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Clinical Effect of the Copper Vapour Laser Compared to Previously Used Argon Laser on Cutaneous Vascular Lesions

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The copper vapour laser has in theory qualities which make it interesting in the treatment of cutaneous vascular malformations. In order to study the clinical effect of the copper vapour laser and to compare its effect with the effect of the argon laser, we treated 38 patients with port-wine stain or facial telangiectasia with the copper vapour laser. Thirty-one patients were evaluated and of these 24 were improved or much improved. Nineteen patients had previously been treated with the argon laser, and in this group the copper vapour laser had better effect than the argon laser in 8 patients and equal effect in 9 patients. In 7 patients side-effects like scarring or hyperpigmentation were noted after treatment with copper vapour laser.

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Port-wine stains (PWS), with a prevalence of 0.3 to 0.5% in the population (1), facial telangiectasia and other vascular cutaneous lesions have in recent years become a common indication for treatment with lasers. Several different types of lasers have been used. The argon laser has been documented to have a good effect (2–6), as well as the pulsed dye laser (7–9). The copper vapour laser (CVL) with two emission peaks, green light at 510 nm and yellow light at 578 nm, has in theory good chances to be effective in the treatment of vascular malformations. The 578 nm emission peak of the CVL corresponds well to one of the absorption peaks of oxyhemoglobin (577 nm), and the light absorption of melanin in this wavelength area is less than at the 488–514 nm (blue-green) wavelength band where the argon laser emits. Reports from centres using the CVL have also shown promising results in the treatment of vascular lesions (10, 11). Histological and histochemical studies have shown that the thermal damage is more selective to ectatic vessels than non-vascular structures with yellow light lasers (12–15).

Both CVL and the pulsed dye laser (PDL) emit yellow light (578 nm and 585 nm, respectively), but in contrast to the PDL which produces a short and high single energy pulse, the light from the CVL is emitted as a train of very short peaks (15–50 ns).

In this study we used a CVL and treated 38 patients, 21 of which had previously been treated with the argon laser. We registered the clinical effect and compared it with the effect of the formerly used argon laser.

MATERIALS AND METHODS

Copper vapour laser

We used a PBI Laser 10 Cu with two emission peaks, green light at 510 nm and yellow light at 578 nm. With this laser you have the possibility to choose whether to use both peaks or just one. We used the 578 nm peak.

The power output used was the minimum power that gave an immediate whitening of the treated spot, "minimal blanching". This power was tested out at the first treatment of every patient and varied between the patients. A higher power setting than "minimal blanching" resulted in a blue-greyish colouring of the treated skin. A power output of 1.5 W was used in 30 of the 38 patients and in the rest of the cases the power was set between 1.0 and 1.4 W. The energy of this laser is delivered as a train of very short pulses, where every single pulse has a duration of 15 nsec and is repeated with a frequency of 10 kHz. The length of this train, the exposure duration or the more true "pulse duration", is adjustable between 20 ms and 1 s. In this case the exposure time was set to 50 ms.

For the delivery of light to the skin surface a quartz optical fibre was used, which produced a spot size diameter of 1 mm^2.

With these parameters the mean energy density was 9.3 J/cm2 with a range of 7.6–9.6 J/cm^2.

Argon laser

A HGM Medical Laser System model 8 was used with a pulse duration of 200 ms as standard at the time of study. The spot size diameter was 1 mm^2. As with the CVL the "minimal blanching" output effect was tested out at the first treatment of every patient. An average power output of 0.87 watt was used with a range of 0.62–1.22 watt. The mean energy density was 22.2 J/cm^2 with a range of 15.8–31.1 J/cm^2.

Patients

Thirty-eight patients were treated with the CVL, 21 (55%) of which were women and 17 (45%) men. The mean age was 33 years (15–81 years) and the mean number of treatments was 2.2. In 34 of the patients the diagnosis was PWS and in the remaining 4 the diagnosis was telangiectasia of the face.

In 35 of the patients the lesion was located in the face and/or neck and in 3 patients on the trunk. Local anaesthesia, lidocaine 10 mg/ml, was used in just one patient.

Twenty-one of the patients had previously been treated with the argon laser (HGM Medical Laser System model 8, pulse duration 200 ms, spot size diameter 1 mm^2) one or several times (mean 6.1 times). Five of these had responded poorly to the argon laser and one had reacted with scarring. The other 15 patients had moderate to good clearing after argon laser but had not completed the therapy. Twenty patients had the diagnosis PWS and one telangiectasia.

Treatment and evaluation

Each patient was seen every 2 months (1–7 months) and the area treated each time varied between 1 and 10 cm^2. Photographs were taken before and after every treatment and these were used in the evaluation. The eyes of the patients were protected by red goggles except in cases with lesions on the eye lids, where a metal shield was placed in front of the eye under the eye lids. For eye anaesthesia in these cases we used oxibuprokain 0.4%.

The patients were told to use sunblock (UVA and UVB) on the lesions and the surrounding area during and at least for 6 months after the treatment.

The effect of the treatment was evaluated after an average of 22 weeks after starting the therapy. The evaluation of the treatment with the CVL as well as the treatment itself was carried out by two doctors. The CVL effect was judged in the meaning of lightening, hyper/hypopigmentation and scarring. The lightening was graded in a three-

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point scale from no effect, via improved (partial clearing) to total clearing. The CVL effect versus the argon laser effect was also graded in a three-point scale, less, equal or better effect than the argon laser.

RESULTS

Thirty-one of the 38 patients were evaluated. Seven patients were excluded due to their own choice. All of the drop-out patients were treated only once.

CVL

One patient had a total clearing of the PWS, 23 had partial clearing and in 7 patients there was no detectable improvement. In the latter group the mean number of treatments was 1.9, while it was 2.6 in the groups with effect (total and partial clearing). The mean power output did not differ between the group without effect and the two groups with effect (1.46 W), while the mean age was 36.6 years in the group without effect versus 34.7 years in the groups with effect.

Argon laser

Nineteen of the evaluated patients had previously been treated with the argon laser. Among these, the CVL had better effect in 8 patients, less pronounced effect in 2, and in 9 patients the treatments had equal effect.

Side-effects

In 7 patients some sort of side-effect was noticed after treatment with the CVL. Six patients showed mild scarring and one patient reacted with local hyperpigmentation. No hypopigmentation was noted. In 3 of the patients with scarring the scar was hypertrophic, and in 3 it was slightly depressed with atrophy. All but one of the scarring reactions were located in the face. There was no significant difference in energy density between the group who reacted with scarring and the group without scarring, 9.2 and 9.3, respectively. The mean age of the patients who reacted with scarring was 24.8 years, compared with 38.0 years in the group with no side-effect (no significant difference).

After argon laser treatment, 1 of the 19 patients evaluated reacted with scarring. The scar was hypertrophic. This patient showed no new scarring when treated with the CVL.

DISCUSSION

PWS have for many years been difficult to treat. When lasers entered the medical scene the treatment became more effective. At first the argon laser was the treatment of choice but lately the pulsed dye laser has become the most effective treatment.

The copper vapour laser has in theory a good potential for being effective in the therapy of vascular changes in the skin. With its 578 nm emission peak it matches the oxyhemoglobin absorption spectrum. The distortion from melanin is minor at this wavelength.

In this study the clinical effect on vascular lesions seems to be better with the CVL than with the argon laser. Earlier studies with CVL have shown better results (10) than ours, which might be due to differences in output energy, pulse duration and of course in the judgement of blanching, always subjective.

The frequency of mild scarring was higher than expected. One explanation could be that the exposure duration, in this case 50 ms, was not ideal. Suggestions for ideal exposure duration of 1–10 ms have been given (16). However, more recent studies with CVL have shown that 50–74 ms exposure duration produces a pattern of vessel-selective damage similar to that of the PDL (15). Another explanation could be that the energy densities were too high.

Although not significant, there is a notable tendency to lower mean age in the group reacting with scarring than in the group without side-effects (24.8 and 38.0 years, respectively). This could indicate that one should be cautious when treating young persons and possibly avoid treating children.

REFERENCES

1. Carruth JAS, McKenzie AL. Medical lasers. Bristol: Adam Hilger Ltd, 1986.
2. Cosman B. Experience in the argon laser therapy of port wine stains. Plast Reconstr Surg 1980; 65: 119–129.
3. Apfelberg D, Maser M, Lash H. The argon laser for cutaneous lesions. JAMA 1981; 245: 2073–2075.
4. Landthaler M, Haina D, Seipp W, et al. Zur Behandlung von Naevi Flammei mit dem Argon-Laser. Hautarzt 1987; 38: 652–659.
5. Neumann R, Knobler R, Lindmaier A. Photoelectric quantitative evaluation on argon laser treatment of port wine stains. Br J Dermatol 1991; 124: 181–186.
6. Malm M, Jurell G, Glas JE, Argon laser treatment of port wine stain. Scand J Plast Reconstr Surg 1988; 22: 245–248.
7. Morelli JG, Tan OT, Garden J. Tunable dye laser (577nm) treatment of port-wine stains. Lasers Surg Med 1986; 6: 94–99.
8. Garden J,Tan O, Parrish JA. The pulsed dye laser: its use at 577 nm wavelength. J Dermatol Surg Oncol 1987; 13: 134–138.
9. Garden J, Polla L, Tan O. The treatment of port wine stains by the pulsed dye laser. Arch Dermatol 1988; 124: 889–896.
10. Pickering J, Walker E, Butler P, van Halewyn C. Copper vapour laser treatment of port-wine stains and other vascular malformations. Br J of Plast Surg 1990; 43: 273–282.
11. Key M, Waner M. Selective destruction of facial telangiectasia using a copper vapour laser. Arch Otolaryngol Head Neck Surg 1992; 118: 509–513.
12. Greenwald J, Rosen S, Andersson R, Harrist T, MacFarland F, Noe J, et al. Comparative histological studies of the tunable dye (at 577 nm) laser and argon laser: the specific vascular effect of the dye laser. J Invest Dermatol 1981; 77: 305–310.
13. Tan O, Carney M, Margolis R, Seki Y, Boll J, Andersson R, et al. Histologic responses of port-wine stains treated by argon, carbon dioxide, and tunable dye lasers. Arch Dermatol 1986; 87: 653–657.
14. Walker EP, Butler PH, Pickering JW, Day WA, Fraser R, van Halewyn CN. Histology of port wine stains after copper vapour laser treatment. Br J of Dermatol 1989; 121: 217–223.
15. Neumann RA, Knobler RM, Leonhartsberger H, Gebhart W. Comparative histochemistry of port-wine stains after copper vapour laser (578 nm) and argon laser treatment. J Invest Dermatol 1992; 99: 160–167.
16. Van Gemert M, Welch A, Amin A. Is there an optimal laser treatment for port wine stains? Lasers Surg Med 1986; 6: 76–83.