

## Comment on: “Poor Long-Term Outcomes of Keratopigmentation With Black Ink for the Treatment of Dysphotopsia Secondary to Laser Peripheral Iridotomies”

### To the Editor:

We read with interest the article published by Jabbour et al titled, “Poor Long-Term Outcomes of Keratopigmentation With Black Ink for the Treatment of Dysphotopsia Secondary to Laser Peripheral Iridotomies.”<sup>1</sup>

We agree with Jabbour et al that anterior stromal puncture with tattoo ink is not an adequate treatment method to address postiridotomy dysphotopsia. The depth and concentration of the ink deposition in the cornea with this technique is too shallow and scattered to allow for the long-term ink retention or for effective light blockade.

In contrast to Jabbour et al, in our experience, we have found good long-term outcomes of lamellar pocket keratopigmentation. We believe that there are some key teaching points about the surgical technique that, if used, can lead to sustained improvement in the visual disability experienced by these patients.

In the analysis of our cases (unpublished internal audit), 14 eyes of 10 patients (average follow-up time of 47 months, range 1–119 months), only 2 patients (3 eyes) had unresolved dysphotopsia after the first corneal tattoo was performed. One of these patients underwent repeat corneal tattooing within a month and experienced complete resolution of dysphotopsias sustained up to her most recent follow-up 10 years later. The second patient opted for observation because his symptoms, while still noticeable, were much improved. All other patients experienced immediate relief

from the procedure, and none have required repeat treatment.

We reported on our corneal tattoo inking technique for iridotomy-related dysphotopsias in 2017<sup>2</sup> and would suggest the additional teaching points to achieve good sustained long-lasting outcomes.

1. The depth of the stromal pocket must be at least 50% or deeper. Stromal pockets that are too shallow do not allow adequate ink retention because more rapid oxidation of the iron oxide occurs. One patient who returned for repeat corneal tattooing had subsequent deeper stromal pockets created than the initial procedure, had immediate and complete symptom resolution, and has not required further intervention.
2. Darker colors contain more iron oxide and are therefore more likely to oxidize. The technique used by Jabbour et al used plain black tattoo ink. In light-colored eyes, we typically mix our tattoo ink with the colors of pink and black to attain a softer dark color, allowing for a better cosmetic outcome. The dilution of the jet black with the pink would decrease the overall amount of iron oxide, leading to less pigment oxidation.
3. Tattoo ink should not be diluted with balanced salt solution which was the technique described in the article. We typically avoid balanced salt solution dilution of the ink to allow for a more dense pigment concentration which prevents light transmission and lasts longer.
4. Even if the ink were to last only 3 to 5 years which has not been the case in our experience, this is still a significant improvement because the symptoms can be very debilitating. Furthermore, the surface procedure is repeatable and noninvasive.

Caution should also be noted with the use of high concentrations of very dark tattoo colors and subsequent magnetic resonance imaging (MRI). Although rare, the iron oxide pigmentation contained within the dark tattoo ink has been reported to lead to second degree

burns in the skin<sup>3</sup> and is hypothesized to be due to the fact that iron oxide is both magnetic and an electrical conductor.<sup>3</sup> Thus, the induced heat increases intracellular water temperature, potentially resulting in a burn. Radiology colleagues informed that patients with tattoos are advised that any areas with a skin tattoo may feel warm after an MRI and that a cold towel compress is useful for relief. Owing to the technique of deposition, dermal tattoos do not typically contain high concentrations of very dark pigment in comparison to corneal tattooing—where there is a requirement for fairly dense pigmentation (owing to an actual physical layer of ink in the lamellar pocket).

The type of tattoo ink also appears to play a role. One case report discussed that pigments such as carbon (black), titanium dioxide (white), copper phthalocyanine (blue green), and indigoid (red) do not seem to exhibit the same ferromagnetic effects on magnetic testing.<sup>4</sup>

We have used the carbon black ink similar to that of Jabbour et al, so the risk is low. However, corneal and dermal tattoo ink is from the same supplier (Spaulding Color Corp, Voorheesville, NY) as that used in the case report of the second degree burn,<sup>3</sup> so there is potential for some adverse event.

Furthermore, MRI-related dysesthesia can be as common as 1.5% in eyeliner tattoos<sup>5</sup> and first degree burns have been noted in nonferrous tattoo inks.<sup>5</sup> The other main foreign suppliers of tattoo ink are companies in China and often have little quality control over their ink constituents, thus potentially being a risk factor. Patients should be counseled and consented preoperatively and should alert their radiologist that they have had previous corneal tattoo if they need future MRI.

We hope that this letter provides some additional pearls of wisdom for cornea surgeons who use this technique. With full informed consent, patients who suffer from debilitating dysphotopsias after peripheral iridotomy can achieve good long-lasting resolution of

their symptoms with a deep intrastromal pocket tattoo treatment.

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## ERRATUM

### Efficacy and Safety of Intense Pulsed Light in Patients With Meibomian Gland Dysfunction—A Randomized, Double-Masked, Sham-Controlled Clinical Trial: Erratum

In the article “Efficacy and Safety of Intense Pulsed Light in Patients With Meibomian Gland Dysfunction—A Randomized, Double-Masked, Sham-Controlled Clinical Trial,” published on pages 325–332 of the March 2020 issue of *Cornea*, the funding statement appeared as follows:

“This study was primarily supported by the 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund) and Ratchadapiseksompotch Fund, Faculty of Medicine, Chulalongkorn University. The funding has no role in conducting this research.”

The authors would like to correct the funding statement to include to provide expanded names of some of the funding bodies and funds. The correct statement should read:

“This study was primarily supported by the 90 Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund), his Majesty the King Bhumibol Adulyadej’s 72nd Birthday Anniversary Scholarship from the Graduate School, Chulalongkorn University and Ratchadapiseksompotch Fund, Faculty of Medicine, Chulalongkorn University. The funding has no role in conducting this research.”

## REFERENCE

1. Piyacomn Y, Kasetsuwan N, Reinprayoon U, et al. Efficacy and safety of intense pulsed light in patients with meibomian gland dysfunction—a randomized, double-masked, sham-controlled clinical trial. *Cornea*. 2020;39:325–332.