The Use of the Copper Vapor Laser for Vascular Lesion Treatment

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Background **: While the effect of the flashlamp pumped dye laser in the treatment of telangiectasia and other vascular disease has been reported by many authors, there have been a few reports on the therapeutic effect of the copper vapor laser(CVL) on telangiectasia and other vascular lesions.**

Objective **: Our purpose was to assess the clinical results in Korean patients who had cutaneous vascular disorders that were treated with the CVL at 578 nm.**

Method **: A total of 23 patients with vascular lesions such as telangiectasia were involved. The effect of the laser treatment was evaluated 3 months after the last treatment.**

Result **: Of the 15 patients with telangiectasia, 12 patients showed good or excellent responses. 2 out of 3 patients with strawberry hemangioma showed good results. As for the other lesions, 2 out of the remaining patients 5 showed excellent results.**

Conclusion **: The CVL has a beneficial effect and is a good alternative treatment modality for vascular lesions. (Ann Dermatol 8:(1)14~18, 1996)**

Key Words : Copper vapor laser, Cutaneous vascular lesion

The copper vapor laser(CVL) is one of the lasers that has important cutaneous applications. It has two kinds of light[1]. One is a yellow light, 578 nm in wavelength, for vascular lesions. The other is a green light, 511 nm in wavelength, for pigmentary lesions.

Another source of yellow light is the flashlamp pumped dye laser. These two lasers, however, differ in the nature of the light they emit such as pulse width, pulse energy levels, and spot size[2]. Unlike flashlamp pumped dye lasers, the CVL is a high-repitition rate pulsed laser, emmitting beams of laser light in discrete but rapid burst[1].

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While the effect of the flashlamp pumped dye laser in the treatment of telangiectasia and other vascular disease has been reported by many authors[3-5], there are few reports on the therapeutic effect of CVL on telangiectasia and other vascular lesions. The results of treatment with CVL have been just sporadically reported[6-8]. Therefore, we analyze and report the result of treatment with CVL on various vascular disorders including telangiectasia in Korean patients.

PATIENTS AND METHOD

Patients

Our study is based on 23 Korean patients who were treated with a CVL. The type of vascular lesions were telangiectasia (15 patients), strawberry haemangioma (3 patients), angiokeratoma (2 patients), scar erythema (1 patient), spider angioma (1 patient), and poikiloderma of Civatte(1 patient)(Table 1). Telangiectases were associated with rosacea in seven patients, and with topical

Table 1. Types of vascular lesions

Type of lesions	No. of patients
Telangiectasia	15
Strawberry hemangima	3
Angiokeratoma	2
Scar erythema	1
Spider angioma	1
Poikiloderma	1
Total	23

steroid abuse in three patients. Their ages ranged from 1 to 82 years(mean 31.4 years). The man to woman ratio was 1.1:1.2.

Methods

A CVL(VCM-10, Visiray Co., Australia) was used for the treatment of affected areas. This CVL produces two wavelengths which can be emitted either separately or together: green (511 nm) and yellow (578 nm). The yellow wavelength is adjustable up to a maximum of 2.5 watts. The CVL emitts a train of pulses with a pulse width of 24 nanoseconds and a pulse repetition rate of 12 kHz. For treatment, the yellow light (578 nm in wavelength) was used in a chopped mode, with pulse duration from 25 to 50 ms. The energy output used varied between 1.8 and 2.5 watts.

The light was delivered via a hand piece. The telangiectatic vessels were traced from the distal end of their section to their proximal thickest sec-

Table 2. Criteria of assessing clinical response by copper vapor laser

Results	Definition	Approximate % change in resolution
Excellent	near normal skin	76 - 100%
Good	marked disappearance	51 - 75%
Fair	moderate disappearance	26 - 50%
Poor	no change to slight diappearance	0 - 25%

Table 3. Treatment results of telangiectasia by CVL

Patient	Sex/Age	Location	No. of treatment	Comments
Excellent				
1	F/45	face	3	rosacea
2	F/51	face	1	steroid-induced telangiectasia
3	F/51	face	2	steroid-induced telangiectasia
4	F/27	arm	2	unilat. nevoid telangiectasia
5	M/19	whole body	2	gen. essential telangiectasia
Good				
6	M/32	nose	2	rosacea
7	M/15	nose	1	rosacea
8	M/82	face	1	rosacea
9	F/51	face	1	steroid-induced telangiecatsia
10	M/45	face	1	rosacea
11	M/40	nose	1	rosacea
12	F/23	ant.chest	5	telangiectasia
Fair				
13	F/59	face	2	telangiectasia
14	M/25	face	1	rosacea
Poor				
15	M/4	face	2	telangiectasia

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Fig. 1. Facial telangiectasia prior to treatment with CVL.

Fig. 2. Result of the treatment of facial telangiectasia with CVL after 2 treatment session.

Table 4. Treatment results of other vascular lesions by CVL

Patient	Sex/Age	Diagnosis	Location	No.of treatment	Dose (J/cm^2)	Result
1	F/3	Str.hemangioma	face	2	18	good
2	M/1	Str.hemangioma	face	1	16	good
3	F/1	Str.hemangioma	face	1	16	fair
4	F/3	Angiokeratoma	eyelid	2	14-16	excellent
5	M/13	Angiokeratoma	ankle	1	16	poor
6	M/35	Scar erythema	face	3	14-16	excellent
7	F/47	Spider angioma	chest	1		poor
8	F/51	Poikiloderma	neck	1	16-18	poor

tion. A spot size ranging from 400 to 800 μm was used. For strawberry hemangioma and scar erythema, hexascan(Prein & Partners, France), an automated delivery system using a 1 mm spot was used. The exposure time was 40 to 60 ms in those cases.

The interval of each treatment session was 3 months. No local anesthetic was used in any of patients, and the patients' eyes were always protected.

Patients were assessed at 3 months after the last CVL treatment by comparing photographs taken before each treatment session. This was carried out by two observers. The response to therapy that was defined as an excellent result had 76-100% resolution of lesions, a good result had 51-75% resolution of lesions, fair results had 26-50% resolution of lesions, and poor results had 0-25% resolution of lesions(Table 2).

RESULT

Of the 15 patients treated with telangiectasia,

12 had a good or excellent response(Fig. 1, 2). The mean number of treatment to achieve over 50% clearing of lesions was about 1.8 sessions. Good or excellent results were achieved in six out of seven patients with telangiectasia associated with rosacea(Table 3).

Two out of three patients with strawberry hemangioma showed a good response. One of two patients with angiokeratoma had an excellent result. A patient with scar erythema also showed an excellent result. However, spider angioma, and poikiloderma of Civatte revealed a poor response (Table 4).

Immediate whitening was observed just after exposure to the laser light and swelling and occasional blistering were noticed within 1 to 2 days. Within 1 to 2 weeks the crusts that formed were separated spontaneously. After that event sunscreen and hydroquinone were applied. All the patients showed transient hyperpigmentation after the laser treatment. No cases of scarring, skin texture change, or persistent postinflammatory hyperpigmentation were noted.

DISCUSSION

As a source of yellow light for the treatment of vascular lesions, several kinds of lasers have been introduced. Of these lasers, the flashlamp pumped dye lasers have been widely used. More recently the CVL was introduced as an alternate source of yellow light. Both the CVL and the flashlamp pumped dye laser emit a similar wavelength light(578 and 585 nm respectively) but differ in the nature of the light[2].

In contrast to a flashlamp pumped dye laser that delivers a 450 microsecond pulse duration, CVL emits a pulsed light with a very short pulse duration of 24 nanoseconds. The pulse repetition rate is in the range of 12000 Hz. This repetition rate is sufficiently high that the beam appears continous to the human eye, that is, quasi-continuous. The individual pulse can not supply sufficient thermal energy to coagulate the vessel being treated. If the laser light is mechanically shuttered, one is able to deliver discrete amounts of laser light to the tissue. The summation of the thermal energy from numerous pulses will coagulate the vessesls.

The selective tissue damage caused by laser radiation is influenced by its wavelength, the exposure duration(pulse width) and the exposure dose(energy density)[9]. As for the wavelength, the greater absorption of light at 577 to 578 nm by oxyhemoglobin, combined with less absorption by melanin are the crucial elements responsible for the greater vascular selectivity[9]. Theoretically, the pulse width or the duration of exposure to laser light should be equal to or less than the thermal relaxation time of the vessel being treated. The thermal relaxation time is defined as the time during which 50% of the incident heat has radiated out of the vessel to adjacent tissues[9]. This varies according to the vessel size.

Even though the yellow light emitted by CVL matches the wavelength that contributes to producing vascular selectivity, CVL may have a non-selective effect with overlying epidermal damage[10,11]. Clinically, all patients treated experienced epidermal whitening immediately after exposure. Swelling and occasional blisters were developed within 1-2 days after treatment. Crusts that formed sloughed off within 2 weeks. However, this damage is different from argon laser that produce diffuse necrosis extended from the epidermis[12,13]. CVL produces damage only in the vascular target and overlying epidermis[10]. In flashlamp pumped dye laser treatment epidermal damage has also been observed[14,15].

Neuman et al[11] reported that excellent to good results were obtained in 69% of cases with facial telangiectasia. Key and Waner[7] reported that 18 of 20 patients treated had a satisfactory response, with a disappearance of the vast majority of vessels. In our series, the success rate of treatment is 80% and similar to the results of the above reports. From the Key and Waner's report, two patients associated with rosacea showed an unsatisfactory response[7]. They thought the reason for failure was that the vessel size was so small that individual vessel tracing and point coagulation were not sufficient to photocoagulate. In contrast, however, in our series 6 out of 7 patients with rosacea showed a good or excellent response. So rosacea is thought to be a good candidate for CVL treatment. Number of treatment sessions for getting over 50% clearing of lesions is 1.8. Comparing with flashlamp pumped dye lasers CVL is more efficacious when treating larger vessels[2].

Animal studies revealed that the mechanisms for destroying cutaneous blood vessels are different when using the CVL as opposed to the pulsed

dye lasers[16]. Dinehart et al's report has shown that treatment with a pulsed dye laser resulted in intravascular coagulation and a rupture of smaller vessels whereas treatment with a CVL resulted in vasoconstriction[8].

Dinehart et al suggested that in early presented and already slightly raised superficial hemangioma CVL might have an advantage over other yellow light lasers. Cherry angioma and anigokeratoma would also respond to treatment with CVL[8]. A good results were obtained in 2 of the 3 patients with strawberry hemangioma and thus stawberry hemangioma could be a candidate. Angiokeratoma and scar erythema also responded to the treatment with CVL. In these cases, if the number of treatment sesseion was increased, the better clinical result could be achieved. Therefore for these lesions multiple treatment session should be necessary. It was not possible to assess an accurate clinical effect in spider angioma and poikiloderma of Civatte because of the few cases involved.

CVL has several advantages when compared with flashlamp pumped dye laser[2]. These are more cosmetical acceptance due to the absence of purpuric macule produced after treatment, less post-treatment swelling and less time in healing. But the disadvantage of CVL is that it is much more difficult to use correctly.

As a complication, only a slight atrophic scarring of the treated skin and hypopigmentation was reported[11]. In our series this complication was not observed. Temporary hyperpigmentation that appeared in our series may be a common phenomenom[11].

In conclusion, CVL is beneficial alternative treatment modality for vascular lesions such as telangiectasia and other lesions.

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