

## Cold plasma "Wound-Sanitizer" – in use observation pilot case study

### Goal:

The recognition of the spectrum of action of the "Wound Sanitizer" in the routine treatment of chronic and secondary healing wound patients. Reactions to inflammation and infection, as well as healing tendencies in terms of granulation and epithelialization. Likewise, changes in the wound environment in the range of the pH value.

### Inclusion criteria:

- Wounds of any genesis with a previous frustrating local therapy over 2 months.
- Secondary wounds that are difficult to heal
- Inflammation and local infections

### Exclusion criteria:

- Antibiotic the last 2 weeks before starting treatment with the "Wound Sanitizer".
- Dry, black necrosis
- Allergies and/or intolerances to local therapy with the "Wound – Sanitizer"

### Procedure:

- Cleaning the wound through a wet phase with a wound irrigation solution
- Application of the plasma-enriched aerosol over 3 minutes
- Covering the wound with a non-active wound dressing (spacer grid)
- Secondary dressing with non-active foam or suction compress.

### Duration of observation:

- 4 weeks
- Visual documentation at the beginning and 1x weekly
- Treatment with "Wound – Sanitizer" 2x weekly

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**Case 1:**

Diagnosis: Ulc. Crur. Ven.  
Gender: female  
Localization: Ankle outside li  
Duration: 14 weeks

**Day 0:**



Exudate: moderate  
Wound base: no epithelialization, granulation, slight plaque  
Infection: no local signs of infection  
Depth: superficial  
Area: Environment dry, scaly, slightly reddened

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**Case 1**

**Day 7**



Exudate:	moderate
Wound base:	already onset of epithelialization, granulation, slight plaque
Infection:	no local signs of infection
Depth:	superficial
Area:	Environment slightly reddened

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**Case 1**  
**Day 14**



Exudate:	little
Wound base:	mostly epithelial
Infection:	no local signs of infection
Depth:	superficial
Area:	slightly reddened

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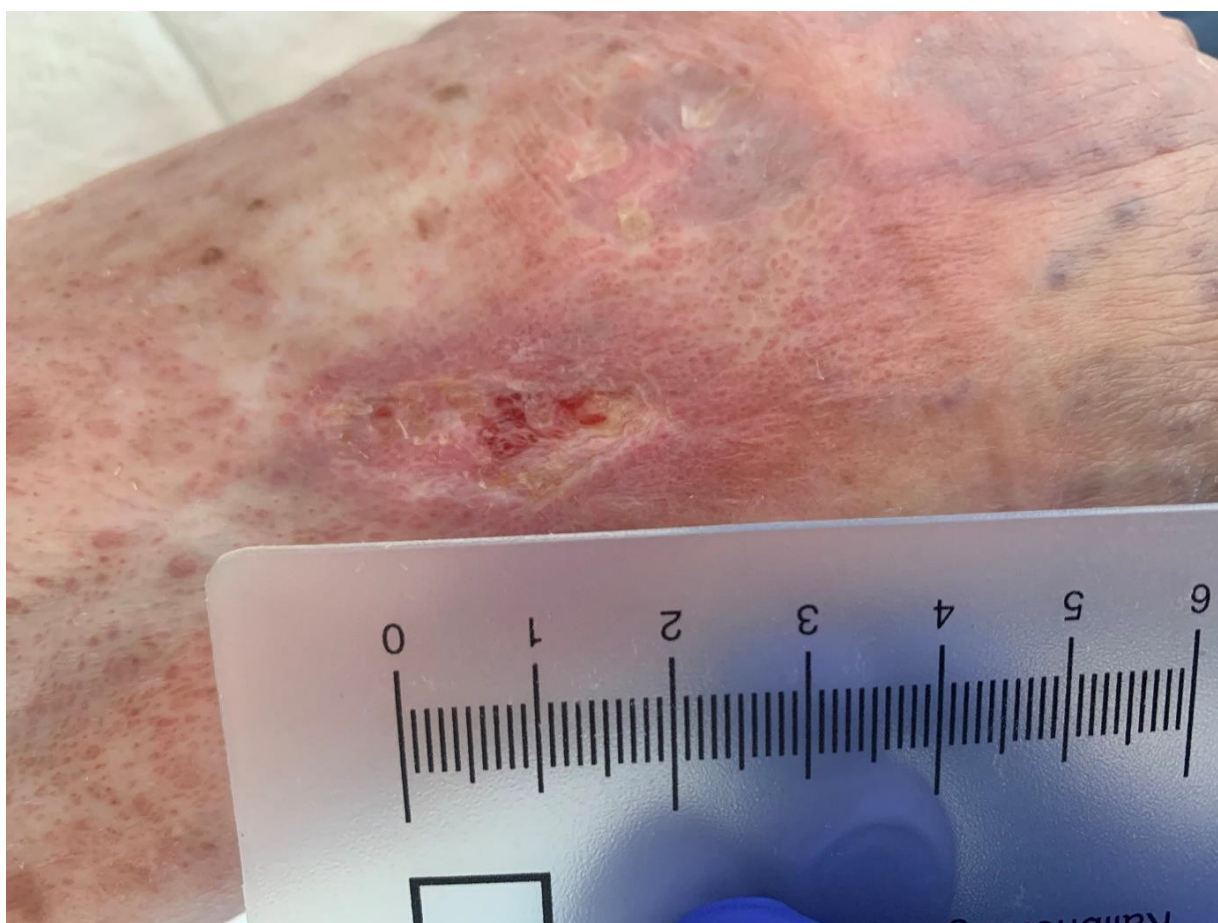
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**Case 1**  
**Day 21**



Exudate:	little
Wound base:	almost complete epithelialization, little plaque
Infection:	no local signs of infection
Depth:	superficial
Area:	slightly reddened

**Case 1**  
**Day 28**



Exudation: little  
Wound base: almost completely healed  
Infection: no local signs of infection  
Depth: superficial  
Area: no special features

**Summary:**

Since the beginning of local therapy with the "Wound – Sanitizer", increasing epithelialization and decrease of fibrin deposits. Due to the rapid reduction of the wound area, there was also a decrease in the amount of wound exudate.

The patient did not report a negative feeling about the therapy.

Within the observation period of 4 weeks, almost complete wound closure occurred.

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**Case 2:**

Diagnosis: times perf. Plant., DM II

Gender: male

Localization: Foot plantar left

Duration: 17 weeks

**Day 0**



Exudate: a lot  
Wound base: granulation, wound pocket after distal  
Infection: slight redness after distal and proximal  
Depth: wound pocket about 2 cm  
Area: wound edge macerated; area slightly keratinized

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**Case 2**

**Day 7**



Exudation: moderate  
Wound base: granulation and incipient epithelialization  
infection: no local signs of infection  
Depth: Wound pocket after distal about 1 cm  
Area: Wound edge slightly macerated, wound area slightly keratinized



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**Fall2**

**Day**

**14**



Exudation:	little
Wound base:	large-scale epithelialization, granulation
Infection:	no local signs of infection
Depth:	no wound pockets, superficial
Area:	Wound area slightly keratinized

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**Case 2**  
**Day 21**



Exudation: little  
Wound base: large-scale epithelization, granulation  
Infection: no local signs of infection  
Depth: superficial  
Area: Wound area slightly keratinized

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**Case 2**  
**Day 28**



Exudate: none  
Wound base: complete epithelial  
Infection: no local signs of infection  
Depth: -  
Area: slightly keratinized

**Summary:**

The patient came forward after a long frustrating treatment by the MVZ with the recommendation of amputation of the 5th toe strand. Already after a short time with the treatment with the "Wound – Sanitizer" a positive progression of the course of wound healing. The wound pocket was closed after 2 weeks, so that after 4 weeks a complete wound closure had to be detected.

Further therapy recommendation: regular podiatric treatment and adequate footwear.

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**Case 3**

Diagnosis: P.S. Healing after bypass

Gender: Male

Localization: Tibia left

Duration: 14 weeks

**Day: 0**



Exudate: a lot  
Wound base: mostly occupied, granulation, fatty tissue  
Infection: slightly reddened, a lot of exudate (bloody, greenish)  
Depth: wound pocket after proximal  
Area: no specialties

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**Fall3**  
**Day 7**



Exudation: moderate  
Wound base: fibrin coating, granulation  
Infection: slight redness  
Depth: no more wound pocket  
Area: no specialties

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**Case 3**  
**Day 14**



Exudation:	moderate
Wound base:	decrease in fibrin, granulation
Infection:	slightly reddened
Depth:	superficial
Area:	slightly reddened

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**Case 3**  
**Day 21**



Exudation: little  
Wound base: epithelialization and granulation  
Infection: no local signs of infection  
Depth: superficial  
Area: no specialties

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**Case 3**  
**Day 28**



Exudate: little  
Wound base: epithelialization  
Infection: no local infection signs  
Depth: superficial  
Area: no special features

**Summary:**

Deep wound healing per sekundam with a lot of greenish exudate in the sense of infection with Gram bacteria. After treatment with the "Wound-Sanitizer" there was a rapid decrease in the amount of exudate. Exudate color bloody, serous after 2x treatment. Subsequently, there was a rapid onset of epithelialization and granulation. On the last day of the observation period, there was an almost complete wound closure with beautiful scarring.



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**Case 4**

Diagnosis: Z.n. Amputation

Gender: male

Localization: Dig V plans right

Duration: 3 weeks

**Day 0**



Exudate: moderate

Wound base: fibrin coating, granulation

Infection: no local signs of infection

Depth: superficial

Area: no specialties

**Case 4**

**Day 7**



Exudate: moderate  
Wound base: fibrin coating, granulation, slight epithelialization from the edge of the wound  
Infection: no local signs of infection  
Depth: superficial  
Area: no specialties

**Case 4**

**Day**

**14**



Exudate: moderate  
Wound base: fibrin coating, granulation, epithelialization  
infection: no local signs of infection  
Depth: superficial  
Area: no specialties

**Case 4**

**Day 21**



Exudate: moderate  
Wound base: fibrin coating, granulation, increase in epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: no specialties

**Case 4**

**Day 28**



Exudate: moderate  
Wound base: decrease in fibrin coating, granulation, increase in epithelialization  
infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Summary:**

Amputation due to vascular occlusion. After revascularization and amputation of the 5th toe, local therapy with the "Wound – Sanitizer". Already after a very short time reduction of the wound area and increase in epithelialization.

Additional therapy: pressure relief through adequate footwear.

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**Case 5**

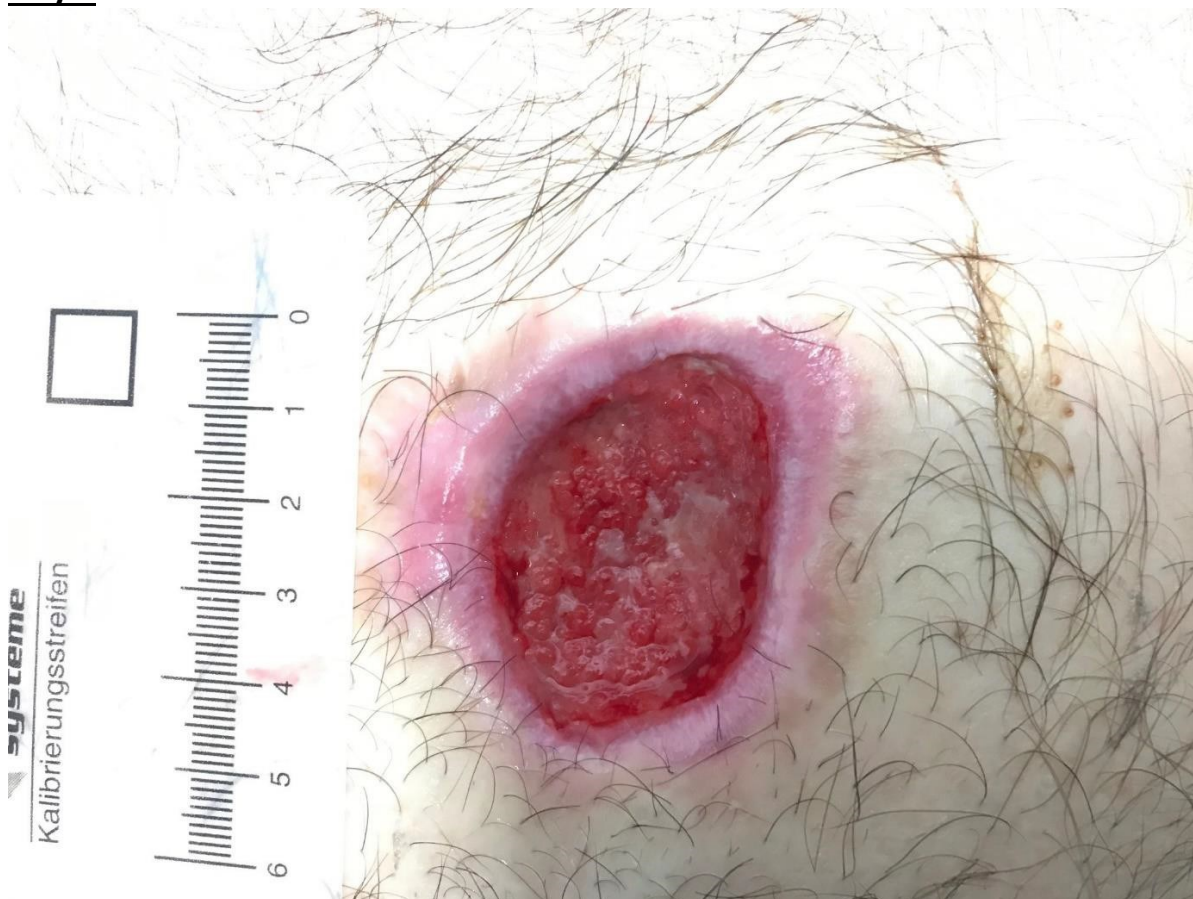
Diagnosis: Traumatic due to self-harm

Gender: Male

Localization: Abdomen

Duration: 3 weeks

**Day 0**



Exudate: a lot  
Wound ground: granulation  
Infection: Gram – rod  
Depth: 1 cm  
Area: without specialties

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**Case 5**

**Day 7**



Exudate: moderate  
Wound base: granulation, incipient epithelialization  
infection: smear negative, no local signs of infection  
depth: 0.5 cm  
Area: without specialties

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**Case 5**  
**Day 14**



Exudate: moderate  
Wound base: granulation, progressive epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without special features



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**Case 5**

**Day 21**



Exudate: moderate  
Wound base: granulation, increasing epithelialization, wound area significantly smaller  
infection: no local signs of infection  
Depth: superficial  
Area: without specialties

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**Case 5**

**Day 28**



Exudate: little  
Wound base: granulation, increasing epithelialization, wound area significantly smaller  
Infection: no local signs of infection  
Depth: superficial  
Area: without special features

**Summary:**

Pat with self-injury with scissors. Wound initially strongly exuding, greenish exudate, no healing tendency by treatment by the family doctor.

Rapid decrease in microbial load after 2 treatments with the "Wound – Sanitizer". Conspicuously rapid epithelialization from the edge of the wound

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**Case 6**

Diagnosis: Metal removal after implant infection

Gender: Male

Localization: inner ankle left

duration: 4 weeks

**Day 0**



Exudate: A lot

Wound base: plaque

Infection: Redness, pain, smear: staphylococci, streptococci

Depth: 2 cm

Area: weeping, inflammatory, eczematous

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**Case 6**

**Day 1**



Exudate: moderate

Wound base: occupied, granulation

Infection: slight redness at the edge of the wound

Depth: 2 cm

Area: significant improvement of the skin condition

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**Case 6**

**Day 2**



Exudate: moderate  
Wound base: granulation  
Infection: no local infection signs  
Depth: 2 cm  
Area: significant improvement

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**Case 6**

**Day 3**



Exudate: moderate  
Wound base: granulation  
Infection: no local signs of infection  
Depth: 1.5 cm  
Area: significant improvement

**Summary:**

Pat after metal removal in case of infection of the implant. Wound environment clearly affected. Strongly weeping, eczematous, reddened. Special attention to the course of the skin situation through the application of "Wound – Sanitizer". Already on the following day significant improvement of the skin condition, without the use of additional steroid-containing topicals.

After 3 days of use with cold plasma almost normal skin condition.

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**Case 7**

Diagnosis: Diabetic ulcer

Gender: Male

Localization: Big toe

Duration: 5 weeks

**Day 0**



Exudate: moderate

Wound base: fibrin coating, granulation

Infection: redness

Depth: superficial

Area: Wound edge slightly macerated, wound environment partly scaly, dry, keratinized

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**Case 7**

**Day 7**



Exudate: moderate  
Wound base: slightly occupied, granulation  
infection: no local signs of infection  
depth: superficial  
Area: without specialties



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**Case 7**  
**Day 14**



Exudate: moderate  
Wound base: granulation  
Infection: no local infection signs  
Depth: superficial  
Area: without specialties

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**Case 7**  
**Day 21**



Exudate: moderate  
Wound base: granulation, incipient epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Case 7**  
**Day 28**



Exudate: moderate  
Wound base: slightly occupied, granulation, increasing epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Summary:**

Pat after weeks of self-therapy with various means. After the start of therapy with the "Wound –Sanitizer" increasing improvement of the wound situation.  
Rapid decrease in signs of inflammation and rapid onset of epithelialization

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**Case 8**

Diagnosis: traumatic injury in existing skin graft

Gender: male

Localization: Achilles tendon

Duration: 3 weeks

**Day 0**



Exudate: moderate

Wound base: plaque

Infection: no local infection signs

Depth: 0.5 cm

Area: dry, scaly, wound edge edematous

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**Case 8**

**Day 7**



Exudate: moderate  
Wound base: plaque, granulation, already onset of epithelialization  
Infection: no local signs of infection  
Depth: 0.5 cm  
Area: without specialties

**Case 8**  
**Day 14**



Exudate: moderate  
Wound base: granulation, epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without special features

**Case 8**  
**Day 21**



Exudate: little  
Wound base: granulation, increasing epithelisation  
infection: no local signs of infection  
Depth: superficial  
Area: without special features

**Case 8**  
**Day 28**



Exudate: little  
Wound base: significant increase in epithelialization, almost wound closure  
Infection: no local signs of infection  
Depth: superficial  
Area: without special features

**Summary:**

Pat injures himself while cycling on skin graft, which had healed for 3 years. Open, gaping wound with visible tendon. Previous treatment by the plastic surgeon, who has recommended a new skin graft as usual with such wounds. Pat wants conservative treatment and avoidance of surgery.

Local therapy with "Wound – Sanitizer" leads to rapid cleansing, granulation and epithelialization of the wound. Almost complete closure during the observation period.



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**Case 9**

Diagnosis: Ulc. crur. ven

Gender: female

Localization: Outer ankles

Duration: 5 weeks

**Day 0**



Exudate: a lot

Wound base: plaque

Infection: Exudate yellowish, cloudy, redness, pain

Depth: superficial

Area: Redness, slight maceration of the wound area

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**Case 9**

**Day 7**



Exudate: moderate  
Wound base: slightly occupied, granulation  
Infection: Exudate bloody serous, no pain  
Depth: superficial  
Area: slightly reddened

**Case 9**

**Day**

**14**



Exudate: moderate  
Wound base: Granulation, significant reduction of wound area  
Infection: no local signs of infection  
Depth: superficial  
Area: without special features

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**Case 9**

**Day 21**



Exudate: moderate  
Wound base: granulation, epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: dry, scaly

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**Case 9**

**Day**

**28**



Exudate: moderate  
Wound base: granulation, epithelialization, strong reduction of wound area  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Summary:**

Chronisch venous ulcer for several weeks. Previous therapy through home care. After starting with the "Wound – Sanitizer" immediate, significant improvement of the wound conditions. Very rapid decrease in wound area during the observation period. Pain already after the 2. Treatment significantly reduced Additional therapy: compression

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**Case 10**

Diagnosis: Ulc. crur. ven  
Sex: female  
Localization: Lower leg right  
Duration: 7 weeks

**Day 0**



Exudate: A lot  
Wound base: plaque  
Infection: Redness, exudate amount, pain  
Depth: superficial  
Area: Redness, slight maceration

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**Case 10**

**Day 7**



Exudate: moderate  
Wound base: slightly occupied, granulation  
infection: no local signs of infection  
depth: superficial  
Area: without specialties

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**Case 10**

**Day 14**



Exudate: moderate  
Wound base: slightly occupied, granulation, onset of epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties



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**Case**

**10**

**Day**

**21**



Exudate: moderate  
Wound base: granulation, progressive epithelialization  
infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Case 10**

**Day 28**



Exudate: moderate  
Wound base: occupied, granulation, significant reduction of wound area  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Summary:**

• Frustrane treatment and stagnation of the wound situation over several weeks.  
After application with "Wound – Sanitizer" rapid onset of wound healing. Decrease in the signs of infection and reduction in the amount of exudate after a short time.  
Sharp decrease in wound areas during the observation period  
Additional therapy: compression

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**Case 11**

Diagnosis: Ulc.cruur.  
ven gender: female  
Localization: Lower leg rebi-side  
Duration: 3 weeks

**Day 0**



Exudate: moderate  
Wound base: plaque  
Infection: dark fibrin deposits, redness  
Depth: superficial  
Area: locally reddened

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**Case 11**

**Day 7**



Exudate: moderate  
Wound base: plaque, granulation  
Infection: no local infection signs  
Depth: superficial  
Area: without specialties

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**Case 11**

**Day 14**



Exudate: moderate  
Wound base: slightly occupied, granulation  
infection: no local signs of infection  
depth: superficial  
Area: without specialties

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**Case 11**

**Day 21**



Exudation: moderate  
Wound base: slightly occupied, granulation, epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

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**Case 11**

**Day 28**



Exudation: moderate  
Wound base: granulation, epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Summary:**

After the start of local therapy with the "Wound – Sanitizer", rapid removal of deposits and signs of infection. Until the end of the observation period, rapid increase in epithelialization.  
Additional therapy: compression

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**Case 12**

Diagnosis: Ulc. crur. ven  
Sex: male  
Localization: Lower leg right  
Duration: 5 weeks

**Day 0**



Exudate: little  
Wound base: plaque  
Infection: local redness  
Depth: superficial  
Area: slight redness



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**Case 12**

**Day 7**



Exudate: little  
Wound base: plaque  
Infection: no local infection signs  
Depth: superficial  
Area: without special ties

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**Case 12**

**Day 14**



Exudate: little  
Wound base: occupied, granulation  
Infection: no local infection signs  
Depth: superficial  
Area: without specialties

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**Case 12**

**Day 21**



Exudate: little  
Wound base: slightly occupied, granulation, massive increase in epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: without specialties

**Case 12**

**Day 28**



Exudate: little  
Wound base: granulation, almost complete epithelialization  
Infection: no local signs of infection  
Depth: superficial  
Area: no special features

**Summary:**

Rapid reduction of signs of infection. Removal of coverings without additional measures.  
Unusually rapid epithelialization up to almost wound closure during the observation period.  
Additional measures: Compression

## Summary of the observation results:

### Goal:

The recognition of the spectrum of action of the "Wound Sanitizer" in the routine treatment of chronic and secondary healing wound patients. Reactions to inflammation and infection, as well as healing tendencies in terms of granulation and epithelialization. Likewise, changes in the wound environment in the range of the pH value

1. Very rapid **decrease in the signs of infection**
2. **Inflammation** of the skin is reduced in the shortest possible time **without additional measures with steroids**
3. **In the case of wounds that are difficult to heal**, a **positive progression** of wound healing could be observed.
4. In many cases, **wound closure** occurs in a **very short time**
5. **Fibrin coatings** are reduced, **granulation** and **epithelialization** are promoted.
6. The application is **simple** and does not require any specially trained personnel
7. The **pH value decreases** with each treatment, so that it can be assumed that there is already **stimulation of wound healing** during the treatment.
8. No **intolerances** were found
9. The use was classified by the patients as **not noticeable to pleasant**.
10. The **pain situation** could be **improved** in a short time

**In view of previous observations, the "Wound – Sanitizer" can be recommended for the local therapeutic treatment of secondary healing wounds, chronic wounds, infected wounds and inflammation of the skin as a supporting additional measure.**

### USP:

There is very good data on cold atmospheric plasmas, which prove that microorganisms are reduced, and wound healing is promoted by the reaction with the plasma-producing gas.

The Wound Sanitizer differs from other plasma devices on the market in that the plasma is applied to the wound surface in enriched aerosols. This prevents and delays primary adhesion, which is essential for the formation of biofilms.

Also known is the positive effect of plasmas in combination with hyper/hypochlorous acid solutions on wound healing and reduction of microorganisms.

With the Wound Sanitizer there is the possibility to combine this combination and apply it directly to the wound. Future treatment options are also possible through this type of plasmaproduction

Gilbert Hämmerle, DGKP, AZWM Wound  
Outpatient Clinic LKH Bregenz/Austria  
Practice for Wound Treatment Slycare GmbH Greiz/Germany