

Case Report

INTRASTROMAL CORNEAL TATTOOING AS TREATMENT IN A CASE OF INTRACTABLE Strabismic DIPLOPIA (Double Binocular Vision)

CARLOS LARIA, M.D., PhD,¹ JORGE L. ALIÓ, M.D., PhD^{2,3}
and DAVID P. PIÑERO, PhD⁴

from (1) Paediatric Ophthalmology & Strabismus Unit. Instituto Oftalmológico de Alicante. VISSUM Corporation, Universidad San Pablo CEU Madrid, (2) Cornea, Cataract, Refractive Surgery and Anterior Segment Surgery Unit. Instituto Oftalmológico de Alicante. VISSUM Corporation. (3) Division of Ophthalmology, Universidad Miguel Hernández, (4) Departamento de Óptica, Farmacología y Anatomía, Universidad de Alicante, Alicante, Spain

ABSTRACT: We present the case of a 29-year old man complaining of intractable diplopia during the last 5 years. He had undergone several surgical procedures for the treatment of his infantile strabismus since age 6 years. After surgery, the patient had been treated on 4 occasions with Botox. He also performed antisuppression exercises to encourage binocular vision.

On our examination, the patient showed a 20/20 visual acuity in both eyes and a strabismic dysfunction with a slight alphabet pattern, which induced a disturbing constant diplopia. Several treatment options were considered for this patient as occlusion therapy or cosmetic contact lenses, but they were not used because they were not acceptable esthetically or not tolerated.

Finally, an optical penalization was induced by means of a black corneal tattooing placed at the centre of the cornea. The patient was followed for a period of 18 months, showing a complete elimination of diplopia with esthetical acceptance and no inflammatory signs.

Received for consideration July 12, 2010; accepted for publication August 23, 2010.

Corresponding Author: Carlos Laria Ochaita. VISSUM. Instituto Oftalmológico de Alicante. Avda. de Denia s/n. Edificio VISSUM, 03016 Alicante, Spain. Email: Larial@telefonica.net

This study has been supported in part by a grant from the Spanish Ministry of Health, Instituto Carlos III, Red Temática de Investigación Cooperativa en Salud "Patología ocular del envejecimiento, calidad visual y calidad de vida", Subproyecto de Calidad Visual (RD07/0062)

None of the authors of this manuscript have any financial interest to disclose.

INTRODUCTION

Keratopigmentation or corneal tattooing has been used for centuries for different uses. One of the main applications of this surgical technique is to improve the cosmetic appearance of corneas after leukomas (1-3). Different kinds of substances have been used for such purpose as copper sulphate, uveal pigment of different eye animals, combinations of Chinese ink and gold dust, gold chloride, platinum, silver salts or titanium dioxide (1-3). Although initially the main indication for keratopigmentation was cosmetic, it has also shown its therapeutic effect in other situations as iris defects (4), opacities after amniotic membrane transplantation (5) or intractable diplopia (6-7). In these cases, the corneal tattooing is able to alleviate the disturbing visual phenomena occurring in these pathological conditions.

The aim of the current case report is to show the potential and benefits of intrastromal corneal tattooing using a lamellar pocket and a new generation pigment as a treatment for a severe diplopia that could not be treated by other conventional means.

CASE REPORT

A 29-year old man complaining of intractable diplopia during the last 5 years presented to our clinic. He had undergone several previous surgeries for the treatment of his infantile strabismus. With the aim of correcting his congenital esotropia he underwent his first surgery at the age of 6 years old. This surgery comprised both medial rectus recession (4.5 mm) and right lateral rectus resection (6 mm). At the age of 15 years, a new right medial rectus recession of 5 mm was performed. An additional strabismus surgery was done afterwards at the

age of 23, which consisted of a “Faden” posterior myopexy operation of both medial rectus, partial tenotomy of both superior obliques, a postoperatively adjustable resection of the right lateral rectus and adjustable recession of the right superior rectus. Afterwards, the patient was treated on 4 occasions with Botox and additionally he performed antipression exercises to encourage binocular vision.

On our clinical examination, the following clinical data was obtained: **Best spectacle-corrected visual acuity** of 20/20 in both eyes (right eye, -3.25 D (diopters) of sphere, -3.25 D of cylinder at 10°; left eye, -3.00 D of sphere, -0.25 D of cylinder at 20°).

Ocular motor study: Left eye dominance with exotropia of 7 prism diopters (with the refractive error corrected). When the patient was fixating with the right eye, a left eye hypertropia of 8 prism diopters (DVD, dissociated vertical deviation) could be measured whereas if the fixating eye was the left eye, a right eye hypertropia of 4-5 prism diopters could be detected. This strabismic dysfunction presented a slight alphabet pattern. The duction movement study showed a grade 1 limitation of the right eye abduction and of the left eye adduction. In addition, a latent nystagmus could be observed.

Ocular sensory study: Diplopia in all directions of gaze. Anomalous retinal correspondence. Significant fusional vergence limitation.

Prism adaptation test: It was not possible to eliminate the diplopia.

Intraocular pressure, anterior segment and fundus within the normal range.

After all surgeries, the patient was initially treated with occlusion therapy and ocular penalization with filters. This modality of treatment was not accepted by the patient due to esthetical reasons. Therefore, the use of a cosmetic contact lens in the right eye with an occlusive aim was intended. However, the contact lens was not well-tolerated. The presence of a dry eye syndrome was the justification for this contact lens intolerance (Schirmer test of 5 and 8 mm for each eye). A new treatment alternative was then considered: the use of Botox to induce a right eye

blepharoptosis, but it was not accepted due also to esthetical reasons.

As all the previous treatment alternatives had failed, intrastromal corneal tattooing in the right eye was considered as a potential solution for avoiding the diplopia. The patient was informed about the risks of the surgery and previously signed an informed consent in accordance with the Helsinki Declaration. The initial steps of the surgical procedure for corneal tattooing were as follows: topical anaesthesia of the right eye (Ocular topical anaesthesia, tetracaine 0.1% + oxybuprocaine 0.4%, Colircusi, Alcon Cusi S.A., Spain), pupillary centre mark, free-hand arcuate incision with a calibrated diamond knife at the level of the circumference of the pupil limit of the contralateral eye in mesopic conditions (measured with the Procyon Pupillometer P2000SA, Procyon Instruments Ltd, London, UK), and intrastromal dissection with a mini-crescent knife, creating a pocket of a 5-mm diameter at an approximately 170 microns depth (**Left, <Figure A**). After the creation of the intrastromal pocket, the pigment was applied (**Figure B**) with a 30G irrigation cannula and

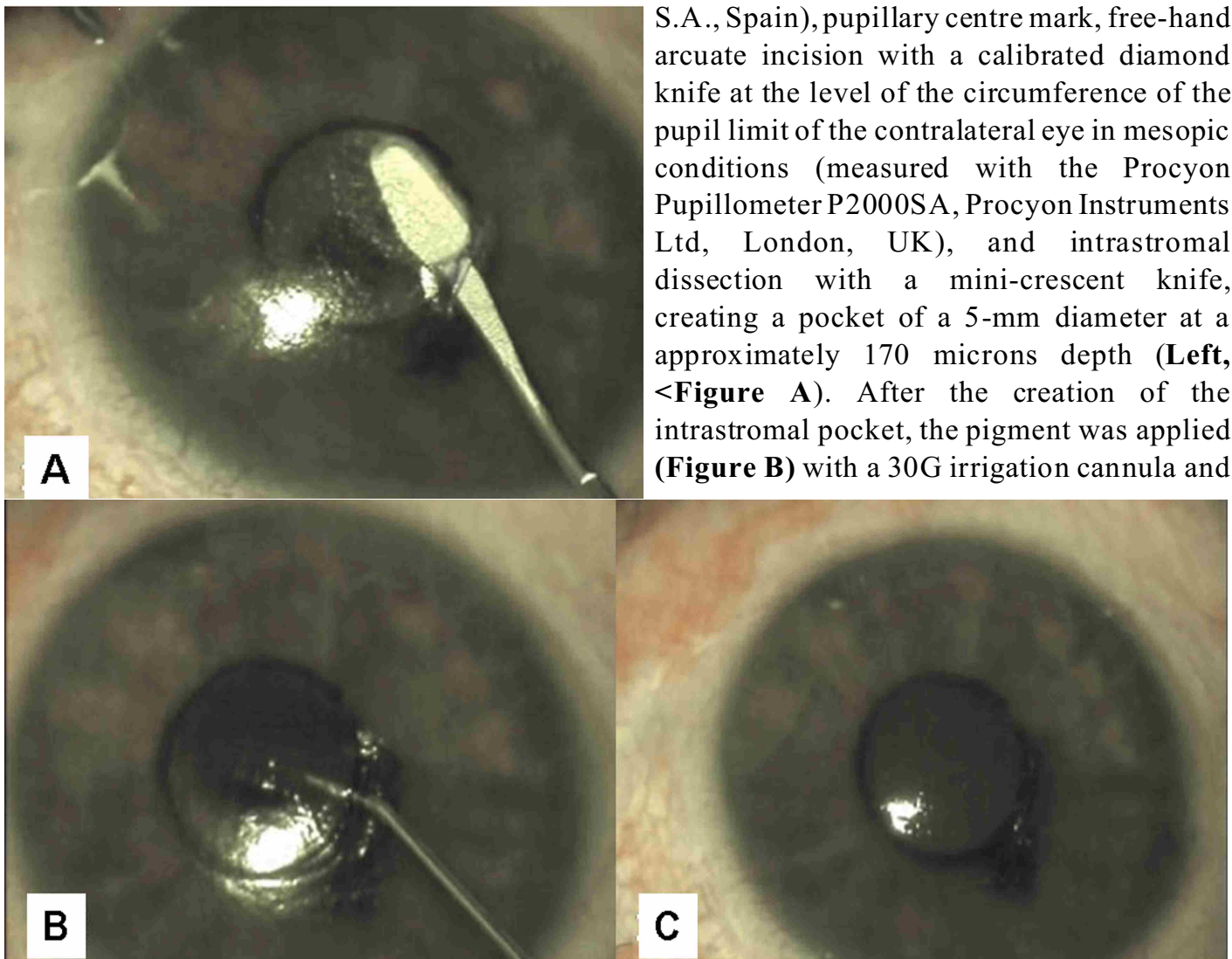


Figure (Laria): Steps of corneal tattooing performed for intractable diplopia. A. Creation of the intrastromal pocket. B. Pigment injection. C. Final outcome.

the eye was finally thoroughly washed with BSS irrigating solution (**Figure B, prior page**). The pigment used was a black iron oxide mineral micronized pigment (Registration No DGFPS 84-PH, Spanish Ministry of Health, 2001), based on 50% iron oxide (ferric oxide, CI 77499). An antibiotic and anti-inflammatory therapy was prescribed to be applied postoperatively, which consisted of 1% cyclopentolate drops every 8 hours for the first 48 hours after surgery and ciprofloxacin and diclofenac drops every 8 hours for 1 week.

As a result of the surgery, an optical penalization was induced due to the black corneal tattooing placed at the centre of the cornea (**Figure C, prior page**). This penalization was the responsible for the disappearance of the diplopia. No inflammatory signs were detected during the follow-up.

DISCUSSION

The ocular sensory analysis of this patient revealed the presence of an anomalous retinal correspondence in the context of a congenital esotropia. This esotropia had been treated previously by means of several surgical procedures, obtaining an excellent esthetical outcome but bad sensory results due to the perception of a constant diplopia. The patient performed antisuppression exercises after the surgical sequence of treatment, which were not optimal and probably they increased the perception of diplopia. It should be remembered that antisuppression exercises could be counterproductive in cases like this.

One alternative for the treatment of the diplopia in this specific case was the use of

optical penalizations by means of filters or ocular patches, but this option was not accepted by the patient. Another alternative was the induction of a chemical blepharoptosis by means of using the botulinum toxin, but this therapeutic option was not accepted either due to the esthetical compromise induced by the treatment. As commented previously, the possibility of adapting cosmetic contact lenses was evaluated, but it was ruled out due to the presence of a dry eye syndrome. Two other alternatives were also considered: the implantation of an occlusive intraocular lens and the performance of a corneal tattooing. The option of an occlusive intraocular lens was discarded because it was the most invasive option with several risks and limitations, as the loss of the accommodative ability of this young patient or the risk of endophthalmitis or uveitis as a consequence of the implant. The corneal tattooing is an extraocular surgical technique, which allows the preservation of the peripheral vision (1-7). It only blocks the central vision, allowing the fundus exploration in conditions of maximal mydriasis (not possible with the occlusive intraocular lens).

In this case, the option of corneal tattooing was finally preferred for treating this intractable diplopia because other less invasive techniques were unacceptable for the patient and this surgical option offers several advantages over other medical and surgical alternatives. The potential complications of corneal tattooing are bacterial infections, unnoticed corneal perforation, uveitis and pigment colouring or migration. These events were prevented by means of a postoperative prophylactic antibiotic and anti-inflammatory treatment, a meticulous microscopic control

and the use of an intrastromal technique for corneal tattooing, which supposes less inflammation as well as less pigment colouring or migration (2). The patient has been followed for a period of 18 months, showing a complete elimination of diplopia and a great satisfaction in the patient with his esthetical appearance, with no negative impact on his social or labour life.

CONCLUSION

Corneal tattooing using an intrastromal pocket for pigment deposition seem to be a useful therapeutic alternative with minimal complications in cases of intractable diplopia where other less invasive options are nor valid or not accepted by the patient. Future studies including several cases like this should be performed in order to corroborate this potential application of keratopigmentation, although it should be considered that this kind of cases are not common in the clinical strabology practice.

REFERENCES:

1. Alio JL, Sirerol B, Walewska-Szafran A: Corneal tattooing (keratopigmentation) to restore cosmetic appearance in severely impaired eyes with new mineral micronized pigments. **Br J Ophthalmol** 2010; 94: 245-249.
2. Mannis MJ, Eghbali K, Schwab IR: Keratopigmentation: A Review of Corneal Tatting. **Cornea** 1999; 18: 633-637.
3. Pickrell KL, Clark EH: Tattooing of corneal scars with insoluble pigments. **Plast Reconstr Surg** 1947 2: 44-59.
4. Burris TE, Holmes-Higgin DK, Silvestrini TA: Lamellar intrastromal corneal tattoo for treating iris defects. **Cornea** 1998;17: 169-73.
5. Lee JE, Jun JB, Choi HY, Oum BS, Lee JS: Corneal tattooing to mask subsequent opacification after amniotic membrane grafting for stromal corneal ulcer. **Acta Ophthalmol Scand** 2006; 84: 696-8.
6. Stone NM, Sommer JEA, Jay JL: Intractable diplopia: A new indication for corneal tattooing. **Br J Ophthalmol** 2008; 92: 1445
7. Reed JW, Beran RF: Elimination of monocular diplopia by corneal tattooing. **Ophthalmic Surg** 1988; 19: 437-9.