Cold plasma treatment can be easily implemented into corneal disease treatment protocols, is **well tolerated** and **safe** with minimal number of adverse reactions.

Argon cold plasma treatment for corneal disease in clinical setting: Short-term and long-term tolerability and safety outcomes

PURPOSE

- To evaluate feasibility, safety and tolerability of cold plasma as **add-on** to standard regimen

COLD PLASMA TREATMENT

- Topical anesthesia (proxymetacaine): 2 drops repeated every 3-5 minutes over 20 minutes
- Application of plasma jet in meandric movement over lesion for 30-90s (60s ≈ 1 cm^2), every 2-6 days until healed
- Flow rate 4.6-4.8 L/min, distance: plasma jet tip slightly touching cornea (conducting mode)

CLINICAL CASES

- 303 eyes in 281 animals (263 dogs, 8 cats, 10 small mammals)
- SCCED n=178, infected/infiltrated stromal ulcer n=76, keratomalacia n=22, corneal perforation n=20, other n=7
- 1044 single treatments, average per case 3.45±1.74 treatments, median 3 treatments (1-9)

TREATMENT FEASIBILITY

- Straight-forward procedure, cold plasma can be easily applied and is tolerated in unsedated animals
- Only few animals experienced procedural distress (3.2%, 8 dogs, 1 cat): air current blowing onto eye surface, restlessness during procedure, extreme agitations. In only two dogs, the therapy could not be continued

ADVERSE REACTIONS AFTER THE PROCEDURE

- Whitish spots in corneal epithelium and anterior stroma in 1.4% of dogs (n=4) directly after the treatment (**figure A**)
- Blepharospasm several hours after the procedure (inadequate anesthesia) in 0.7% of dogs (n=2)

ADVERSE EVENTS

- Short term (<30 d): Stromal infiltrate (n=7) and keratomalacia (n=1) in SCCED cases; keratomalacia or progression of stromal lesion could not be halted with the treatment (n=4), epithelial tears after complete reepithelization or peripheral epithelial tears in centrally not-yet healed SCCED (n=12) (**figure B**)
- Long term (>30 d): persistent corneal fibrosis and pigmentation despite intensive post-reepithelization therapy (n=12), glaucoma (n=3, 163-451 days after the treatment), other events developing in single cases (n=5)

Figure B: Most common adverse event that was seen in SCCED was epithelial non-adhesion and tears after complete reepithelization (**1, 2**) and peripheral epithelial tears in not-yet healed ulcers (**3**). Arrows show ulcerated areas already epithelized before. This was observed in French Bulldogs only. Significance of this event remains unclear and could be due to overly fast epithelial healing process.

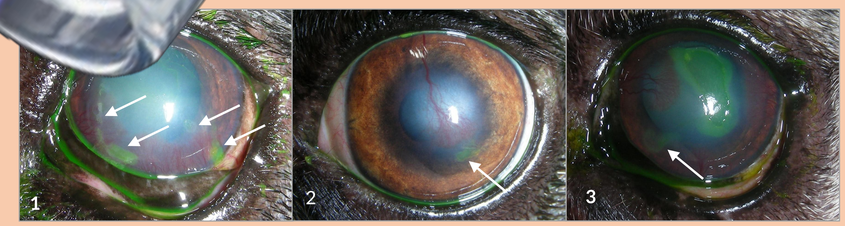
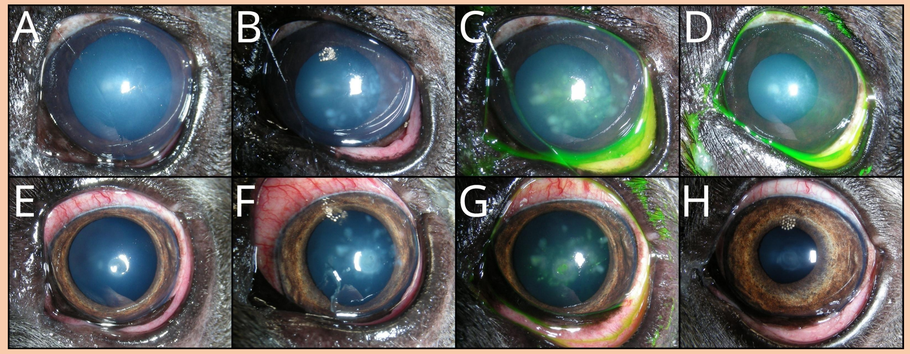
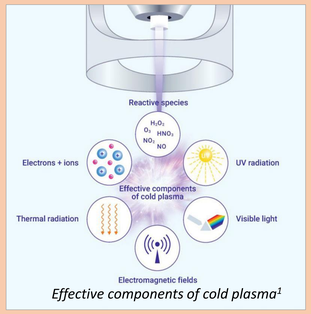


Figure A: Adverse reaction seen immediately after the treatment that was observed in four canine eyes (4/285, 1.4%), examples: An Eight-year-old French Bulldog presenting with SCCED showed fluorescein-negative epithelial and anterior stromal whitish spots after the third ACP treatment (A-D). A four-year-old French Bulldog presenting with small-scale mid-stromal infected ulcer showed whitish anterior stromal spots that were centrally fluorescein positive (G) after both second and third ACP treatment (E-H). (A+E) Before the treatment, (B+F, C+G with fluorescein) immediately after ACP treatment, (D+H) healed state.



Cold atmospheric plasma (argon gas):



Effective components of cold plasma[1]

kINPen® VET, Neoplas GmbH[1]

In-vitro study*[2] *on effectivity of cold plasma against canine bacterial keratitis pathogens:

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Argon cold atmospheric plasma eradicates pathogens *in vitro* that are commonly associated with canine bacterial keratitis

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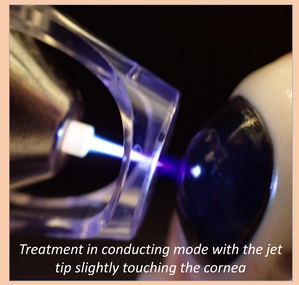
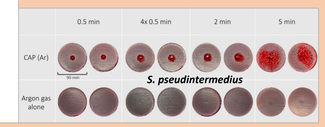
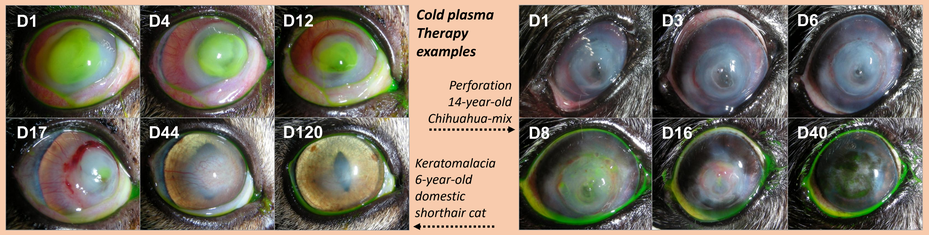


Treatment in conducting mode with the jet tip slightly touching the cornea





Literature/sources:
1. https://www.neoplas-vet.com/kinpenvet/
2. Marx AH, Oltmanns H, Meißner J, Verspohl J, Fuchsluger T, Busse C. Argon cold atmospheric plasma eradicates pathogens in vitro that are commonly associated with canine bacterial keratitis. Front Vet Sci. 2024;10:1320145. doi:10.3389/fvets.2023.1320145.

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