

CASE REPORT: Combination of Er:YAG and Nd:YAG Laser for Treatment of Warts

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ABSTRACT

Cutaneous warts represent an unsightly and sometimes painful disturbance, which may resolve spontaneously. In cases where warts do not resolve, various treatment modalities are available. Laser treatment is a relatively efficient and patient-comfortable approach, although sometimes more than 4 treatment sessions are needed and there may be unresponsiveness and recurrence of deep warts. We report here on a new method combining Er:YAG and Nd:YAG laser treatment. Of the 17 warts treated, all resulted in complete clearance and none showed recurrence in 2 years. The efficacy of the method can be attributable to its efficient ablation of warts without damaging the surrounding tissue, which allows for fast recovery. Additionally, Nd:YAG laser treatment effectively complements the treatment by affecting the underlying vessels, thus potentially disrupting the supply to the residual wart tissue.

Key words: viral warts, verruca, Er:YAG, Nd:YAG.

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I. INTRODUCTION

Cutaneous warts are benign skin proliferations caused by human papillomavirus (HPV) infection, with prevalence varying between 3% [1, 2] and 24% [3], depending on age and population studied. The clinical appearance depends to some extent on the type of HPV and the anatomical site affected. The most common type of warts are common warts (*verruca vulgaris*), which most frequently affect the hands and feet, and when found around the nail plate these are called periungual warts; filiform or digitate warts are mainly observed on the scalp or the beard area; plane or flat warts (*verruca plana*) are most commonly found on the distal limbs and face; single or mosaic plantar warts (*verruca plantaris*) are most commonly found on the feet [4, 5]. Generally, cutaneous warts can last for a few months to a

couple of years and usually resolve spontaneously in healthy people. However, some may persist for many years and represent an unsightly (face) or painful (feet) disturbance. Traditional therapy consists of topical agents containing salicylic and/or lactic acid, cryosurgery, electrocautery or more aggressive methods, e.g. surgical excision or immunotherapy, for the most resistant warts [4]. However, problems that limit the usability of traditional therapies are: modest efficacy when compared to no treatment, relatively high recurrence rates, absence of response in some cases and skin discoloration at the site of application.

The use of lasers in wart treatment has already been reported. 585 nm pulsed dye lasers have been used for treating recalcitrant warts, but up to 5 sessions were needed to achieve resolution, which was not always complete [6, 8]. Long-pulsed Nd:YAG lasers have also been used for the treatment of recalcitrant or untreated warts; common warts responded well, but deep palmoplantar warts required up to 4 laser sessions [7]. Laser pulses from these lasers are absorbed by haemoglobin and therefore target the blood vessels and indirectly affect the wart through thermal damage of blood vessels. Ablative CO₂ or Er:YAG lasers, on the other hand, completely remove the wart tissue by ablation. Treatment of recalcitrant warts with CO₂ lasers has resulted in clearances from 64% to 100%, but scarring, hypopigmentation and pain may occur [9, 10]. The Er:YAG laser with 2940 nm emission has a 10x greater absorption in water compared to the CO₂ laser. This results in enhanced tissue vaporisation and reduced thermal damage, reducing the risk of side effects, e.g. scarring or hypopigmentation. Wollina et al. (2001) reported a well-tolerated and patient-comfortable treatment of difficult-to-treat plantar or periungual warts with clearances of 72%. However, plantar warts did not respond completely and had a 24% relapse rate [11]. In a second study the same author combined Er:YAG laser with four to six cycles of topical podophyllotoxin, a plant toxin with antimitotic activity and good safety profile, and achieve increased clearance of resistant warts [12].

Since both Er:YAG and Nd:YAG lasers have proven effective in wart treatment, though with some limitations, we decided to evaluate a combination therapy considering the diverse mechanism of action of each laser wavelength.

II. PATIENTS AND METHODS

13 patients (6 males and 7 females), mean age 26.6 (range 5 – 57), have been included in the analysis. In total, 17 warts, of which 9 plantar (including 2 large mosaic warts), 5 common and 3 periungual, were treated with an Er:YAG/Nd:YAG laser (SP Dynamis, Fotona, Slovenia). With respect to body location, 8 warts were found on the sole, 3 on the toe, 2 on the arm, 3 on the finger and 1 on the face. Treatment was performed in 2 steps. The 1st step consisted of ablation of the warts with Er:YAG using the following settings: R11 handpiece, 2 mm spot size, 300 microsecond pulse duration, 10 J/cm², 10 Hz. The 2nd step consisted of coagulation with Nd:YAG using the following parameters: R33 handpiece, 4 mm spot size, 15 ms pulse duration, 240 J/cm² and 1 Hz. During treatment the treated site was cooled (with a Zimmer cooler). 3 patients also received local anaesthesia with 2% lidocaine. Patients returned for follow-up at two years post treatment.

III. RESULTS

71% of the warts were cleared after a single laser session and 29% were cleared after two laser sessions. In the latter case, the 2nd session was performed at least 1 month after the first session. Plantar mosaic and periungual warts proved to be more resistant to laser treatment; 2 sessions were needed to clear these types of warts, whereas a single session was necessary for common and simple plantar warts. All patients came regularly to follow-up visits, ending up with a follow-up of 2 years, and no recurrences were observed. On average, 1.3 sessions were needed, considering the number of warts per type distribution (Figure 1), to achieve a 100% clearance rate. The method proved to be safe and comfortable for the patients: Nd:YAG coagulation after ablation resulted in no post-treatment bleeding (Figure 6), and no infection or scar formation on the treatment site were recorded at follow-up visits. Only 1 patient developed post-inflammatory hyperpigmentation on the treated site, which is a rare but known possible side effect of laser treatment, and 1 patient developed de-novo filiform wart at an adjacent location.

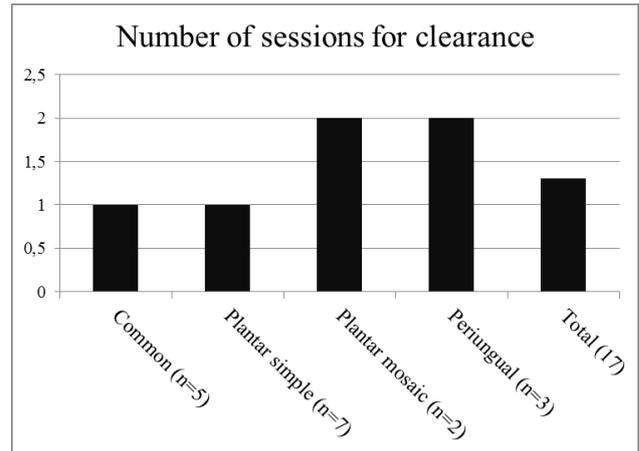


Fig. 1: Average number of treatments according to type of warts.

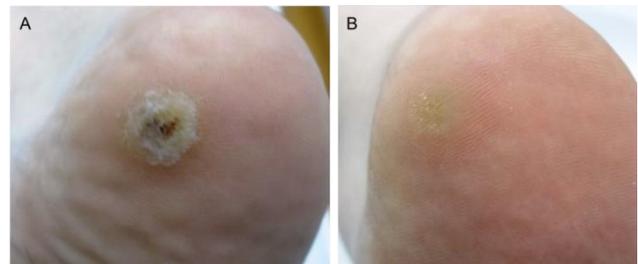


Fig. 2: Plantar wart (A) before and (B) 2 months after a single session of laser treatment.

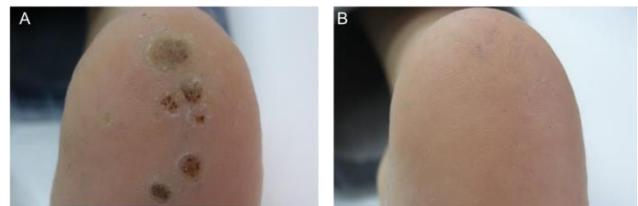


Fig. 3: Multiple plantar warts (A) before and (B) 2 years after a single session of laser treatment.



Fig. 4: Two cases of plantar mosaic warts (A, C) before and (B, D) 2 years after two sessions of laser treatment.



Fig. 5: Periungual warts (A) before and (B) 2 months after two sessions of laser treatment.

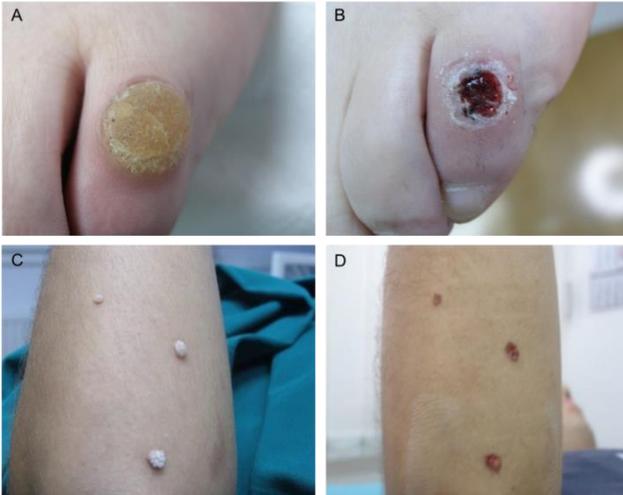


Fig. 6: Two cases of common warts (A, C) before and (B, D) immediately after laser treatment.

IV. DISCUSSION

There is no single treatment that results in clearance of the different types of cutaneous warts. In healthy people, especially young people, warts usually resolve spontaneously. However, warts in patients with a long-lasting infection or immunosuppressed patients may be more resistant to treatment and usually do not resolve spontaneously. Treatment may also be recommended because of pain or due to aesthetic reasons. In these cases the ideal goal of treatment shall be complete wart clearance without recurrence, no scar formation and induction of life-long immunity [13]. Topical applications containing salicylic acid and lactic acid have been shown to provide clearances in 67% of patients with hand warts, 84% of patients with simple plantar warts and only 45% of those with mosaic plantar warts [14]. Cryotherapy resulted in slightly better clearances for hand warts (75%), however, repeated treatments were needed and efficacy was highly dependent on the interval between sessions. Moreover, this procedure is painful and commonly associated with blistering and possible hypo- and hyper-pigmentations. Plantar warts are more difficult to treat by cryotherapy and paring the wart before treatment can increase the clearance

rate, but not all plantar warts are appropriate for cryotherapy.

Ablative lasers provide a valid alternative to conventional treatments especially in cases of more resistant warts, e.g. periungual or mosaic plantar warts. CO₂ laser treatment resulted in clearances of 64% to 100%, but scarring and post-operative pain were associated with the treatment [9, 10, 15]. The tissue interaction of the CO₂ laser beam provides some degree of coagulation of the surrounding tissue, known as residual thermal damage [16]. This effect, on the other hand, compromises wound healing, leading to extended healing times and an increased risk of side effects. Therefore, the use of Er:YAG lasers, having a 10-fold increased specificity for absorption in water (which minimizes thermal damage), seems a rational alternative. Reported rates of recurrence after Er:YAG wart removal are from 6% to 24% [11, 12, 16]. In order to reduce this rate we applied an additional Nd:YAG step, potentially targeting the vasculature supplying the wart. To the best of our knowledge this is the first report on the combination of Er:YAG and Nd:YAG for the treatments of cutaneous warts.

13 patients with a total of 17 warts were treated with this new approach. A 100% clearance in an average of 1.3 treatment sessions was achieved, including also with more resistant mosaic plantar and periungual warts. Plantar warts, especially those found on the feet, usually cover much deeper skin layers. The Er:YAG laser enables a layer-by-layer precise ablation of the tissue to remove the wart in its entirety without considerable damage to the adjacent tissue, thus reducing the risk of recurrence. In fact, none of the patients developed a recurrence in 2 years. Only 1 patient developed a wart on a location adjacent to the treatment area. Intra-procedural contamination of adjacent tissue is unlikely, since HPV DNA was found to be absent in the plume of Er:YAG treated warts [17]. Nevertheless, the use of a protective face mask and a smoke evacuator with the suction tip 1 cm from the treatment site is still recommended.

The low recurrence rate may also be explained by a synergistic effect of Nd:YAG on the wart. Nd:YAG laser alone has been used for wart treatment using similar parameters as those used in our study. Han et al. reported clearance rates of 96%, however, up to four treatment sessions were required [7]. Semprimoznik et al. reported on a case of mosaic plantar warts being effectively cleared after a single session of Nd:YAG using the same parameters as in our study. Although the mechanism of Nd:YAG action on warts is not proven yet, the most probable Nd:YAG targets are the dilated vessels in the papillary

dermis, which are a characteristic feature of warts[7]. Light microscopic evaluation of Nd:YAG treated warts have shown epidermal necrosis and destroyed blood vessels in the dermis surrounded by a dense inflammatory infiltrate [7]. In our study, targeting the vessels that supply nutrients and oxygen to the virally infected tissue may have additionally aided in eliminating the wart, even in cases where ablation did not remove the wart tissue completely and recurrence would have occurred otherwise. Delivering adequate therapeutic laser energy was suggested to be a critical point in achieving efficient wart removal with Nd:YAG alone [19]. In their study Bingol et al. [19] have used a technique of triple circle pulse overlapping in order to achieve this effect. With our method, the majority of wart tissue is removed in the first step by ablation, therefore exposing the underlying vasculature more directly to the Nd:YAG laser beam and enhancing its absorption.

Therefore, we suggest that Er:YAG ablation of warts combined with Nd:YAG coagulation of the dilated wart vessels is a promising and efficient method of wart elimination. In addition to achieving clearances of 100% without recurrence in two years, the procedure is convenient for the patient since a maximum of two sessions is needed.

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