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MANAGEMENT OF CORNEAL NEOVASCULARISATION WITH FREQUENCY DOUBLED ND: YAG LASER IN A TERTIARY MEDICAL COLLEGE OF EASTERN INDIA

Ophthalmology

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KEYWORDS

INTRODUCTION

A normal transparent cornea is essential to provide an appropriate anterior refractive surface, and maintaining corneal avascularity is a vital characteristic of corneal physiology. Corneal disease is the third most common cause of blindness worldwide, and corneal neovascularization is present in most of the affected cases. Abnormal, new grown blood vessels in corneas sprout from pre-existing peri corneal vascular structures. Corneal neovascularization, which is a nonspecific response to different clinical insults than a diagnosis, occurs in a wide variety of corneal pathologies including congenital diseases, contact lens-related hypoxia, inflammatory disorders, chemical burns, limbal stem cell deficiency, allergy, trauma, infectious keratitis, autoimmune diseases, and corneal graft rejection [1,2]. These pathologies lead to disequilibrium between proangiogenic and antiangiogenic factors that can result in the proliferation and migration of vascular endothelial cells into the corneal stroma [4, 5]. Neovascularization is a frequent complication of corneal infection, and the prevalence of infectious keratitis reflects a general picture of the extent of corneal neovascularization that occurs worldwide. Trachoma, Herpetic and fungal keratitis are the major cause of infection related corneal neovascularisation in Indian subcontinent. Corneal neovascularization is also a feature of contact lens wear, particularly extended-wear usage of soft hydrogel lenses, with 1.3% of 9 million contact lens wearer estimated to have new corneal vessels. Neovascularization is part of the repair of extensive chemical damage to the cornea. Corneal neovascularization can lead to a decrease in visual acuity because of oedema, persistent inflammation, intrastromal protein and lipid deposition, and scarring. Various methods have been developed and used over years to occlude corneal vessels to avoid above mentioned untoward effects. These include medical treatments; such as, topical steroids nonsteroidal anti-inflammatory drugs, cyclosporin A and anti- VEGF agents [3,4,5,6]. Radiation, diathermy [7], conjunctival resection and limbal stem cell transplantation are the invasive methods used. Laser photocoagulation was first reported in early 1970s in humans as one of the modality for treating corneal neovascularisation . Lack of high recurrence gives it an edge over anti VEGF agents.

AIM

In this study we evaluated the efficacy and safety profile of Frequency doubled Nd: YAG laser photocoagulation in treating corneal neovascularisation.

MATERIAL AND METHODS

Total of 60 eyes of 60 patients of either sex suffering from corneal neovascularisation in quiescent eyes were prospectively evaluated and were treated by frequency doubled Nd: YAG laser after taking informed consent in the Department of Ophthalmology of a tertiary hospital, India. We followed the tennets of Helsinki declaration. The essential inclusion criteria were: 18 years of age or more with superficial and/or deep corneal vascularisation up to two quadrants with healed corneal disease. Patients with extensive corneal neovascularisation, active inflammation of the ocular surface, an active corneal stromal infiltrate, a corneal epithelial defect, adherent leucoma, uveitis, raised Intraocular Pressure (IOP), corneal dystrophies, corneal degeneration, any chronic co-morbid eye condition like cataract, glaucoma, diabetic retinopathy, hypertensive retinopathy, were excluded from our study.

Complete ophthalmic examination and documentation of all the patients was done which included recording of the best corrected visual acuity, IOP, extent of corneal opacity and vascularisation. Corneal vascularisation and opacity were measured using retro illumination on Haag Streit Slit lamp (X16 magnifications). To map or record the extent of corneal vascularisation and corneal opacity colour coded grid diagrams (1 mm^2 on grid representing 0.2 mm x 0.2 mm of cornea) and anterior segment photographs were used. Laser photocoagulation was done using frequency-doubled Nd: YAG (532 nm) laser and Abraham contact lens. Laser parameters used were 120-480 mw of power, 50-150µm spot size and 0.05 seconds pulse duration. After subjective verification of the diameter and position of corneal vessels the ocular surface was anaesthetised using topical 4% xylocaine hydrochloride. Ocular viscoelastic device was used as a coupling agent between the eye and the Abraham contact lens and the lens was placed on the corneal surface. The slit lamp beam and the red light spot were focused at 30°-45° oblique illumination and X16 magnification on the vessel to be lasered and the laser was applied starting from the limbus towards the paracentral cornea (2-3mm inwards) along the new vessels first and then from limbus towards the periphery. The cessation of blood flow or blanching of the lasered vessel was taken as the end point. We avoided applying laser in the central corneal region to prevent any possible damage in the visual axis and also the central vessels regress on their own because blood supply to them is cut off when the paracentral and peripheral vascularization is effectively photocoagulated. The laser power used to start from minimal i.e., 120 mw, was increased further up to 480 mw depending on the subjective variability of corneal vessels (superficial to deep vessels and from patient to patient). The patients were prescribed topical steroids and lubricants four times daily and timolol two times daily for one week following laser treatment. The follow up of the patients was done at day 1, first week and then monthly for first 3 months after the last laser treatment. At each follow up, complete ocular assessment was done recording the effect of laser on vessels as complete occlusion, partial occlusion, recanalization and appearance of shunt vessels on slit lamp bio microscopy. Data analysis was done by Epi Info 7.1.3.0 version. The observations were documented and statistically analysed using the paired t-test.

RESULTS

The age of the patients included in the study ranged from 18 to70 years with the mean age of 45.87 years. In our study, out of 60 patients satisfying the inclusion criteria, 36 (60%) Patients were male and 40 (20%) were female. The mean area of corneal vascularisation in patients before laser treatment was 31.93% of the total corneal area; this decreased to 17.62% of the total corneal area at three months follow-up after laser treatment which was statistically significant .The mean area of corneal opacity in patients included in our study before laser treatment decreased from 30.75% of the total corneal area to

23.74% after three months of the laser treatment. Out of 314 corneal vessels from 60 eyes of 60 patients included in this study, we found that 168 (53.51%) vessels were completely occluded, 32(10.19%) vessels were partially occluded and 114(36.3%) vessels recanalized which was not found to be statistically significant (p=0.5931).

Out of 60 patients included in this study, 17 patients had complications after laser treatment. Amongst them corneal haemorrhage was found to be most frequent occurring in 15(25%) of our patients and the other 2(3.33%) patients having iris damage as a complication. For the rest 43 patients, the post laser period was satisfactory without any complication.

DISCUSSION

In our study, Frequency-doubled Nd: YAG (532 nm) laser photocoagulation appeared to be a safe and effective modality for treating corneal vascularisation showing an effective reduction in the area of corneal vascularisation from 31.93% to 17.62% area thus accounting for a percentage decrease of 44.08% in the area of corneal neovascularisation at the end of 3 months follow up after the frequency-doubled Nd: YAG (532 nm) laser treatment which is comparable to 41.2% reduction in mean percentage area of corneal vascularization at three months follow up in the study conducted by Bhatti N et al., and Sharma A et al., with a reduction of 54.15% in percentage area of corneal neovascularisation at 3 months follow-up (p 0.05) [8]. In the study by Sharma A and Samal A et al, topical betamethasone 0.1% drops twice daily for one week after laser therapy was used resulting in higher success rate as topical steroids has additional therapeutic effect on corneal neovascularisation [9].

Visual Acuity Although the increase in mean best corrected visual acuity was statistically insignificant but we observed improvement in visual acuity in 5 out of 40 patients during our study. One patient with best corrected visual acuity of 2/60 before laser improved to best corrected visual acuity of 6/36 and the other improved from 4/60 to 6/24 at the end of 3 months after laser treatment. Two of our patients improved to the best corrected visual acuity of 6/24 from 6/60 at the end of three months. One of our patients had an improvement of two Snellen's lines from 6/36 to 6/18. Increase in visual acuity was an encouraging finding in our study. Visual acuity of rest of the patients was unaltered. In the study of Bhatti N et al., two of their patients with best corrected visual acuity of less than 4/60 improved to the best corrected visual acuity of 6/24 at the end of three months .[8]

Sequential Changes in Corneal Blood Vessels : The sequential changes in corneal blood vessels following laser treatment was evaluated which showed that the number of totally occluded corneal vessels increased while most of the partially occluded vessels closed completely during follow-up due to thrombus formation in the lumen of vessels .We found that out of 185 vessels, 99 corneal vessels (53.51%) were completely occluded and 17 (9.19%) were partially occluded after laser treatment at 3 months follow up. The number of occluded vessels increased from 76 at one week to 99 at 3 months follow up. Out of 194 vessels, 80 (41.2%) vessels were completely occluded in study of Bhatti N et al. [8].

In addition, the numbers of recanalised vessels increased from 48 at one week to 69 at 3 months follow up. In this study, 37.29% (69 out of 185 vessels) of corneal vessels were recanalised at the end of 3 months which is much less than 58.8% (114 out of 194 vessels) of recanalised vessels by Bhatti N et al [8], and comparable to 35.14% recanalised vessels in the study conducted by Sharma A et al. [9] .Recanalisation of vessels can occur due to inadequacy of laser on those vessels and relatively deeper situation of few vessels. At the end of 3 months 3 shunt vessels were formed in our study as against the 2 shunt vessels reported by Sharma A et al., in the year 2001 [9].

Our study demonstrates that frequency-doubled Nd:YAG (532 nm) laser photocoagulation is an effective method of decreasing the area of corneal vascularisation in quiescent eyes without causing any significant serious complications. Laser photocoagulation is a safe outpatient procedure and can be performed under topical anaesthesia, is simple and well tolerated by the patient. Lack of serious complications makes it an effective alternative to other methods for reducing corneal vascularization in quiescent eyes with vascularised corneal opacities. The power of laser should be adequate enough just to blanch the respective corneal vessel. Use of excess laser power results in increased post laser inflammation thus acting as a stimulus for revascularization. None of the patients had an increase in corneal stromal vascularization immediately after laser treatment or recurrences later.

Therefore, we propose that laser photocoagulation is a valuable adjunctive tool in the treatment of corneal stromal vascularization.

CONCLUSION

Frequency doubled Nd:YAG laser is an effective and safe method for treating corneal neovascularisation of varied etiology.

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