Eckardt Forceps Tip Widening for the Removal of Posterior Intraocular Foreign Bodies Bigger Than 1 mm

Purpose: To propose a new technique with an "old" tool to allow for better intraocular foreign body (IOFB) grasping and manipulation during minimvasive vitreoretinal surgery.

Methods: The authors report herein their technique on seven eyes, diagnosed with posterior IOFBs, in which the surgery consisted of a 23-gauge vitrectomy, using, for IOFB grasping, a Grieshaber DSP 23-gauge Eckardt forceps, properly modified intraoperatively. Such result was achieved by enlarging the forceps opening bite, according to the IOFB size.

Results: In all patients, IOFBs were removed using the modified 23-gauge Grieshaber Eckardt forceps. In 6 cases, a combined phacovitrectomy was performed, and the IOFB expressed through the corneal phacoincision; in one phakic patient, the removal was performed through the sclerotomy, extended just as needed.

Conclusion: The Grieshaber Eckardt forceps commonly used in MIVS can be used in IOFB surgery for a scleral or corneal removal. In case of IOFB bigger than 1 mm, enlarging the forceps bite according the IOFB size provides a firm and safe grip, allowing the surgeon to complete the surgery without switching to bigger and more traumatic instrumentation, reducing collateral damage and shortening the surgery time.

The removal of an intraocular foreign body (IOFB) from the posterior segment of the eye is challenging. In addition to surgical skills, it requires specific instrumentation to avoid IOFB slippage and inadvertent retinal trauma. Metallic IOFBs can be removed using magnets, and the nonmetallic IOFBs require the use of forceps.

Intraocular foreign body removal through minimally invasive vitrectomy has already been described; however, the commonly used vitreoretinal forceps may be inadequate to ensure a secure grasp of the object. The wide variety of proposed IOFB forceps and tools are in 19/20 gauge and allow for the IOFB extraction by the extending of the scleral wound or through a sclerocorneal tunnel.

The authors propose herein a novel technique of modifying the Eckardt forceps commonly used in 23/25-gauge vitrectomy, to grasp and remove IOFBs of different shapes and materials.

Patients and Methods

Seven patients, 6 men, 1 woman, aged from 35 to 55, referred to the Ophthalmic Department of Pellegrini Hospital from January 2016 to June 2018, and diagnosed with posterior IOFB, were retrospectively reviewed. In all male patients, the trauma was work-related and, in the female, was due to a domestic accident.

All patients underwent preoperative full clinical eye examination; to determine localization and size of IOFBs, a B-scan ultrasonography and a computed orbital tomography were performed; immersion biometry ultrasound and optical biometry were obtained in both eyes for each patient to calculate the power of

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None of the authors has any financial/conflicting interests to disclose.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal’s Web site (www.retinajournal.com).

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the intraocular lens (IOL) in case of combined phacovitrectomy.

Four cases underwent a primary wound repair; the surgical procedure for IOFB removal was scheduled according to the evidence of endophthalmitis; in one eye, an early vitrectomy was performed after three days because of eye pain and anterior chamber inflammation worsening; in the other eyes, the surgery was deferred 10 to 20 days to avoid hemorrhage-related complications. Traumatic cataract was observed in six eyes.

Surgeries were performed under local anesthesia with peribulbar block.

Six patients underwent phacoemulsification followed by a three-port 23-gauge pars plana vitrectomy with chandelier light; one patient had a clear lens and underwent a sole vitrectomy. Surgical procedures were performed using either the 23-gauge vitrectomy system from Alcon (Accurus Vitrectomy System; Alcon Laboratories, Fort Worth, TX) plus 25-gauge chandelier Alcon or Photon (Synergetics), or the 23-gauge EVA vitrectomy system (DORC) with 27-gauge chandelier, depending on the period of surgery. A noncontact Biom indirect viewing system (Oculus) was used for visualization of the posterior segment.

A thorough vitrectomy was completed with scleral depression and all vitreous adherences to the IOFB released. Preservative-free triamcinolone acetonide was used in six patients to complete the posterior hyaloid detachment (PVD), then perfluorocarbon liquid (PFCL), to protect the posterior pole from the IOFB loosing, was injected. When embedded into the retina, IOFB was freed from the tissue with soft maneuvers; internal limiting membrane, dyed with Brilliant Peel (Fluoron, Geuder), was peeled under PFCL in two patients. A posterior capsulotomy with the cutter was performed in four cases; in two others, the traumatic peripheral capsule tear was centralized to allow for the IOFB displacement into the anterior chamber. In each case of anterior IOFB removal, the size bite of the forceps was not sufficient to grasp the IOFB; hence, the bite was intraoperatively enlarged.

Surgical Technique

In the proposed technique, a 23-gauge Grieshaber Revolution DSP Eckardt forceps for ILM peeling was modified by widening the bite of the two tips. The 1-mm bite size of these forceps (prong–prong distance, measured intraoperatively with a ruler) can be increased by delicately pulling each prong externally until a larger opening of 3 mm is reached.

The integrity and the “C”-shape of the tip should be checked; the pulling can be executed with a tool (e.g., Snellen loop) or manually; at the end, the surgeon should verify the forceps tip’s alignment.

Perfect closure of the forceps prongs is not necessary to achieve a good and firm grip.

The increased bite size of the forceps allows the surgeon to better grasp IOFBs of different size and shape; in addition, the specific “pincer” shape of the Eckardt forceps tips allows the surgeon to “better embrace” the foreign body, avoiding slippage.

In phakic patients, the IOFB can be removed through a scleral opening by widening the wound just enough to allow the IOFB through it, and no further enlargement due to the forceps size is required.

In case of combined phacovitrectomy, the IOFB, displaced into the anterior chamber, can be extracted by enlarging the corneal phacoincision (see Video, Supplemental Digital Content 1, http://links.lww.com/IAE/B181, which demonstrates the Eckardt forceps enlargement procedure and the IOFB better grasping and maneuvering).

In our case series, both the 23 and 25 Eckardt forceps were used, sometimes in bimanual fashion, to peel the ILM, free, and manipulate the IOFB; the 23 Eckardt forceps was preferred for a safer and firmer grip on the IOFB.

Results

All IOFBs were successfully removed during the surgery. In six eyes, IOFBs were moved from the posterior chamber to the pupillary field, leaned on the posterior capsule or on the iris and removed through the main corneal incision; in four cases, the corneal phacoincision was 1 mm widened; in five cases, a preloaded three-piece intraocular lens (Avansee Preset Kowa), was implanted into the sulcus. One patient had retinal detachment with posterior retinal necrosis and was left aphakic.

A posterior capsulotomy with the cutter was performed in four cases; in two others, the traumatic peripheral capsule tear was centralized to allow for an atraumatic passage of the IOFB through the pupillary field.

In one phakic patient, IOFB did not touch the retina, so a minimal vitrectomy without posterior hyaloid detachment induction was performed, and IOFB extracted by removing the 23-gauge trocar and little widening of the scleral wound.

To complete the surgery, endolaser was performed in all patients, 1,000 cs silicone oil was used in three cases and SF6 gas in three others as endotamponade to
prevent retinal detachment. The sclerotomies were closed with 8-0 vicryl sutures.

Six patients ended with a best-corrected visual acuity of 20/40 or better; one patient had a posterior retinal necrosis that prevented any visual improvement.

The average IOFBs size was 3.5 mm in length and 2.5 mm in width (Table 1, which shows surgical characteristic—endolaser treatment, tamponade agents used—and functional results).

Discussion

Approaching the IOFB surgery in small-gauge vitrectomy gives the advantages of shorter operating times and faster visual recovery; however, the need to grasp and remove IOFBs of different location, size, and shape brings in technical hurdles and limitations. The use of Eckardt forceps, designed for ILM peeling with end-gripping platform and thin tips, allows the surgeon to manipulate the retina and IOFB adherences with delicate approaches and improved visualization; however, specific tools are sometimes required to grasp and maneuver IOFBs inside the eye.

We have experienced that the Grieshaber DSP Eckardt forceps, properly modified to extend the bite size, allows the surgeon to catch the foreign body according to its shape, “embracing” it with a stable grip. The fineness of the tips provides the surgeon with maximum visibility, while the arched and flat ends allow the forceps to safely slide over the retina during the grasping maneuvers.

When a firm grip is achieved, IOFBs can be removed either widening the phacocorneal incision in case of combined surgery, or by enlarging the scleral wound just enough to let the IOFB pass through, when vitrectomy alone is performed.

The anterior extraction in our opinion offers the advantage of more controlled maneuvers: the foreign body remains visible both in the moving through the posterior capsulotomy and leaning it on the iris or on the posterior capsule.

The most challenging point of this technique could be the IOFB switching from the grasping forceps to another forceps in a handshake fashion, laying it on the posterior capsule or on the iris allows the surgeon to switch to the proper tool for the anterior extraction.

This technique is available for both 23 and 25 Grieshaber Eckardt forceps; however, the ductility and flexibility of the 25-gauge forceps make the IOFB grasping and maneuvering more challenging, specially in case of larger and heavy IOFB.

In conclusion, we think that the benefits of using a modified 23-gauge Eckardt forceps for IOFBs of different shapes and materials, bigger than 1 mm, specially in case of combined phacominvasive vitrectomy, could be crucial in the success of this surgery.

This technique has some limitations. Our experience is limited to the 23-gauge Grieshaber revolution DSP

| Table 1. Surgical Characteristic (Endolaser Treatment, Tamponade Agents Used) and Functional Results |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| Patients                                         | No. 1                                           | No. 2                                           | No. 3                                           | No. 4                                           | No. 5                                           | No. 6                                           | No. 7                                           |
| Site of entrance                                 | Sclera                                          | Cornea                                          | Sclera                                          | Cornea                                          | Cornea                                          | Cornea                                          | Sclera                                          |
| Timing surgery (d.a.i.)                          | 10                                              | 12                                              | 7                                               | 15                                              | 2                                               | 14                                              | 20                                              |
| Vitrectomy machine                               | Accurus                                         | Accurus                                         | Accurus                                         | Dorc                                            | Dorc                                            | Dorc                                            | Dorc                                            |
|                                              | 23-gauge                                         | 23-gauge                                         | 23-gauge                                         | 23-gauge                                         | 23-gauge                                         | 23-gauge                                         | 23-gauge                                         |
| Vitreous hemorrhage                              | ++                                              | ++                                              | +                                               | ++                                              | ++++                                           | -                                               | ++                                              |
| FB location                                      | P                                               | P                                               | P                                               | MP                                              | MP                                             | P                                               | P                                               |
| Retinal tear                                     | Yes                                             | Yes                                             | No                                              | No                                              | Yes                                             | Yes                                             | Yes                                             |
| Traumatic cataract                               | Yes                                             | Yes                                             | No                                              | Yes                                             | Yes                                             | Yes                                             | Yes                                             |
| Initial V.A.                                     | 20/80                                           | HM                                              | 20/50                                           | HM                                              | LP                                             | HM                                              | HM                                              |
| Cataract surgery                                 | I-A                                             | I-A                                             | No                                              | I-A                                             | I-A                                             | I-A                                             | I-A                                             |
| PVD induction                                    | Yes                                             | Yes                                             | No                                              | Yes                                             | Yes                                             | Yes                                             | Yes                                             |
| Intravitreal TCA                                  | Yes                                             | Yes                                             | No                                              | Yes                                             | Yes                                             | Yes                                             | Yes                                             |
| Pc360/around IOFB                                | Yes                                             | Yes/no                                          | No                                              | Yes/yes                                         | Yes/no                                          | Yes/yes                                         | Yes/yes                                         |
| PFCL                                            | Yes                                             | Yes                                             | No                                              | Yes                                             | Yes                                             | Yes                                             | Yes                                             |
| SF6 gas                                         | Yes                                             | No                                              | No                                              | Yes                                             | No                                              | No                                              | Yes                                             |
| Silicon oil 1000 cs                               | No                                              | Yes                                             | No                                              | Yes                                             | No                                              | Yes                                             | No                                              |
| Site of removal                                  | Cornea                                          | Cornea                                          | Sclera                                          | Cornea                                          | Cornea                                          | Cornea                                          | Cornea                                          |
| Exit site widening                               | No                                              | Yes                                             | Yes                                             | No                                              | Yes                                             | No                                              | Yes                                             |
| Final V.A.                                      | 20/25                                           | 20/40                                           | 20/20                                           | 20/32                                           | LP                                              | 20/40                                           | 20/25                                           |

d.a.i.: number of days after injury.

vitreous hemorrhage: +mild, ++ partial, ++++total.

FB, foreign body; HM, hand motion; I-A, infusion/aspiration; MP, mild periphery; P, periphery; P, posterior pole; Pc, posterior photocoagulation; PFCL, perfluorocarbon liquid; PVD, posterior vitreous detachment; TCA, triamcinolone acetonide; V.A., visual acuity.
Eckardt forceps, not all disposable Eckardt forceps models can be modified to obtain a bite size extension. Moreover, this technique cannot work for spherical and smooth foreign bodies as pellet gun.

In conclusion, we think that this proposed technique is easy to perform and puts in the hands of the surgeon an “old” tool with a new use; the disposable Eckardt forceps is easily available for the vitreoretinal surgeon in standard vitrectomy sets; the IOFB surgery can be performed preserving the advantage of the MIVS: the shorter surgery time and the minimal collateral damage especially when the surgical procedures are moved to the anterior segment of the eye.

Key words: Eckardt forceps, IOFB, traumatic cataract, vitreoretinal surgery.

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