Two cases of pen ink scleral tattoos and a brief review of the literature

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1. Introduction

Tattooing of the eye dates to the early 2nd century Roman Empire and was first performed on the cornea. In 150 C.E., Galen of Pergamon, an ancient physician and philosopher, first described cauterizing the cornea of patients with unsightly corneal scarring, and then using copper sulfate to dye the area in order to improve cosmesis. Corneal tattooing is still performed today as a cosmetic treatment for corneal opacities, as well as to treat symptomatic glare from iris defects such as polycoria, traumatic iridodialysis, and laser peripheral iridotomies. Corneal tattooing to change perceived iris color has also been described.

Scleral tattooing, also referred to as episcleral, subconjunctival, or simply eyeball tattooing, is a relatively new form of extreme body modification that first emerged in 2007. There are few reports of the management of these tattoos in the medical literature, and we aim to increase the body of knowledge surrounding this rare and potentially dangerous practice.

2. Findings

2.1. Case 1

A male in his 20’s was brought to the emergency room with bilateral eye pain, swelling, and discharge for two to three weeks. He reported that three weeks prior while incarcerated, he drained a black ink gel pen into an insulin needle and injected the ink underneath the conjunctiva of both eyes. Initially, the patient had no symptoms, but 6-8 days after...
Table 1
Comprehensive list of all previously reported cases of scleral tattooing in the medical literature and their characteristics.

| Author            | # of cases | Age | Gender | Country | Color Ink | Type of Ink | Complications                                                                 | Required surgery?                  | Loss of eye? | Final visual acuity | Other Comments                                                                 |
|--------------------|------------|-----|--------|---------|-----------|-------------|--------------------------------------------------------------------------------|-------------------------------------|--------------|---------------------|--------------------------------------------------------------------------------|
| Chan et al.        | 3          | 39 F | Canada | Blue    | Tattoo Ink (Starbrite) | Inadvertent puncture wound without injection of ink | Yes - globe exploration          | No          | Unknown             | Recovered well, lost to follow up after 1 week. Suspected endophthalmitis but tap negative. Lens zonules dissolved leading to lens subluxation. |
| 41 M               | Canada     | Blue | Inadvertent puncture and injection of 1 cc of ink into anterior chamber | Yes - Anterior chamber washout, tap and inject, pars plana vitrectomy, then pars plana lensectomy and insertion of sulcus lens. | No | 20/200                      |                       |                                        | Pathology demonstrated staining of the inner retina, sclera, and the corneal endothelium, as well as endothelial cell loss and corneal edema. |
| 24 M               | Canada     | Black | Tattoo Ink (metal-free) | Inadvertent puncture and injection of ink | Yes - anterior chamber washout, pars plana vitrectomy, and lensectomy. Enucleation 2 months later. | Yes - Alcaligenes faecalis endophthalmitis and complications eventually leading to phthisis requiring enucleation. | No          | Unknown             | Enucleated                                                                 |
| Duarte et al.      | 2          | 26 M | Mexico | Green  | Unknown | Orbital cellitis and posterior scleritis with choroidal detachment and macular folds. | Yes - Right tarsorrhaphy due to conjunctival exposure. | No          | 20/25               | Subconjunctival penicillin injected during tattooing, and the patient had a known penicillin allergy. Patient was without pain or decrease in vision. |
| 17 M               | Mexico     | Orange | Unknown | Episcleral nodules | No | No |                                   |                       | 20/200                  | Had persistent elevations of IOP even after initial washout and required trabeculectomy. |
| Cruz et al.        | 1          | 25 F | Brazil | Black  | Unknown | Tattoo ink (“Eternal Ink”) | Inadvertent puncture and injection of ink into anterior chamber resulting in severe inflammation, capsular lens opacity, and secondary glaucoma. | Yes - Anterior chamber washout, then trabeculectomy for pressure control. | No          | 20/100              |                                                                                  |
| Cruz et al.        | 1          | 28 M | Brazil | Blue    | Unknown | Conjunctivitis and anterior uveitis | No | No | 20/25               | Managed with topical drops only. Scanning electron microscopy X-ray microanalysis of the tattoo red ink revealed significant signals of iron, barium, and copper. |
| Oswaldo Rodriguez-Avila et al. | 1           | 32 M | Mexico | Red | Tattoo ink | Inadvertent globe penetration | Yes - pars plana vitrectomy | no | 20/80               |                                                                                  |
| Ng et al.          | 1          | 34 M | UK     | White  | Fibracolor Finger Paint | Inadvertent globe puncture | Yes - open globe repair, lensectomy, then subsequent inferior scleral melt requiring sclero-corneal patch graft, amniotic membrane grafting, eventually penetrating keratoplasty. | No | 20/125              | Was attempting to cover up undesirable scleromalacia from previous eye surgeries. Self-guided technique via YouTube. |
| Paulo et al.       | 1          | 29 M | Colombia | Green | Unknown | Inadvertent globe puncture in both eyes | Yes - anterior chamber washout of both eyes. | No | 20/25              | Patient was a tattoo artist and had a history of schizophrenia. Patient asymptomatic. |
| Brodie et al.      | 1          | 43 M | UK     | Red    | Tattoo ink | Episcleral nodules | No | No | 20/20              | First case reported in medical literature. Patient asymptomatic. Inferior retinal break with localized retinal detachment was found at the site of inadvertent puncture. |
| Dixon et al.       | 1          | 39 M | USA    | Green  | Tattoo ink | Inadvertent globe puncture in right eye | Yes - globe exploration and pars plana vitrectomy with barrier laser and silicone oil. | No | 20/20              |                                                                                  |
| Tubek et al.       | 1          | 21 F | Poland | Black  | Unknown | Inadvertent puncture in the right eye with injection of ink into the anterior chamber | Yes - anterior chamber washout followed by pars plana vitrectomy. | No | Light perception | Developed persistent ocular hypertension and significant cataract. Also had conjunctival lumps in the asymptomatic left eye similar to those in Brodie et al. |
| Jalil et al.       | 1          | 49 M | UK     | Blue   | Unknown | Inadvertent puncture with injection of ink into vitreous | Yes - pars plana vitrectomy with silicone oil tamponade. Later developed proliferative vitreoretinopathy, needed additional vitrectomy and long-term silicone oil tamponade. | No | Unknown            | CT scan demonstrated an IOFB appearance possibly due to subretinal concentration of crystals, found to be titanium dioxide and copper containing particles. |
tattooing he began to experience drainage and pain from both eyes. He was initially evaluated by an outside provider and was given a short course of oral azithromycin without improvement.

Uncorrected visual acuity on initial presentation to the ophthalmologist was 20/20 in both eyes. Intraocular pressures were 22 mmHg in the right eye and 23 mmHg in the left eye. He had mild eyelid edema in both eyes, bilateral 360-degree black conjunctival pigmentation and chemosis greater on the left side (Fig. 1). Fluorescein exam revealed small inferior focal areas of uptake corresponding to reported injection sites in both eyes which were Seidel-negative. Both corneas were clear and the anterior and posterior segment exams revealed no inflammation and were unremarkable in both eyes. A CT scan of the orbits showed formed globes and no foreign bodies in either eye. His symptoms and examination represented a chemical or allergic contact conjunctivitis.

The patient was prescribed dexamethasone/neomycin sulfate/polymyxin B sulfate ointment four times a day and moxifloxacin drops four times a day in both eyes. He returned to clinic two weeks later with improved chemosis and symptoms. The moxifloxacin drops were discontinued, and the ointment slowly tapered over the next 6 weeks. The patient was seen again 6 weeks later off all eye medications and had complete resolution of symptoms. Examination at that time included 20/20 vision in both eyes, normal intraocular pressures, and no persistent chemosis. Subconjunctival ink/pigmentation was still present, but notably reduced. Faint hyperpigmentation of the lower eyelid skin was noted in both eyes as seen in Fig. 1.

2.2. Case 2

A male in his 20’s presented to the ophthalmology clinic with one month of itching and irritation in both eyes. He denied pain or any decrease in vision. The patient reported draining a black gel pen into an insulin needle and, with the help of another inmate, injected the ink into both conjunctivae approximately one month prior. He had been using erythromycin ointment sporadically in both eyes for approximately 3 weeks, prescribed by an outside provider soon after the tattooing.

Initial exam included uncorrected visual acuity of 20/30 in the right eye and 20/40 in the left. Intraocular pressures were 13 mmHg in the right eye and 14 mmHg in the left. Both eyes had mild eyelid edema with a faint discoloration of the eyelid skin. The right eye had 360° of densely pigmented conjunctiva and mild chemosis, a 2.5mm diameter conjunctival defect inferiorly, and scattered subconjunctival hemorrhage (Fig. 2A). The left eye had 360° of densely pigmented conjunctiva and mild chemosis, a small 1.5mm diameter conjunctival defect super-temporally, and subconjunctival hemorrhage. The remaining anterior and posterior segment exams of both eyes were unremarkable and with no inflammation.

Treatment with erythromycin ointment four times a day was continued, with encouragement to improve adherence. Two weeks later, the conjunctival defects in both eyes had resolved. Three months later, the patient had developed moderate conjunctivochalasia inferiorly in both eyes. The vision at this visit improved to 20/20 in both eyes. A 2mm ring of conjunctiva around the limbus in both eyes had returned to its normal white color and the conjunctiva was overall less deeply pigmented (Fig. 2B).

3. Discussion

Scleral tattooing has emerged as a novel form of extreme body modification. With only 14 cases in the medical literature to date, its complications are just becoming recognized. Traditional tattoo inks, when inadvertently injected inside the anterior chamber or vitreous, can cause devastating injury to the eye and its structures including uveitis, corneal endothelial failure, secondary glaucoma, retinal detachments, infection, and loss of eye.9,11,13,15,17,19 From our literature review, 10/14 (71%) cases previously reported were complicated by inadvertent globe puncture, and these cases had more serious visual consequences, especially if ink was injected while inside the eye. In cases without globe puncture, less serious side effects tend to occur and are likely related to hypersensitivity of the conjunctiva to the ink itself and include irritation and conjunctival chemosis as in our cases and others, as well as episcleral nodules.10,12,16,18 These are likely secondary to known iron, barium, copper, or titanium dioxide pigments in tattoo ink or other associated components of the ink formulation.

The cases presented here are unique and novel in that these tattoos were administered using gel pen ink and insulin needles. This is the first report of pen ink scleral tattoos in the literature. Although tattooing within prisons in the United States and many other countries is prohibited, up to 45% of inmates receive tattoos during their incarceration.20 It is possible, however, that this rate is decreasing.21 Prison skin tattooing is often done with improvised and non-sterile materials, including sewing needles, hypodermic needles, guitar strings, and inks from pens and melted plastics. The risks of prison tattooing include infection and transmissible diseases such as Hepatitis B and C, and possibly HIV.22 Pen ink for skin tattooing has been described in the dermatology literature to rarely cause localized skin reactions, some specifically to components of the ink such as Solvent Blue 36 which is commonly found in blue pen ink.23–25 Hypersensitivity reactions can result from traditional dermal tattooing as well, and ranges from mild irritation to granulomatous inflammation requiring tattoo removal or excision.25 To our knowledge there is no report of pen ink or prison tattoos causing unique or increased local side effects as compared to traditional tattoo ink.

These side effects in the skin from tattoo ink or pen ink may also manifest in the conjunctival, episcleral, and scleral tissues in the presence of ink. As Tubek et al. previously noted, if these reactions do occur and are persistent even with medical treatment, complete removal of dye-containing conjunctiva would be exceedingly difficult especially in cases with permanent tattoo ink, presenting a unique challenge.18

Fig. 1. Case 1 left eye in panel A at initial presentation and panel B at 6-week follow up showing densely pigmented conjunctiva and faint hyperpigmentation of the periocular skin improving over time.
Even if scleral tattooing is unevenful, and in some cases fades with time, the staining of the conjunctival tissue can make for difficult detection of important diseases such as conjunctival melanoma, scleral icterus, scleritis, or underlying scleral thinning. Additionally, uncomplicated dermal tattoos can cause delayed systemic immune reactions, such as in the well-described entity of tattoo-associated uveitis in which patients can develop bilateral uveitis and granulomatous inflammation of tattoosed skin, usually occurring at least after 6 months after tattooing. Although there have already been reports of immediate anterior uveitis after scleral tattooing, there have been no reports of an uncomplicated scleral tattooing presenting with delayed tattoo-associated uveitis so it is unknown whether the proximity of the ink may increase this risk.

As seen in our cases and two others, spontaneous migration of dye into the periorcular soft tissues can occur. It is difficult to know whether it is possible for the inks to similarly migrate through an intact sclera and directly affect intraocular structures.

4. Conclusions

We present two cases of scleral tattooing using insulin needles and pen ink. Scleral tattooing can be fraught with procedural complications and can be potentially blinding if globe penetration or infection occurs. What we can gain from these two cases is that pen ink scleral tattoos evolve quite rapidly compared to other tattoo methods, with the ability to clear the ink from the subconjunctival space. Evidenced by our cases and others, uncomplicated scleral tattooing can be treated conservatively with various topical medications, but every patient should be thoroughly evaluated with a dilated fundus exam due to risk of inadvertent globe penetration. Insight into the long-term complications of scleral tattooing remains to be seen, and even seemingly uncomplicated tattooing may have long term consequences. One of the more concerning consequences of scleral tattooing could be the masking of underlying ocular surface malignancy, though this has not yet been reported. We caution patients against the practice of scleral tattooing due to the very real danger of permanent blindness or loss of eye and advise patients to seek medical attention immediately for any adverse events.

Patient consent

Written consent to publish this case has not been obtained. This report does not contain any personal identifying information. The Colorado Multiple Institution Review Board (COMIRB) has reviewed and approved the images and descriptions contained in this case series, COMIRB protocol #20-0887, and have deemed the information provided in the case report as unidentifiable.

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Authorship

All authors attest that they meet the current ICMJE criteria for authorship.

Declaration of competing interest

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