Short communication

Surgical intrastromal keratopigmentation using tattoo ink

A.M. Garrido-Hermosilla\textsuperscript{a,}\textsuperscript{*}, R.A. Ángeles-Figueroa\textsuperscript{b}, M. Gessa-Sorroche\textsuperscript{b}

\textsuperscript{a} Servicio de Oftalmología, Hospital Universitario Virgen Macarena, Sevilla, Spain
\textsuperscript{b} Unidad de Oculoplastia, Órbita y Vías Lagrimales, Hospital Universitario Virgen Macarena, Sevilla, Spain

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\textbf{ABSTRACT}

Case report: A 31-year-old woman who had undergone surgery for a congenital cataract as a newborn developed bilateral malignant glaucoma, which was refractory to medical-surgical treatment. The patient currently has terminal glaucoma and severe band keratopathy. For esthetic purposes, we performed intrastromal keratopigmentation surgery using ink for skin tattoos supplied in sterile single-dose vessels. No secondary effects or complications were observed.

Discussion: Keratopigmentation or corneal tattooing can now be used as a last resort in patients who are unable to tolerate cosmetic contact or intraocular lenses, or in whom corneal transplant is contraindicated.

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Queratopigmentación quirúrgica intraestromal con tinta para tatuaje cutáneo

\textbf{RESUMEN}

Caso clínico: Mujer de 31 años intervenida de cataratas congénitas siendo aún lactante, que desarrolla posteriormente un glaucoma maligno bilateral refractario a tratamiento médico-quirúrgico, hasta alcanzar el estado actual terminal con queratopatía en banda severa. Por este motivo, se realiza con fines estéticos una queratopigmentación quirúrgica intraestromal con la novedad de emplear envases monodosis estériles de tinta para tatuaje cutáneo, sin hallarse efectos secundarios ni otras complicaciones.

Discusión: La queratopigmentación o tatuaje corneal constituye actualmente el último recurso en pacientes que no toleran las lentes cosméticas o intraoculares y en los que el trasplante corneal está contraindicado.

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Introduction

Keratopigmentation, or corneal tattooing, has been performed since the dawn of civilization to improve esthetic appearance of subjects with various types of corneal opacities, using a wide range of products, such as Indian ink, reduced copper and tannin metal powders, organic dyes, animal eyes uveal pigment, soot particles, and so on.

Clinical case

A 31-year-old female patient, born preterm by Cesarean section due to fetal distress. Her ocular history includes bilateral congenital cataracts, for which she underwent surgery while she was still a newborn. Thus, at 4 years of age, her right eye visual acuity ranged from 0.7 to one meter distance with Pigassou optotype, while her left eye only had perception of light, resulting from a malignant glaucoma refractory to topical treatment. For this reason, two trabeculectomies were performed over several years in her right eye, and three more trabeculectomies in her left eye, also applying limbal cryotherapy once on each eye. However, progression was negative, reaching current status of terminal glaucoma, visual acuity with perception of light in her right eye and amaurosis in her left eye. At the same time, due to her baseline eye disease, the patient began to develop bilateral band keratopathy, which continued to increase and prevented visualization of the ocular fundus.

Current surgery involves making a bilateral keratopigmentation, starting with the left eye, which still shows minimal traces of the Indian ink used over two decades ago in a similar surgery with unsuccessful results (Fig. 1). Under local topical and subconjunctival anesthesia, after adapting a Liebermann speculum, a traction suture was placed on tenon-episclera with 3-0 silk, given that patient had horizontal rotatory nystagmus which greatly hampered surgery.

Then, the pupil area was delimited by suction corneal trephine with a 4 mm diameter, reaching the stromal region where the ink was to be injected. In our case, we used a single dose of black ink for skin tattoos, with 3 ml content (Alkimia Inkside® Deep Black, Alkimia Technology and Stetic S.A., Madrid, Spain, Fig. 2A). As this was a sterility-certified single-dose container, and pursuant to health legislation in our country, no prior sterilization process was required.

After pupillary area trephination, a cleavage plane was opened in the anterior corneal stroma using a 30-gauge needle. Subsequently, the needle was attached to an insulin syringe pre-loaded with black ink deposited beforehand in a sterile cup. Then, about 10–15 punctures were performed in the previously delimited stromal plane. After each anterior stromal puncture, the assistant surgeon irrigated the corneal surface abundantly with saline solution under pressure, subsequently drying it with cellulose hemostats. Thus, the main surgeon had proper visualization of ink distribution in order to locate the remaining areas to be punctured. Immediate post-operative appearance can be seen in Figs. 2B and C.

After surgery, antibiotic, low-power anti-inflammatory and cycloplegic eye drops were instilled. Finally, a therapeutic contact lens was placed to protect the corneal surface from external agents. The contact lens was difficult to place due to existing band keratopathy in her left eye; this led to more irregular adaptation (Fig. 2D).

Discussion

Currently, the keratopigmentation, or corneal tattooing, surgical technique is rarely used to treat corneal leukoma and coloboma of the iris and aniridia of diverse origin causing glare or diploia. This is essentially due to technological advances in the field of keratoplasty, cosmetic contact lenses or intraocular lenses to remedy specific iris defects. For this reason, currently, keratopigmentation is the last resort in patients unable to tolerate these lenses and those for whom corneal transplantation is contraindicated, as the patient referred to herein.

In our case, we chose to perform intrastromal keratopigmentation, since ink permanence is more durable than on superficial corneal staining, although with the passage of time regular retreatments must be applied when chromatic attenuation occurs. Likewise, there are potential complications, such as infection, corneal perforation with pigment transfer to the anterior chamber and acute anterior uveitis, none of which has occurred in our experience.

Moreover, severe band keratopathy has greatly hampered surgery, leading to difficulties in finding an anterior stromal plane suitable for black ink injection, as this is a corneal parenchyma markedly degenerated by baseline eye disease. Nevertheless, the final esthetic result of our patient one week after surgery has been very favorable (Figs. 3 and 4), considering that no preliminary treatment was applied to reduce her marked band keratopathy, such as chelation with ethylenediaminetetraacetic acid. Still, other surgeries will be needed to achieve an even more durable and finished appearance in both eyes.

Another important fact has been the use of specific ink for skin tattoos in the cornea without any side effects. In this regard, the use of sterile single-dose containers greatly facilitates both the surgery in time and in form, since its content does not require prior hospital sterilization. Likewise, they do not require special preparation; storage at room temperature for many years is quite easy.

![Fig. 1 - Initial appearance before surgical keratopigmentation. The upper left eye shows some upper remnants of the Indian ink used years ago with poor esthetic results. Marked bilateral band keratopathy is also shown.](image-url)
Fig. 2 – (A) Sterile single dose of black ink for skin tattoos used in keratopigmentation. (B and C) Immediate postoperative appearance of the left eye. (D) Note the difficult adaptation of the therapeutic contact lens on the operated cornea, due to severe keratopathy in existing band.

Fig. 3 – (A and C) Right eye not operated. (B and D) Left eye cornea biomicroscopy one week after surgical keratopigmentation. Note the esthetic difference.
is optimal. Therefore, these single-dose inks for skin tattoos containers will be an option to consider in future cases of surgical keratopigmentation.

In conclusion, keratopigmentation must stop being considered by ophthalmologists as an obsolete procedure, since there are patients for whom this technique could be the only possibility to improve their esthetic appearance and, ultimately, their quality of life. Therefore, although longer-term studies are needed with larger case series, it should at least be available as an alternative resource.

**Conflicts of interest**

The authors declare that they have no conflicts of interest.

**REFERENCES**