

# Comparative effects of honey based and silver/charcoal based dressings on the healing of venous leg ulcers

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Infections, biofilms and critical colonization are frequently observed in venous ulcers. Silver and charcoal are used to control bacterial colonization, whereas honey dressings are useful for cleaning and healing owing to their antioxidant and antibacterial properties. Matrix metalloproteinases are often found in excess in chronic wounds, which can be regulated with polyhydrated ionogens. This clinical study included 60 patients whose ulcers stopped healing, were at risk of infection, with foul odor or discoloration of granulation tissue. One group was treated with honey based dressing (HBD, MelMax™) and the other group with silver/charcoal based dressing (S/CD, Actisorb silver™). Plotting the measured wound areas in both groups during the trial revealed significant differences in the effects of both dressings. In HBD group, ulcer size was reduced by a mean of 36.7% in 44 days on average. In contrast, in S/CD group, ulcer size stagnated with a mean 2.8% decrease in 42 days on average. These data clearly show that honey based dressings are best for chronic wounds that are critically colonized, infected or lined with different biofilms. They benefit from faster cleaning and healing; in addition, these patients need less additional systemic antibiotics.

**KEY WORDS:** honey based dressing, silver/charcoal based dressing, venous leg ulcers

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## INTRODUCTION

Infections, biofilms and critical colonization present great problem to the practitioners who are daily in contact with venous leg ulcers. Not only does wound infection determine wound healing itself, but also influences the balance between certain matrix metalloproteinases (MMPs) and production of reactive oxygen species (ROS). Such ulcers do not tend to heal and therefore need special treatment. In medicine, silver and charcoal, widely used to control bacterial colonization, have known antibacterial properties. In addition, phenolic acid rich honey together with synthetic blend of metal ions is efficient for cleaning and healing of the wounds *via* their antioxidant properties and ability to restore the balance between MMPs and tissue inhibitors of metalloproteinases (TIMPs) (1).

## POSITIVE EFFECTS OF HONEY AND METAL IONS

The HBD (MelMax™, Dermagenics), a sterile acetate mesh for wounds, was used in a clinical trial. It is imbedded by preparation of purified buckwheat honey in 75% and the rest of 25% is made of polyhydrated ionogens (PHI-5), a diverse synthetic mixture of metal ions, such as Cu, Fe, Mg, Ca and Zn, citric acid and polyethylene glycol. Metal ions of the dressing influence the healing metabolism processes of chronic wounds, while citric acid controls the environment pH. After HBD application, PHI-5 and honey are released into the wound bed.

Besides infections and bacterial colonization of chronic wounds, the healing process may also be disturbed by a higher amount of certain MMPs or lower concentration of their TIMPs. In addition, ROS, hydrogen perox-

ide and HCl can directly damage the cells and therefore also lower the healing rate.

Adequate amounts of MMPs are essential for epidermal growth and in chronic wounds they can be in excess. It has been established that PHI-5 with its ability to lower MMP-2 concentrations, ROS production and complement activity normalizes the microenvironment and therefore not only reduces inflammation but also accelerates epithelialization. Containing many phenols, honey acts as an antioxidant by activating granulocytes and lowering the complement cascade reaction. It also has an antibacterial function due to the great amount of free fatty acids, which is further stimulated by acidic pH (2-7).

### LINKING DIFFERENT ANTIBACTERIAL DRESSINGS WITH THE USE OF SYSTEMIC ANTIBIOTICS

Sixty patients (average age 74 years) with 60 venous leg ulcers were included in this clinical study. Severe diseases like insulin-dependent diabetes mellitus, rheumatoid arthritis, uncontrollable hypertension, cardiac decompensation, carcinoma and immobility were the exclusion criteria.

Ulcers were chosen by certain characteristics, e.g., not only having ankle brachial pressure index higher than 0.8 plus staging as B or C class by Falanga classification (Tables 1 and 2), but also having one of the follow-

ing: delayed or stopped healing, risk of infection, and foul odor or discoloration of granulation tissue. Then they were randomly allocated to one of two groups: group 1 (average age 72) treated with honey based dressing (MelMax™) and group 2 treated with silver/charcoal based dressing (Actisorb silver™, Johnson & Johnson), which also possesses antibacterial properties and high absorptive capacity. In addition, compression with long-stretch bandages was used in all patients from both groups. The mean duration of ulcer before the study was 27 months in group 1 and 38 months in group 2 (8,9).

At the beginning of the study, ulcer areas were drawn into the respective film dressings and precisely measured with a digital planimeter (Placom KP-90N, Japan); it was also repeated later. Dressings were changed when clinically needed and patients were observed for 6 weeks or less, if the ulcers healed in the meantime.

Because of the possible risk of systemic infection, one swab from the wound bed was taken in 15 patients, including nine group 1 and six group 2 patients. After one week of therapy, additional systemic antibiotic therapy was required by only one group 1 patient treated with honey based dressing, as compared with all group 2 patients treated with silver/charcoal based dressing (Fig. 1). Plotting the measured wound area at the beginning and at the end of the study revealed significant differences in the effects of the two dressings (Fig. 2). As for the size of ulcers in HBD group, they showed great reduction from the mean of 28 cm<sup>2</sup> (min 1 cm<sup>2</sup>, max 133 cm<sup>2</sup>) to 17 cm<sup>2</sup> (min 0 cm<sup>2</sup>, max 72 cm<sup>2</sup>), yielding the impressive percentage result of 36.7% in the mean duration of treatment of 44 days. In contrast, in the S/CD group they showed stagnation with little or no improvement over time (mean duration of therapy was 42 days) from the initial mean size of 16 cm<sup>2</sup> (min 1 cm<sup>2</sup>, max 74 cm<sup>2</sup>) to the eventual 15 cm<sup>2</sup> (min 1 cm<sup>2</sup>, max 70 cm<sup>2</sup>), yielding a merely 2.8% decrease in ulcer area (Fig. 3).

This is even more impressive given the fact that at the start of observation, the wounds to be treated with HBD were on average 44% larger (Fig. 4).

Observing each individual patient, the relative change between the beginning and the end of the study is obvious. Despite worsening of some ulcers, indicated as an increase in wound area over 100, the vast majority improved. Astonishingly, one ulcer showed complete recovery.

Table 1. Patient characteristics

		AS - Actisorb	MM - MelMax
Gender (M/F)	Male %	27%	23%
	Female %	73%	77%
Patient age (yrs)	Minimum	53	48
	Maximum	89	83
	Mean	76	72
	Median	78	73
Wound onset (months)	Minimum	3	1
	Maximum	144	80
	Mean	38	27
	Median	21	18
Duration of treatment (days)	Minimum	37	16
	Maximum	51	70
	Mean	42	44
	Median	42	44
Number of patients at start	Count	30	30

Table 2. Falanga classification of wound bed

Color				Exudates	
	Granulation tissue	Fibrin	Necroses		Controlled/dressing changing once per week
A	100%	-	-	1	
B	50%-100%	+	-		
C	50%	+	-	2	Part controlled/dressings changing every 2-3 days
D	+/-	+	+	3	Uncontrolled/dressings changing daily

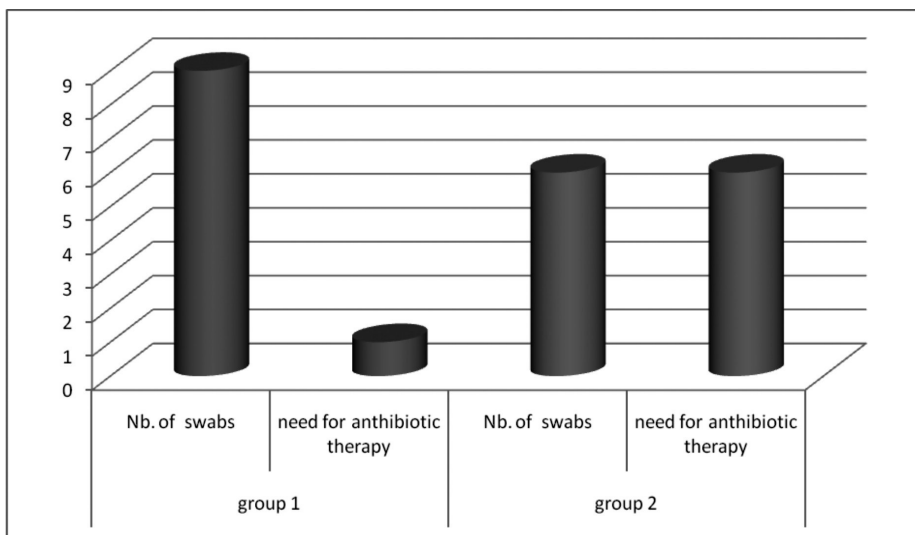


Fig. 1. Requirement of antibiotic therapy in both groups.

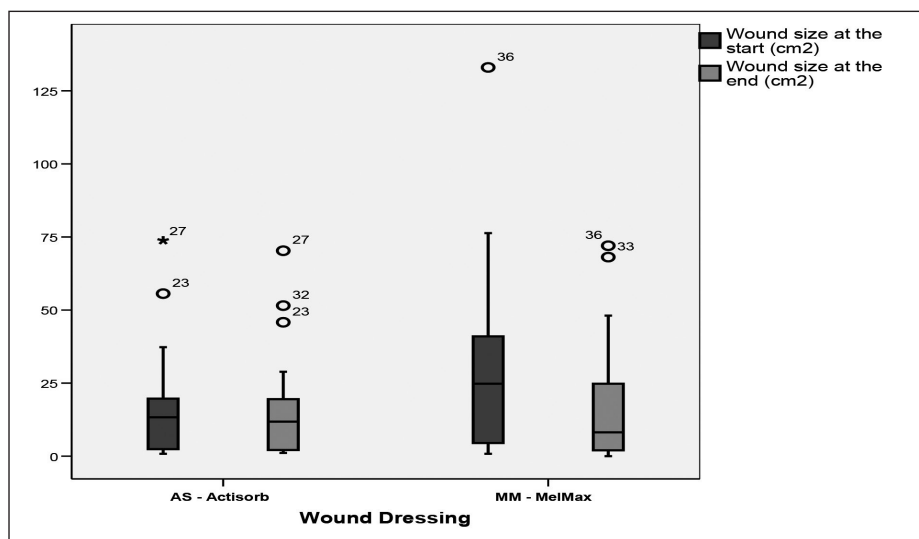


Fig. 2. Differences in wound size for both dressings at the start and at the end of the study.

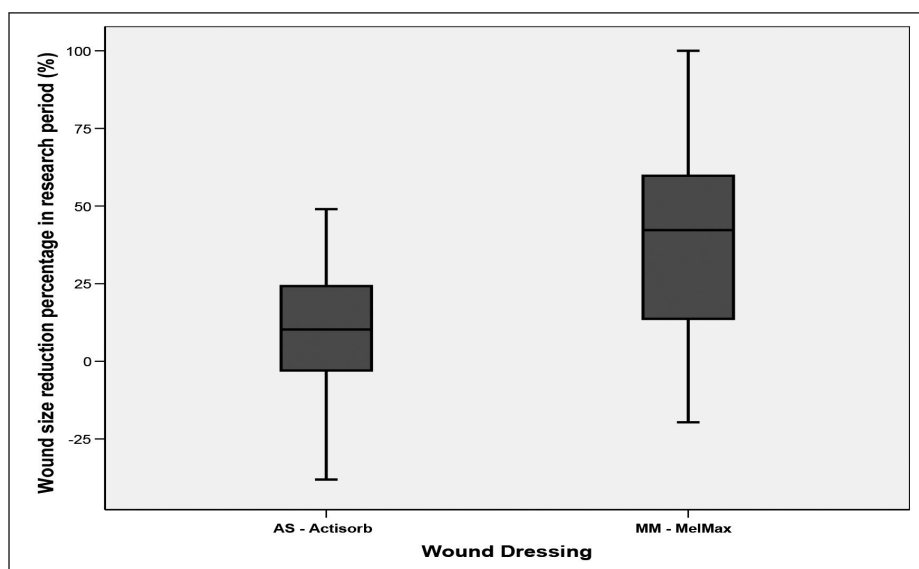


Fig. 3. Wound size reduction with both dressings in percentage during the study.

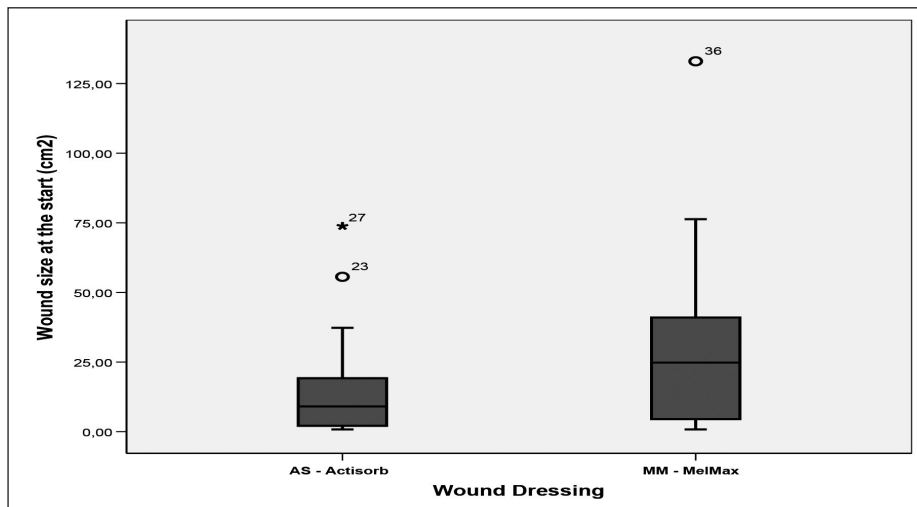


Fig. 4. Differences in wound size in both groups.

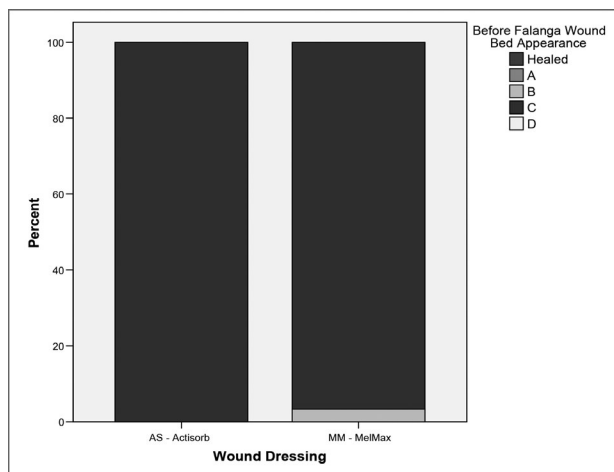


Fig. 5. Wound beds before the study.

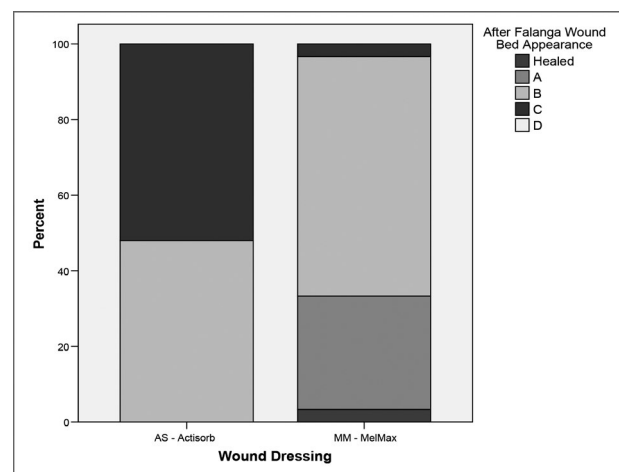


Fig. 6. Wound beds at the end of the study, showing better progress in HBD group.

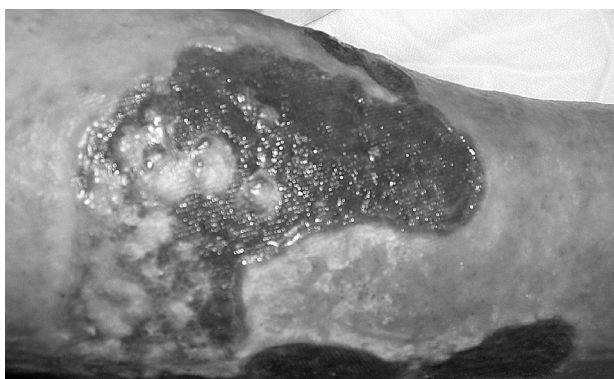


Fig. 7. Patient no. 1 before the study.

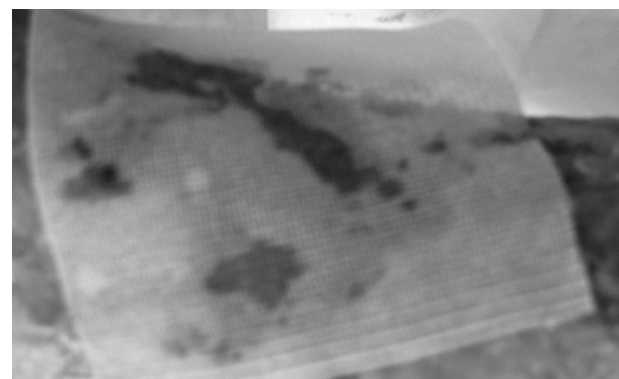


Fig. 8. Patient no. 1 during the application of HBD.

By Falanga classifications were at the beginning and at the end estimated wound beds of all ulcers in both patient groups. Figs 5 and 6 show differences and progress during the study, which was obviously better in HBD group.

The progress in healing is best illustrated in the figures below, showing just one of the HBD group patients (Figs 7-9).

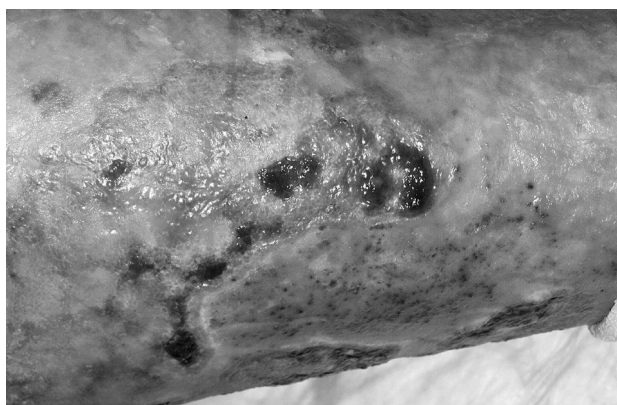


Fig. 9. Patient no. 1 at the end of the study.

## CONCLUSION

Concurrent with the decrease in wound area and the degree of ulcer inflammation, the level of wound exudate declined. The results presented clearly show that honey based dressings such as HBD are very appropriate for chronic wounds, which are critically colonized, infected or lined with different biofilms. Not only they show faster cleaning and healing than ulcers treated with silver/charcoal based dressings such as S/CD, but also patients treated with them need less additional systemic antibiotics.

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## SAŽETAK

### KOMPARATIVNI UČINCI OBLOGA TEMELJENIH NA MEDU I NA SREBRU/UGLJENU U LIJEČENJU VENSkih VRIJEDOVA NOGU

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Kod venskih vrijedova se često opažaju infekcije, biofilmovi i kritične kolonizacije. Za suzbijanje bakterijske kolonizacije koriste se srebro i ugljen, dok su obloge s medom namijenjene čišćenju i zacjeljivanju, jer imaju antioksidantno i antibakterijsko djelovanje. U kroničnim ranama se često nađu u prekomjernoj količini matriks metaloproteinaze, što se može regulirati polihidriranim jonogenima. U ovo kliničko istraživanje bilo je uključeno 60 pacijenata čiji su vrijedovi prestali zacjeljivati pa su bili u riziku od infekcije s granulacijskim tkivo neugodnog vonja i diskoloracije. Jedna je skupina liječena oblogama na temelju meda – HBD (Melmax™), a druga oblogama na temelju srebra/ugljena – S/CD (Antisorb silver™). Usporedbom mjerenja područja vrijeda obih skupina tijekom istraživanja ukazalo se na značajne razlike učinaka između obloga. Veličina vrijedova u skupini HBD smanjila se na 36,7 % u srednjem trajanju liječenja od 44 dana. Za razliku od toga vrijedovi skupine S/CD ostali su isti s malim poboljšanjem od 2,8 % smanjenja područja u prosjeku od 42 dana. To je očiti prikaz da su obloge na temelju meda najbolje za kronične rane koje su kritički kolonizirane, inficirane ili pokrivene različitim biofilmovima. One su korisne zbog bržeg čišćenja i zaraštavanja, a osim toga pacijenti trebaju manje dodatnih sistemskih antibiotika

**KLJUČNE RIJEČI:** obloge na temelju meda, obloge na temelju srebra/ugljena, zacjeljivanje kroničnog vrijeda