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RESEARCH LETTER

Cold atmospheric pressure plasma clears molluscum contagiosum

Molluscum contagiosum (MC), a disease of viral aetiology, typically occurs in children, but also in adults Although 'self-limited', MC has a significant impact on quality of life.[1] Physical removal, cryotherapy and topical pharmacotherapies have been tried with varying success.[2] In-office cantharidin application is a commonly used treatment, especially in the paediatric population.[3] Cold atmospheric plasma (CAP) is an ionized gas created by high-frequency electric discharge. Initially used to treat chronic ulcers,[4] it has been successfully tested to treat actinic keratoses[5] and warts[6,7] as a non-ablative modality, possibly treating warts via induction of apoptosis of virus-infected cells.[4] As MC and warts share similarities in aetiology, cutaneous manifestations and treatment, we hypothesized that CAP may be an effective treatment for MC.

A 12-year-old patient presented with several months' history of multiple, untreated lesions of MC on the face, neck, shoulder and thighs. The mother elected cantharidin treatment for the non-facial lesions, but not for the face because of the risk of dyspigmentation. After obtaining informed consent, the patient was enrolled in a CAP treatment study for his facial lesions (Western Institutional Review Board: 20130084). For the cantharidin treatment, a 0.7% collodion-based solution was used, which we applied to all treated lesions, instructing the mother to wash it off 3 h post-application. For the CAP treatment, we used a pulse generator supplying 20 kV pulse at 200 Hz (FPG10-01NM10, FID GmbH, Germany) to a 5 mm diameter quartz-covered copper electrode of 10 cm length, as described previously.[5] (Although there are commercially available CAP devices, this specific device is a research prototype.) The tip of the electrode was placed 1 mm above every lesion and gently moved in a circular pattern for 2 min (Figure S2). Treatment sessions were repeated at 1-month intervals for a total of 4 sessions, and the patient returned for a final evaluation 2 months after the last session. No after care was given or prescribed following the treatment sessions. After completing the treatment course, all treated lesions resolved: the cantharidin-treated lesions have cleared after 1–2 applications, and the CAP-treated lesions required 1–4 treatments. While the cantharidin-treated lesions had residual post-inflammatory hyper- and hypopigmentation, the

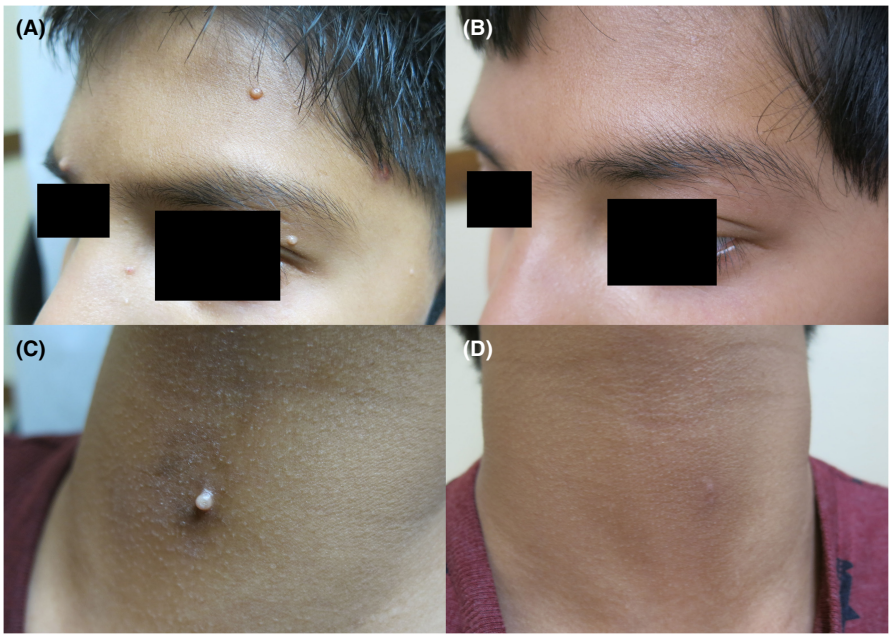


FIGURE 1 Treatment results of cold atmospheric pressure plasma (CAP) and cantharidin. CAP-treated lesions of molluscum contagiosum before treatment (A), and after 1–4 treatments leading to full clearance, and no recurrence 2 months after the last treatment session (B), Cantharidin-treated lesions before treatment (C), and after resolving with post-inflammatory hyperpigmentation, without recurrence 4 months after the last of 1–2 treatment sessions (D)

This study was approved by the Western Institutional Review Board, date: 11/7/2018, protocol number: 20130084.

This study was registered on ClinicalTrials.gov Registration number: NCT02759900 Registration date: 4/26/2016.

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CAP-treated lesions healed without any pigmentary change or scar (Figure 1). Both treatments were well tolerated, without discomfort at the time of application. There was no report of discomfort, or any other adverse effects following the CAP treatment, but there was mild discomfort at the cantharidin application sites on the day after treatment.

Cold atmospheric plasma is an emerging therapeutic tool with an evolving role in dermatology. Pilot studies have shown that CAP may be an effective, non-ablative treatment for actinic keratosis and warts, beyond its already established role as a treatment for chronic wounds and ulcers. In our case, CAP successfully cleared all treated lesions of MC, although it required up to four treatments, while all the cantharidin-treated lesions cleared after two applications. This also means that some CAP-treated lesions 'survived' 2 months after the resolution of the cantharidin-treated lesions, making a distant immunological effect from the cantharidin treatment unlikely. In this proof-of-concept study, we demonstrated that CAP may be used to treat MC, and that the treatment is well tolerated and painless, which is an important consideration as MC typically occurs in childhood. Unlike cantharidin that causes blister formation, CAP does not create clinically significant inflammation, which explains why CAP-treated lesions healed without dyspigmentation in our case. While the great tolerability and excellent cosmetic outcome of CAP treatment is encouraging, it is important to note that we are presenting only a solitary case of a condition that is known to often resolve spontaneously, thus larger, placebo-controlled studies are needed to confirm the efficacy of CAP for the treatment of MC and to optimize treatment settings, perhaps increasing treatment frequency to shorten overall treatment duration.

AUTHOR CONTRIBUTION

All authors have read and approved the final version of the manuscript. All authors have substantially contributed to this work, their detailed contributions are listed below: PCF: Designing study, performing treatments, evaluating results, writing paper. GF: designing study, writing paper. AF: designing study.

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None.

KEYWORDS

cantharidin, cold plasma, molluscum contagiosum, non-thermal atmospheric pressure plasma

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

INFORMED CONSENT

The patients in this manuscript have given written informed consent to publication of their case details.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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