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Warts Treatment by 810 nm Diode Laser Irradiation: A New Approach

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Abstract: The present work was done in an attempt to build systematic procedures for treating warts by 810 nm diode laser regarding dose parameters, application parameters and laser safety. The study was done in Al- Kindy Teaching Hospital in Baghdad, Iraq during the period from 1st October 2003 till 1st April 2004. Fifteen patients completed the treatment and they were followed for the period of 3 months. Recalcitrant and extensive warts were selected for the study. Patients were randomly divided into 3 groups to be treated by different laser powers 9, 12 and 15 W, power density of 286 W/cm^2, 381W/cm^2, 477 W/cm^2 pulse duration of 0.2 s, interval of 0.2 s and repeated pulses were used. The mode of application was either circular or radial. Pain occurred for about 1 week after treatment especially on movement (when lesions near joint) to all group and power density. Oozing occurred from lesion with scales and oedema after laser treatment for about 1 week. Post-inflammatory hypo-pigmentation might occur after the lesion have healed completely. No recurrence of lesions after complete healing of lesions. Complete healing of the lesion was noticed, no scarring after complete healing of lesion. Diode laser therapy of recalcitrant and extensive viral warts could be considered as a valuable alternative to other more traditional techniques. This treatment can offer a good result in eliminating the verrucae and their sequelae of recurrence, scarring and the post-operative pain.

Introduction

Viral warts are benign epidermal neoplasms caused by human papillomas virus infection. Individual variations in cell-mediated immunity may explain differences in severity and duration of warts (Habif, 1996).

Warts occur in normal people and persist for prolonged periods, sometimes many years. These may be a source of considerable discomfort and embarrassment to the patients. Various conventional treatments have been employed to deal with these lesions. The treatment included destructive techniques such as curettage, electrocautery, surgical excision, and cryotherapy. Immunostimulation like levamisol, cimetidene, and dinitrochlor-benzene sensiti-zation, virucidal agents like glutaraldehyde or formaldehyde, and the use of intralesional agents such as bleomycin or interferon-α (Shelley and Shelley; 1991; Wilkinson, 1998). Warts that fail to respond to conventional treatment have been considered as recalcitrant. In the last years, there are many reports from different areas of the world concerning the use of the CO_2 laser (Wheeland and Walker, 1986), pulsed dye laser (Kauvar et al., 1995), copper vapor laser (Nemeth and Hpudek, 1991).

The present work was done in an attempt to build a systematic procedure for treating warts by diode laser regarding dose parameters, application parameters and laser safety.

Materials and Methods

This study was done in the outpatient clinic in the department of Dermatology and Venereology, Al-Kindy Teaching Hospital during the period from 1st October 2003 to 1st April 2004. Fifteen patients with extensive or recalcitrant warts were selected for diode laser therapy. Extensive refers to more than five

lesions, or lesions larger than 2 cm in diameter warts were considered recalcitrant if they persisted for at least 12 months and were unresponsive to at least one conventional treatment modality such as local keratolytic agent, electro-surgery, simple surgical excision or cryosurgery. A full history was taken regarding the age, sex, duration of the lesion, site of the lesion and number of the lesions.

Whether the laser treatment is the first time treatment of the lesion or second type of treatment and the lesion was recurrent or unresponsive to previous treatments. A careful examination was performed of measuring the size of lesion (dimension). The age of patients ranged between 7- 40 years.

Preparation of warts lesion to be treated was done by sterilizing the area by povidon iodine solution 10% and infiltrate locally with 2% xylocaine hydrochloride without adrenalin. The laser beam was prepared to irradiate the area of wart according to the power needed, pulse duration, and intervals.

An 810 $\pm$ 20 nm diode laser unit was used with pulse mode, 200 ms pulse duration and 200 ms repetition rate. The laser light applied in contact method either circular or radial methods.

1. Circular method was used if the wart is large (larger than 0.5cm). in diameter that it need to put the laser beam at the edge of wart until the blanch then changing the site of laser beam nearby area in the edge until all the edge be blanched and become like a white ring around the wart with difference shape and size (which needed to excised by either curette or scissor to remove the wart from the skin). Then irradiation to the area around the wart is done to kill the virus if present around the wart and prevent recurrence of lesion after that.

2. Radial method was used for small wart (less than 0.5 cm in diameter), the diode beam was putting in the center of wart then irradiated the wart center by the power needed to treat the patient till the wart became blanching from center to peripheral. Then wart was easily removed by slight pressure (by curate) and no bleeding occurred.

The laser beam applied to area about 5 mm wide beyond the visible edge of the wart, because the human papilloma, virus has been demonstrated in apparently normal epidermis surrounding viral warts (Ferenczy, Nagai; 1985).

The study was done on 15 patients. Patients were divided into 3 groups to be treated by different power; Group 1 with 9 W, power density 286 W/cm^2 (see Table 1), Group 2 with 12 W, power density 381 W/cm^2 (see Table 2), and Group 3 with 15 W, power density 477 W/cm^2 (see Table 3).

The sites affected were shown in Tables (1-3) are related to number. There were usually many lesions seen in one patient, other one lesion in another patient, i.e., 70 warts in 1 patient down to 1 wart in other patients.

The number of patients have one lesion was 2, number of patients have less than 10 lesions was 7, while number of patients have more than 10 lesions was 6. There was no difference in treatment by laser regarding. The lower power (9 W) was used in face, small lesion, and child. The medium power (12 W) was used in extremities small lesion, adult, while high power (15 W) was used in extremities, large, adult.

Fifteen patients with a large number of warts completed the period of follow up for 3 months. the lesions were distribute mainly in the upper and lower extremities, and face (Tables 1-3). Specific symptoms that bring the patients to the hospital were pain, or discomfort in the wart site as well as cosmetic embarrassment.

In 5 patients other conventional modalities of treatment have been used and fail to eradicate the warts. In others patients have extensive warts with no history of previous treatment. The duration of the lesions prior to laser therapy ranged from 6 month to 6 years in groups of patients.

Results

The patients were seen on the next day looking for early post-operative complications and then followed up at approximately 2 weeks intervals for 6 weeks. The patients were asked to come 3 months after the operation. Complete cure was considered. When the wart completely eradicated, it does not recurrence with restoration of normal skin markings was achieved. Any associated complications like infection, scaring, hyperpigmentation, hypo-pigmentation or any other sequelae were looked for.

After passing of laser beam in warts lesions, complete clearance of the lesion was noticed, no recurrence of lesion after complete healing. The healing usually occurs by granulation tissue formation. This took between 2-6 weeks depending on the size of the lesion. No scaring

in the treated areas was apparent. Pain was experienced after laser treatment for about 1 week duration. It was mild that didn't interfere with the patient activity and didn't necessitate medication; no post operative infection had been seen.

Table 1: Patients treated by diode laser (power 9 W, power density 286 W/cm^2, pulse duration 0.2 s, interval 0.2 s)

Case No.	Age/ yr.	Sex	Site	No.of lesions	Size	Duration/ Month of lesion	Recurrent after conventional treatment or 1st time	Procedure
1	24	M	Foot, leg	3	2 X 3 cm 0.5 X 0.5 mm 4 mm thickness	48	Recurrent	Circular Radial
2	20	M	Finger	3	0.5 X 0.5 cm 3 mm thickness	24	1st time	Radial
3	25	M	Face	6	1 X 1 cm 0.25 X 0.5 cm 4-5 mm thickness	8	1st time	Radial
4	14	F	Foot	3	0.5 X 0.5 cm 3-4 mm thickness	12	1st time	Radial
5	40	F	hands	2	0.25X 0.25 cm 2 mm thickness	6	1st time	Radial

Table 2: Patients treated by diode laser (power 12 W, power density 381 W/cm^2, pulse duration 0.2 s, interval 0.2 s)

Case No.	Age / Yr	Sex	Site	No.of lesions	Size	Duration / month of lesion	Recurrent after conventional treatment or 1st time	Procedure
1	7	F	Finger, near nail	1	0.5x0.25 cm 2 mm thickness	6	1st time	Radial
2	12	M	Hand	1	1x 1 cm 3-4 mm thickness	2	1st time	Circular
3	40	F	Toe, hand	3	1x 1 cm 4-5 mm thickness	24	1st time	Circular
4	20	F	Hands (dorsum) fingers	20	2x 2 cm 0.5 x 0.5 mm 3-4 mm thickness	8	Recurrent	Circular radial

Table 3: Patients treated by diode laser (power 15W, power density 477 W/cm^2, pulse duration 0.2 s, interval 0.2s)

Case No.	Age / Yr.	Sex	Site	No. of lesions	Size	Duration/ month of lesion	Recurrent after conven. treatment or 1st time	Procedure
1	20	F	Palms	About 70	3x5 cm largest 0.5x0.25 cm smallest 2-4 mm thickness	6	Recurrent	Circular for large radial for small
2	21	F	Dorsum of palm	=	0.4-0.5 cm thickness 2-3 mm	7	1st time treatment	Circular radial
3	33	F	Palm+ fingers	4	0.5x 0.5 cm 4 mm thickness	12	1st time	Circular
4	19	F	Big toe	7	1x 2 cm large 3x4 mm small Thickness 3-4mm	12	Recurrent	Circular Radial
5	40	F	In feet	20	2x3 cm 0.5x 1 cm thickness	72	Recurrent	Circular Radial
6	30	M	In foot and toe	30	3x 4 cm, 1x1 cm, 3-4 mm thickness	12	1st time	Circular radial

Post-inflammatory hypopigmentation might seen in some of patient in follow up of patients.

In Group 1, and as shown in Table 1 and Plates 1 and 2, pain, oozing, scales, oedema occurred for about 1 week post laser treatment. Complete healing of lesions has been seen post treatment of about 6 weeks. (Plate 3). Post-inflammatory hypopigmentation might occur after the lesion has healed completely.

No scaring, no recurrence in follow up time for 3 months. Irradiation of laser for one patient in face was done (one wart treated and not for other warts), but in following up of patient, increase in number of warts were seen in face, but after irradiation of all new and old lesions, the lesions disappeared completely, the history of patient was taken about the lesion (the patient had bronchitis, influenza with high fever at that time after first time irradiation that may cause decrease immunity of the body which lead to exacerbation of virus and increase number of warts in face , then after irradiation of all warts by diode laser at 9W power lead to disappearance of all lesions due to eradication of virus by laser beam that lead to disappearance of lesion.

In Group 2, as shown in Table 2 and Plates 4, 5 and 6, a complete healing of lesions have been seen after laser irradiation. Pain, oozing, oedema and scales occurred for about 1 week after laser treatment. Post- inflammatory hypopigmentation might occur after the lesion had healed (during follow up period of 3 months). No scaring or recurrence after complete healing was observed. Disappearance of other lesions in other parts of the body (not irradiated by diode laser beam) after using diode laser in treating warts, happened in one patient in this group. This may be due to increase immunity of the body after irradiation of warts.

In Group 3, as shown in Table 3, Plates 7, 8 and 9, a complete healing of lesions have also been seen after laser irradiation. The pain, oozing, oedema, and scales occurred for about 1 week after laser irradiation. Post- inflammatory hypopigmentation might occur after the lesion has healed completely. No scaring, or recurrence after complete healing, these observed in

following up of patient for 3 months. One patient, in this group, showed disappearance of other lesions in other parts of the body (not irradiated by diode laser) after using diode laser in treating warts. This may be due to increase the immunity of the body after irradiation of warts (Ferenczy, Nagai; 1985).

Plate 1: Warts lesion in face of patient pre-laser treatment. **Plate 2:** The warts lesion in face post-laser treatment. **Plate 3:** Lesion in face after 6 weeks of laser treatment showing complete healing, no scarring. **Plate 4:** Warts lesion pre-laser irradiation. **Plate 5:** The lesion post-laser irradiation. **Plate 6:** The lesion after 9 weeks of laser irradiation, complete healing. **Plate 7:** Warts lesion in dorsal aspect of left foot in 2 toes, pre-laser treatment. **Plate 8:** The lesion post-laser treatment. **Plate 9:** Six weeks after laser irradiation, complete healing

Discussion

Scarring has been stressed upon in previous studies using different other types of laser, but in this study no scaring has seen using diode laser. This may be due to the wavelength of diode laser, and in sequence difference in penetration depth. In spite of the fact that post operative pain was reported in most of the patients, this goes in agreement with many works (McBurney, 1984) used other types of laser. There was no infection; this was probably due to self-sterilizing action of the laser light. This study confirms that the ability of the diode laser to eradicate resistant cutaneous viral warts. This has been seen in our patients at following up. The mechanism of action of the diode laser on warts lesion in the 3 groups of patients is due to its wavelength (810 nm). This wavelength is well absorbed by hemoglobin which allows effective, selective and safe treatment of tissue.

The thermal tissue interaction is based on the absorption of laser light and the transformation of laser energy into heat. The

intensity of the light absorption is dependent on the tissue type and the wavelength, laser energy applied, and the penetration depth of the diode laser light in tissue is 2 – 3 mm; this makes the diode laser especially attractive for treatment of sensible structures, where the thermal destruction of surrounding tissue should be avoided in any case. Because of a low specific absorption and considerable scattering, coagulation can only be achieved at low and medium power densities. Tissue vaporization is possible at high power densities and/or by contact applications.

The coagulation zone is limited to 0.1-1 mm depending on the power density/exposure time ratio. Using appropriate parameters, the selective occlusion of vessels to be treated is possible without the thermal destruction of surrounding tissue (Therapeutic guidelines; 2000). The absorption maximum in hemoglobin leads to the deposition of high amount of energy in vessels. The surrounding tissue is not affected during the irradiation because the light is absorbed more strongly in blood than in skin. Shrinkage of the tissue caused by the thermal effect is mandatory for the occlusion of vessels. (Therapeutic guidelines; 2000)

Conclusion

Diode laser therapy of recalcitrant and extensive viral warts should be considered as a viable alternative to other more traditional techniques. This treatment can offers a good results in eliminating the venrucae and their sequelae of recurrence, scaring and post operative pain.

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الخلاصة تمت دراسة حالة 15 مريضا من كلا الجنسين مصابين بداء الثآليل تراوحت اعمارهم بين 7 و 40 عاما بين تشرين الاول 2003 و نيسان 2004 . الثآليل المعالجة كانت في الاماكن الاكثر شيوعا بالجسم (مثل اليد والقدم والوجه) ومختلفة بالعدد والحجم والمدة واستعملت طرق مختلفة. في العمل الحالي عولج المرضى بعد ان قسموا الى 3 مجاميع ، كل مجموعة عولجت باستخدام ليزر الدايود بطول موجى810 نانومتر بقدرة 9 و 12 و 15 واط وبزمن تشعيع 200 ملي ثانية ومدة النبضة 200 ملي ثانية . توبعت حالات المرضى لمدة ثلاثة اشهر. النتائج كانت شفاء تام للثآليل ولا عودة للمرض بعد الشفاء، ولا يوجد تليف, وفي بعضها ظهر تغير لون الجلد (فتوح اللون) للمنطقة المعالجة بالليزر. بعض التورم والقشور ظهرت ولمدة اسبوع بعد العلاج باشعة الليزر ثم أختفت .