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Background:

Plasma medicine is a relatively new scientific field with great therapeutic potential. A recent prospective randomized controlled trial has shown that cold argon plasma has beneficial effects on wound healing by decreasing the bacterial load. To identify additional therapeutic possibilities and to look into new potential applications, we investigated the treatment of pruritic diseases, which often represent a therapeutic challenge. Pruritus is known to be the most frequent dermatological symptom which considerably impairs the quality of life of patients particularly as chronic condition.

Objectives:

To assess the efficacy and safety of cold atmospheric argon plasma treatment as an add-on therapy for patients with various types of pruritic diseases.

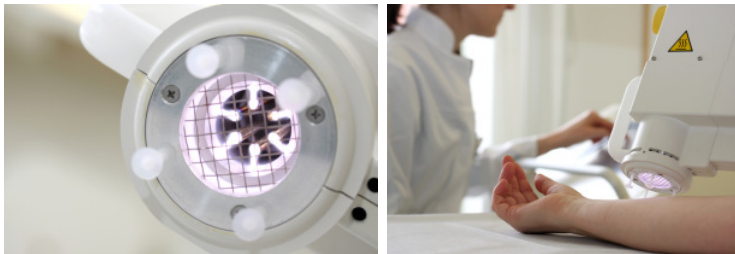


Fig. 1: The plasma torch (MicroPlaSter β®)
(2.45 GHz, 86 W, Ar 2.2 slm, treatment diameter ≈ 5 cm, distance to torch 2 cm)
Plasma is generated at 6 stainless steel electrodes and then transported to the target area via gas flow. The torch itself is cooled by air flow.

Patients and methods:

In this prospective randomized controlled phase II study, we treated 46 patients with pruritic diseases of different etiology, for example, atopic eczema, prurigo, drug eruption, etc., with cold atmospheric argon plasma for 2 min daily in addition to standard treatment (topical and systemic drugs, UV phototherapy). All patients were used as their own control, and the control skin areas were treated with argon gas. The treatment device was the MicroPlaSter β® developed by the Max Planck Institute for Extraterrestrial Physics (Fig. 1)

The outcome measure was a reduction in itching measured by means of a visual analogue score (VAS) from 0 to 10 on antipruritic long- and short-term effects. Further analyses were made to detect differences between the reduction of pruritus depending on patients' gender, the duration of pruritus and the risk factor stress.

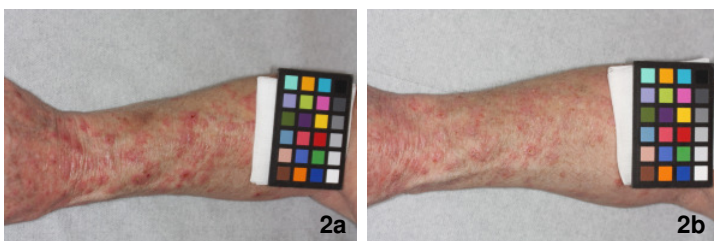


Fig. 2: Skin lesions within the course of therapy
Forearm of a 70-year-old patient with exacerbation of atopic eczema before first (2a) and after 6 treatments (2b) with cold atmospheric argon plasma. Plasma therapy reduced pruritus from 6.5 to 2.3 points; however, argon gas application showed almost the same result. Co-therapy consisted in topical and systemic glucocorticoids, polidocanol, antihistamines and phototherapy with UVA/UVB.

Results:

An average of 4.74 cold argon plasma and argon gas (as control) treatments were administered per randomized area (ranging from 1 to 14, total treatments n = 218).

VAS scores at baseline were comparable in both groups: plasma 4.57 (SD 2.38) and argon gas 4.34 (SD 2.35). We found no significant differences in VAS reduction between the treatment with cold atmospheric argon plasma and argon gas only, neither with regard to antipruritic long-term effects (mean VAS difference of 1.97 (SD 1.33) for plasma treated areas; 1.74 (SD 2.37) for argon gas treated areas; p=0.224, 95% CI: [-0.15; 0.60]) nor to short-term effects (mean VAS difference of 1.92 (SD 1.33) for plasma treated areas and 1.97 (SD 1.29); p=0.544, 95% CI: [-0.21; 0.11] for argon gas) (Fig. 3). In both groups, patients experienced a significant reduction of pruritus at the end of therapy compared to baseline (mean difference of 1.97 (p<0.0001) for plasma and 1.74 (p<0.0001) for placebo). The analyses for the between-subject factors gender (female vs. male), duration (acute ≤ 6 weeks vs. chronic > 6 weeks) and the risk factor stress (stress vs. not stressed) did not differ statistically. No relevant side effects occurred, and plasma treatment was well-tolerated.

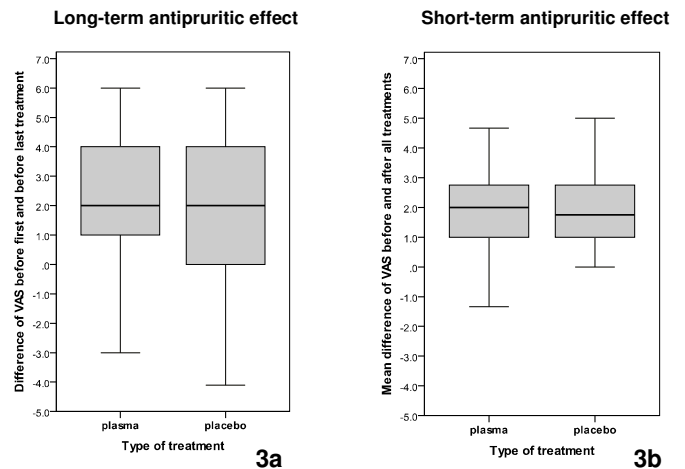


Fig. 3: Long-term and short-term antipruritic effects
Boxplots showing the difference of VAS before and after treatment with regard to the long-term effect (3a) and the short-term effect (3b) for plasma and placebo treated areas. No significant differences in VAS reduction were found between the treatment with cold atmospheric argon plasma and argon gas only.

Conclusion:

- ✓ Cold atmospheric plasma treatment did not result in higher pruritus reduction than treatment with argon gas only, although each treatment led to a significant reduction of pruritus.
- ✓ Both treatment options had similar tolerability and proved to be safe.

Acknowledgement:

We thank ADTEC Plasma Technology Co. Ltd. Hiroshima for the allocation of the MicroPlaSter β®.