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Case Report

Non-Penetrating Glaucoma Surgery (Non-Penetrating Deep Sclerectomy and Canaloplasty) in Patients with Poorly Controlled Glaucoma after DSAEK (Descemet Stripping Automatized Endothelial Keratoplasty)

Boned-Murillo A[1]*, Diaz-Barreda[1], Martínez-Morales J[1], Pérez-Navarro I[1], Pérez-García D[1], Ascaso-Puyuelo J[1,2], Pardina-Claver E[1] and Ibáñez-Alperte J[1]

[1]*Department of Ophthalmology, Lozano Blesa University Hospital, Zaragoza, Spain*

[2]*Aragón Health Research Institute (IIS Aragón), Zaragoza, Spain*

***Corresponding Author:** Boned-Murillo A, Department of Ophthalmology, Lozano Blesa University Hospital, Zaragoza, Spain.

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Abstract

Objective: To evaluate the efficacy and safety of non-penetrating glaucoma surgery (Non-penetrating Deep Sclerectomy -NPDS-and Canaloplasty -CP-) in 3 consecutive eyes of patients with pre-existing glaucoma uncontrolled after DSAEK (Descemet Stripping Automated Endothelial Keratoplasty).

Materials and Methods: NPDS was performed in 2 cases, with an intrascleral implantation and topical adjuvant mitomycin C 0.2 mg/ml/2 minutes and canaloplasty in 1 case by 360 ° Schlemm's canal viscodylation using the Itrack® system and suture is placed through Schlemm's canal and tied off to create tension and therefore open Schlemm's canal. The values of IOP (Intraocular Pressure), corneal biomechanical properties were analyzed using Ocular Response Analyzer® (ORA) and the number of anti-glaucomatous drugs before and after surgery. Intra and postoperative complications were also recorded.

Results: The preoperative IOPs were 32, 26 and 20 mmHg in the patients. Patients with pre-existing glaucoma operated with non-penetrating glaucoma surgery showed lower values of IOPcc (Corrected Intraocular Pressure with respect to the Cornea) after the intervention (initial IOPcc 33.2, 15 and 24 compared to final IOPcc 11.9, 15.2 and 15.1) while CH (corneal hysteresis) increased (initial CH 5.9, 4.4 and 4.7 compared to final CH 11.2, 7.5 and 5.2). After one year, all patients had IOP ≤ 18 mm Hg.

Four antiglaucoma drugs were used preoperatively in 2 cases and 3 were used in the other. One patient required postoperative antiglaucoma medications. Neodymium-doped yttrium aluminium garnet (NdYAG) laser goniopuncture was required in one patient. In one case, a micro-rupture of the descemetic trabecular window occurred, which did not require peripheral iridectomy as an intraoperative complication.

Conclusion: NPDS and canaloplasty could be a safe and effective alternative to conventional filtering surgery after DSAEK in patients with pre-existing uncontrolled glaucoma, although larger series and longer follow-up periods are required to establish the real role of this type of surgery in patients undergoing DSAEK.

Keywords: *DSAEK; Non-Penetrating Glaucoma Surgery; NPDS; Canaloplasty; IOP; ORA*

Abbreviations

NPDS: Non-penetrating Deep Sclerectomy; CP: Canaloplasty; DSAEK: Descemet Stripping Automatized Endothelial Keratoplasty; IOP: Intraocular Pressure; ORA: Ocular Response Analyzer®; IOPcc: Cornea corrected Intraocular Pressure; VA: Visual Acuity; CH: Corneal Hysteresis; NdYAG: Neodymium-Doped Yttrium Aluminium Garnet; CRF: Corneal Resistance Factor

Introduction

When performing a corneal transplant, DSAEK (Descemet Stripping Automatized Endothelial Keratoplasty) is an elective technique. But despite the advantages over other techniques, with better and faster recovery of VA (visual acuity), less incidence of astigmatism and less graft rejection, the appearance of secondary glaucoma or worsening of pre-existing glaucoma after this intervention can happen. Although these patients are usually approached through perforating filtering surgery (trabeculectomy), non-penetrating glaucoma surgeries (Non-Penetrating Deep Sclerectomy - NPDS -and Canaloplasty -CP-) could reduce the number of postoperative complications [2].

For these reasons, we evaluate the efficacy and safety of non-penetrating glaucoma surgery in 3 consecutive eyes of patients with pre-existing uncontrolled glaucoma after DSAEK (Descemet Stripping Automatized Endothelial Keratoplasty), analyzing the values of Goldman IOP (Intraocular Pressure), corneal biomechanics with Reichert ORA® (Ocular Response Analyzer) and the number of anti-glaucomatous drugs pre and post-surgery, as well as intra and postoperative complications.

Case Report

Case 1: The patient underwent a DSAEK 5 months ago (retransplantation pending due to graft rejection), in treatment with Brinzolamide/Brimonidine (2 times a day) and Bimatoprost (1 time a day) with IOP Goldmann 32 mmHg, with IOP cc (Cornea corrected Intraocular Pressure) 33.2, and CH (corneal hysteresis) 5.9. An NPDS was performed with a Snoper AJL® intrascleral implant and topical adjuvant mitomycin C 0.2 mg/ml/2 minutes (Figure 1), producing a micro-rupture of the descemetic trabeculum window as an intraoperative complication, which did not require peripheral iridectomy. The week after the intervention, IOP cc showed lower values (initial IOP cc 33.2 compared to final IOP cc 12.7), while CH increased (initial CH 5.9 vs. final CH 10.2). One month after the intervention, IOP cc values were 12.6 and the CH amounted to 10.6, and one year later IOP cc was 11.9 and CH 11.2.

Figure 1: *Removal of Schlemm Canal's roof at NPDS.*

Case 2: The patient was operated 8 months ago for DSAEK, on treatment with Timolol/Bimatoprost (once a day) and Timolol/Dorzolamide (twice a day) and IOP Goldman 26 mmHg, IOP cc 16.7 and CH 6.1. A CP was performed by means of 360° channel viscodylation and suture using the Itrack® system (Figure 2 and 3) and after one week the IOPcc was reduced to 15 and the CH to 4.4. The patient required treatment with Timolol/Brimonidine (2 times a day), 0.15% sodium hyaluronate/5% sodium chloride (2 times a day) and Fluorometolone (1 time a day) and was included in the retransplantation list secondary to graft rejection. One month after the surgery, IOP cc values were 17.3 and the CH amounted 5.4 (Figure 4) and one year later the IOP cc was 15.2 and CH 7.5.

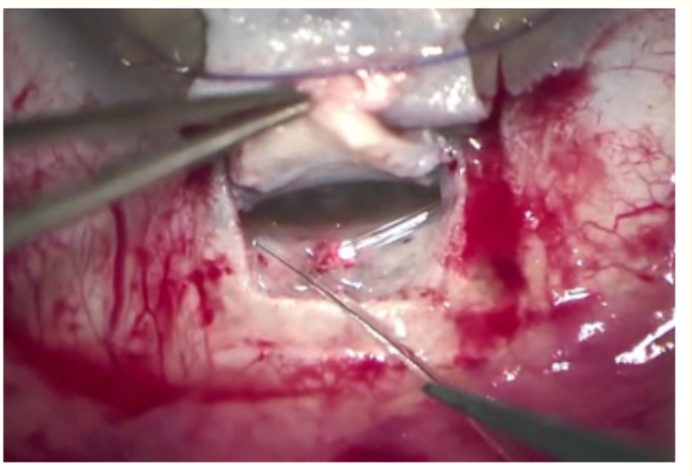

Figure 2: *Canaloplasty 360º with viscodylation, visualizing the catheter through the Schlemm canal.*

Figure 3: *Schlemm canal's suture using the Itrack® system with suture (Prolene 5/0).*

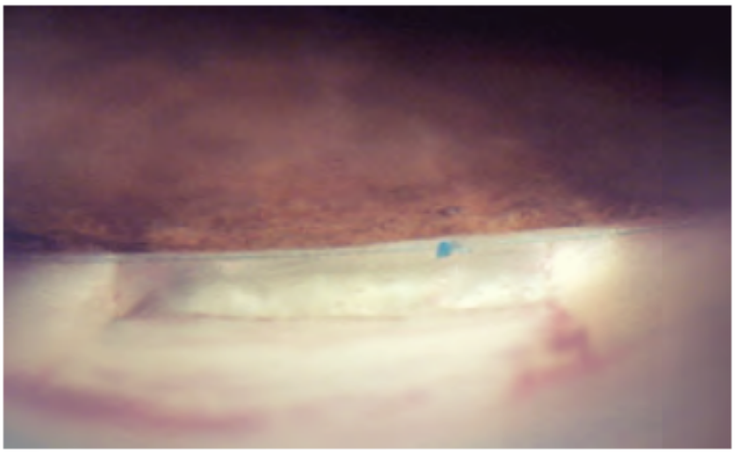

Figure 4: *Gonioscopic image of the knotted Prolene after canaloplasty.*

Case 3: A patient operated for DSAEK 14 months ago with treatment with Timolol/Bimatoprost (once a day). Preoperative IOPs figures 20 mmHg, IOP cc 24 mm Hg and CH was 4.7. NPDS was performed with an intrascleral implant and topical adjuvant mitomycin C 0.2 mg/ml/2 minutes. In the postoperative week, IOPP cc decreased to 16.6 and the CH amounted to 3.5. One month later, IOP cc values were 15.4 and the CH 4.8, and one year after the intervention, IOP cc was 15.1 and CH 6.2.

Four antiglaucoma drugs were used preoperatively in 2 cases and 3 were used in the other. NdYAG laser goniopuncture was required in one patient. In one case, a micro-rupture of the descemetic trabeculus window occurred, which did not require peripheral iridectomy as an intraoperative complication. One year after the intervention, all patients had an IOP ≤ 18 mm Hg, and only one of the patients required postoperative antiglaucoma medications.

Results and Discussion

Keratoplasty secondary glaucoma is one of the most frequent post-surgical complications of corneal transplantation, with a risk of > 30 mmHg of IOP increase in the first six months after the intervention, being higher in case of pre-existing glaucoma [2]. Furthermore, it is estimated that about 17% of DSAEK grafts are rejected in patients with pre-existing glaucoma [4]. For all these reasons, we must study the characteristics of our patient and assess all the available therapeutic possibilities. Although the percentage of patients with pre-existing glaucoma which underwent DSAEK requiring glaucoma filtering surgery has been estimated 27.6% [4], generally trabeculectomy, non-penetrating glaucoma surgeries seem to be also effective, reducing in the number of postoperative complications and with a longer graft survival and earlier recovery [2].

Nowadays, corneal biomechanics have played a leading role in the diagnosis and management of multiple ophthalmic pathologies, especially those in which a structural corneal alteration is suspected. Its application has been verified in corneal ectasias, corneal dystrophies and the study of corneal transplantation (such as DSAEK), as well as in the case of glaucoma, both due to the evidence of the relationship with low corneal thickness and the results in its main control method, Goldman's contact IOP [3].

One of its main contributions is the compensation of results with biomechanical values. IOPcc, less influenced by corneal characteristics than that obtained with the Goldmann flattening tonometer estimates a compensated IOP value in pathologies with corneal alterations that could present higher IOP and so, glaucomatous damage not initially estimated [1].

On the other hand, when evaluating the evolution of glaucoma patients, we must consider the biomechanics of the cornea, which is related to the resistance and deformation of the corneal tissue subjected to any external action. Using ORA®, we analyzed CH, related to corneal viscoelasticity and an evidence of corneal damping capacity, along with the corneal resistance factor (CRF) [1,3]. The reduction of these values can be considered as a risk factor for progression in glaucoma [3].

We know that patients with simple chronic glaucoma have low CH values even with normal CRF and ECC, and low CH levels may be considered a risk factor for disease progression. In case of patients operated with glaucoma surgery after DSAEK, it is observed that IOP cc decreases greatly in the most immediate postoperative period (first day - first week), but it begins to stabilize around next month, while CH evolves contrary, very low at the beginning but improving in the postoperative period.

Conclusion

IOP cc of pre-existing glaucoma patients operated on with filtering glaucoma surgery showed lower values after the intervention (initial IOP cc 33.2, 15, and 24 compared to final IOP cc 11.9, 15.2, and 15.1) while CH increased (initial CH 5.9, 4.4 and 4.7 vs. final CH 11.2, 7.5 and 5.2). And although our sample is small and the follow-up period is short, we observed that one year after the intervention all the patients had an IOP ≤ 18 mm Hg (Table 1).

		Preoperative	1 week postoperative	1 month postoperative	1 year postoperative
PIOg (mmHg)	Case 1	32	14	13	13
	Case 2	26	18	20	18
	Case 3	20	17	13	14
PIOcc (mmHg)	Case 1	33.2	12.7	12.6	11.9
	Case 2	16.7	15	17.3	15.2
	Case 3	24	16.6	15.4	15.1
CH (mmHg)	Case 1	5.9	10.2	10.6	11.2
	Case 2	6.1	4.4	5.4	7.5
	Case 3	4.7	3.5	4.8	6.2

Table 1: *Pre- and postoperative intraocular pressure (IOP) in 3 eyes with pre-existing glaucoma uncontrolled after DSAEK (Descemet Stripping Automated Endothelial Keratoplasty).*

In conclusion, NPDS and canaloplasty could be a safe and effective alternative to conventional filtering surgery after DSAEK in patients with pre-existing uncontrolled glaucoma, although larger series and longer follow-up periods are required to establish the real role of this type of surgeries in patients undergoing DSAEK.

Conflict of Interest

There is no any financial interest or any conflict of interest to declare.

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