

## Press release neoplas tools GmbH

Key words: Diabetic foot syndrome, chronic wounds, cold plasma

### The world's first placebo-controlled clinical trial proves the successful application of cold plasma jet *kINPen*<sup>®</sup> MED in diabetic foot ulcers: Reactivation and acceleration of wound healing scientifically confirmed

Greifswald/Bad Oeynhausen, July 22nd, 2020. Chronic wounds resulting from diabetic foot syndrome heal significantly faster if the standard therapy is complemented with atmospheric cold plasma treatments. This has now been successfully proved by scientists in the first placebo-controlled, randomised and patient-blinded clinical trial. The study device used was the *kINPen*<sup>®</sup> MED plasmajet of *neoplas tools*, a joint development with the *Leibniz Institute for Plasma Science and Technology e. V.* (INP). The study results have now been published in the *Journal of the American Medical Association (JAMA Network Open)*.<sup>1</sup>

Around 900,000 Germans suffer from chronic wounds, i.e. wounds that do not heal or show impaired wound healing.<sup>2</sup> One of the most frequent causes of chronic wounds is the diabetic foot ulcer (DFU). Diabetes or DFU account for 70 percent of all amputations performed in Germany every year.<sup>3</sup> Moreover, the treatment of chronic wounds results in high health care costs of around 10,000 EUR per year and patient.<sup>4</sup>

Case reports and laboratory tests have been suggesting for years that the application of cold atmospheric plasma (CAP) can stimulate the healing process of chronic wounds, supporting a faster wound closure. This effect has now been clinically demonstrated for the first time in a clinical trial performed by physicians and scientists at the *Herz- und Diabeteszentrum NRW* (HDZ NRW; University Hospital for the treatment of cardiac, vascular and diabetic diseases of the Ruhr University of Bochum, Bad Oeynhausen, Germany), and at the *Klinikum Karlsburg* (medical centre for cardiac and diabetic diseases, Karlsburg, Germany). This first-of-its-kind randomised, placebo-controlled and patient-blinded study investigated the treatment of 62 DFS wounds in 43 hospitalised patients with adjuvant cold plasma therapy. These DFS wounds had a severity of 1B and 2B in accordance with the Wagner Armstrong Classification, and had not shown any tendency to heal for a minimum of three weeks despite standard wound therapy in an outpatient setting.

The wounds were randomised into two groups of 31 wounds each (with patients with several wounds potentially being randomised both into the test and the control group). In the test group, the wounds were treated 8 times within the course of 14 days with cold plasma from the *kINPen*<sup>®</sup> MED plasmajet (30 seconds per cm<sup>2</sup> of wound surface), in addition to the standard wound therapy. The control group received a treatment with a simulated, inactive plasma (placebo). Primary study endpoints were the reduction of

---

<sup>1</sup> Stratmann B, Costea T-C, Nolte C, et al.: Effect of cold atmospheric plasma therapy vs standard therapy placebo on wound healing in patients with diabetic foot ulcers: a randomized clinical trial. *JAMA Network Open*. 2020;3(7):e2010411. doi:10.1001/jamanetworkopen.2020.10411

<sup>2</sup> Abschlussbericht der Forschungsgruppe Primärmedizinische Versorgung (PMV): Epidemiologie und Versorgung von Patienten mit chronischen Wunden (Final report of the Primary Medical Care (PMV) research group: Epidemiology and Treatment of Patients with Chronic Wounds), 2016. Berlin, 2016. <https://www.bvmed.de/download/pmv-zusammenfassung-der-ergebnisse>

<sup>3</sup> Morbach S et al.: Diabetisches Fußsyndrom (Diabetic Foot Syndrome). *Diabetologie* 2017; 12 (Suppl 2): S181–S189 (DOI <https://doi.org/10.1055/s-0043-115979>)

<sup>4</sup> Purwins S et al.: Cost-of-illness of chronic leg ulcers in Germany. *Int Wound J*. 2010 Apr;7(2):97-102 (DOI: <https://doi.org/10.1111/j.1742-481x.2010.00660.x>)

wound surface after 14 days of treatment and the reduction of the infection status and microbial load of the wounds. Secondary endpoints were e.g. the time to 10 % wound closure, the health-related quality of life and the safety and tolerability of the treatment.

### **Wound surface healing increased by 55 percent**

After the 14 days of treatment the surface of the wounds treated with the cold plasma had reduced by an average of 69.5 percent. The average reduction in the placebo group was 44.8 percent. This means that the amount of wound surface closed under cold plasma treatment was 55 percent higher than the amount closed under the standard treatment alone. This is a statistically significant result ( $p=0.03$ ). The plasma treatment was painless and well tolerated. None of the study patients experienced any plasma therapy related side effects throughout the course of the treatment. The patients will be kept under observation for five more years for an assessment of the long-term safety of the treatment.

“With this study we were able for the first time to provide clinically controlled evidence that cold plasma actively promotes wound healing,” comments PD Dr. Bernd Stratmann, research director at the diabetes centre of the *Herz- und Diabeteszentrum NRW* and first author of the study. “This means that the results confirm previous insights from case studies. In contrast to the placebo group, the healing process was activated in all wounds treated with cold plasma (defined as a minimum reduction of the wound surface of 10 %). As a result, the cold plasma treatment led to accelerated wound healing and thus to faster wound closure compared to standard treatment alone.”

“The important study results of the *kINPen® MED* plasmajet represents a major milestone in the clinical development of cold plasma technology,” Ulrike Sailer, managing partner of *neoplas tools GmbH*, is pleased to note. “Today, with its pinpoint plasma beam and controlled plasma quality, our *kINPen® MED* plasmajet already offers doctors and hospitals a precise and effective treatment of wounds, especially in the presence of recesses and cavities as frequently experienced in connection with the diabetic foot ulcer. We will continue our work on technological high-precision solutions - and thus on the future development of plasma medicine - together with our long-standing research partner *INP*, under the leadership of Prof. Dr. Klaus-Dieter Weltmann.”

### **Cold plasma effect activates wound healing**

With regard to the end points “infection status” and “reduction of microbial load”, a bigger reduction was measured in the plasma group compared to placebo. However, the differences between the two groups was not statistically significant, as Prof. Dr. Dr. Diethelm Tschoepe, medical director of the diabetes centre of the *Herz- und Diabeteszentrum NRW* and principal study investigator illustrates: “All wounds were treated with the standard therapy, including wound disinfection and debridement prior to the plasma therapy, plus systemic antibiotics as required. This initial treatment regimen – applied in both groups - explains why it was not possible to demonstrate the statistically significant antimicrobial effect of cold plasma as proven in other studies.” The results support the findings of many scientific *INP* publications. According to PD Dr. Stratmann’s interpretation of the study results, “atmospheric cold plasma has its own individual effect that activates wound healing. This effect cannot be explained by the antimicrobial effect of the plasma alone.”

### **Shorter hospitalisation periods for DFS patients**

The study investigated patients in an inpatient setup. Patients are usually hospitalised for the treatment of DFU if the wounds do not heal despite standard treatment under everyday life conditions. However, every hospitalisation also involves increased treatment costs and considerable limitations for the patients. According to Prof. Dr. Dr. Diethelm Tschoepe, “faster wound healing potentially leads to an earlier discharge of patients from the hospital. As a result, cold plasma treatments may not only benefit future patients, but they may also have an added economic relevance for the health system.”

### Study references:

Bernd Stratmann, PhD; Tania-Cristina Costea, MD; Catharina Nolte, MD; Jonas Hiller, MD; Jörn Schmidt, MD; Jörg Reindel, MD; Kai Masur, PhD; Wolfgang Motz, MD; Jürgen Timm, MD; Wolfgang Kerner, MD, Diethelm Tschoepe, MD: *Effect of Cold Atmospheric Plasma Therapy vs Standard Therapy Placebo on Wound Healing in Patients With Diabetic Foot Ulcers*. JAMA Network Open; 2020;3(7):e2010411. DOI: 10.1001/jamanetworkopen.2020.10411

### About neoplas tools GmbH

neoplas tools GmbH was founded in 2009 as a spin-off of the *Leibniz Institute for Plasma Science and Technology e. V.* (INP) in Greifswald, Germany. Ulrike Sailer took over the position of managing partner at the end of 2019. Based on the INP research into plasma medicine, the emerging company develops innovative products for medical applications. The first product developed on this basis is the CE-marked *kINPen® MED* atmospheric pressure plasmajet, the first internationally approved and marketed plasma jet for the treatment of chronic wounds and pathogen-induced skin disorders. It is the result of a long-lasting cooperation with the INP institute, the university hospital of Greifswald, Germany, the Charité hospital of Berlin, Germany, and various industrial partners.

### About *kINPen® MED*

The *kINPen® MED* plasmajet is the first atmospheric pressure plasma jet to receive CE approval for the treatment of chronic wounds and pathogen-induced skin disorders. The plasma jet applies a physical cold plasma with a temperature of < 39 degrees Celsius with pinpoint precision and without wound contact. Areas with an uneven profile, recesses or cavities can be reached easily and treated evenly. The noble gas argon used for the generation of the plasma provides a controlled atmosphere around the generated plasma beam, thus ensuring a consistent high treatment quality.

### Press contact

Claudia Kerber

Telephone: +49 (0)3834 515 201

Mobile: + 49 (0)162 23 770 70

[claudia.kerber@neoplas-tools.eu](mailto:claudia.kerber@neoplas-tools.eu)

neoplas tools GmbH

Walther-Rathenau-Straße 49a

17489 Greifswald

