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The ROYAL COLLEGE of OPHTHALMOLOGISTS

CORRESPONDENCE

Comment on: 'Acute primary angle closure-treatment strategies, evidences and economical considerations'

Mykolas Pajaujis[1] · Tom Eke[2]

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Chan et al. reviewed strategies for the initial management of acute primary angle closure (APAC) [1]. We feel that the authors have overlooked a quick, low-risk option: corneal indentation (indentation gonioscopy, IG).

We find that IG is a quick, easy, patient-friendly technique that often gives an immediate reduction in intraocular pressure (IOP) in APAC. The technique requires a standard small diameter four-mirror gonioscopy contact lens without flange (e.g. Posner or Sussman type). In APAC, gonioscopy will confirm closed angle, but gentle pressure on the gonio-lens may allow the angle to open, at least in part [2]. In this case, all that ophthalmologist needs to do is to sustain this pressure, keeping the angle open to allow outflow of aqueous. The patient should be warned of possible discomfort. We like to re-measure the IOP after 10–20 s of indentation; if the IOP has reduced, indentation may be repeated. Successful IG can give a rapid reduction of IOP. This may translate to immediate improvement of symptoms, fewer medications, avoidance of more risky procedures, and more rapid progression to a more definitive treatment such as laser iridotomy.

Good success rates of this technique have been published [3, 4]. Our own clinical audit confirms that IG is definitely worth attempting. Our trainees achieved a clinically useful reduction in IOP in 3 out of 7 cases. These 'successful' cases presented with IOP's of 55, 52, and 52 mmHg, immediate post-indentation IOP's were 26, 40, and 43 mmHg, respectively (IOP reductions of 52, 23, and 17%). Better IOP response occurred in patients with more recent onset of their symptoms.

We suggest that IG is done as part of the initial management of all cases of APAC. It takes less than a minute, and if successful can lead to quicker resolution of symptoms, faster, easier, safer management. If a four-mirror gonio-lens is unavailable, indentation can be done with any other smooth, round instrument such as a muscle hook or even the fingertip (through closed eyelid) [5]. If IG does not lower the IOP, then the clinician should proceed with other options [1].

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Comment on: How do paper and electronic records compare for completeness? A three centre study

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We congratulate Wu et al. on their study, as monitoring of records is important for clinical and medicolegal reasons, especially during the challenging transition towards paperless working in NHS hospitals [1–3]. However, we have concerns with their study methodology and conclusions.

New glaucoma referrals were reviewed at three sites with two different EPR systems at different stages of rollout and clinical engagement. They compared these to 'pooled' paper records from only two sites with no mention of possible use of structured paper proformas or paramedical staff collating data. Conclusions are based on data sampled possibly randomly over 5 years (2010–2015), including a changeover phase in 2014, which itself could have contributed to poorer outcomes. Separating the values for the EPR systems also provides some clues on poor quality (Table 1). Both systems may have been used simultaneously at Moorfields during transition when it was left to clinician preference as it is difficult to explain how 1 in 10 new referrals did not have eye pressures recorded. Gonioscopy recording in EPR is significantly different to paper records and, as expected, had low entries but, interestingly, did not differ between both systems.

We also tracked data quality over 1 year in our eye casualty after EPR (Medisoft) introduction, and noted consistent issues with use of free text entries due to lack of familiarity, inadequate data fields and few specified forced choice defaults. Moreover, as staff changed during this period there was a gradual deterioration in record quality (Table 2). We recommend regular electronic record audits with continued targeted training following mandatory induction. Feedback via user groups can facilitate software changes in future EPR versions allowing better integration with workflow.

Although Wu et al. rightly raise awareness on this issue, it is important to not make biased and unsupported conclusions on electronic working, e.g., electronic data is more accessible, but data breaches may not be more common, but just more easily tracked. EPR has the power to truly transform healthcare, but we need to focus on the roll out to ensure better integration with workflow to fully realize their potential.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Table 1 Data review: separating the percentage entry for two EPR systems and paper across relevant fields (Wu et al.) [1]

	Medisoft (%) $n = 170$	Open eyes (%) $n = 100$	Paper (%) $n = 170$	χ^2 p-values Paper versus Medisoft (Open eyes)
Intraocular pressure	98.8	90	100	0.50 (<0.001)[a]
Central corneal thickness	80.6	85	85.9	0.19 (0.84)
Gonioscopy	62.35	64	88.8	<0.001 (<0.001)
Fundus examination	88.8	69	90	0.72 (<0.001)
Past medical history	81.17	58	92.4	0.002 (<0.001)
Current medications	80.58	47	93.5	<0.001 (<0.001)
Glaucoma medications	78.8	28	88.2	0.19 (<0.001)
Drug allergies	78.8	38	87.6	0.03 (<0.001)

[a]Fisher exact test

Table 2 Summary of our data in eye casualty record quality audit (UHCW)

	2016 $n = 100$	2017 $n = 100$	χ^2 p-values 2016 versus 2017 Medisoft entries
Presenting complaint	99	85	<0.001
Past ocular history	70	57	0.06
Past medical history	63	38	<0.001
Drug history	27	22	0.41
Allergies	49	21	<0.001
Family history	19	5	0.002
Social history	12	5	0.04
Diagnosis	95	93	0.55
Prescription recorded	100	99	1[a]
Outcome recorded	98	96	0.41

[a]Fisher exact test

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Response to: Comment on 'How do paper and electronic records compare for completeness? A three centre study'

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To the Editor,

We thank Qadir and Kadyan for their comments concerning our study [1]. The interesting point is that the data they share shows exactly the same findings as we report. With specific reference to our methodology:

1. We sampled the data over three sites with two different EPR systems as we believe this reduced the bias of analysis based on a specific EPR.

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2. Data collection was over period of time that allowed staff training and familiarisation of the systems as they were being introduced.
3. Our Table 1 showed the results of both EPR systems separately and combined together to allow readers to interpret the data in detail independently. For the Moorfields City Road data, we identified the samples of new patients with a stamp in the medical notes to indicate full documentation of the entry on EPR, based on the discretion of the clinicians. The fact IOP was only recorded in 90% of the Openeyes entry we speculate was due to it not being a forced choice option.
4. Both electronic and paper data entry in all three sites can be performed by clinicians, trained ophthalmic nurses and technicians. The final entries were all completed by the clinicians. For the paper entry, structured paper new patient proformas were used across three sites.

Following on from our study, one of the centres (Western Eye Hospital) has carried out incremental changes to the EPR documentation in the outpatient glaucoma service. Consent forms are currently scanned and outcome sheets are being made electronic. This programme has now been rolled out to the whole ophthalmology department making it paperless/paperlight.

Whilst we agree electronic records are the 'way of the future', the findings of both our study and the findings of Qadir and Kadyan highlight the need for regular and continuous evaluation of the electronic system. This evaluation will ensure safety and reliability in the transition to a 'paperless', or at least a 'paperlight', NHS.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Macular toxicity secondary to occupational exposure to gold melting

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Case Presentation

A 60-year-old man was referred to the Vitreoretinal Department of the Manchester Royal Eye Hospital due to progressive distortion in the left eye. He also complained of increasing difficulty in reading and also of the presence of dark spots in his central vision left worse than the right eye.

The patient's visual symptoms were first attributed to his left cataract but after cataract surgery, he became more aware of a central scotoma.

Of note, the patient mentioned that he worked in the jewelry industry and one of his major tasks was the melting of pure gold. He admitted that occasionally he melted gold without wearing protective goggles, although usually he wore eye protection. He also denied exposure to bright sunlight or looking at the sun for a long time, and he denied any other laser exposure.

On clinical examination, his best corrected visual acuity (BCVA) was 0.7 and 0.9 LogMAR right and left, respectively. Pupillary reflexes were normal and the rest of the

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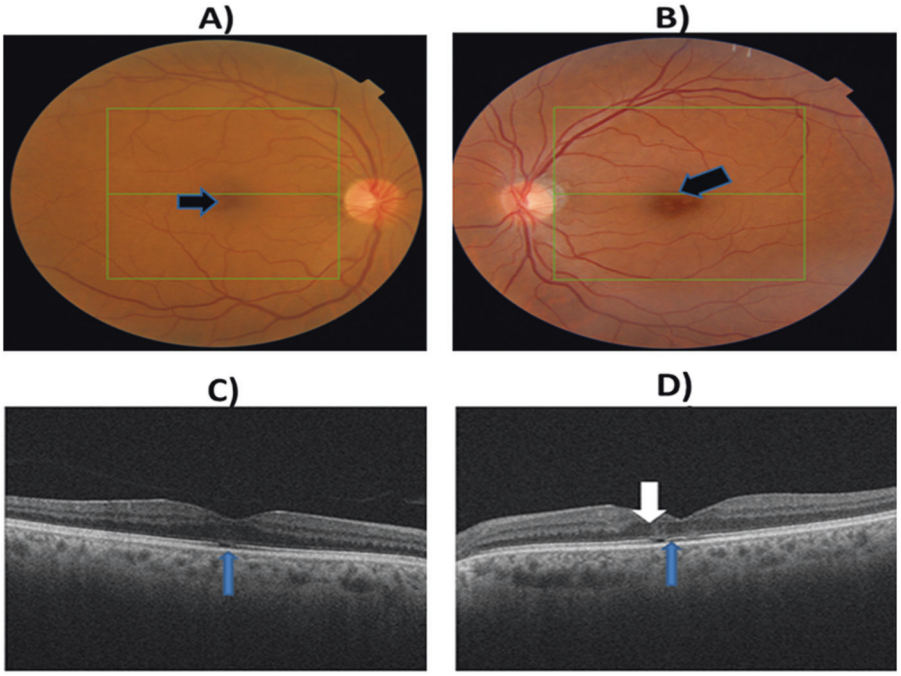

Fig. 1 Top line from left to right: Colour photographs of both fundi. **a** Right fundus. There are some subtle retinal pigment epithelial (RPE) changes at the right fovea (Black arrow). **b** Left fundus. The same RPE changes are present but more prominent in the left fovea compared to the right. No other obvious abnormalities are seen in the peripheral retina of either eye. Bottom Line from left to right: Macula OCT of both eyes. **c** Right Macula. Note the loss of the ellipsoid as shown by the thin blue arrow **d** Left Macula. Note the loss and disruption of the ellipsoid zone as shown by the thin blue arrow, which is more prominent in the left macula compared to the right. In addition, the white arrow demonstrates the vertical hyperreflective pillars that traverse the retinal thickness from the ILM to the RPE

anterior segment examination was normal too. On dilated fundoscopy, the presence of small yellow lesions in both maculae was noted. The findings were more prominent in the left eye compared to the right (Fig. 1a, b). Multimodal imaging including optical coherence tomography (OCT) and fundus autofluorescence (FAF) were obtained with a confocal scanning laser ophthalmoscope (Spectralis HRA-OCT; Spectralis HRA-FAF; Heidelberg Eye Explorer, Version 1.9.17.0, Heidelberg Engineering, Heidelberg, Germany).

A macula OCT demonstrated sub-foveal attenuation, disruption and loss of the ellipsoid layer in both maculae left worse than right (Fig. 1a, b). Furthermore, there were some changes in the inner retinal layers of the left macula as well (Fig. 1c, d). In addition, the left FAF revealed a central area of hypo-autofluorescence which correlated with the central area of disruption and loss of integrity of the sub-foveal ellipsoid zone (Fig. 2).

Both optic discs and peripheral retinal did not exhibit any abnormalities.

Based on the history, clinical and multimodal-imaging findings, our hypothesis is macular damage due to occupational exposure during the process of pure gold melting.

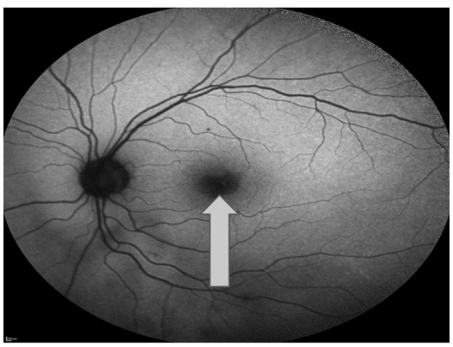

Fig. 2 Fundus autofluorescence of the left eye. The yellow arrow demonstrates a central area of hypo-autofluorescence corresponding to the area of disruption and loss of ellipsoid layer at the level of the left fovea

Discussion

Light is a form of electromagnetic radiation exhibiting dual wave and particle properties [1]. The wavelengths that can interact with the eye can be divided further in three categories: ultraviolet, visible and infrared. When the light interacts and gets absorbed by a photoreceptor, its particle properties play a pivotal role [1].

The electromagnetic spectrum between 400 and 1400 nm is deemed the retinal hazard region [1]. Three different types of retinal damage can occur due to light toxicity: photothermal, photochemical and photomechanical [1]. We postulate that our patient developed a photochemical injury due to exposure to the melting process of gold.

When trying to melt pure gold in powder form, it has been found that powdered gold is more sensitive and reflective in the infrared region from 1060 to 1090 nm [2]. A specific laser system called selective laser melting (SLM, MTT Technologies Group SLM 100) has been designed to produce infrared wavelength in the aforementioned region [2]. The wavelengths emitted by the SLM machine fall within the retinal hazard region and thus, they can potentially be harmful to the human retina.

We postulate that these infrared waves might have reflected onto the surface of the powdered melting gold, and hit the patient's macula while the patient was gazing directly without protective goggles. As the patient had repeatedly done so, there may have been a cumulative aggregation of photochemical retinal toxicity that eventually led to the manifestation of the retinal pigment epithelial (RPE) changes and the OCT and FAF findings described above. These are very typical findings of photochemical injury [1]. They provide a logical explanation for the patient's central visual disturbances and distortion mainly in his left eye.

Another possible type of damage that might have contributed was photothermal injury due to increase in the temperature of the retina cells, which subsequently resulted in the denaturation of retinal proteins, and loss of their tertiary structure with simultaneous liquefaction of the photoreceptor cell membrane [1]. Indeed, during gold melting, the increase in thermal energy produced might have penetrated the eye and reached the macular area while the patient was working and gazing directly without protective goggles.

Absorption of photothermal energy is thought to occur by one of three pigments: melanin located primarily in the melanosomes of the retinal pigment epithelium (RPE) and melanocytes of the choroid, xanthophyll located primarily in Muller cells and neurosensory retina, and haemoglobin in the blood vessels of the neurosensory retina and choroid. Melanin, the most effective absorber, is located primarily in the RPE. Therefore, an eye with an abundance of melanosomes, as in a heavily pigmented fundus (as is the case of our patient who is dark skinned), will more readily absorb photothermal energy. Following the application of laser to the retina and RPE, histological evidence of thermal damage is seen initially at the level of both the RPE and photoreceptors [3]. Therefore, both photochemical and photothermal damage from gold melting may have contributed to the ocular damage seen in this patient.

Conclusion

To the best of our knowledge, this is the first reported case of macular light toxicity secondary to the process of gold melting, and highlights the importance of wearing protective goggles when undertaking this process.

Ophthalmic exposure to radiation during gold melting should be considered an occupational hazard. The jewelry industry should mandate adequate safety precautions in terms of protective goggles, which block at least the infrared region from 1060 to 1090 nm. Otherwise further irreversible visual loss may occur in other workers.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Metastatic melanoma and immunotherapy-related uveitis: an incidence in Northern Ireland

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To the Editor,

Inflammatory eye disease, namely uveitis, is a well-documented adverse effect of immunotherapy, a novel treatment option that has revolutionised the outcomes for patients with metastatic melanoma. By blocking immune checkpoint proteins CTLA-4 (Ipilimumab) and PD-1 (Nivolumab, Pembrolizumab) on the surface of T-lymphocytes, the drugs cause the desired effect of tumour regression [1], but can also result in numerous immune-related adverse effects (irAEs) [2]. The incidence of uveitis secondary to CTLA-4 and PD-1 blockade in melanoma patients is said to be less than 1% [3, 4]. The phenomenon has also been reported in patients treated with BRAF/MEK inhibitor-targeted therapies (Dabrafenib/Trametinib/Vemurafenib) [5].

In this article, we present the incidence of uveitis in all patients in Northern Ireland treated with immunotherapy and targeted therapies for metastatic melanoma since the inception of the use of these agents in 2012. Of the 214 patients treated with immunotherapy between 2012 and 2018, six developed uveitis (five bilateral anterior and one panuveitis), a calculated incidence of 2.8%, significantly higher than quoted in the literature (<1%) [3, 4]. For BRAF/MEK inhibitor-targeted therapies, of the 81 patients treated there were four cases of uveitis (two bilateral anterior, one intermediate and one panuveitis), an incidence of 4.9%.

We now present two interesting illustrative cases as examples of patients with metastatic melanoma treated with immunotherapy and how their ocular immune-related adverse effects were managed.

Our first case is a 77-year-old woman with metastatic melanoma treated with Pembrolizumab therapy. During her second cycle, she developed blurred vision in her left eye, hearing loss and marked poliosis of her eyelashes. Ocular

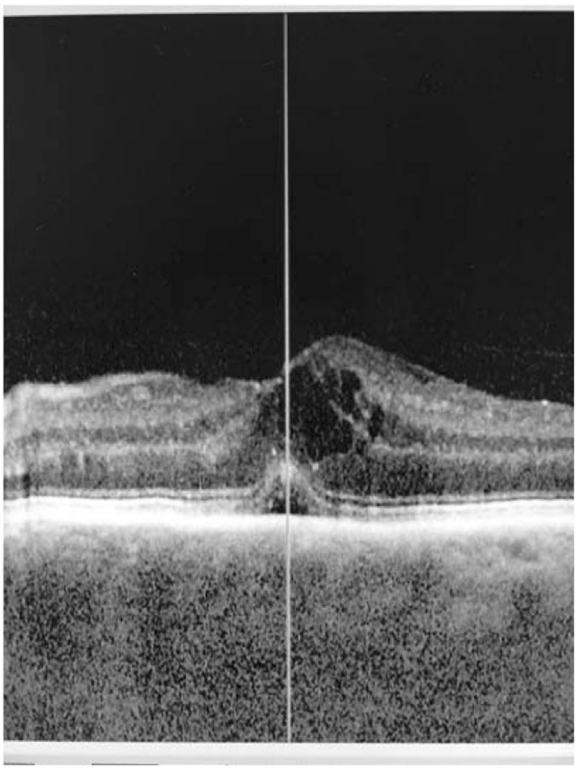

Fig. 1 OCT left eye showing resolving intra-retinal fluid with oral steroids

I declare that the material presented is original research, has not been previously published and has not been submitted for publication elsewhere while under consideration.

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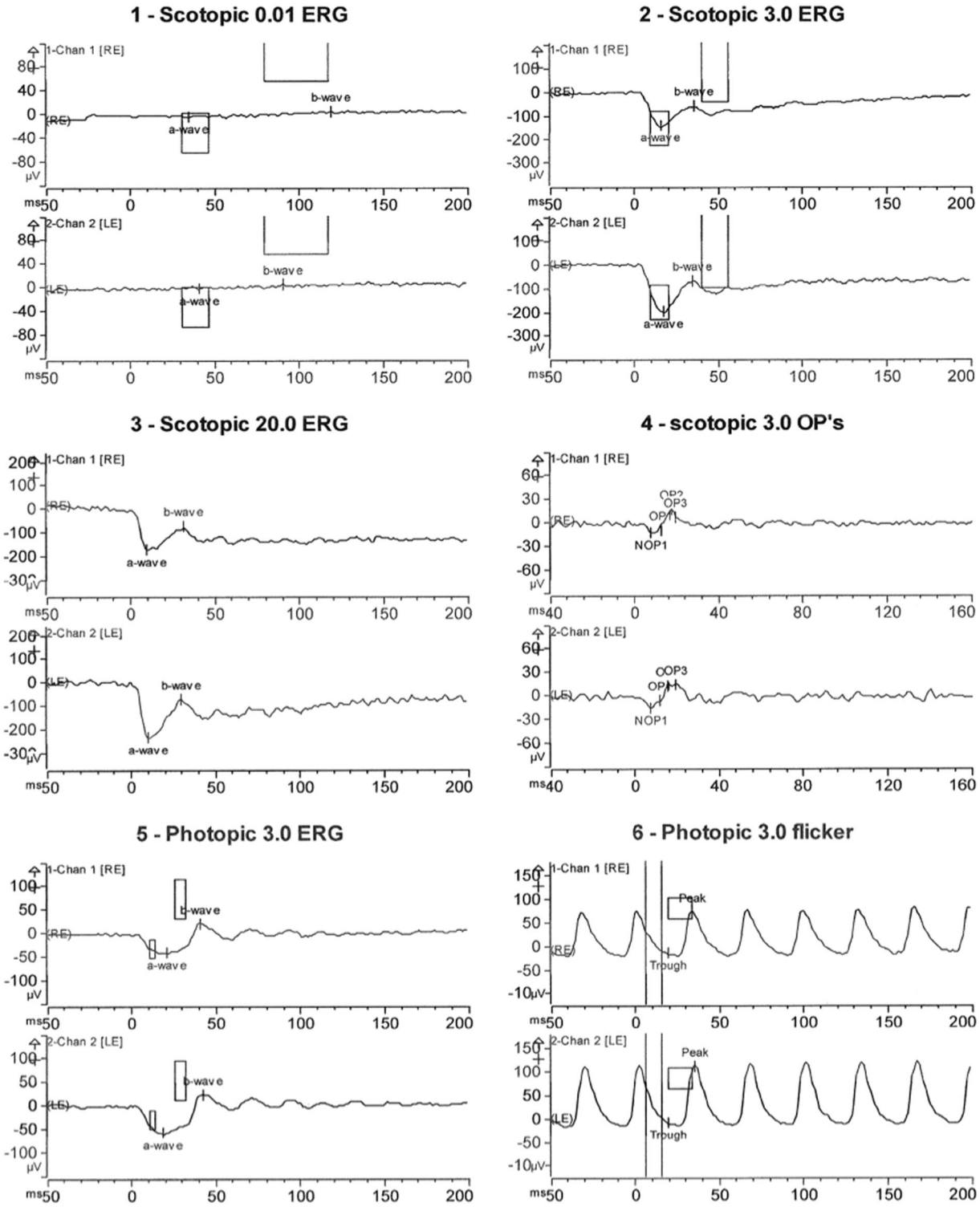

Fig. 2 Electroretinography (ERG) suggestive of melanoma-associated retinopathy (MAR)—absent rod function in scotopic ERG, and selective reduction of the 'b-wave' with preservation of the 'a-wave' resulting in a negative type ERG overall

examination revealed bilateral panuveitis with exudative retinal detachments, which was worse in the left eye. It was felt that this patient had developed a VKH (Vogt Koyanagi Harada)-like syndrome secondary to her immunotherapy. Her optical coherence tomography and vision improved with oral steroids and topical PredForte (Fig. 1).

A 72-year-old gentleman with metastatic melanoma is the focus of our second case. Treated with two cycles

of Ipilimumab/Nivolumab and five cycles of Pembrolizumab, he developed bilateral anterior uveitis and raised intra-ocular pressures (IOPs). His ocular inflammation was treated with Maxidex, and IOPs controlled with Latanoprost and Betagan. Unfortunately he developed further irAEs, including grade 2 colitis, adrenal insufficiency and diabetes. His immunotherapy was discontinued due to cumulative toxicity despite complete radiological response. Interestingly, after the resolution of all ocular inflammation, poor vision in the left eye persisted (6/24) and electrophysiology led to a diagnosis of melanoma-associated retinopathy (MAR), a paraneoplastic autoimmune complication of melanoma (Fig. 2). This was confirmed by the presence of anti-recoverin and carbonic anhydrase II antibodies.

Clinicians must be vigilant for inflammatory adverse effects of immunotherapy in the eye. Often the effects are minor; however, rarely, certain cases can be sight threatening. None of our patients had immunotherapy discontinued due to ocular irAEs alone, and all were managed with topical and oral steroids. Our data highlight the higher-than-anticipated incidence of ocular inflammation in patients on novel therapies for metastatic melanoma in Northern Ireland.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Self-tattooing of eyeball with inadvertent corneoscleral perforation: the implication of social media

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To the Editor

Body modification procedures are becoming increasingly popular, especially, in the social media generation where an easily accessible self-care or Do-It-Yourself (DIY) culture is common [1]. We report a case of inadvertent corneoscleral perforation following self-attempt of bilateral ocular tattooing guided by a YouTube video.

A 34-year-old Caucasian man presented to our eye casualty with an acute painful right eye after performing a DIY ocular tattooing procedure using a 31-gauge hypodermic needle, and Fibracolor white baby finger paint purchased online. After multiple prompting during the initial consultation, the patient disclosed a past history of bilateral laser epithelial keratomileusis (LASEK) for myopia, radical bilateral bulbar conjunctivalectomy for post-LASEK chronic bulbar conjunctival

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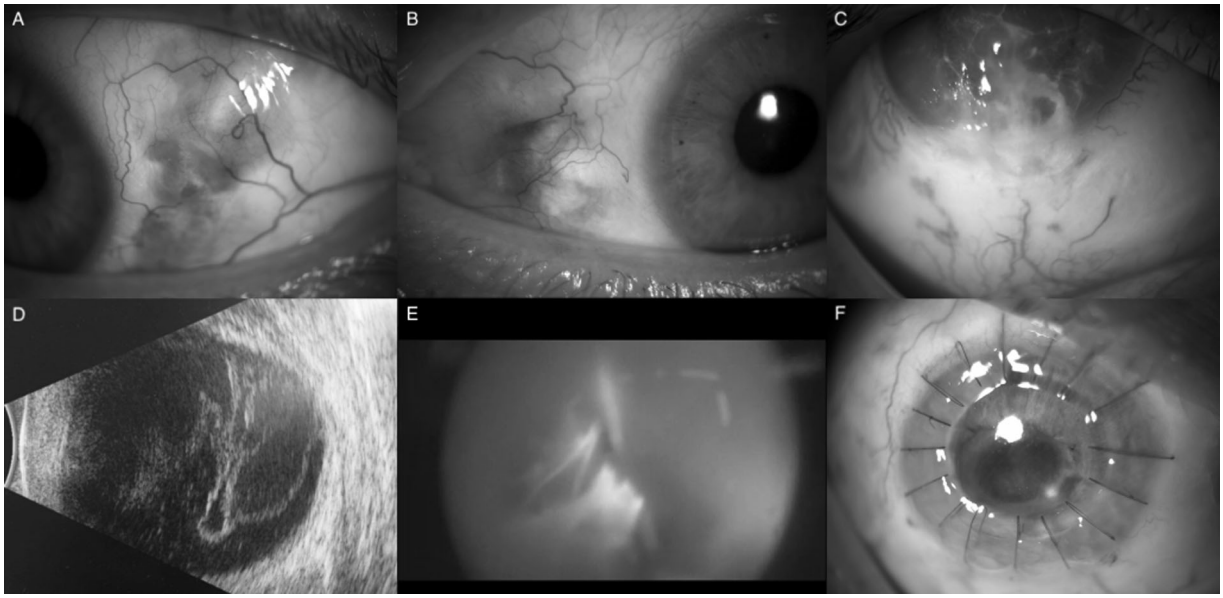

Fig. 1 **a** Slit-lamp photography of the right eye showing dark patches on the sclera related to scleromalacia. **b** Slit-lamp photography of the left eye showing white paint material in the sub-Tenon space and scleromalacia. **c** Slit-lamp photography of the right eye showing fibrinous material in the anterior chamber with hypermature white cataract obscuring the fundal view. **d** Ocular B-scan ultrasound of the right eye showed discrete, mobile echogenic particles within the vitreous cavity. **e** Extensive contamination of the right vitreous with white paint material noted intraoperatively. **f** Slit-lamp photography showing a clear full-thickness/penetrating corneal graft with marked transpupillary membrane

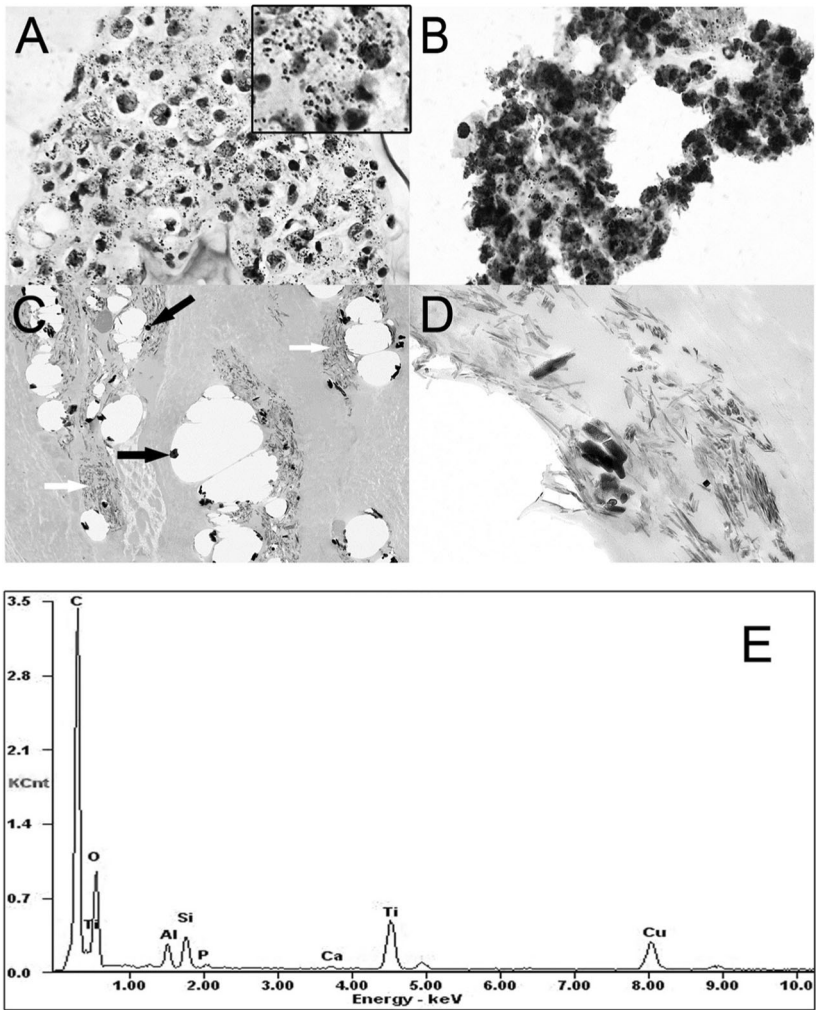

Fig. 2 **a** Hematoxylin and Eosin (H&E) stained cell block preparation from the vitreous biopsy showing macrophages containing paint particles in their cytoplasm. This is clearly shown in the top right inset plate. **b** CD68 immunohistochemistry, confirming that the cells containing the paint particles are macrophages. Brown is positive staining. **c** Transmission electron micrograph (TEM) showing the larger electron dense paint particles (black arrows) and the smaller more crystalline paint particles (white arrows). The white holes are artefacts of tissue processing. **d** Higher power TEM showing the larger, more electron dense paint particles just below of centre and the accompanying, smaller, more numerous, less electron dense, more crystalline paint particles. **e** The energy dispersive microanalysis of X-ray read-out showing the various elements present in the white paint: C carbon, O oxygen, Al aluminium, Si silicon, P phosphorus, Ca calcium, Ti titanium Cu copper

hyperaemia, consequent cosmetically unacceptable scleromalacia and self-ocular tattooing.

At presentation, the corrected-distance-visual-acuity was hand movement (right eye) and 6/5 (left eye). There were bilateral scleromalacia involving 360° of the bulbar associated with overlying calcified plaques (Fig. 1a, b). Examination revealed a right flat anterior chamber with white pseudohypopyon (Fig. 1c) and an intraocular pressure (IOP) of 8 mmHg. Fundal examination was completely obscured by a hypermature cataract and ocular B-scan ultrasound revealed discrete, mobile echogenic intravitreal particles (Fig. 1d). Examination of the left eye showed a low-grade anterior uveitis, which was successfully treated with topical drops.

He underwent an emergency right primary repair of inferior corneal laceration followed by lensectomy, surgical posterior capsulotomy and vitrectomy, which revealed extensive contamination of the vitreous with paint particles (Fig. 1e). The vitreous sample was sent for histopathology analysis (Fig. 2a–e). A few weeks later, a progressive inferior corneoscleral melt was observed, necessitating further surgeries, such as allogeneic lamellar sclero-corneal patch graft, amniotic membrane graft and ultimately a penetrating keratoplasty. At final follow-up, his corneal graft remained clear with a normal IOP and corrected-distance-visual-acuity of 6/36 (Fig. 1f).

Ocular tattooing has been used to treat disfiguring corneal scar, intractable diplopia and glare [2]. However, these invasive procedures can potentiate sight-threatening complications, especially, when performed by non-medically trained personnel [3]. Episcleral or conjunctival tattooing was first described in 2007 and, so far, there are several reports highlighting the significant complications associated with this type of procedure, including severe intraocular inflammation, cataract, secondary glaucoma, orbital cellulitis, scleritis and globe perforation [3, 4]. These complications arise either from the direct injury of the injection or from the hypersensitivity reaction to the constituents or contaminants of the injected pigments [3]. In addition, patients may not readily disclose the entire history of self-tattooing complicating the diagnosis and management of the injury [3], as highlighted in our case.

The easy accessibility to social media in the current generation may act as a double-edged sword. With the rapid proliferation of health information online, it is becoming a common culture where patients turn to the internet as their first source of information and guidance on self-care procedures [5]. Clinicians need to maintain a low index of suspicion for self-treatment when encountering unexplained injuries to enable timely recognition and intervention of the complications. Awareness of these sight-threatening complications needs to be raised amongst the health professionals, general public and regulatory bodies.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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