcers, and pressure ulcers) wounds only, there is a healing benefit from BSBG treatment. Percent healed at 12 weeks (**a**) and percent healed at 24 weeks (**b**)



BSBG—bioactive soluble beta-glucan gel

Chronic ulcers (arterial leg ulcers, VLUs, DFUs, and PUs) were assessed as a planned subgroup analysis and this was identified as a significant predictor of wound healing in the proportional hazards regression analysis, p<0.001, with the chronic ulcers having a substantially lower healing rate compared with chronic non-ulcer wounds (trauma wounds, burns, postoperative wounds and donor site wounds). There was a substantial effect of BSBG adjunct treatment for the ulcer type wounds, mean=5.80 (95% CI: 3.18 to 10.6) over the 12-week primary end-point evaluation period, and mean=3.29 (CI: 2.48 to 4.37) over the complete 24-week extended

Table 5. Healing outcomes with ulcer type (arterial leg ulcers, venous leg ulcers, diabetic foot ulcers, and pressure ulcers) wounds

	12 weeks			24 weeks		
	BSBG	**Control**		**BSBG**	**Control**	
Healing response rate			Difference			Difference
>40% reduction by week 4	80%	62%	**18%*** **	60%	27%	**33%*** **
	(116/145)	(91/146)		(43/72)	(19/71)	
Size reduction versus baseline†						
Week 1	–25%	–19%	**–6%**	–8%	–2%	**–5%**
Week 2	–51%	–38%	**–13%****	–25%	–10%	**–15%****
Week 3	–69%	–51%	**–18%*** **	–46%	–16%	**–30%*** **
Week 4	–79%	–59%	**–21%*** **	–61%	–20%	**–41%*** **
Wounds healed, by week, %†						
Week 4	49%	35%	**14%****	19%	15%	**4%**
Week 8	80%	66%	**14%*** **	61%	30%	**31%*** **
Week 12	81%	66%	**15%*** **	62%	30%	**32%*** **
Week 16	88%	68%	**20%*** **	77%	31%	**46%*** **
Week 20	95%	70%	**25%*** **	90%	34%	**56%*** **
Week 24	96%	75%	**21%*** **	92%	46%	**46%*** **

*Statistically significant p<0.1, **p<0.05, ***p<0.01;†Per cent for wounds with follow-up to that week or longer;
BSBG—bioactive soluble beta-glucan gel

follow-up period (both p<0.001). Correspondingly wound healing response rate and mean rate of wound size reduction over time were also accentuated in chronic ulcer wounds only versus all chronic wounds, with significantly greater differences in healing response rate +33% (p=0.001), significantly greater mean wound size reduction from the second week of 15% (p=0.04), and 56% more wounds healed by week 20 (p<0.001) (Table 6).

Secondary outcomes discussion

No significant difference was observed in the need for wound debridement, with just one patient requiring wound debridement (in the control group), and with pain and wound slough levels improved in line with the observed wound healing benefit. By week four the mean slough coverage (and the proportion of wounds with any slough) in the BSBG group was 1% (2%) versus 3% (13%) in the control group. Mean pain scores (and the percentage of patients with any pain) were 0.6% (21%) and 1.0% (21%) in the BSBG group and control group respectively, p=0.09 (p=0.01), by week four, despite higher mean pains scores and more patients reporting pain in the BSBG group at baseline.

Overall patient satisfaction and stated ease of use was very high for the BSBG group, with a mean treatment satisfaction of 8.9 and 9.6 for ease of use (maximum score of 10) at the end of their treatment period (most patients required <8 weeks treatment), relative to a mean treatment satisfaction of 7.6 before BSBG was introduced, a significant improvement in mean satisfaction (p<0.001). Treatment satisfaction and ease of use was not recorded within the retrospective control group.

Discussion

The wound healing results of this clinical evaluation support the work of other key authors who have used BSBG as an adjunct to normal standards of wound care, which is reassuring. Published results of BSBG as an adjunct to standard care for DFU in a randomised, double-blind comparator-controlled clinical trial demonstrated that 56% (15/27) of treated wounds fully healed by week 12, compared to 37% (11/30) that received standard care, (p=0.094).[18] A more recent clinical evaluation of BSBG by King et al. on various aetiologies of wound groups, 39 patients recruited with 26 going on to full treatment completion.[13] Of these 26 patients, at 12 weeks, 7/26 wounds fully healed with an additional 8/26 demonstrating a 50% reduction in wound size. At 12-week study closure only six patients had no progression. The authors acknowledge that the results of a six-month follow-up, as well as further work over a longer period of time, may enrich the data further.

Limitations/adverse events

The cohort group represented a moderate sample who self-presented with slow-to-heal or static chronic wounds within a community setting. Although clear benefits of an eight-week treatment and six-month follow-up period of BSBG application to a wide range of wound groups has been achieved, the product's effects within acute wounds, within acute care setting and the population under the age of five has not been addressed. Due to the product contraindications within infected wounds, this also omits a patient group which is frequently presented with slow-to-heal and chronic wounds. Further work in this area is recommended.

The evaluation has, however, included patients of a wide age range and various typical slow-to-heal or static chronic wound groups. The data was collected and cross-checked by the author to maintain consistency with analysis.

Conclusion

Slow-to-heal, static chronic wounds across all aspects of health-care will continue to be a challenge, particularly in the current health-care climate where care provision alongside tight financial constraints is the norm. The fundamental management of all wounds requires timely assessment, management, evaluation and review, with specialist referral when standard conservative management is not aiding the wound healing process. This moderate patient-treatment evaluation has demonstrated positive outcomes in wound reduction, improving not only patient quality of wound care provision but also demonstrating a much-needed financial saving in this patient group across a community setting. The retrospective group analysis aids in the 'full picture' of normal practice and resulting outcomes with similar patient groups and environment. The use of innovative products such as BSBG therapy alongside robust patient and carer education models and evidenced-based care packages are important in ensuring that care is provided at the right time for the right patient with the best outcomes achieved. Ongoing evaluative clinical exploration, research and publication are therefore recommended in regard to the use of BSBG to further expand our current toolbox of wound care. JWC

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References

1 While A. Rising health-care costs within limited resources, Br J Community Nurs. 2015; 20(6):310. https://doi.org/10.12968/bjcn.2015.20.6.310

2 Gray D, White R, Cooper P et al. Understanding Applied Wound Management, Wounds UK 2009 1(1):62–68

3 Bateman S. Use of topical haemoglobin on sloughy wounds in the community setting. Br J Community Nurs 2015; Suppl Wound Care:S32, S34-9. https://doi.org/10.12968/bjcn.2015.20.Sup9.S32

4 Skjaeveland I, Engstad RE. Can the activation of the body's own key cells in wound healing, wound macrophages, make a positive contribution in the treatment of chronic wounds? Sar 2013; 21(4):5–7. https://tinyurl.com/ycav48mk (accessed 20 August 2018)

5 Posnett J, Gottrup F, Lundgren H, Saal G. The resourse impact of wounds on health-care providers in Europe. J Wound Care 2009; 18(4):154-161

6 Grothier, L. Three goals; deslough, manage exudate and promote

healing. Clinical benefits of Urgoclean. Br J Nursing 2016; 25(20 suppl 2): S1-S32
7 Guest JF, Ayoub N, McIlwraith T et al. Health economic burden that wounds impose on the NHS in the UK. BMJ Open 2015; 5(12):e009283 http://tinyurl.com/j3q8hzg (accessed 20 August 2018)
8 Guo S, DiPietro LA. Factors affecting wound healing. J Dent Res 2010; 89(3):219–229. https://doi.org/10.1177/0022034509359125
9 Chadwick P, McCardle J, Mohamud L et al. Appropriate use of topical haemoglobin in chroni wound management: consensus recommendations. Wounds UK/EWMA special 2015; 11(5):1–4
10 Steed DL, Attinger C, Colaizzi T et al. Guidelines for the treatment of diabetic ulcers. Wound Repair Regen 2006; 14(6):680–692. https://doi.org/10.1111/j.1524-475X.2006.00176.x
11 Hunt SD, Elg F. The clinical effectiveness of haemoglobin spray (Granulox) as adjunctive therapy in the treatment of chronic diabetic foot ulcers. Diabet Foot Ankle 2016; 7(7):33101. https://doi.org/ 10.3402/dfa.v7.33101
12 Markova A, Mostow E et al. US skin disease assessment: ulcer andwound care, Dermatol Clin 2012; 30(1):107–111, https://doi.org/10.1016/j.det.201.08.005
13 King, B, Barrett, S, Cutting, KF. Clinical evaluation of a bioactive beta-glucan gel in the treatment of 'hard to heal' wounds. J Wound Care 2017; 26(2):58–63. https://doi.org/10.12968/jowc.2017.26.2.58
14 Raa, J. Immune modulation by non-digestible and non-absorbable beta-1,3/1,6-glucan. Microbial Ecol Health Dis 2015; 26. https://doi.org/10.3402/mehd.v26.27824
15 Brancato SK, Albina JE. Wound macrophages as key regulators of repair origin, phenotype, and function. Am J Pathol 2011; 178(1):19–25. https://doi.org/10.1016/j.ajpath.2010.08.003
16 Koh TJ, DiPietro LA. Inflammation and wound healing: the role of themacrophage. Expert Rev Mol Med 2011; 13:e23. https://doi.org/10.1017/S1462399411001943
17 Hunt SD. Topical oxygen-haemoglobin use on sloughy wounds: positive patient outcomes and the promotion of self-care. Wounds UK 2015; 11(4):74-81
18 Zykova SN, Balandina KA, Vorokhobina NV et al. Macrophage stimulating agent soluble yeast β-1, 3/1,6-glucan as a topical treatment of diabetic foot and leg ulcers: a randomized, double blind, placebo-controlled phase II study. J Diabetes Investig 2014; 5(4):392–399. https://doi.org/10.1111/jdi.12165
19 Cutting KF. The nature of beta glucans and the role in wound care of a novel bioactive beta glucan gel. Woulgan 2017; Poster. https://tinyurl.com/y7puaxbo (accessed 20 August 2018)