

Long Pulsed Nd:YAG Lasers in the Management of Cutaneous Warts

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Citation

Shrestha S, Karn D. Long Pulsed Nd:YAG Lasers in the Management of Cutaneous Warts. *Kathmandu Univ Med J.* 2018;61(1):60-4.

ABSTRACT

Background

Despite multiple treatment options, there is no consensus on a particular treatment modality in warts. Previous studies have reported safety and efficacy of long-pulsed Neodymium-doped yttrium aluminium garnet (Nd:YAG) laser, with clearance rates higher than those achieved with other therapies. This study was designed to evaluate the efficacy of long-pulsed Nd:YAG laser in the treatment of warts in Nepal.

Objective

To assess the efficacy of Long pulsed Nd:YAG in the management of verruca vulgaris.

Method

Fourty cases of common warts over hands and feet were enrolled in the study. Patients with less than 10 lesions were chosen. Up to three sessions of 1064 nm Long pulse Nd:YAG treatment were done, at the interval of one month. No concomitant topical or other treatment was done.

Result

Out of the 40 patients, four patients were lost to follow up. Among 36 patients, eight patients (22%) achieved clearance of warts in single session, while 12 (33%) patients and six patients (16%) improved after second and third sessions of laser respectively. Hence, we observed 72% clearance rate after three sessions of lasers. Adverse effects were pain during treatment and scarring in few patients.

Conclusion

Long pulse Nd:YAG is effective in the treatment of verruca. However, pain and tissue damage are the limitations. Hence, we suggest that Long Pulsed Nd:YAG lasers are effective in recalcitrant cutaneous and palmoplantar warts.

KEY WORDS

Clearance, Lasers, Palmoplantar, Verrucae

INTRODUCTION

Verrucae are common benign skin conditions, caused by Human Papilloma Virus (HPV) infection. The incidence of verrucae ranges from 0.84% to 4.7% worldwide.¹ Transmission occurs via direct skin-to-skin contact or indirect contamination of inanimate objects when skin barrier is compromised.² They may be self-limited but may run an unpredictable course. Various treatment modalities such as cryotherapy, salicylic acid, surgery, lasers, imiquimod and bleomycin have been tried with variable success.³ There is no antiviral treatment specific for HPV. Common approach is to damage the infected epithelium, while others are immunomodulatory, antiproliferative or virucidal.³

Lasers have been tried in the past because of their properties of hyperthermia, blood vessel destruction and immune response. Lasers such as Pulsed dye laser (PDL), Nd:YAG laser and Carbon dioxide (CO₂) lasers have shown variable efficacy of 32-75%,56-96% and 56-74% respectively.³⁻⁷ In 2016, a systematic review of lasers on nongenital verrucae showed that out of 35 studies on lasers, treatment efficacy varied among individual lasers, and PDL was equivalent to conventional treatment modalities.^{8,9}

Long pulsed Nd:YAG 1064 nm laser relatively spares the epidermal melanin, reaches deeper dermis, targets blood vessels and is cost effective. Hence, our study aims to evaluate the efficacy of Nd:YAG lasers in common and palmoplantar warts in Nepal.

METHODS

This prospective, experimental study was conducted in the outpatient dermatology department of Dhulikhel Hospital, between June 2016 to February 2017. There were 40 patients enrolled in the study. Male and female patients older than 10 years of age were chosen. The number and age of the patients is limited because of the painful nature of this treatment. Patients with common warts of hands and feet, palmoplantar warts and those with less than 10 lesions were included in the study. Periungual warts were included under common warts of hands and feet. Palmoplantar warts were dealt separately because of thicker skin and anticipated difference in outcome.

Ethical clearance was obtained from the Institutional Review Board of Kathmandu University School of Medical Sciences prior to the study. Informed consent was taken from patients, after due explanation of the research purpose.

Patients who were treated for cutaneous warts within the last three months were excluded. Patients with history of photosensitivity, active infection or keloidal tendency were not included as well.

Long pulsed Nd:YAG lasers (1064 nm) was used for the treatment of warts. Up to three sessions of laser therapy were given, at the interval of one month. Local anesthesia with injectable 2% lignocaine with epinephrine was given prior to laser therapy in all cases. The parameters for laser device used were fluence of 150J/cm², pulse width 10 secs and spot size of 5 mm. The entire wart along with a 2 mm margin of the surrounding tissue was irradiated. Given laser parameters were used for all verrucae, irrespective of their size, however number of shots delivered varied according to size of the lesion, in order to cover the entire lesion and its surrounding. End point of each laser session was observed as appearance of crusting, scaling and blackish swelling.^{2,4,5}

Clinical photographs were taken in all patients. Topical antibiotic cream fusidic acid was applied after the procedure for 1 week. Patients were followed up at 1 week, and then monthly up to six months to monitor for clearance of warts.

A self-designed proforma prepared by the investigator was used. A prospective purposive sampling method was used. Data was entered in Microsoft excel and analysed by SPSS 20. Descriptive data was provided in tables and figures. Bivariate analysis was done by paired T- test for quantitative data.

RESULTS

Total of 40 patients were enrolled in the study, of which, four were lost to follow up. Among 36 patients remaining for complete analysis, warts were assessed for clearance.

The patients in this study were between 13 to 38 years of age, and their mean age was 26 years. Male to female ratio was 1.2:1. The socio-demographic variables are depicted in Table 1.

Table 1. Sociodemographic variables of the patients

Variable	Frequency (Percentage)
Age	
11-20 years	10 (27.8)
21-30 years	16 (44.4)
31-40 years	10 (27.8)
Gender	
Male	20 (55.5)
Female	16 (44.4)
Duration of lesions	
≥ 6 months	16 (44.4)
< 6 months	20 (55.5)
Skin Type	
Fitzpatrick skin type IV	10 (27.8)
Fitzpatrick skin type V	20 (55.5)
Fitzpatrick skin type VI	6 (16.7)

In this study, the number of warts treated in any patient was less than 10, among which 72.2% had less than five lesions. The clinical variables of the patients is shown in Table 2.

Table 2. Clinical variables of patients with cutaneous warts

Variable	Frequency (%)
Type of wart	
Common warts of hands and feet	20 (55.5)
Palmoplantar warts	16 (44.4)
No. of warts (per patient)	
1 to 5	26 (72.2)
5 to 10	10 (27.8)

Number of sessions for clearance of warts was variable among patients. In total of 72.2% patients, clearance of their warts after 3 sessions. Mean number of sessions required was 2.17 ± 0.78 . And during six months of follow-up, there was no recurrence. Scarring occurred in 38% of the patients, out of which 22% were of skin type V. However, when compared with total number of persons with each skin type, percentage scarring in skin type IV and V were 40% each, while 33% in skin type VI. We did not evaluate about types of the scarring, as it did not fall under primary objectives of the research. Treatment variables are shown in Table 3.

Table 3. Treatment variables

Variable	Frequency (%)
No of sessions required for clearance	
1 session	8 (22.2 Clearance)
2 sessions	12 (33.3 Clearance)
3 sessions	6 (16.7 Clearance)
Total clearance percentage	26 (72.2)
Scarring according to skin type	
Fitzpatrick skin type IV	4 (11)
Fitzpatrick skin type V	8 (22)
Fitzpatrick skin type VI	2 (5)
Total patients with scarring	14 (38)

In this study, clearance rate did not differ significantly between common and palmoplantar warts ($p > 0.05$) but was significantly more in patients with lesser number of warts ($p = 0.05$). The clearance rate according to type and number of warts are given in Table 4.

Table 4. Factors affecting clearance

Clinical variables	Clearance	p-value
Type of warts	Yes No	
Common wart	14 6	0.81 (>0.05)
Palmoplantar wart	12 4	
No of warts		
More than 5 warts	4 6	0.05
Less than 5 warts	22 4	

DISCUSSION

Approximately 30% of warts regress spontaneously within the first few months of appearance, more so in children.¹⁰ Treatment is aimed to prevent further spread, decrease infectivity and for cosmetic concern.¹¹

Various treatment modalities, such as topical ointments, cryotherapy, immunotherapy have been tried with variable success. Newer modalities such as intralesional immunotherapy, bleomycin and lasers have shown effective clearance rates of warts in recent studies.^{3,12,13} Lasers are noninvasive treatment modalities, which have shown excellent clearance rates in previous studies, especially in recalcitrant and palmoplantar warts. Pfau A et al. reported a case showing clearance of recalcitrant warts with long pulsed Nd:YAG 1064 nm laser.¹⁴

According to the principle of laser therapy, depending on the pulse duration and energy density, it leads to coagulation (photodermal effect) or blasting (photomechanical effect) of target tissue.¹⁵ In verrucae, laser induced hyperthermia promotes the clearance of HPV affected and surrounding keratinocytes, via apoptosis and immune activation. HPV virus has been shown to respond more to treatment with heat than cryotherapy, and hyperthermia causes apoptosis of cells at temperature more than 39-44° C.^{16,17} Lasers promote migrational maturation of epidermal langerhans cells, leading to immune response. These Langerhan cells regenerate every two weeks and epidermal turnover time is 52-75 days.¹⁷ Hence lasers could be repeated every two weeks and 3 months period can be taken as an end point for treatment response.

Although the exact mechanism of Long pulsed Nd:YAG lasers in cutaneous warts isn't known, it emits a visible light spectrum of 1064 nm, that delivers light energy to hyperkeratotic and thickened epidermis associated with warts.⁴ It targets dilated blood vessels, which heat up rapidly and burst, leading to purpura, showing histopathological evidence of separation of dermo-epidermal junction, epidermal necrosis, and RBC extravasation, hence leading to destruction of warts.⁵ However, because of longer wavelength and relative sparing of melanin, minimal surrounding tissue damage is anticipated.⁴ Cost effectiveness of long pulsed Nd:YAG lasers compared to other lasers, is an additional advantage. Hence, we conducted this study to evaluate the efficacy of long pulsed Nd:YAG lasers in the management of verrucae.

In our study, patients were between the age group of 13 to 38 years. The mean age was 26 years, similar to Han et al, who showed mean age of 21 years. However, their patients were between 3 to 67 years of age. Male to female ratio in our study was 1.2:1, similar to Kimura et al. However, Smith et al and Goldberg et al had more female patients, showing male to female ratio of 1:1.2 and 1:2.5 respectively.

The clearance rates of common and palmoplantar warts, after 3 sessions of treatment was 72% in our study. This

Table 5. List of previous studies with Nd:YAG lasers and their efficacy in cutaneous warts.

Study (Year)	n	Type of laser	No of sessions (Mean)	Clearance rate (%)
Han et al. (2009) ⁵	369	Long pulsed Nd:YAG	4 (1.49)	96
Kimura et al. (2014) ⁴	20	Long pulsed Nd:YAG	6 (3.8)	56
Smith et al. (2015) ¹¹	53	Long pulsed Nd:YAG	4 (3.6)	69.8
Goldberg et al. (2015) ²	25	Long pulsed Nd:YAG	3	76

is comparable to previous studies with clearance rates between 56 to 76%.^{2,4,5,11} However, studies do not have uniformity in number of cases, types of wart treated and laser parameters used during treatment. This might have been the confounding factors for such wide range of clearance rates.

Previous studies have shown that optimal treatment sessions for clearance depended on factors such as number of warts, duration of lesion and site of the lesion. Clearance was higher in patients with single wart, warts of hands and feet, and those with older lesions.^{4,5} Patients with palmoplantar warts required longer treatment sessions for complete clearance or had incomplete response.⁵ In our study, there was no significant difference in clearance of old and recent warts. Clearance did not vary significantly ($p>0.05$) among common and palmoplantar warts as well. However, clearance rates were significantly higher ($p=0.05$) in patients with lesser number of warts in our study.

Mild adverse effects such as pain and burning sensation have been uniformly reported previously. However, scarring, hypopigmentation and hyperpigmentation was noted in

studies using higher laser parameters such as fluence and spot size.⁵ Interestingly, Smith et al. proposed that use of injectable analgesics might increase the risk of scarring during laser procedure.¹¹ In their study, they have noted tissue breakdown in almost half of their patients opting for injection lignocaine. Subcutaneous injection disrupt the surrounding tissue, making them more vulnerable to laser induced hyperthermia.¹¹

In our study, scarring was seen in 38% of our patients, which could be because of injectable anesthetic use. Scarring percentage in each skin type was comparable, hence skin color did not seem to contribute to tissue damage. Long pulsed Nd:YAG laser is a painful procedure and although clearance is reported better than other lasers, it is associated with residual tissue damage.¹⁸

Limitation of this study is that we did not have control group to compare the results. Also, the number of patients in the study was small. Further, the confounding factors could be different sizes of verruca lesions and no definite measurement tool for assessing of efficacy, except for clinical evidence. Moreover, long term follow up after 6 months could provide information on recurrence. Large randomized, blinded, multi-center trials with uniform laser parameters would provide more accurate insight to the efficacy of Nd:YAG lasers in warts.

CONCLUSION

Long pulse Nd:YAG 1064 nm has shown effectiveness in the treatment of cutaneous verruca. However, pain and tissue damage are common limitations. Hence, we suggest that Long Pulsed Nd:YAG lasers can be used in recalcitrant cutaneous and palmoplantar warts.

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