

1 ***Occlusion of Aquaport Flow in a Case of Toxic Anterior***  
2 ***Segment Syndrome Following Implantable Collamer***  
3 ***Lens Surgery Causing Severe Pupillary Block***

4 **Short Title: TASS with Pupillary Block following ICL**

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36 **ABSTRACT**

37 A V4c toric implantable collamer lens (ICL) was implanted in the left eye of a 32-year-old  
38 female. After one week the lens was 15° off axis and uneventful lens alignment correction was  
39 performed. At postoperative day 1 (POD#1) an intraocular pressure (IOP) of 11mmHg and mild  
40 corneal edema were observed. At POD#7 there was a UDVA of 20/800, an IOP of 44 mmHg,  
41 diffuse corneal edema and fibrin strands in the anterior chamber. Toxic anterior segment  
42 syndrome (TASS) was diagnosed and topical steroids, cycloplegia, anti-glaucoma drops and oral  
43 acetazolamide were prescribed. At POD#9 dispersed endothelial pigment with a fixed mid-  
44 dilated pupil were identified. Anterior segment optical coherence tomography showed strands of  
45 fibrin blocking the central ICL hole and angle closure. Pupillary block related to the fibrin  
46 occluded Aquaport hole consecutive to TASS was diagnosed. The patient underwent ICL  
47 removal, but continued with an atonic, hyporeflexic pupil as a complication.

48

49 **INTRODUCTION**

50 Refractive error is a leading cause of reversible visual impairment worldwide, and corrective  
51 refractive surgery is one of the most frequently used ocular surgeries globally.<sup>1</sup> For a young  
52 phakic patient with refractive error, several possible methods of surgical correction exist  
53 including surface ablation, laser-assisted in-situ keratomileusis (LASIK), small incision lenticule  
54 extraction (SMILE) and phakic intraocular lenses (IOLs).<sup>2</sup> For those with high refractive errors  
55 or with corneas at risk for ectasia, a phakic IOL may be a more suitable option.<sup>3</sup>

56 Phakic IOLs can generally either be placed in the anterior chamber (iris-fixated) or in the sulcus.  
57 The advantage of the former is the greater distance from the lens, and of the latter is the greater  
58 distance from the corneal endothelium.<sup>4,5</sup> Implantable collamer lenses (ICL) (STAAR Surgical,  
59 Monrovia, CA, USA) are FDA approved and are the most popular phakic IOL worldwide  
60 because of the ease of implantation and safety profile.<sup>6</sup> The latest ICL model (V4c, not FDA  
61 approved) has a tiny central hole (AquaPORT) allowing for increased flow of aqueous  
62 preserving the nutrient supply to the lens and preventing pupillary block without the need to  
63 perform a peripheral iridotomy.<sup>7</sup>

64 In the current case report we present a case where following ICL implantation the patient  
65 developed toxic anterior segment syndrome (TASS) with a subsequent pupillary block as a  
66 consequence of the occlusion of the Aquaport flow hole related to the presence of fibrin  
67 confirmed with anterior segment optical coherence tomography (AS-OCT). To the best of our  
68 knowledge, this is the first case of pupillary block secondary to TASS in a patient with an  
69 AquaPORT containing ICL V4c. This case demonstrate that Aquaport may not prevent pupillary  
70 occlusion in cases with anterior chamber inflammation as in TASS.

71 **CASE PRESENTATION**

72 A 32-year-old female keratoconus patient first presented to our center (Department of Cornea  
73 and Refractive Surgery, Vissum Instituto Oftalmologico, , Alicante, Spain) complaining of  
74 deterioration in vision in her left eye following implantation of intracorneal ring segments  
75 (ICRS) for the treatment of progressive keratoconus in another center. Upon examination she  
76 presented with an uncorrected distance visual acuity (UDVA) of 20/63 and a topography  
77 demonstrating that the ICRS was the cause of refractive error and irregular astigmatism as they  
78 were improperly placed. The patient subsequently underwent removal of ICRS combined with

79 epithelium-off corneal crosslinking (3mW/cm<sup>2</sup> for 30 minutes) in her left eye without any  
80 adverse events.

81 After a period of six months of stable manifest refraction of -1.0 -3.25 x 165° correcting the  
82 patient to 20/20, the patient elected to undergo toric ICL implantation in her left eye. At the one-  
83 week post ICL visit the UDVA was 20/25 and the lens was noted to have good vault (**Figure 1A**)  
84 but was however 15 degrees off axis. The patient elected to undergo lens rotation that same day  
85 without any intraoperative adverse events.

86 At the postoperative day 1 (POD#1) following ICL rotation the patient complained of blurry  
87 vision and had a UDVA of 20/63 with a normal IOP of 11mmHg and some corneal edema limited to  
88 the midperiphery with a few cells in the anterior chamber (**Figure 1B**). The patient continued to  
89 receive prednisolone acetate 1% and moxifloxacin 0.5% QID each.

90 At POD#7 following ICL rotation the patient complained of further deterioration in vision and  
91 presented with a UDVA of 20/800, an IOP of 44mmHg, limbus to limbus corneal edema and  
92 fibrin strands in the anterior chamber without a hypopyon level (**Figure 1C**). Under the working  
93 diagnosis of TASS the patient was treated with topical prednisolone acetate 1% (Q2H),  
94 cycloplegia and received both topical antiglaucoma medication and oral acetazolamide with  
95 potassium supplementation to control the IOP.

96 At POD#9 following ICL rotation the patient demonstrated dispersed pigment on the  
97 endothelium as well as a fixed mid-dilated pupil (**Figure 2**). On AS-OCT, strands of fibrin  
98 blocking the central AquaPORT hole of the ICL were clearly documented as well as angle  
99 closure (**Figure 1D**). Under the working diagnosis of pupillary block secondary to TASS the  
100 patient underwent removal of the toric ICL and was left with an unreactive pupil and corneal  
101 edema that resolved within a period of one month and a final corrected distance visual acuity  
102 (CDVA) of 20/32. However, a fixed mydriatic pupil was left as a consequence of the high IOP  
103 levels (Urrets Zavalía Syndrome) caused by the pupillary block.

104

## 105 **DISCUSSION**

106 This case report demonstrates a case of TASS with pupillary block developed in a patient with an  
107 ICL V4c implant. The serial pictures of AS-OCT taken clearly demonstrate the formation of  
108 corneal edema, fibrin strands, closure of the central hole of the ICL and development of angle  
109 closure. To the best of our knowledge, this is the first case of pupillary block secondary to TASS  
110 in a patient with an AquaPORT containing ICL V4c.

111 Often, the exact etiology of TASS is unknown. It can occur after any intraocular anterior  
112 segment intervention and is the result of a sterile inflammatory reaction to a toxic substance such  
113 as extremes of pH or osmolarity and/or the presence of preservative or detergent residue.<sup>8</sup>  
114 Typically, TASS develops within 48 hours following surgery with the most common finding  
115 being diffuse corneal edema involving the periphery and it is often accompanied by fibrin strands  
116 and trabeculitis manifesting as increased IOP.<sup>8</sup> In the current case the patient had normal IOP  
117 and mild corneal edema at POD#1 which was attributed to the procedure itself although in  
118 retrospect it may have been disproportionate to the intervention itself (uneventful ICL rotation).  
119 At POD#7 when fibrin strands and increased IOP were noted, the diagnosis of TASS was  
120 evident.

121 There is a paucity of data regarding the development of TASS following ICL implants. Sridhar et  
122 al. reported the first case of TASS following the use of an older model of the ICL in 2013.<sup>9</sup> In  
123 2016 Eissa et al. reported that one out of 54 eyes receiving the Aquaport ICL developed TASS.<sup>10</sup>  
124 Recently, Singh et al. reported one case of TASS following Aquaport ICL with no increased  
125 IOP.<sup>11</sup> In none of the aforementioned cases (n=3) of TASS was pupillary block evident. In the  
126 current case, the TASS related fibrin strands blocked the AquaPORT hole preventing flow of  
127 aqueous humor and leading to subsequent pupillary block as clearly demonstrated on serial AS-  
128 OCT photos.

129 To the best of our knowledge, occlusion of the Aquaport has yet to be reported as a complication  
130 of ICL implantation.<sup>12</sup> The resulting pupillary block secondary to TASS due to occlusion of the  
131 Aquaport following ICL V4c implantation was clearly demonstrated by serial AS-OCT images.  
132 This case demonstrate that an Aquaport hole may not be enough to prevent pupillary block in  
133 cases with postoperative intraocular inflammation, causing severe postoperative complications  
134 such as Urrets Zavalía Syndrome. Clinicians should consider this diagnosis in cases with corneal  
135 edema in the early postoperative period following AquaPORT ICL insertion. Raised awareness  
136 and a fast, timely intervention may improve patient outcomes.

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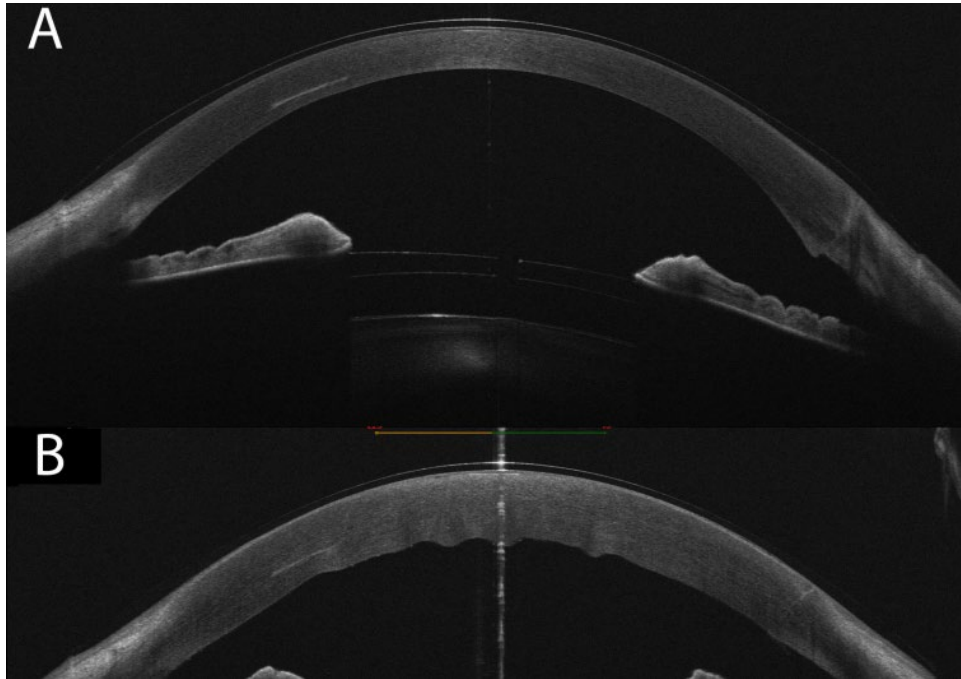
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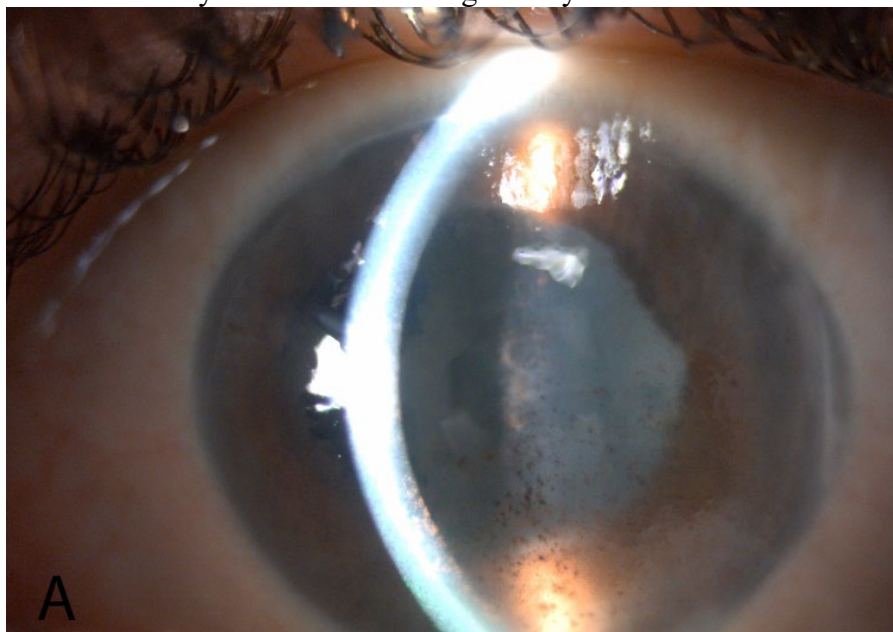
192 **FIGURE LEGENDS**

193 **Figure 1.** Serial anterior segment optical coherence tomography pictures demonstrating (A)  
194 implantable collamer lens (ICL) with good vault (~1 x corneal thickness) prior to lens alignment  
195 correction. (B) Postoperative day 1 following lens alignment correction corneal edema can be  
196 seen with an open angle and no fibrin strands. (C) Postoperative day 7 following (ICL) alignment  
197 demonstrating pupillary strands forming and (D) by postoperative day 9 fulminant pupillary  
198 block has developed.



199

200 **Figure 2.** Postoperative day 9 following ICL alignment demonstrating diffused pigment  
201 dispersion on the corneal endothelium with a fixed mid-dilated pupil resulting from the pupillary  
202 block secondary to toxic anterior segment syndrome.



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