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Opinion Article

Cosmetic Laser Related Retinal Injuries

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Abstract

Cosmetic industries are booming in many Asian cities where the uptake of laser treatment is becoming more frequent. The close proximity of the cosmetic laser handheld probe to the ocular adnexa is at risk of jeopardizing the retina. Cosmetic laser related eye injury was rare, and as an occupational hazard to the laser operating personnel was even rarer. Here, we present our opinion on reviewing reported cases in English literature. We aim to raise the awareness of cosmetic laser procedures' devastating effect to the eye and subsequent ophthalmic management issues.

Keywords

Ophthalmology; Cosmetic Laser; Dermatology; Retina, Macula; Surgery; Vision; Eye

Introduction

Cosmetic industries are booming in many Asian cities where the uptake of laser treatment is becoming more frequent. Carbon dioxide, yttrium-aluminum-garnet and diode laser are commonly used in the aesthetic industry around the eyelids and periocular region for hair epilation, facial resurfacing and subcutaneous vein treatment [1-5]. With the vast expansion of

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laser indications in aesthetics, it carries harm to both clients and operators without strict compliance to proper safety protection and regulation [6,7]. The eyes are particularly vulnerable to laser injury through the thin eyelid skin and abundance of pigment-rich chromophores [8]. When laser is applied for cosmetics, the close proximity of the handheld probe to the ocular adnexa is at risk of jeopardizing the retina due to non-dispersed beam through the translucent cornea, lens and vitreous. Cases of cosmetic laser induced peripheral retinal injuries had been rarely reported (Chen, Shum, Kim) and all vision had recovered without intervention [9-11].

Discussion

We performed literature search in EMBASE, MEDLINE via OvidSP, PubMed, Google Scholar with terms cosmetic, eye, laser and injury and reviewed the reported cases. Cosmetic laser related eye injury were mostly case reports, with the beauty parlor clients being the victim most of the time. Cosmetic laser related eye injury was rare, and as an occupational hazard to the laser operating personnel was even rarer. Four case reports were found for cosmetic laser-induced retinal injury [9-12]. Their clinical histories and outcomes were summarized in Table 1. Three out of 4 patients had peripheral retinal injuries [9-11]. The initial symptoms were due to vitreous and retinal hemorrhage, and had remarkable recovery of vision without any surgical intervention [9-11]. There was one report of a 55-year-old patient with laser eye injury by a dermatologist complicated by secondary choroidal neovascularization later. It appeared that cosmetic laser eye injuries can rarely lead to devastating visual complications [13].

Among the commonly used carbon dioxide, yttrium-aluminum-garnet and diode laser [1]. Nd:YAG laser of 1064 nm is gaining popularity in Asia cosmetic industry due to its effect to deeper pigmentation and darker skin type [14,15]. Whereas Q-switch Nd:YAG is popular for its nanosecond duration that suits the short thermal relaxation time of melanosome in keeping the photothermal and photoacoustic effects limited to melanin only [16,17]. Asian usually is of Fitzpatrick's skin photo type of IV to V and laser parameters in terms of spot size, duration, energy were all variable according to characteristics of the target [18,19].

However, the retina is particularly vulnerable to this Class 4 infrared range of retina hazard laser [20]. The wavelength of Nd:YAG 1064 nm laser makes it invisible to human eye and allows it to penetrate deeper into tissue compared to shorter wavelength of laser, making intraocular structures vulnerable to injury. In the cases reported by Chen, et al., Kim, et al., and Lee, et al., fibrosis occurred after retinal hemorrhage was absorbed, which resulted in scar formation and adhesions rather than progression into retinal detachment [9,11,12].

Increased risk of retinal detachment has been a speculated complication following Nd:YAG vitreolysis and Nd:YAG capsulotomy. The American Society of Retina Specialists (ASRS) Research and Safety in Therapeutics (ReST) Committee retrospectively reported 2 cases of retinal detachments and a case of retinal tear out of 15 complications following Nd:YAG vitreolysis in 2016-2017 [21]. Retinal detachment following Nd:YAG vitreolysis has been

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reported in 2 other retrospective case reviews [22,23]. Reported rates for retinal detachment after Nd:YAG capsulotomy was ranged between 0% to 4.8% [24,25]. The epidemiological evidence of retinal detachment associated with Nd:YAG capsulotomy and vitreolysis remains controversial due to the limited number of prospective clinical trials. A plausible mechanism is light emission damages the vitreous by oxidative stress, ionization, vaporization and cavitation leading to the loss of hyaluronic acid and liquefaction, and subsequently detachment of the posterior hyaloid causing RRD. Similarly, cosmetic Nd:YAG laser may lead to retinal detachment if inadvertently aimed to the eye. Cosmetic laser is mostly done in indoor settings where the eye is accommodating, with a short distance from the portable, handheld laser source. The cornea and lens help to focus the 1064 nm laser directly into the eye, thus, increasing the irradiance towards the vitreous and retina [26]. A number of factors may lead to predisposition to retinal detachment following cosmetic Nd:YAG laser injury to the peripheral retina, including long axial length myopia, high power laser and pseudophakic/aphakic eyes.

A histologic study by Manning, et al., demonstrated that Nd:YAG laser can lead to disruption of all retinal layers, a defect in Bruch membrane, and choroidal vessel rupture to cause subretinal hemorrhage, which may leak to the front of retina to form preretinal haemorrhage [13]. From the reported laboratory accidents, industrial and military experience, Nd:YAG 1064 nm laser is capable of causing retinal, sub-retinal or vitreous haemorrhage, with a similar clinical course of resorption of blood and subsequent scarring, macula hole and pre-retinal membrane formation [27-29]. We believed prompt surgical intervention was necessary to improve the visibility of retinal examination to achieve hemostasis, to identify the site of laser injury and to identify and treat any retinal breaks.

It is generally believed that the location of the retinal injury is the most important prognostic factor in determining the functional damage to the retina after laser eye injuries, publications reported good visual prognosis as most reported injuries were in the peripheral retina [30]. Reported laser eye injuries most frequently occurred during laser beam alignment or adjustment in experimental laboratories, industries and military [31]. The design of cosmetic laser apparatus is usually compact, handheld and portable, enhancing its uses in beauty parlors. Long wavelength Nd:YAG laser sources are more effective for pigmented Asian skin, however, it has high risk of penetration into deep intraocular tissues without protective media to the eye. Standard precaution as a safety measure for occupational health in terms of room design, authorization to facility usage and wavelength-specific safety goggles should follow the International Electrotechnical Commission (IEC) documents [32]. Protective eyewears should have permanent labels on the optical density for the wavelength covered, side shield protection, and intact surface [33]. Standardized regulation on laser machine operator's proficiency training, registration and licensing, continuous renewal education are all suggested for legal authorization [34,35]. Legal claims from complications of cosmetic laser is not uncommon, yet legislation on regulation of aesthetic laser is not perfect [36,37].

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	Chen 2014 [9]	Shum 2016 [10]	Kim 2019 [11]	Lee 2019 [12]
Patient Demographics	25 years old /Female	31 years old /Female	27 years old /Female	55 years old /Male
Occupation	Unknown	Aesthetician	Skin care technician	Dermatologist
Laser Type	Nd:YAG 1064 nm	Nd:YAG 1064 nm	Nd:YAG 1064 nm	Nd:YAG 1064 nm
Injury Mechanism	Unanticipated eye exposure during alig nment	Direct eye exposure with fixation on probe	Unanticipated eye exposure during alig nment	Reflection from reflective surface
Eye Protection	Nil	Sunglasses	Nil	Nil
Timing	Unknown	1 day	3 days	2 weeks
Presentation	Flashes, floaters	“Pop” sound, floaters, blurring of vision	Scotoma	Central scotoma
Presenting Visual Acuity	20/20	6/30	20/20	4/32
Examination Findings	Inferior retinal burn with retinal edema around, vitreous haemorrhage	Well-demarcated semicircular patch of retinal edema nasal to optic disc, with overlying retinal haemorrhage of 2 DD and blood clot	Peripheral retina at 2 o’clock a 4 DD of subretinal haemorrhage with 2.5 DD of preretinal haemorrhage at center	Elevated intraretinal and subretinal haemorrhage of ¾ DD, Choroidal neovascularization
Treatment	Oral prednisolone and vitamins (dosage not mentioned)	Observe	Oral steroids and vitamins (dosage not mentioned)	Intravitreal bevacizumab 1.25mg 3 times in 5 months
Outcome	Defaulted follow-up	Scarred retina, residual dense scotoma	Scarred retina, residual scotoma	Not mentioned
Nd:YAG: Neodymium-doped Yttrium-Aluminium-Garnet DD: Disc Diameters				

Table 1: Cosmetic laser-induced retinal injury cases summary.

Lee LCO | Volume 2; Issue 3 (2021) | JOAR-2(3)-022 | Opinion Article

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Conclusion

The complication profiles following cosmetic laser eye injuries are poorly understood because these cases were scarcely reported and most had minor vitreous bleeding and good recovery without intervention. Our opinion article aims to raise the awareness of cosmetic laser procedures' devastating effect to the eye and subsequent ophthalmic management issues. In case of inadvertent cosmetic laser eye injury, the victim must seek prompt ophthalmic consultation, for thorough eye check including a fundal exam. Initial floaters and vitreous hemorrhage may mask an underlying retinal detachment, therefore, patient must be followed-up frequently for early detection. Cosmetic laser procedures of the face have become more popular, and can cause eye injury to operator as severe as blindness without proper ocular protection. Training of operating personnel on laser safety eyewear is important on reducing this occupational hazard, and regulation on cosmetic laser usage out of medical area will prevent accidental eye injury leading to blindness.

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