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REVIEW

Is It Possible for Light-Based Hair Removal Home Devices to Induce Ocular Damage? Systematic Review

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Abstract: Light-based hair removal home devices emit intense pulse light (IPL) or Diode laser. While the Food and Drug Administration controls them in the US, Europe continues to classify them as cosmetic products. Emerging concerns are: what if an unprotected eye is inadvertently exposed to light emission? Or if the consumer tries to overcome the protective safety features? We performed this systematic review by searching the Medline, CENTRAL, and Google Scholar databases to investigate the ocular damage reported after exposure to IPL for hair removal. We could not identify any case reported following exposure to home devices; however, a total of 20 patients were identified with iris atrophy, anterior chamber inflammation, and/or retinal pigment epithelium damage following exposure to office IPL or Diode lights. 40% were not using any protective eyewear during the light procedure. The reported fluences were in the range of 20–24 J/cm^2. Although the ocular damage was identified following office devices, the reported fluences were within the home device's limits. For that, manufacturers should provide clear instructions on the package regarding the ocular hazards, the importance of using protective goggles, and a firm warning not to overcome the contact sensors. Home device-induced ocular damage is still a concern, perhaps under-reported.

Keywords: light-based home devices, IPL, intense pulse light, laser safety, hair removal, ocular damage

Introduction

Home-use light-based device manufacturing has grown exponentially over the last few years. Indeed, their popularity increased as a mean of depilation in the privacy of consumers' homes at a lower cost than in professional settings. Most of those devices are based on intense pulse light (IPL); however, few laser home devices are available on the market.[1,2] The IPL is noncoherent light with a broad wavelength output ranging from 500 to 1200 nm.[3] Unlike lasers, pulses are generated from electrical current bursts that stimulate xenon gas-containing chambers. The emitted light is filtered using "cutoff" filters to limit the undesirable lower end of the spectrum minimizing tissue damage.[3,4] IPLs emit broad wavelengths within the visible and near-infrared spectrum diminishing the selective photothermolysis of the specified chromophores. Nevertheless, Cohen et al reviewed the literature, and they stated that the grade of evidence as by the Oxford Centre for Evidence-Based Medicine guidelines for the efficacy of home light-based hair removal devices is A.[5,6]

Those devices are under different regulation systems in the United States compared to European countries. While they are considered medical devices controlled by the Food and Drug Administration (FDA) in the United States, Europe continues to consider them as cosmetic products.[2,7] The FDA imposes an obligatory premarket approval (PMA) requisite to make them safe for human use and suitable for consumer use even without healthcare professional supervision. In that term, the FDA is committed to selected laser standards issued by the International Electrotechnical Commission [IEC 60825–1 (Safety of laser products – Part 1: Equipment classification and requirements) and IEC 60601-1-11:2010 (Medical electrical equipment Part 1–11: General requirements for basic safety and essential performance. Collateral standard: Requirements for medical electrical equipment and medical electrical systems used in the home healthcare

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environment).[8] According to the updated IEC 60825–1 Ed. 3.0 b:2014, the international laser standards introduced a new class, class 1 C, designed for laser products requiring contact application to fire.[9] The home-use light-based hair removal devices fall into class 1, as claimed by their manufacturers, and they might be reclassified into class 1 C, as most of them incorporate safety contact sensors that minimize inadvertent light emissions when the probe is not in direct contact with the skin.[10,11] By that, ocular damage is supposed to be prevented by engineering means. As a result, a good number of IPL home devices are not supplemented with protective eyewear. An emerging concern exists, despite the lower fluence rates of home devices compared to office IPL devices: what if an unprotected eye is inadvertently exposed to light emission? Or what if the consumer tried to overcome the protective safety features? In our experience, some of our patients have already tried to overcome the contact sensors for adjusting the device output window to the curved body parts.

It is essential that IPL home device consumers are well informed regarding the presumed ocular hazards, the precautions that must be taken during the procedure, and the clinical signs of varying ocular complications. We conducted this review to describe the reported ocular complications following IPL exposure, the most common ocular segment that has been damaged, and how the damage was presented clinically.

Methodology

We followed the PRISMA methodology in our search, i.e., Preferred Reporting Items for Systematic Review and Meta-Analysis. Initially, we searched the PROSPERO database to detect duplicate works; however, we did not find any ongoing or published similar reviews. Subsequently, this review was registered in PROSPERO, with an ID number CRD42023429287. Our search strategy is summarized in the study flow chart. An electronic search of the Medline, CENTRAL, Cochrane, and Google Scholar databases was conducted using the terms ocular complication, ocular damage, intense pulse light, and IPL home devices. Furthermore, cited references from the ResearchGate database were further explored to identify any relevant articles. We included articles if they met our inclusion criteria: case reports of ocular damage following exposure to IPL used for dermatologic indications, written in English or in a language reliably translated to English. Papers were excluded if they described ocular injuries after laser exposure other than IPL if the exposure occurred in nonclinical settings or for non-dermatologic indications.

Data were extracted by one investigator and cross-checked by a second reviewer. At the same time, papers were critically appraised using the Critical Appraisal Tools, Joanna Briggs Institute, 2020.[12] The quality checks the adequacy of the patients and their clinical condition description, the presence of conclusive evidence of the diagnosis provided, a clear description of the intervention given and the post-intervention outcomes. Generated data are summarized in an Excel sheet and subsequently tabulated. Dichotomous variables were descriptively calculated using frequencies and percentages.

Results

A total of 18 articles[13–30] including 20 patients were identified in the literature, describing ocular complications following exposure to an IPL source (60%) or to a diode laser (40%) [Figure 1]. Most patients (95%) were female; their mean age was 40 (St. deviation 12). Of those reporting the usage of protective eyewear or not, 40% did not use any protective measure, an additional 30% shifted the protective eyewear during the procedure, and one patient was wearing cosmetic contact lenses during the procedure.[22] Three patients reported that they directly looked at the IPL probe while it was fired up.[15,24,27] Eighteen patients (90%) received facial IPL treatment, and 17 of their procedures were performed in a periocular location. Of those reported laser parameters, the fluence used was in the range of 20–24 J/cm^2.

Clinically (Table 1), the symptoms of ocular complications started during the procedure in 7 (35%) patients, a few hours after the procedure in 4 (20%) patients, and within two days after the procedure in 6 (30%) patients. The most reported symptom was photophobia (75%), followed by ocular pain and visual disturbances (60%). Thirty percent of the patients reported eye redness as their presenting symptom. Half of the patients reported left laterality of the injury, 20% reported bilateral complications, and 30% reported right laterality. The most common complication reported was iris atrophy (65%) caused by IPL exposure in 61% of the cases and by diode laser in an additional 38%. Anterior chamber inflammation was the second most common complication, reported in 60% of the cases (Figure 2). Interestingly, the

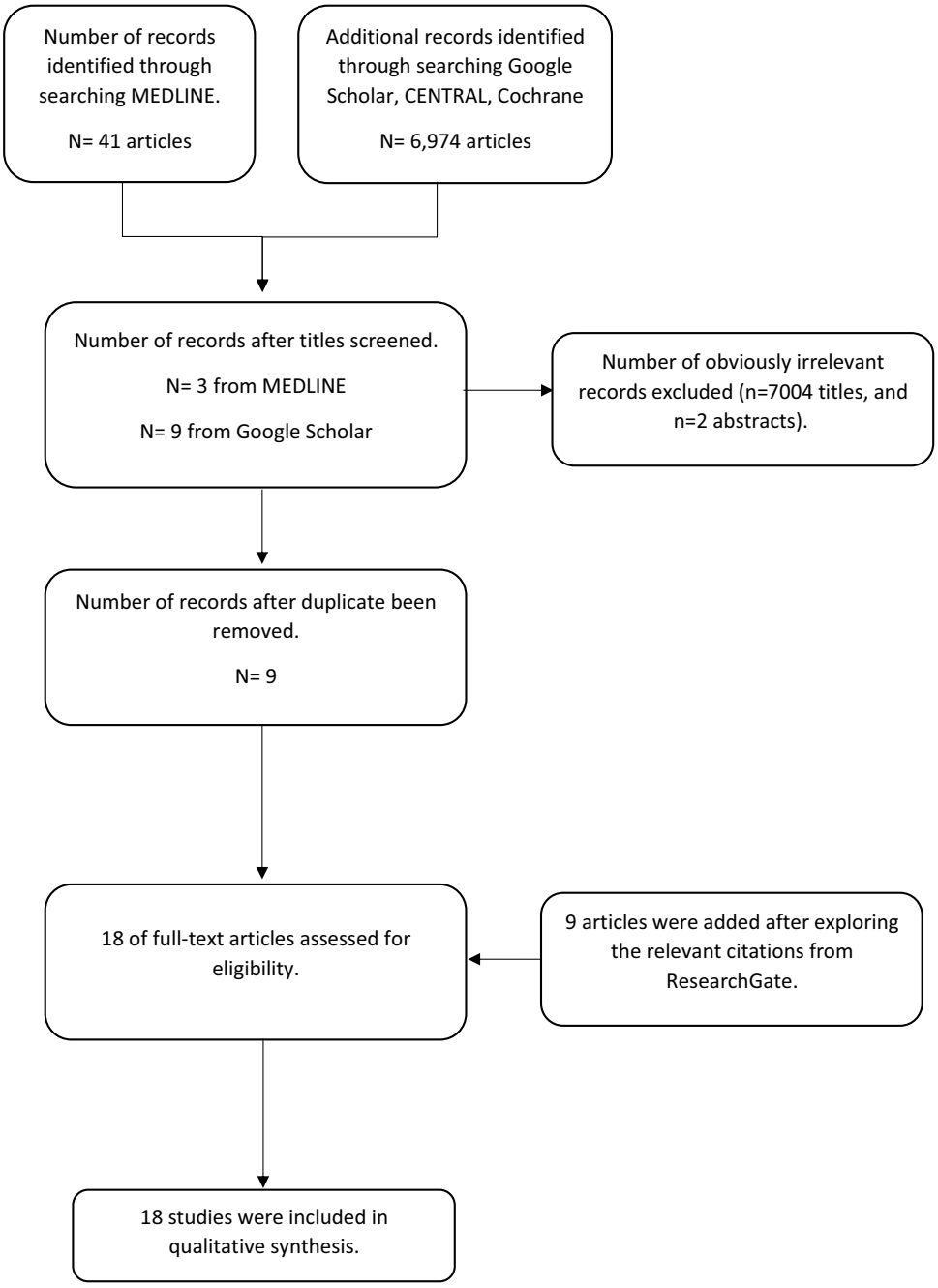

Figure 1 PRISMA chart flow.

retinal pigment epithelium was damaged in four patients (20%), equally experienced following IPL or diode exposure. In one case,[22] where the patient was wearing cosmetic contact lenses during the IPL procedure, the lens pigment was deposited over the cornea, which was corrected surgically using a No. 15 blade.

All the reported cases of anterior chamber inflammation improved completely; however, iris atrophy did not. All 14 reported cases of iris atrophy were permanent at the follow-up visits: 6 weeks to 3 years from the injury. Of those 14 cases, 6 cases developed additional ocular complications in the follow-up visits: 3 cases had permanent posterior iris synechiae,[17,19,23] one case developed transient glaucoma that improved after stopping the topical steroid,[20] an additional case developed persistent posterior subcapsular cataract,[14] and another case was complicated with persistent peripheral visual field defects.[30] In the same context, the three reported cases of retinal damage persisted for months. While a case

Table 1 Patient Characteristics, Clinical Settings and Ocular Structural Damages Induced by Intense Pulse Light/Diode Laser

Characteristics	**N (%) 20 (100%)**
Gender	
Female	19 (95%)
Male	1 (5%)
Clinical settings	
The patient was receiving the light procedure	18 (90%)
The patient was performing the light procedure	2 (10%)*
Type of the light source	
Diode	8 (40%)
IPL devices Sciton BBL, Paulo Alto, CA, USA Quantum SR, Lumenis Inc., Santa Clara, CA Harmony equipment, Alma Lasers Ltd., Israel Elos Plus SR applicator, Syneron Candela (Irvine, CA, USA)	12 (60%) 1 1 1 1
Site of the procedure	
Face	18 (90%)
Face including eyelids or periocular skin	17 (85%)
Use of protective eyewear	
No	8 (40%)
Yes, but was shifted during the procedure	6 (30%)
Onset of the symptoms	
During the procedure	7 (35%)
Few hours after the procedure	4 (20%)
Within 2 days after the procedure	6 (30%)
Clinical presentation	
Ocular pain	12 (60%)
Photophobia	15 (75%)
Visual disturbance	12 (60%)
Eye redness	6 (30%)
Structural damage	
Iris atrophy • Caused by diode. • Caused by IPL.	13 (65%) • 5 (38.5%) • 8 (61.5%)
Anterior chamber inflammation	12 (60%)

(*Continued*)

Table 1 (Continued).

Characteristics	N (%) 20 (100%)
Retinal pigment epithelium	4 (20%)
• Caused by diode.	• 2 (50%)
• Caused by IPL.	• 2 (50%)
Cornea**	1 (5%)

Notes: *One of them was performing the procedure on herself. **The patient was wearing cosmetic contact lenses during the entire procedure.

of retinal detachment and choroidal neovascularization improved after medical treatment, a case that developed a macular hole was partially corrected surgically with a remnant persistent retinal pigment epithelium defect, and a further case of persistent retinal pigment epithelium interruption was reported (Table 2).

Discussion

Ocular injury following laser or light-based devices is not an uncommon devastating complication that can be minimized by proper training and adherence to safety protocols. Investigating a legal national resource in the US identified 174 cases of litigation involving laser procedures; more than half of them were performed for hair removal. A total of 2.2% of those cases were related to ocular injuries. More than 50% of the cases were associated with a lack of informed consent, and an additional 0.5% were related to a lack of goggles.[31] In parallel, more than three-quarters of the reported IPL-induced ocular injuries we identified were secondary to the improper use of protective eyewear.

Although all the reported cases we identified were office-based devices, home-based devices can induce a similar pattern of injuries. For illustration, Town et al[32] measured 18 IPL medical and nonmedical CE devices and 36 applicator parameters; they identified up to 10% higher emitted fluence from the applicators compared to the claimed fluence by the manufacturers, and 9 out

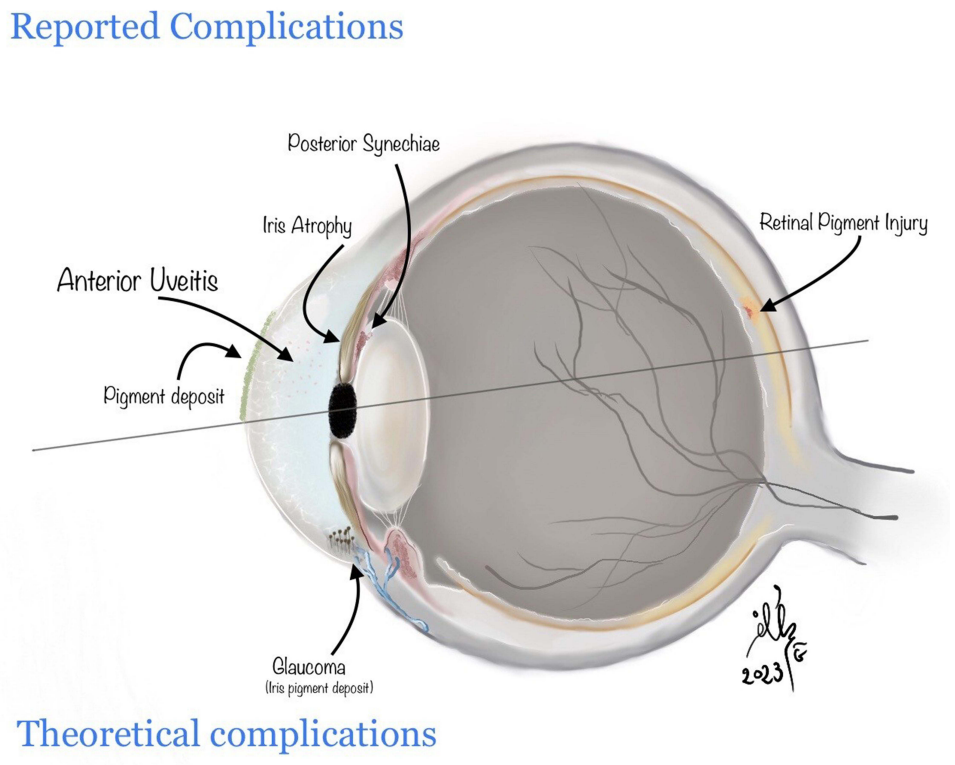

Figure 2 Ocular complications reported following exposure to IPL or Diode laser.

Table 2 Clinical Course of the Ocular Complications Induced by Intense Pulse Light/Diode Laser and the Undertaken Treatment Measures

Patients	Anterior Segment	Posterior Segment	Treatment	Follow Up
Wessely et al (2002)[29]	Intra ocular pressure (IOP): 8 mmHg. Anterior chamber: mild irritation with Tyndall + and Sanguis cells ++, the pupil was unrounded after 4 o'clock. Iris pigment epithelial defects between 1 and 6 o'clock.	The lens, vitreous and fundus were normal for age.	Topical prednisolone acetate 6×/d.	In the left eye, there was a permanent slight rounding of the pupil and a faint feeling of glare.
Brilakis et al (2004)[13]	Slit lamp: iris atrophy superiorly in the left eye. The lens: nuclear sclerosis. IOP: 14 mmHg in each eye.	Fundus examination was unremarkable.	Not reported	6 weeks post diode: same changes.
Herbold et al (2005)[20]	Both pupils are oval in shape. There are defects in the sphincter of both irises and pigment dispersion. A clump of pigment or iris stroma was seen at the pupillary margin of the left eye, along with focal blue-whitish anterior subcapsular lens opacities in both eyes.	Fundus examination was unremarkable.	2 oral doses of 100-mg steroid, topical prednisolone 1% (5 times per day), and topical pilocarpine 2% (once daily).	During the 5th week, the intraocular pressure (IOP) increased to 21 mmHg in the right eye and 31 mmHg in the left eye. However, after discontinuing the use of topical steroids, the pressure returned to normal. After 9 months, the pathological findings in the anterior segments persisted, as well as the symptom of photophobia.
Halkiadakis et al (2007)[19]	There is marked iris atrophy and posterior synechiae in the left eye. Both eyes have intraocular pressure of 14mmHg.	Fundus examination produced unremarkable findings.		At 6 months: The patient continued to experience sensitivity to light in her left eye.
Sheikh et al (2007)[30]	There was dilation present in the perilimbal conjunctival vessels. The right eye had a 4+ inflammatory reaction with pigment and a few white blood cells. The iris in the right eye was dilated and immobile, with patchy areas of reduced pigmentation and transillumination.	There was no cataract, and the posterior segment examination was normal	Topical Prednisolone acetate 1% every 2 hours, homatropine twice daily, and Maxidex ointment.	After a follow-up, it was found that the uveitis had resolved. However, the atonic pupil remained persistent. Electroretinographies showed dysfunction in both the rod and cone systems in the peripheral retina, while Humphrey visual field testing revealed a diffuse peripheral defect temporally. Multifocal electroretinography trace arrays, ring averages, and 3-D response density topographic maps were abnormal in the right eye. Even after two years, the patient's status remained unchanged.
Pang et al (2008)[17]	Bilateral ocular injection caused moderate inflammation in the anterior chamber resulting in iritis or anterior uveitis. The left pupillary margin adhered 180 degrees to the lens leading to posterior synechiae. The iris showed transillumination defects, giving it a "moth-eaten" appearance.	Posterior segments appeared normal.	Hourly topical steroid.	At 6 weeks: Anterior uveitis is settled. **Persisted posterior synechiae and transillumination defects**. At 3 years: Light adaptation impairment. No further episodes of iritis.

Hong et al (2010)[22]	The measurement of intraocular pressure (IOP) is 16 mmHg in the right eye and 14 mmHg in the left eye. During a slit-lamp examination, there is conjunctival injection, mild chemosis, and the deposition of color pigment from the cosmetic contact lens on the corneal epithelium. The fluorescein dye staining shows punctate epithelial erosions and corneal epithelial defects in both eyes.		Corneal epithelium and the deposited pigments were scraped using a no. 15 blade under local anaesthesia with 0.5%, proparacaine. No residual pigment was detected. 5% levofloxacin was prescribed topically 8 times a day with hourly 0.1% hyaluronic acid.	At 7 days: After undergoing a slit-lamp examination, it was found that the corneal epithelial defects and corneal erosions had healed successfully without any complications. After undergoing a slit-lamp examination, it was found that the corneal epithelial defects and corneal erosions had healed successfully without any complications.
Javey et al (2010)[18]	Measurement results: Left pupil: 4mm in longest diameter, minimally reactive. IOP: 14 mmHg (right) and 9 mmHg (left). Left eye anterior chamber: 1+ cellular reaction with some flare in.	Dilated fundus examination was unremarkable in both eyes.	Prednisolone acetate 1% eye drops four times a day for 3 days, then tapered over 6 days. Followed by topical homatropine 5% twice a day in an attempt to break presumed posterior synechiae.	At 18 days old, the left eye showed signs of superior-nasal iris atrophy, iris transillumination defects, and pigment on the anterior capsule. Four months later, a 35-MHz b-scan ultrasound was conducted on the anterior segment of the same eye. The results showed that the peripheral iris was thinner at the superonasal region, measuring only 0.4mm thick. However, the inferotemporal iris was thicker at 0.6mm. No posterior synechiae were detected during the ultrasound.
Lee at al. (2011)[23] Case 1	The right pupil measured 3 mm and was minimally reactive, while the left pupil measured 5 mm and was reactive. Keratic precipitates were present in the right eye.		Tobramycin/dexamethasone ophthalmic ointment 3 times a day. Followed by Lotemax 4 times a day and Cyclopentolate to break up the synechiae.	When the patient reached 9 days, they experienced intermittent blurriness and were sensitive to ambient light. There were also transillumination defects and iris atrophy in the superonasal area of their right eye. During the 2-year follow-up, the patient continued to suffer from constant pain and photophobia. The transillumination defects and iris atrophy remained unchanged.
Lee et al (2011)[23] Case 2	The pupil on the left side appears slightly oval and minimally responsive, measuring 4 mm at its longest point and showing signs of atrophy. The intraocular pressure measured 14 mm Hg on the right eye and 9 mm Hg on the left. Mild inflammation was observed in the left eye, with a 1+ cellular reaction and flare in the anterior chamber.		Prednisolone acetate 1% eye drops four times a day, homatropine 5% to break the synechiae. Atropine and phenylephrine in further attempt to break the perceived synechiae were given at 1 month later.	At 3 weeks, there was evidence of superonasal iris atrophy, posterior synechiae, a 1+ cellular reaction with flare, and pigment on the anterior lens. At 1 month, during a slit-lamp examination, it was noted that the left pupil was irregular and fixed when dilated pharmacologically. Additionally, there was iris transillumination of the superior aspect of the left eye and posterior synechiae present.
Jewsbury et al (2012)[21]	There was diffuse conjunctival injection and intrastromal hemorrhages in the right eye. There were also 2+ cells in the anterior chamber and diffuse transillumination defects in the iris.	Fundus examination revealed no abnormality.	Topical steroids and a cycloplegic.	Anisocoria and severe glare are caused by defects in the iris stromal transillumination. A tinted contact lens has been prescribed to alleviate the symptoms.

(*Continued*)

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Table 2 (Continued).

Patients	Anterior Segment	Posterior Segment	Treatment	Follow Up
Passos et al (2012)[28]	In the anterior chamber, there is more intense temporal iris atrophy in the ciliary portion than in the pupil. This atrophy extends from approximately 1:00 to 3:00 hours. Additionally, there is an accentuated lesion of the pigment epithelium causing intense iris transillumination. In the pupil, there are discrete irregularities and posterior synechiae present.	Fundoscopic examination: normal.	Not reported	
Crabb et al (2014)[16]	The intraocular pressure (IOP) was 18 mmHg in the right eye and 14 mmHg in the left eye. There was a sectoral palsy in the inferior nasal quadrant, with two areas of iris atrophy located at the 6 and 9 o'clock positions. Additionally, there was significant inflammation in the anterior chamber, with a flare of 2+ and 2+ cells present.		G. dexamethasone 0.1% every hour and G. homatropine 2% thrice daily to the left eye, tapered and ceased over 4 weeks.	At 6 weeks, the patient had persistent dyscoria in the left eye with significant and progressive iris atrophy, as well as open drainage angles with pigment deposits in the inferior angle. After 10 weeks, there was prompt recovery with no symptoms or intraocular inflammation.
Rho et al (2016)[25]	The Intraocular pressure was 17 mmHg in the right eye and 18 mmHg in the left eye. During a slit-lamp examination, ciliary injection of the conjunctiva and aqueous cells were graded +2 in both eyes.		Topical corticosteroid four times a day.	After a week, the symptoms have been resolved.
Chang et el. (2018)[15]	The anterior segment was silent.	During the fundus examination, a juxtafoveal creamy patch was observed in the right eye. The patch showed a small detachment of the retinal pigment epithelium with thin hyperreflective material on top. However, there was no indication of choroidal neovascularization on OCT angiography. Additionally, a fluorescein angiography was conducted 7 days later, which revealed a neovascular net at the lesion site.	Intravitreal injection of ranibizumab (0.5 mg/0.05 cm3) effectively decreased the CNV and retinal pigment epithelium detachment	Intravitreal ranibizumab was repeated **1 month** later. CNV was undetectable on OCTA **2.5 months** after the initial visit.
Nordqvist et al (2018)[26]	In the left eye of the patient, there were signs of conjunctival hyperemia, a 1+ flare and 1+ cells in the anterior chamber, and a tadpole pupil. During the retro-illumination slit-lamp examination, temporal iris defects were observed. Additionally, there was a lack of pupillary contraction on the temporal side of the left eye.	The intraocular pressure, fundus examination, and macular OCT (optical coherence tomography) were within normal limits.	Topical 0.5% prednisolone acetate TID and 0.5% tropicamide TID. Valacyclovir 500 mg TID was given to cover a possible primary episode of herpetic infection.	At 3 months, there were no cells or flares in the anterior chamber and the conjunctiva was calm. However, iris atrophy persisted.
García et al (2020)[14] Case 1	There was irregular expansion of the pupils (mydriasis) along with a moderate (2+) inflammatory reaction and a combination of redness in the conjunctiva (mixed conjunctival hyperemia). The intraocular pressure (IOP) was within normal range.	Funduscopic examination was normal.	Prednisolone acetate eye drops every 8 hours and cycloplegic eye drops every 12 hours.	At 6 months, the patient experiences persistent photophobia. During the slit-lamp examination, corectopia is observed along with atrophy of the temporal root of the iris.

García et al (2020)[14] Case 2	During the slit-lamp examination, there was sectoral retraction of the iris towards the super-temporal quadrant. There was also a 2+ inflammatory reaction in the anterior chamber, small pigmented retro-keratic deposits, and mixed conjunctival hyperemia. The IOP was normal.	Fundus scan was normal.	Prednisolone acetate eye drops were prescribed every 8 hours and cycloplegic eye drops every 12 hours.	At 9 months, the patient experiences persistent photophobia and blurred vision. During a slit-lamp examination, the patient is found to have upper temporal corectopy, lower iris atrophy, and a new posterior subcapsular cataract.
Maganti et al (2022)[24]	IOP: normal.	During the examination of her left eye, a full-thickness macular hole (FTMH) was discovered on the fundus. It is worth noting that her fundus exam was normal eight months prior. An optical coherence tomography (OCT) scan of her left eye confirmed the presence of an FTMH that measures 150 mm, and a retinal pigment epithelium (RPE) transmission defect at the center of the hole. Additionally, a hyperautofluorescent area in the fovea was observed on the fundus autofluorescence.	Pars plana vitrectomy, internal limiting membrane peeling, and 20% SF6 gas injection in her left eye	After 4 weeks, a fundus exam and OCT revealed a slightly larger FTMH measuring 313 mm and a persistent RPE transmission defect. At 8 weeks, surgery was performed. Two months after the operation, an examination and OCT showed that the macular hole was closed, but there was still a small sub-foveal elevation and subtle ellipsoid zone disruption as well as a persistent RPE transmission defect.
Durmus et al (2022)[27]	The IOP were 14- and 16-mm Hg. Bilateral anterior segments were normal under slit-lamp examination.	Fundus exam shows a yellow-white lesion in the inferior fovea of the right eye, indicating a retinal burn. OCT of the right eye shows irregular hyperreflectivity in the retinal pigment epithelium (RPE) and outer retinal layers.	Topical corticosteroid, the dose was gradually reduced over a 4-week period.	During the first week's OCT scan, hyporeflective spaces were detected at the inner-outer segment junction line. By the first month, the interruption in the RPE and inner-outer segment bands had become more noticeable on OCT.

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of the 18 devices exceeded the medical Class 4 laser standards (> +20%). Additionally, 65.5% of the devices they tested showed inaccurate cutoff filters by more than 20 nm, as claimed by the manufacturers. Considering the lack of strict wide-nation regulations over light-based home device manufacturing and commercial pressures, discrepancies between the measured and manufacturers' claimed parameters are also possible for home devices. As an instance, Eadie et al[33] examined one IPL home device for ocular safety hazards, and they discovered that the retinal thermal hazard was exceeded at a fluence of 11 J/cm^2 and 20 cm viewing distance following firing the IPL home device they tested. It is worth mentioning that the maximum available energy from IPL home devices is between 7.5 and 30 Joules (J) delivered over a spot size of 2–6 cm^2 over 2.5–60 milliseconds (Ms). On the other hand, home-based laser devices such as (Tria Beauty, Dublin, CA 94568, USA) deliver up to 22 J/cm2 over a spot size of 0.79 cm^2 and a pulse duration of 600 ms.[1,2,7] Nevertheless, we identified the reported ocular injuries following exposure to a similar fluence range to the home devices. Moreover, the increasing reports of ocular damage following exposure to low-energy laser sources, such as toy laser pointers, warrant the hazardous possibility of such events following exposure to low-energy home-based light sources.[34]

Interestingly, authors of a recent surveillance-based study investigated the post marketing voluntary reports of adverse events noticed following exposure to home-IPL devices, they detected 34 cases of eye pain of unknown clinical significance.[35] Equally concerning, we randomly searched online market engines such as Amazon.com to identify the available hair removal light-based home devices. Predictably, out of 20 randomly detected devices searched for FDA clearance at 510(k) Premarket Notification (fda.gov),[36] 10 market-available devices are not FDA cleared. Eight out of the 20 randomly selected devices lack supplementary goggles with the device's package (Table 3).

Table 3 Randomly Picked Online Available Light-Based Hair Removal Home Devices Manufacturing Properties

Device	FDA Clearance	Supplementary Goggles	Skin Contact Sensor	Fluence Level
Braun IPL Hair Removal New Silk Expert Pro 5 PL5157, SkinPro (SensoAdapt)	Yes	No	Yes	6 J/cm^2
Aopvui, IPL Hair Removal (B0BM444LNK)	No	Yes	Yes	19.35 J/cm^2
Ulike Laser Hair Removal, Air 3 IPL Hair Removal with Sapphire Ice-Cooling System (B0BXPDTJRR)	Yes	Yes	Yes	21 J/cm^2
LYSMOSKI, Laser Hair Removal With Cooling System (B0B5ZKX19R)	No	Yes	Yes	13 J/cm^2
Aopvui, Laser Hair Removal (B0BM3NYQ4T)	No	Yes	Yes	13 J/ cm^2
AMZGIRL Laser Hair Removal (B0BVZ13ZY7)	No	Yes	Yes	12.5 J/cm^2
JOVS Venus Pro II IPL Hair Removal (B0BDD38H6C)	No	Yes	Unknown	6 J/cm^2
JOVS X IPL Hair Removal (B09XTYDV3F)	No	Yes	Yes	7 J/cm^2
LUBEX IPL Hair Removal (B0C2TDVGQ6)	No	Yes	Unknown	15 J/ cm^2
IBORRIA IPL Hair Removal, BR2020 (B0B5GLJN9W)	No	Yes	Unknown	18.6 J/cm^2
OUBABO IPL Hair Removal Device with Cooling System (B0BNLPQTQ8)	No	Yes	Unknown	15.1 J/ cm^2
Kenzzi IPL Hair Removal	No	No	Yes	5 J/cm^2
SmoothSkin Bare Plus Ultrafast IPL Permanent Hair Reduction	Yes	No	Yes	6 J/cm^2
COSBEAUTY IPL Hair Removal	Yes	No	Yes	
Silk'n SensEpil Hair Removal Device	Yes	No	Yes	5 J/cm^2
Tria Hair Removal Laser 4X	Yes	No	Yes	20 J/cm^2
Remington i-light 6780, IPL hair removal.	Yes	No	Yes	8 J/cm^2
Dongguan Define Beauty Electronic Technology, SOSERIVD IPL hair removal	Yes	Yes	Unknown	Unknown
LumaRx Pro IPL hair removal	Yes	No	Unknown	8 J/ cm^2
Elos Me IPL, Lescolton infinity Ice Effect II.	Yes	Yes	Yes	23 J/cm^2

Clinically, IPL-induced ocular injuries most commonly present with photophobia and most widely cause iris atrophy. Ocular pain, pupil irregularities, and visual disturbances are additional concerning symptoms. Early identification of the signs and symptoms is equally essential for both physicians and home device consumers to prevent further ocular damage and complications such as iris pigment flakes and subsequent glaucoma formation. Thought-provoking, in parallel with the reported laser-induced ocular injuries,[37] IPL-induced ocular injuries showed left-side laterality as well, which might be triggered by the patient's position during the procedure in relation to the operator's dominant hand.

Conclusion

Light-based home devices are widely available in the market, in most of the world, their manufacturing process is not under strict medical safety regulations, and they are widely available in the markets. The available home devices are emitting IPL or diode lasers under the control of skin contact sensors, making the manufacturers of a good number of them not supplying the package with protective eyewear. Although the ocular damage identified in our paper was reported following IPL office-based devices, home devices can induce a similar pattern of injury that might be under-reported. Given the cumulative evidence of the inaccurate light energy levels delivered by different in-office and home-based systems and the reported damage following exposure to 20–24 J/cm^2 fluence levels, which are within the home-based device's energy levels, the possible severe permanent consequences of the damage cannot be ignored. IPL-induced ocular damage most commonly affects the iris, causing permanent atrophy with devastating photophobia. Awareness of the ocular hazards of IPL devices must be raised, and protective eyewear should be supplied to consumers' hands. Manufacturers should provide clear instructions on the device package regarding ocular hazards, the importance of using protective goggles, and a firm warning for consumers not to try to overcome the protective safety features of the sensors. Both practitioners and consumers must be aware of the signs and symptoms of possible ocular damage to seek prompt medical care.

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Disclosure

The authors report no conflicts of interest in this work.

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