Simple and novel technique of using lampblack soot as a corneal tattoo for disfiguring corneal opacities

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The aim of this study was to report a series of corneal tattooing in three eyes of three patients with disfiguring corneal scar and no visual potential, which underwent the procedure using the lampblack prepared in the operating room (OR), and to describe the novel technique of lampblack preparation for the surgery. The depth of corneal opacity was carefully assessed and a superficial lamellar pocket was made by lamellar separation using corneal dissectors, following which the prepared lampblack soot using materials available in the OR was deposited in the pocket. At a mean follow-up of 6 months, all the eyes had a stable corneal surface with an acceptable cosmetic outcome. Corneal tattoo using lampblack gives a satisfactory cosmetic result with good patient satisfaction and improved quality of life in the eyes with disfiguring corneal scar.

Key words: Corneal tattoo, lamellar pockets, lampblack soot

Corneal disfiguring scars not only cause ocular problems such as poor vision, glare, and photophobia but can also cause cosmetic blemishes that can affect patient’s social interactions. Different treatment options such as a cosmetic contact lens, enucleation with orbital implants, and corneal tattooing are available for disfiguring corneal scars with nil vision potential. Corneal tattooing, among all, is considered as the safest and the most inexpensive procedure.[1]

Different tattooing methods have been used such as chemical dyeing, using gold or platinum chloride, and nonmetallic tattooing with India ink, China ink, lampblack, and other organic dyes.[2,3] Numerous methods of performing corneal tattooing have been described in the literature like anterior stromal puncture, lamellar pockets, intrastromal air injection, microkeratome, and femtosecond-assisted creation of lamellar pockets.[4,5]

We report three cases of disfiguring corneal scars with nil vision potential, who underwent corneal tattoo using lampblack soot prepared in the operating room (OR), which is used for the first time. Also, we describe in detail the novel technique of preparation of lampblack in OR and its application in corneal tattooing.

Surgical Technique

We report a case series of three eyes of three patients, who had come to seek medical advice to improve their cosmetic appearance. The age group of patients was between 22 and 30 years. Two of them had a history of longstanding retinal detachment, and one patient had anterior segment dysgenesis with dense ambylopia. All the patients had leucoma involving the entire cornea, with one patient having added band-shaped keratopathy [Figs. 1a, 2a, and 3a]. All these patients had no other option of functional improvement of vision by any of the treatment modalities. Penetrating keratoplasty was not considered, as these eyes had no visual potential and there is a high risk of complications involved with the corneal transplant.

Figure 1: (a) Preoperative slit-lamp image of the eye with dense corneal scarring with iris atrophy, peripheral anterior synechiae, and anterior capsular cataract with anterior segment dysgenesis. (b) Postoperative slit-lamp image of the eye after corneal tattooing with lampblack

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For cosmetic correction, they were given options of cosmetic contact lens, corneal tattooing, and enucleation with an orbital implant. All the three patients chose corneal tattooing as the cosmetic option.

All the patients underwent comprehensive ocular examination, which included slit-lamp biomicroscopy to assess the depth of corneal opacity and corneal thickness. Anterior segment optical coherence tomography (AS-OCT; Optovue, Fremont) was performed in all the cases preoperatively to assess the depth of the corneal opacity. B-scan ultrasonography was performed to exclude any intraocular pathology. Informed consent was taken for slit-lamp photography pre- and postprocedure and for the use of photographs in medical research [Figs. 1-3].

Corneal tattooing was performed in all the three patients after informed consent. The procedure was carried out in the OR under peribulbar anesthesia. Lampblack soot was prepared in OR under sterile conditions with the technique as described below.

A wick was made with rolled-up cotton gauze soaked in a liquid mixture of 1-propanol and 2-propanol with a total alcohol concentration of 75% (STERILLIUM®). This wick was lighted up, and the flame was interrupted by lowering a noncombustible, heat-resistant, nonflammable metal container, near the top third, onto it for sufficient time [Fig. 6a], held with an artery forceps. Lampblack soot is thus formed, as a result of partial combustion of alcohol, when the hydrocarbons turn into carbon monoxide instead of carbon dioxide. The produced soot in this manner was allowed to collect all along the surface of the container [Fig. 6b] and cooled adequately. The char was then scraped off the surface with a folded tissue paper [Fig. 6c] and a knife blade [Fig. 6d] (which separates with ease) and was collected in a glass/metal container for further use.

The depth of corneal opacity was carefully assessed preoperatively, and a superficial lamellar pocket was made by lamellar separation using corneal dissectors [Fig. 6e]. Care was taken to avoid corneal perforation. Inlay tattooing was done in the lamellar pocket thus created, by inserting the prepared tattoo material in layers, in the interface, with the help of iris repositor [Fig. 6f]. This maneuver was repeated multiple times in the area of the cornea to be tattooed [Fig. 6g] until the final cosmesis was reached [Fig. 6h].

**Figure 2:** (a) Preoperative slit-lamp image of the eye with vascularized corneal scarring with band-shaped keratopathy. (b) Postoperative slit-lamp image of the eye after corneal tattooing with lampblack

**Figure 3:** (a) Preoperative slit-lamp image of the eye with dense corneal edema, neovascularization of iris, and shallow anterior chamber. (b) Postoperative slit-lamp image of the eye after corneal tattooing with lampblack

**Figure 4:** (a, b) Pre- and postoperative external photos of Patient 2

**Figure 5:** (a, b) Pre- and postoperative external photos of Patient 3
Postoperatively, topical gatifloxacin 0.3% and dexamethasone 0.1% combination eye drops were prescribed four times per day for 1 week and gradually tapered on weekly basis. The patients were followed up at 1 day, 1 week, and 1, 3, and 6 months. Slit-lamp photographs were taken in the postoperative period for comparison with preoperative cosmetic appearance.

**Results**

All the patients underwent corneal tattooing using lampblack soot prepared in OR with inlay tattooing in the lamellar pocket. None of the patients had any intraocular complications. In the immediate postoperative period, minimal conjunctival hyperemia and foreign body sensation were noticed in all the three eyes, which disappeared during the first week. All the patients were satisfied with the cosmetic appearance [Figs. 4b and 5b]. All the patients had a mean follow-up of 6 months (range 6–12 months). There was no incidence of corneal infection, and none of these patients had fading of tattoo color during the mean follow-up period of 6 months. AS-OCT of the eye in the postoperative period showed a well-demarcated hyperreflectivity in the posterior stroma suggestive of the carbon soot particles and corresponding underlying shadow effect [Fig. 7a-d].

**Discussion**

Corneal tattooing is a valuable therapeutic alternative in patients with cosmetically disfiguring corneal scars and nil vision potential. Many modifications have been reported for corneal tattooing, ranging from the application of dye to de-epithelialized corneal stroma to the latest advances like using femtosecond laser for the creation of lamellar pockets.\[^2^,^4^\]

We report a novel technique of lampblack preparation in the OR and its use as a corneal tattoo material. This technique is cost-effective, involves minimal expertise, and the materials can be made readily available in the OR.\[^7^\]

Lampblack is a type of carbon black. It is very small particles of carbon, obtained in the form of soot, is very stable, and deteriorates slowly over time. It has been used since mankind invented fire and is still used as a very strong opaque pigment. It has been used throughout history to make inks. The greater pigment density and its relative permanence is understandable, as by the lamellar procedure, two surfaces are being tattooed simultaneously, the corneal bed and the inner surface of the lamellar flap, thus duplicating the amount of pigment deposited in the cornea.

Homogeneous pigmentation, faster surgery, ease of tattoo material preparation, and a better and less symptomatic postoperative recovery among patients are the advantages. The corneal surface being untouched, the staining is not exposed to the tear film; hence, the eye is less symptomatic after the procedure. When compared with other described procedures such as anterior stromal puncture with India ink dye applications, this procedure did not result in any repeated epithelial breakdowns, which can happen with the former procedure. Also, we did not notice any infection in the postoperative procedure. However, careful dissection of the lamellar pockets has to be done in the eyes with preexisting sealed corneal perforations or dense leucoma to prevent any intraoperative perforations. In such eyes where the operating view is not clear, the use of a light pipe illumination at the limbus gives a better view to dissect the lamellar pocket. Anterior stromal puncture with dye application works well for superficial corneal scars but does not give a good cosmetic outcome in deeper opacities with dense scars. In corneas with dense corneal opacity, this method of deeper lamellar dissection with pigmentation with lampblack soot gives a

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**Figure 6:** (a-d) Lampblack preparation technique in operating room and its collection. (e-h) Lamellar pocket creation and inlay technique of corneal tattoo with prepared lampblack
better cosmetic outcome when compared with previously described techniques.

This technique showed cosmetically good outcomes in the three eyes in our series during the follow-up period. A large number of cases with a longer follow-up and comparing the results with previously described techniques would give a better insight to this newly described method of corneal tattoo.

**Conclusion**

To conclude, corneal tattooing with lampblack is a simple, safe, and cost-effective technique that gives acceptable cosmetic results. It does not require expensive materials or instruments and offers a promising option for cosmetic correction of corneal opacities with unsightly corneal scars.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Al-Shymali O, Rodriguez AE, Amesty MA, Alio JL. Superficial keratopigmentation: An alternative solution for patients with cosmetically or functionally impaired eyes. Cornea 2019;38:54-61.
2. Lin HC, Wang YL, Chen GW, Yen CH. Corneal tattooing and anterior stromal puncture for treating symptomatic bullous keratopathy. Cornea 2016;35:355-7.
3. Park JH, Um T, Kim MJ, Tchah H, Kim JY. A new multiple non continuous puncture (pointage) technique for corneal tattooing. Int J Ophthalmol 2015;8:928-32.
4. Kim JH, Lee D, Hahn TW, Choi SK. New surgical strategy for corneal tattooing using a femtosecond laser. Cornea 2009;28:80-4.
5. Fogla R, Gupta A, Indumathy TR. Microkeratome-assisted corneal tattooing: A case report. Cornea 2010;29:446-8.
6. Jeong J, Lee HJ, Lee SH. Corneal tattooing method using dye injection into the anterior stroma infiltrated with small air bubbles. Acta Ophthalmol 2013;91:e1-7.
7. Ravindra MS, Meda DR. A novel indigenous technique for corneal tattooing using self-prepared do-it-yourself carbon soot pigment. Indian J Ophthalmol 2021;69:2516-20.