Surgical management of IOFB - Challenging scenarios

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History of IOFB removal

The Life and Works of Guilhelmus Fabricius Hildanus (1560–1634)

of joints was treated with baths, cataplasms, fat, aromatic embrocations, emollient plasters and stretching apparatus. The simplest form of physical treatment was a basket filled with stones which was to be lifted hourly by the patient with an ankylosed elbow. He remarked that patients with ankylosed joints possessed greater power in the affected limbs.

There were various treatments for kypho-scoliosis. A kyphotic child of two was cured by wearing an iron plate for a year. This straightened the spine by exciting constant pressure on the projecting vertebrae. Spinal curvature after fractures was treated by laying the patient on a bench and applying two thick linen bands, one above and the other below the site. While traction was exerted on each, the surgeon manipulated the spine. If this failed, open reduction was performed.

Ophthalmology

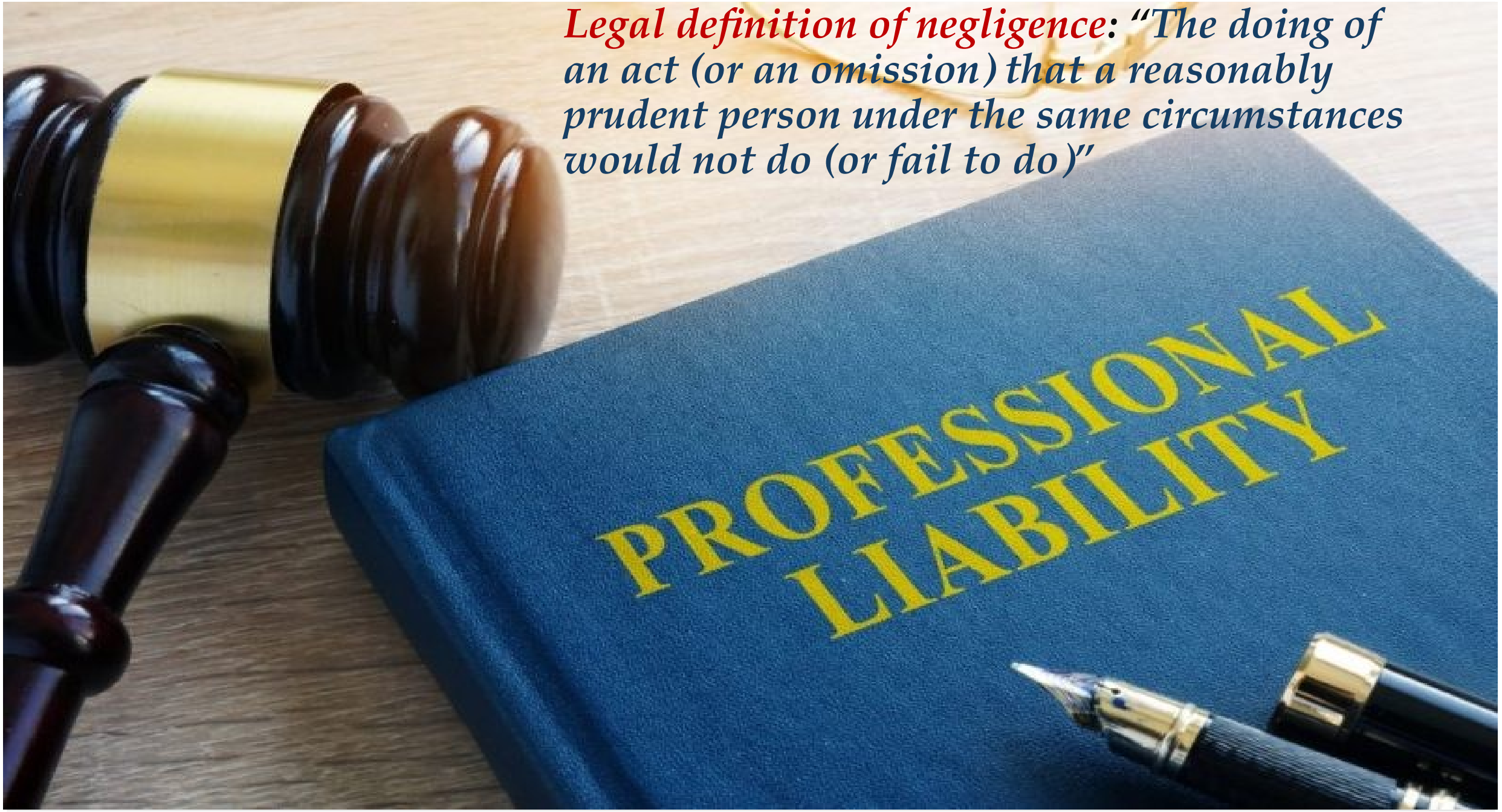
The first extraction of a metal particle from the eye is attributed to Fabricius' wife. The story is told by Fabricius:

A countryman bought some iron and was striking two pieces together to prove its quality when a splinter flew into his eye and stuck in the cornea, causing him great pain. The local surgeons tried everything for many days but to no purpose and the pain and inflammation so increased that he came to see me (in Berne) on March 5 1624. I used all the means I could think of for some days but the splinter was so small that it could not be removed by instruments; when behold! my wife hit on the very thing. I kept the eye open with both hands while she held a magnet as close as possible to it, and after several trials, for he could not stand the light long, we saw the iron leap from the eye to the stone (Leonardo, 1943).

Although it is commonly thought that this was the first magnet extraction of a metal particle from the eye, Nettler and Nettler (1947) state that Hieronymus Brunschwig described it in 1462.

Fabricius' usual method of removing foreign bodies stuck in the eye was by the use of a special pair of forceps and an instrument rather like a long ear-pick. The latter was pressed firmly against the cornea with the concave side towards the particle, and the patient was asked to turn his eye in the appropriate direction; the object impinged against it and was then removed with the forceps. He

- **Marie Colinet & Wilhelm Fabricius (1560-1634)**



Legal definition of negligence*: *"The doing of an act (or an omission) that a reasonably prudent person under the same circumstances would not do (or fail to do)"

Sources of litigation

- Improper disclosure about nature, purpose and prognosis of disease
- Failure to Inform the potential risks
- Improper equipment Usage and Failure
- Failure or delay in Diagnosis

Management Objectives

Establish integrity
Prevent infection
Remove IOFB
Maintain clear media
Manage RD
IOP Control
Prevent Sympathetic Ophthalmia
NPL is not a contraindication for surgery

Immediate IOFB Removal

PROS	• Single procedure • Decreased risk of endophthalmitis and PVR
CONS	• Integrity of laceration ,Anterior segment pathology, requirement of keratoprosthesis • Availability of OR personnel and equipment

Delayed IOFB Removal

PROS	• Better integrity of repaired laceration • Resolution of anterior segment pathology • Availability of OR personnel and equipment
CONS	• Two procedures • Increased risk of endophthalmitis and PVR

Delayed Intraocular Foreign Body Removal without Endophthalmitis during Operations Iraqi Freedom and Enduring Freedom

Marcus H. Colyer, MD,[1] Eric D. Weber, MD,[1] Eric D. Weichel, MD,[1] John S. B. Dick, MD,[2] Kraig S. Bower, MD,[1] Thomas P. Ward, MD,[1] Julia A. Haller, MD[3]

Surgical management

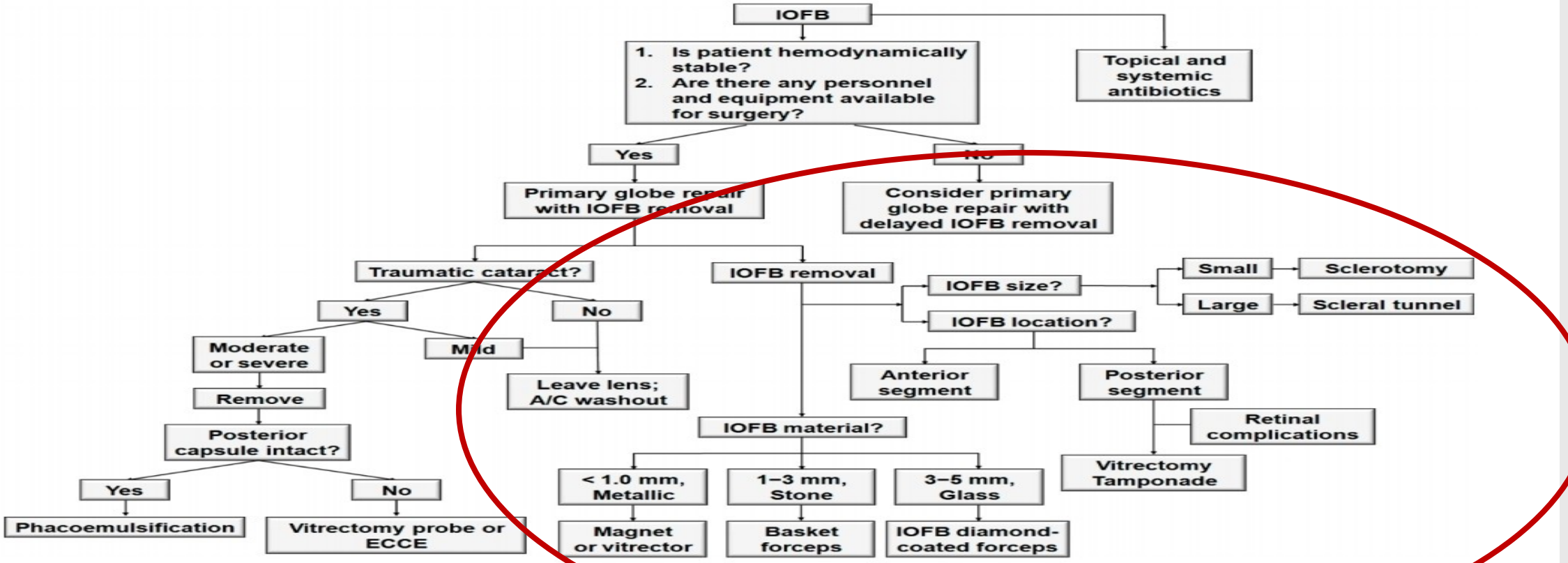


Figure 8. Algorithm for the management of intraocular foreign bodies. IOFB = intraocular foreign body; A/C = anterior chamber; ECCE = extracapsular cataract extraction.

Jung et al. IOFB Diagnostic protocols and treatment strategies in ocular trauma patients. J.Clin Med 2021, 10,1861.

TABLE 24–6 MANAGEMENT RECOMMENDATIONS FOR FERROUS IOFBS

IOFB/Eye's Condition	*Location*	*Electrophysiologic and/or Clinical Signs of Siderosis*	*Recommendation*
Fresh	Anywhere	−	Remove
Chronic	Anterior segment	−	Remove/retain
Chronic	Lens (no cataract)	−	Retain
Chronic	Lens (no cataract)	+	Remove
Chronic	Lens (cataract)	−	Remove/retain
Chronic	Lens (cataract)	+	Remove
Chronic	Vitreous	−	Retain/remove
Chronic	Vitreous	+	Remove
Chronic	Encapsulated in retina	−	Retain/remove
Chronic	Encapsulated in retina	+	Remove
Chronic	Subretinal	−	Retain
Chronic	Subretinal	+	Remove
Blind, painful, phthisical eye	Anywhere	+/−	Enucleate

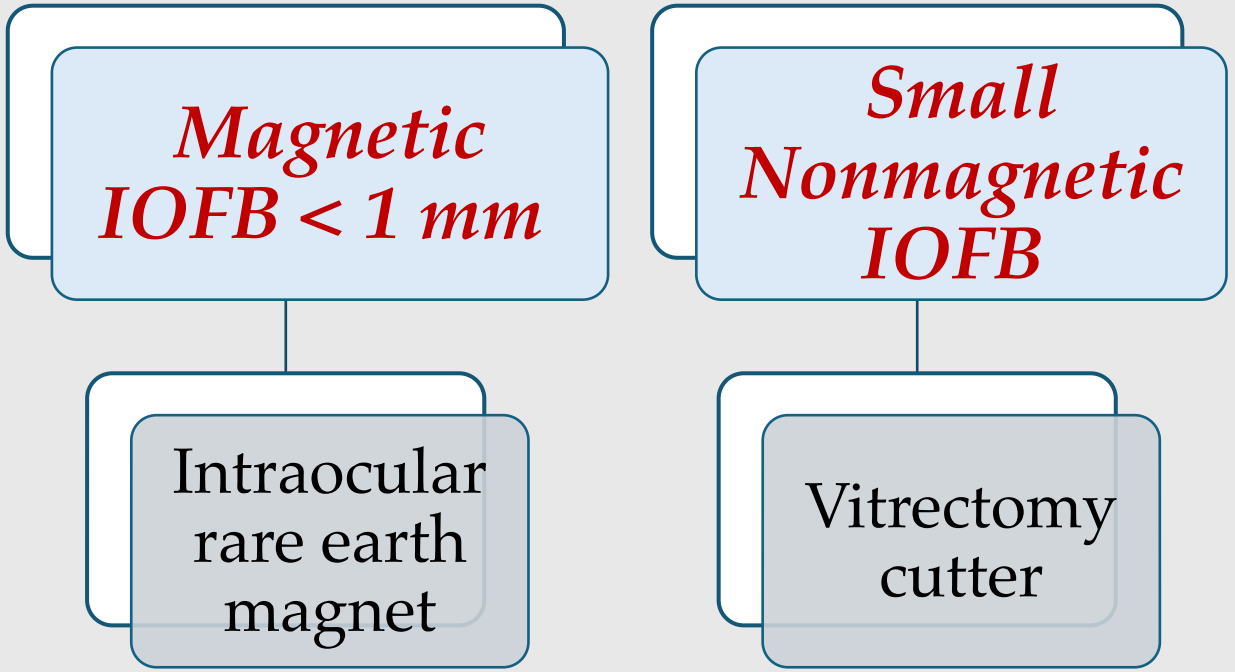
Ocular Trauma Principles and Practice - Chapter 24 IOFB - Ferenc Kuhn

IOFB Removal

Three routes

- Anterior
- Posterior
- Pars plana
  - With vitrectomy
  - Without vitrectomy

Small IOFB


Magnetic IOFB < 1 mm
Intraocular rare earth magnet
Small Nonmagnetic IOFB
Vitrectomy cutter

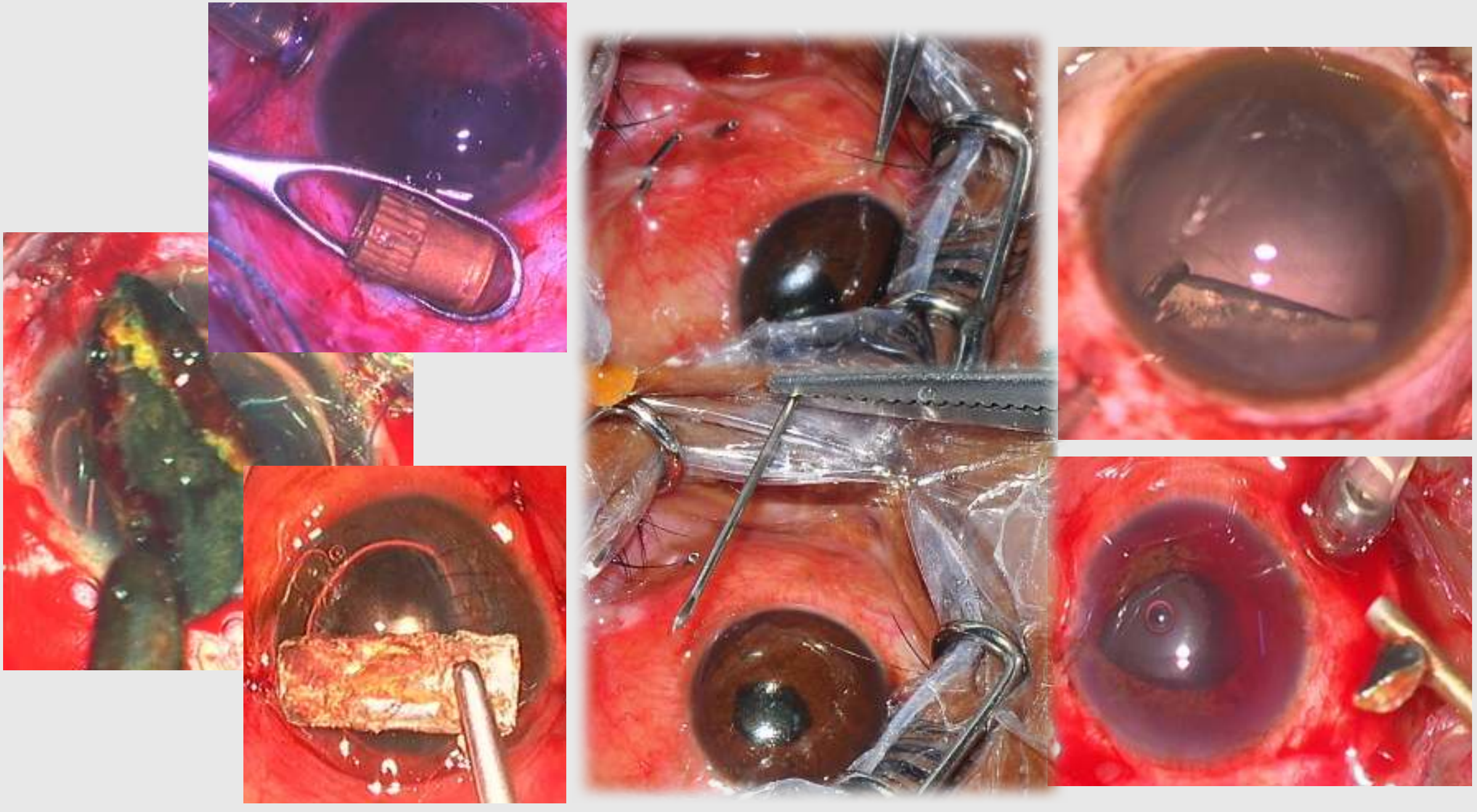
Large IOFB

IOFB (1-3 mm)	• Active compression forceps(e.g. De Juan) • Basket forceps
IOFB (3.0-5.0 mm) and Glass IOFB	• Diamond-coated forceps
IOFB (4x4x4 mm^3)	• T shaped sclerotomy or through anterior chamber

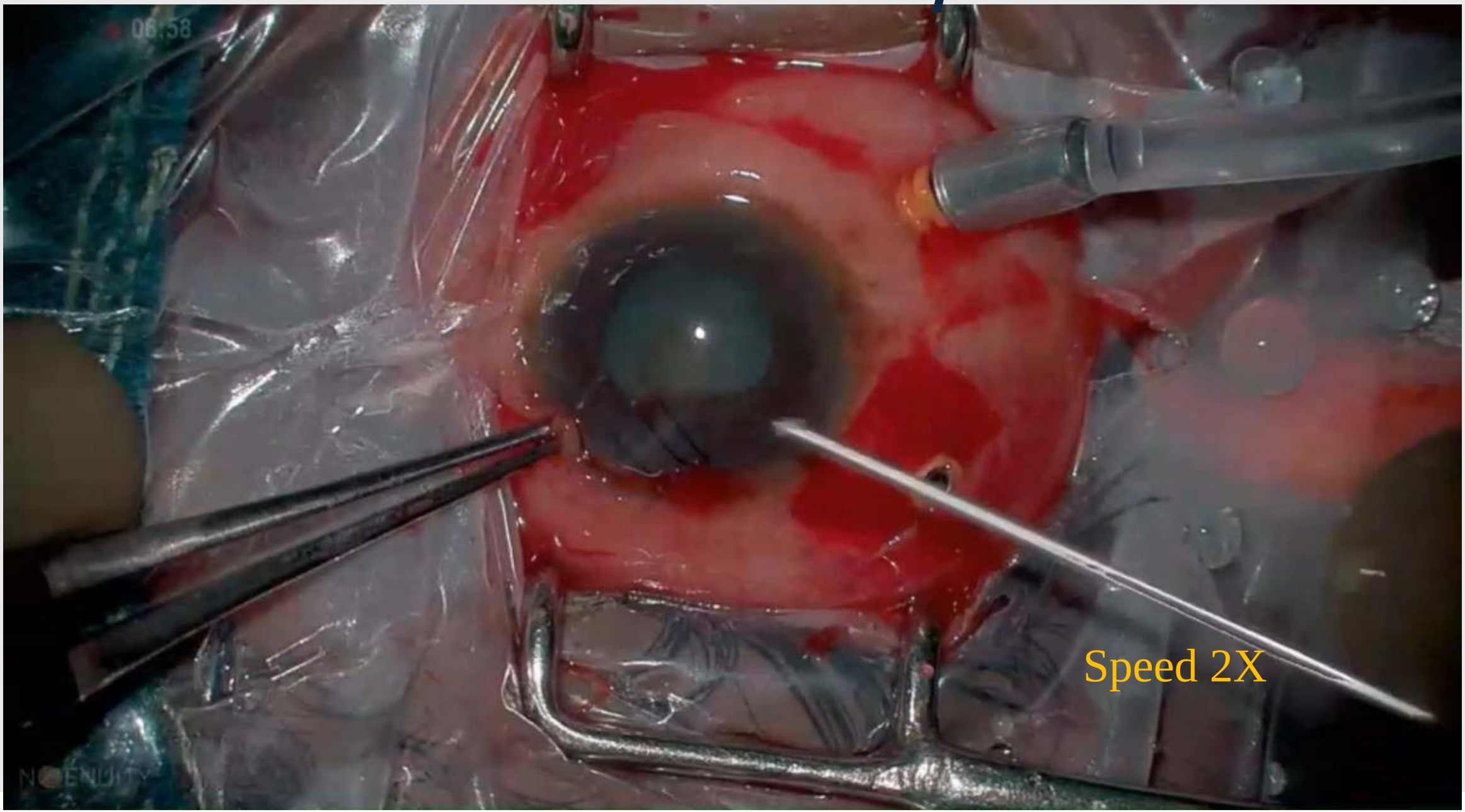
Management of IOFB

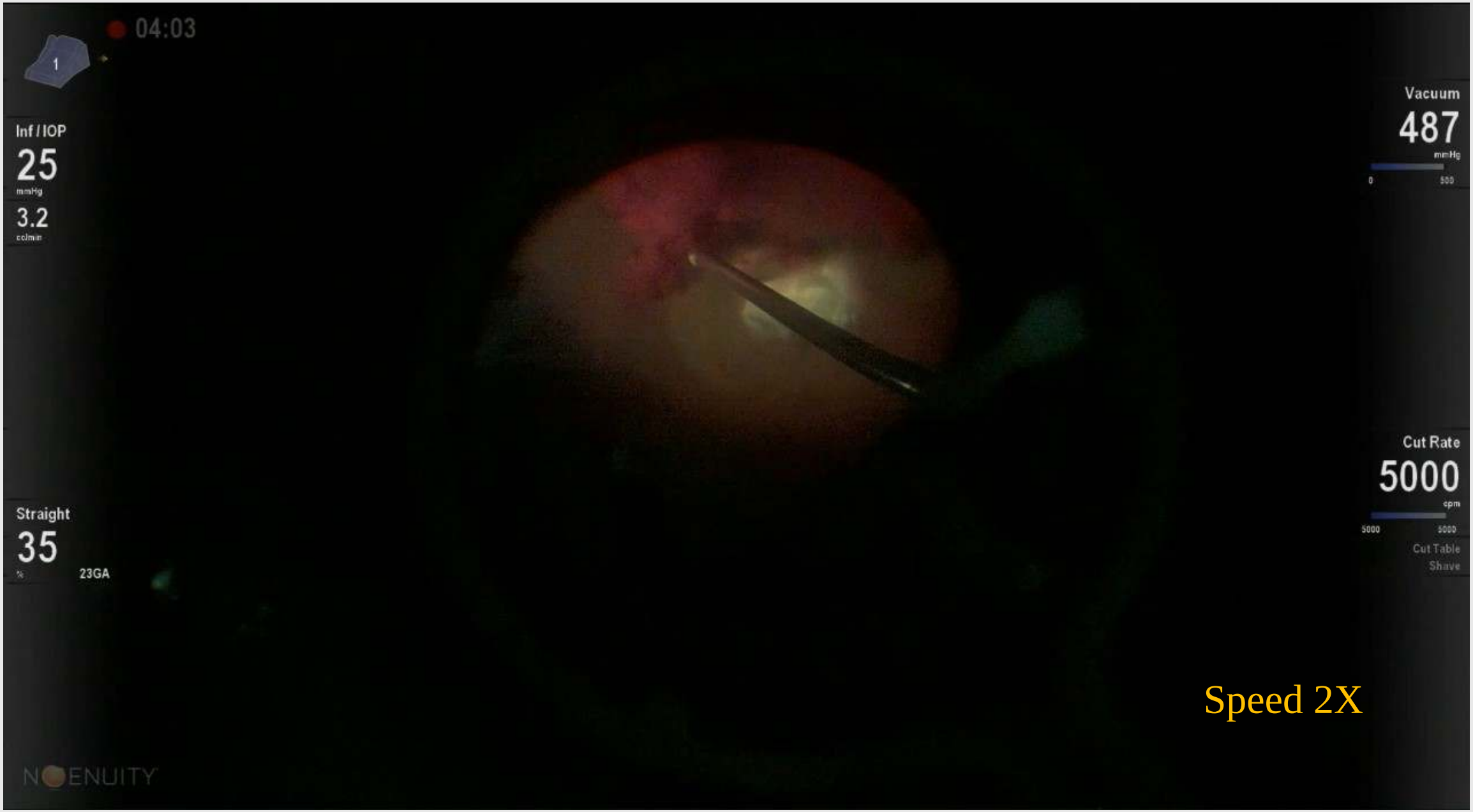
	Well Visualized	Poorly Visualized
Intravitreal		
Magnetic	External Magnet	Vitrectomy , Forceps/REM
Non Magnetic	Vitrectomy/Forceps	Vitrectomy , Forceps
Intraretinal		
Magnetic	Transscleral Trap door/PPV, Forceps/REM	Vitrectomy , Forceps/REM
Non Magnetic	Transscleral Trap door/PPV, Forceps	**Vitrectomy , Forceps**

Retina – Textbook by Stephen J Ryan



IOFB Posterior pole

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487
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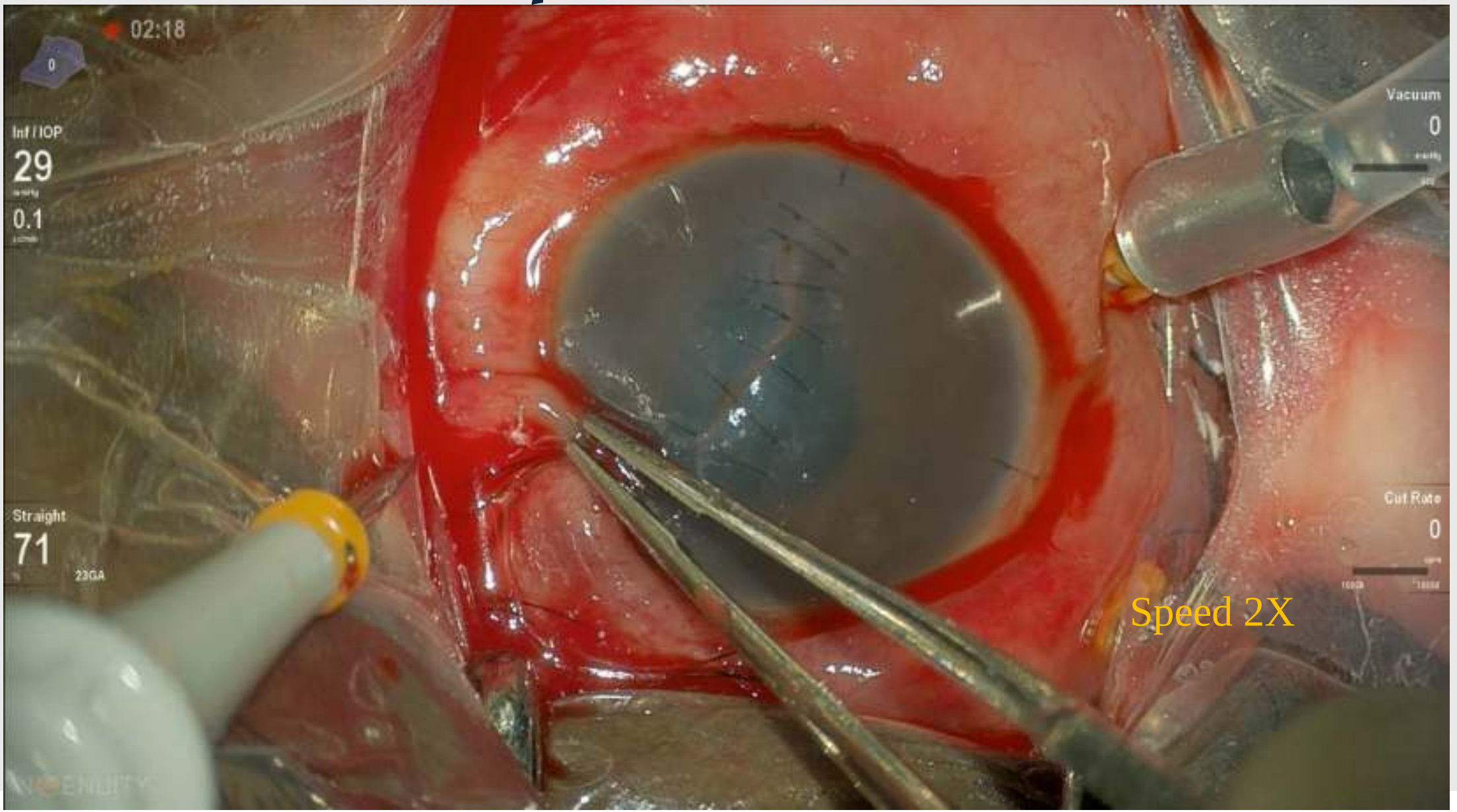
5000
5000
Cut Table
Shave
NOVENUITY
Speed 2X


Speed 2X
Alcon
a Novartis company

Peripheral IOFB



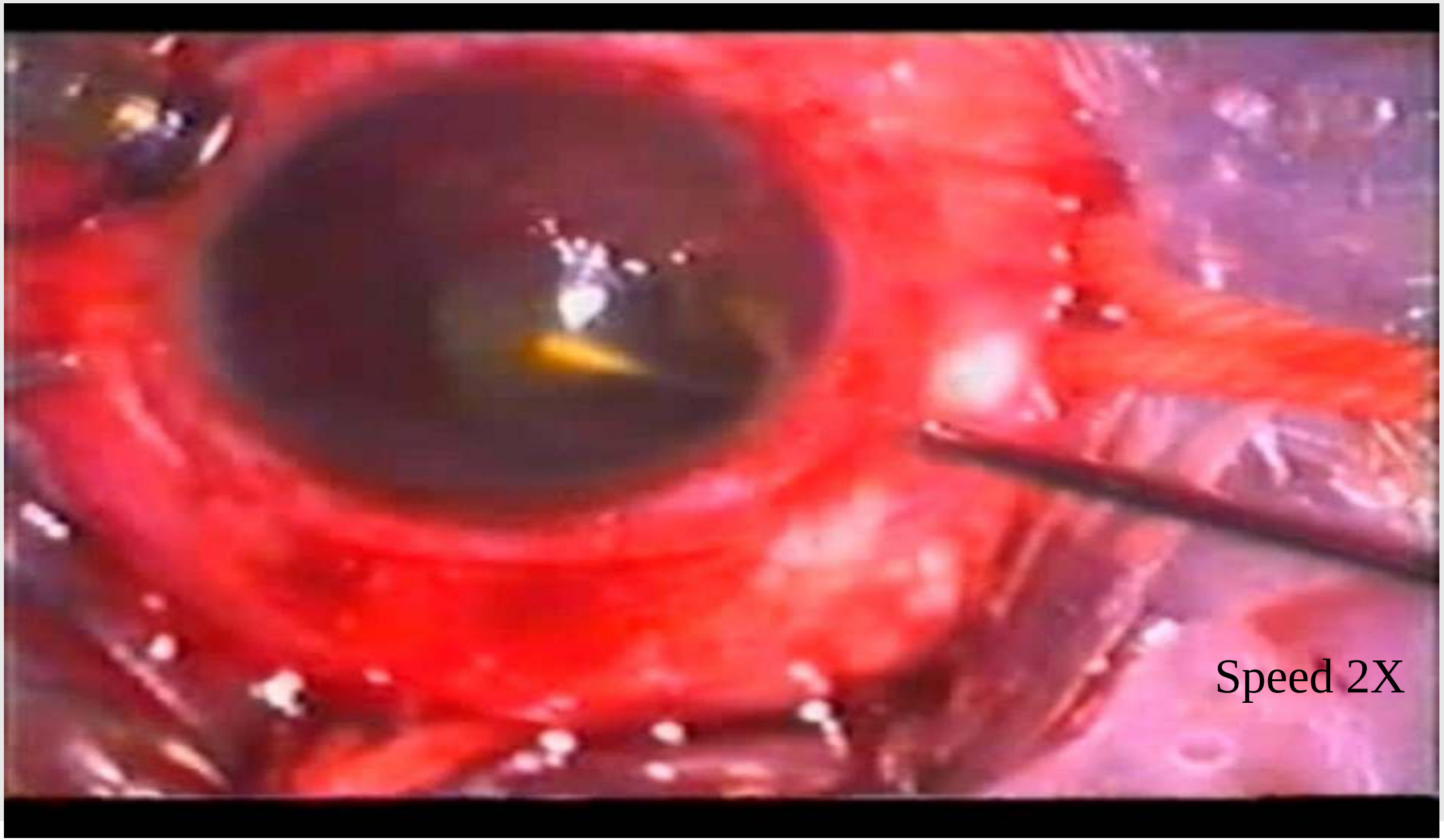

Speed 2X
Alcon
a Novartis company

Pars plana FB

Speed 2X

IOFB OR EOFB ?

Precious FB



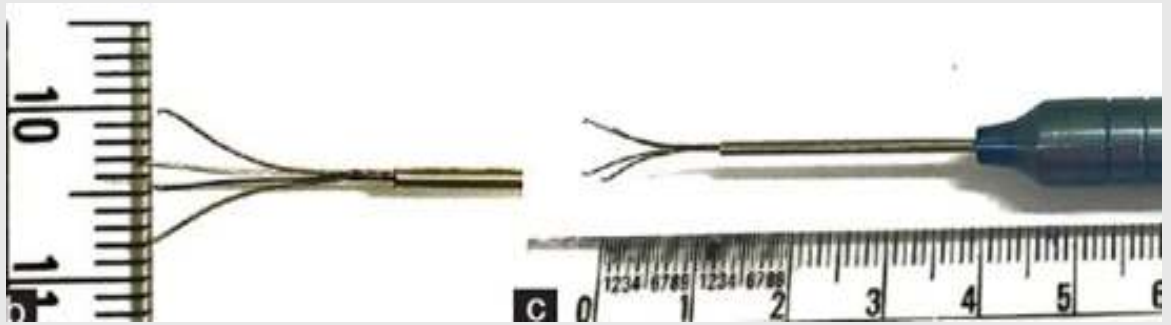
Tools of the trade

Claw forceps

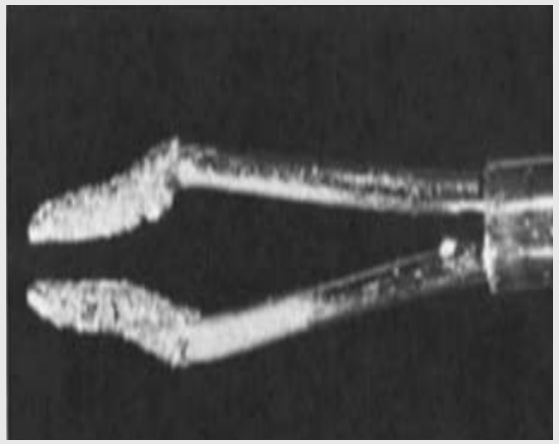
- Extendable foreign body forceps

  Titanium handle with 19-G stainless steel shaft

- To-and-fro movement of the plunger is controlled by a knob
- **4 prongs** of Nitinol wire- Alloy of **Nickel and Titanium**

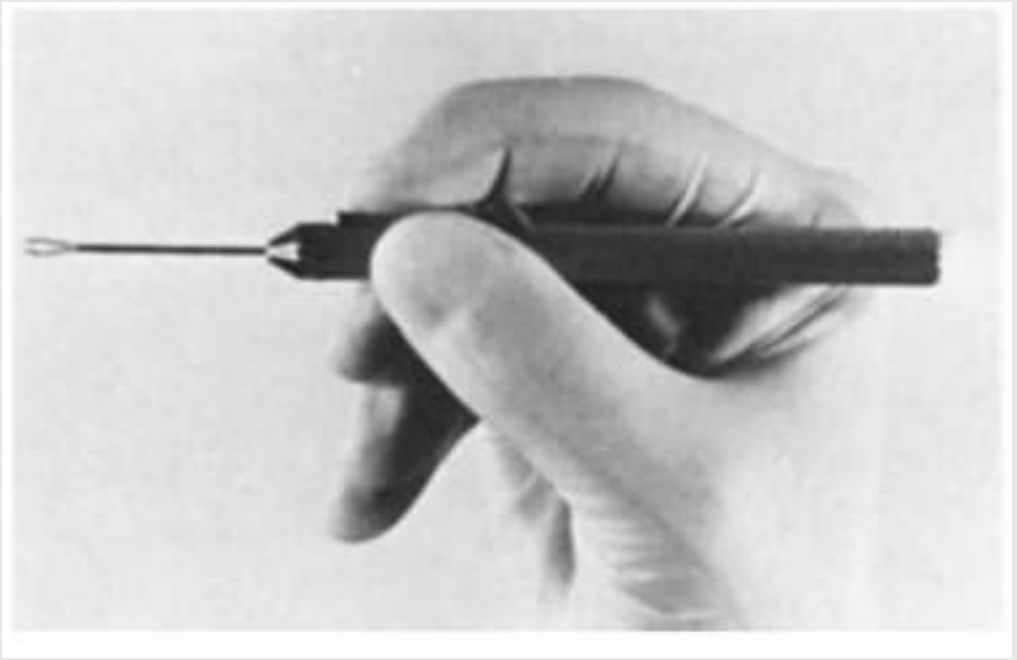


Maneesh Bapaye et al. The claw : A novel intraocular foreign body removal forceps. IJO . 2018 Dec ; 66(12) 1845-1848



Diamond coated forceps

- Diamond-coated forceps for IOFB of any shape and composition
- 2 parallel jaws – 1.2 mm wide
- Wedge shaped control on sliding back open the jaws
- Closing occurs by automatic spring action



Dyson Hickingbotham et al. Diamond coated all-purpose foreign body forceps. AJO Feb 1981. Vol 91. No.2

Microalligator forceps

- Removal of large IOFB
- 15 cm long, can grasp IOFB upto 6 mm size
- **Advantages** - firm grasp, less chances of slippage
- **Pitfalls -** Needs 1.8 mm sclerotomy

Potential crushing force can lead to splintering

Figure 2. The micro alligator forceps: a 45°-angle long shaft, serrated jaws (arrow), 4-mm jaw length, 6-mm maximum opening width, and 1.5-mm tip width.

Liang et al. Removal of a giant nonmagnetic intraocular foreign body using microalligator forceps. OSLI Retina. May/June 2014 Vol.45, No.3

Magnets in IOFB removal

- Magnetism of a metallic FB directly related to iron content
- A magnetic foreign body orients longitudinally to the magnet
- Change of orientation can be damaging if it occurs near the retina
- Strength decreases as its distance from the FB increases

Albert and Jakobiec's Principle and Practice of Ophthalmology textbook

Internal magnet

- **Rare-earth magnet attracts ferro- magnetic objects**
- 20-gauge shaft
- Needs conjunctival peritomy and 20G MVR blade to create sclerotomy
- Provides a controlled amount of force for dissecting the foreign body from surrounding tissues

External electromagnet

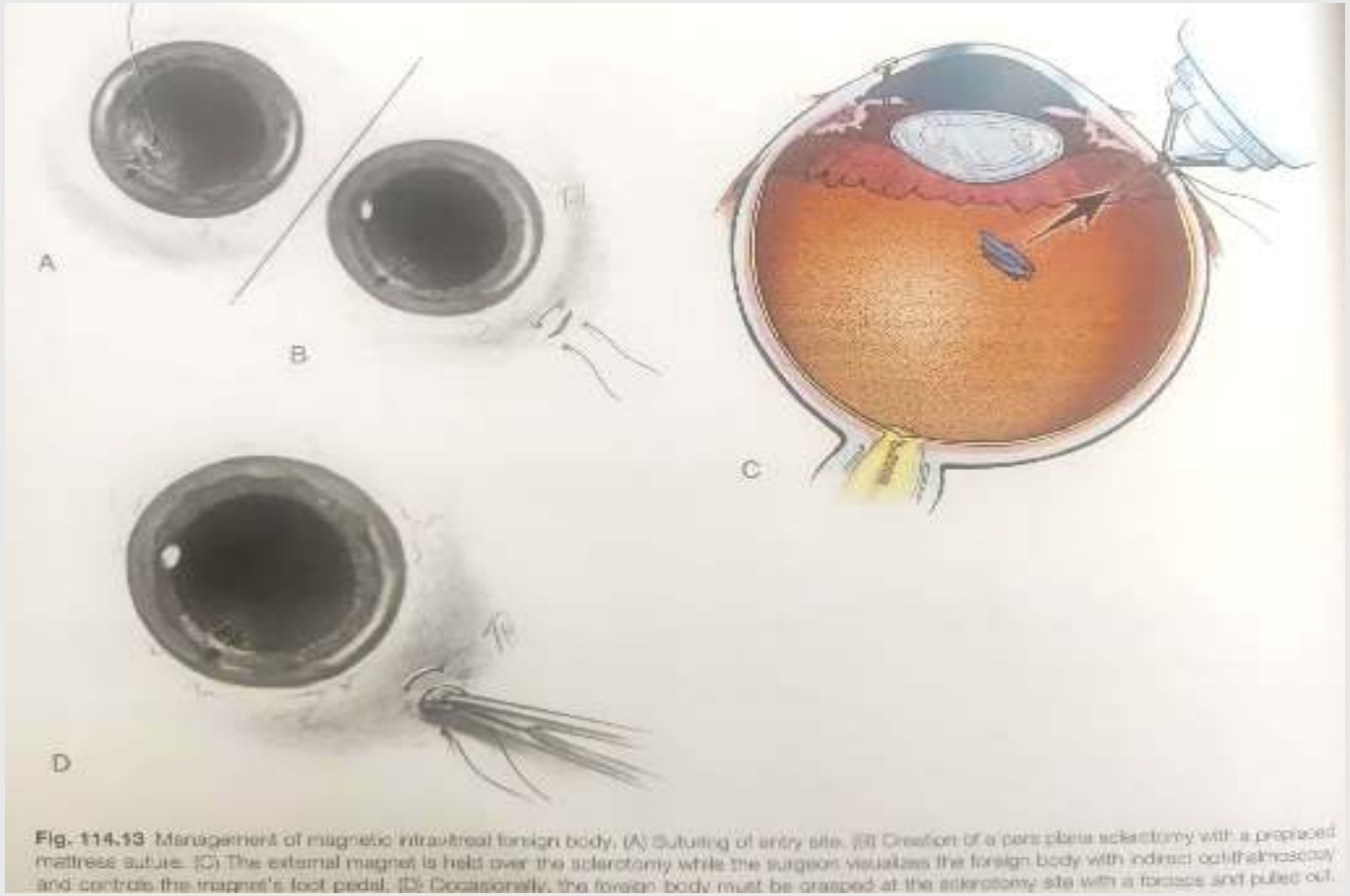


Fig. 114.13 Management of magnetic intravitreal foreign body. (A) Suturing of entry site. (B) Creation of a pars plana sclerotomy with a preplaced mattress suture. (C) The external magnet is held over the sclerotomy while the surgeon visualizes the foreign body with indirect ophthalmoscopy and controls the magnet's foot pedal. (D) Occasionally, the foreign body must be grasped at the sclerotomy site with a forceps and pulled out.

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VACUUM
CHARGE
OFF
MAINS
PILOT
F/SWITCH
MAGNET

Jumping effect

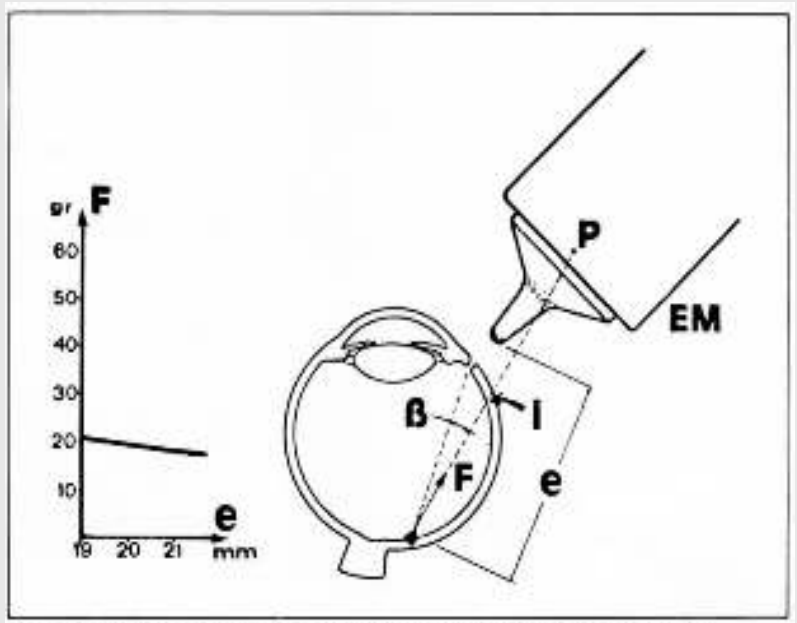

Figure 1: Diagrammatic Representation of forces involved Using the Standard Electromagnet. When the magnetic pole (P) and the foreign body are not aligned with the wound, the line of force is angled (ß) and a secondary incarceration of the foreign body is possible (i). The force field graph F = f(e) demonstrates the near constancy of the pull-power of the electromagnet (EM) equiped with a short extraocular tip. The flatness of the slope mathematically explains the "jumping" effect observed with all electromagnets.

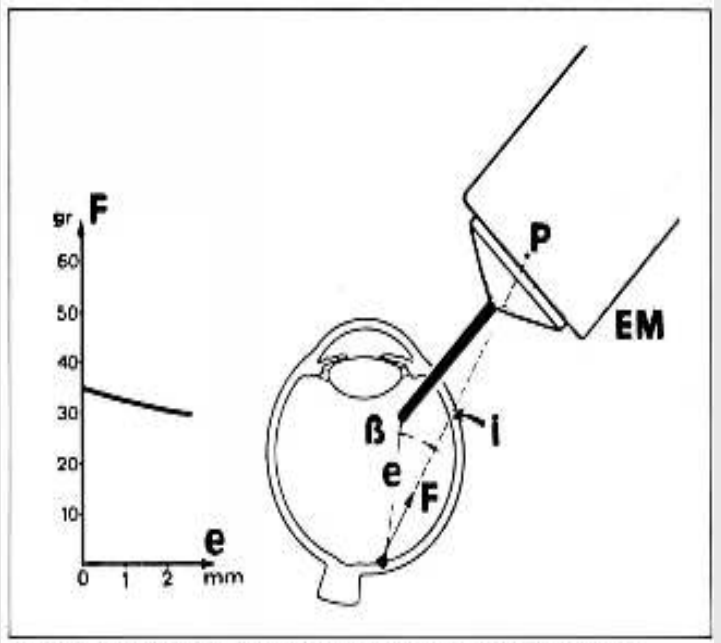

Figure 2: Diagrammatic Representation of Forces Involved With the Modified Electromagnet. The addiction of a thin extension to the pole piece does not prevent a secondary incarceration at(i). Power is applied to the electromagnet (EM) before contact is made with the foreign body. Note the slight increase in the slope and intensity of force-field obtained with the new intraocular tip. The added extension does not eliminate the "jumping" effect.

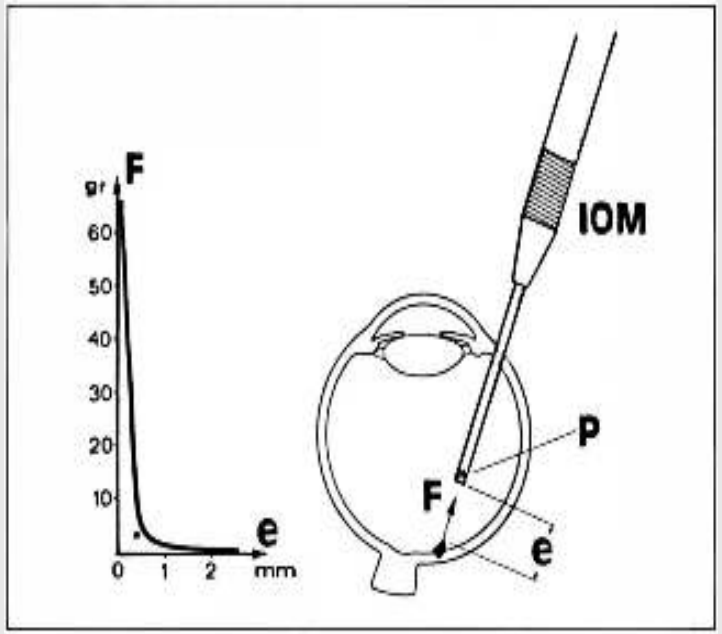

Figure 3: Diagrammatic Representation of Forces Involved With the Rare-Earth IOM. The magnetic pole (P) of the rare-earth IOM is located at the tip of the instrument and is always closest to the foreign body. Secondary incarceration is thusly impossible. The force-field diagram is strongly sloped. Very large pull-forces exist only at close proximity to the foreign body, making the IOM free of the "jumping" effect characterizing electromagnets.

Parel et al. Recent advances in foreign body extractors.ARQ.BRAS.OFTAL.54(2), 1991

Clinical Ophthalmology

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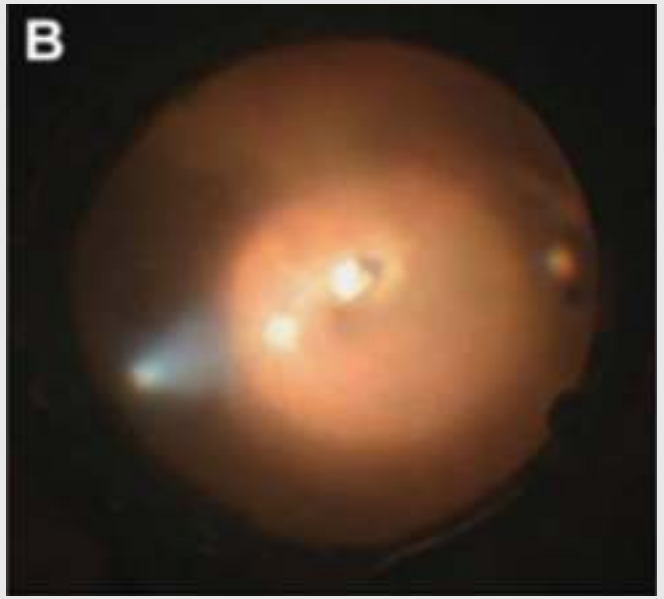
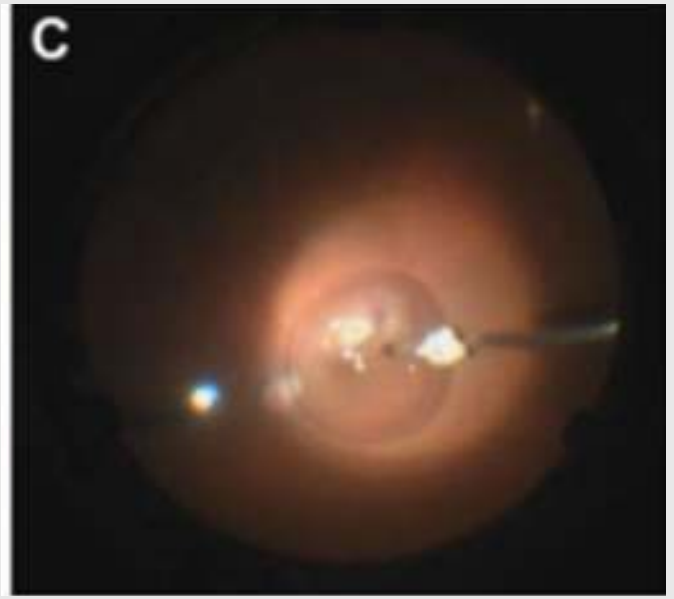
METHODOLOGY

Perfluorocarbon liquid-assisted intraocular foreign body removal

This article was published in the following Dove Press journal:
Clinical Ophthalmology



- Role of PFO in removal of IOFB from posterior segment
- PFO slides IOFB outside the macula for safer retrieval
- PFO protects the posterior pole from IOFB drops



Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.elsevier.com/locate/ajoc

Case report

Glass intraocular foreign body removal with a nitinol stone basket

Andrew W. Francis[a,b], Frances Wu[c], Ivy Zhu[d], Daniel de Souza Pereira[c], Robert B. Bhisitkul[c,*]

- CT identified 9 mm polygonal IOFB in posterior segment
- A staged procedure was performed for globe rupture
- Later 23-gauge PPV, PPL & and removal of IOFBs using

Nitinol stone basket

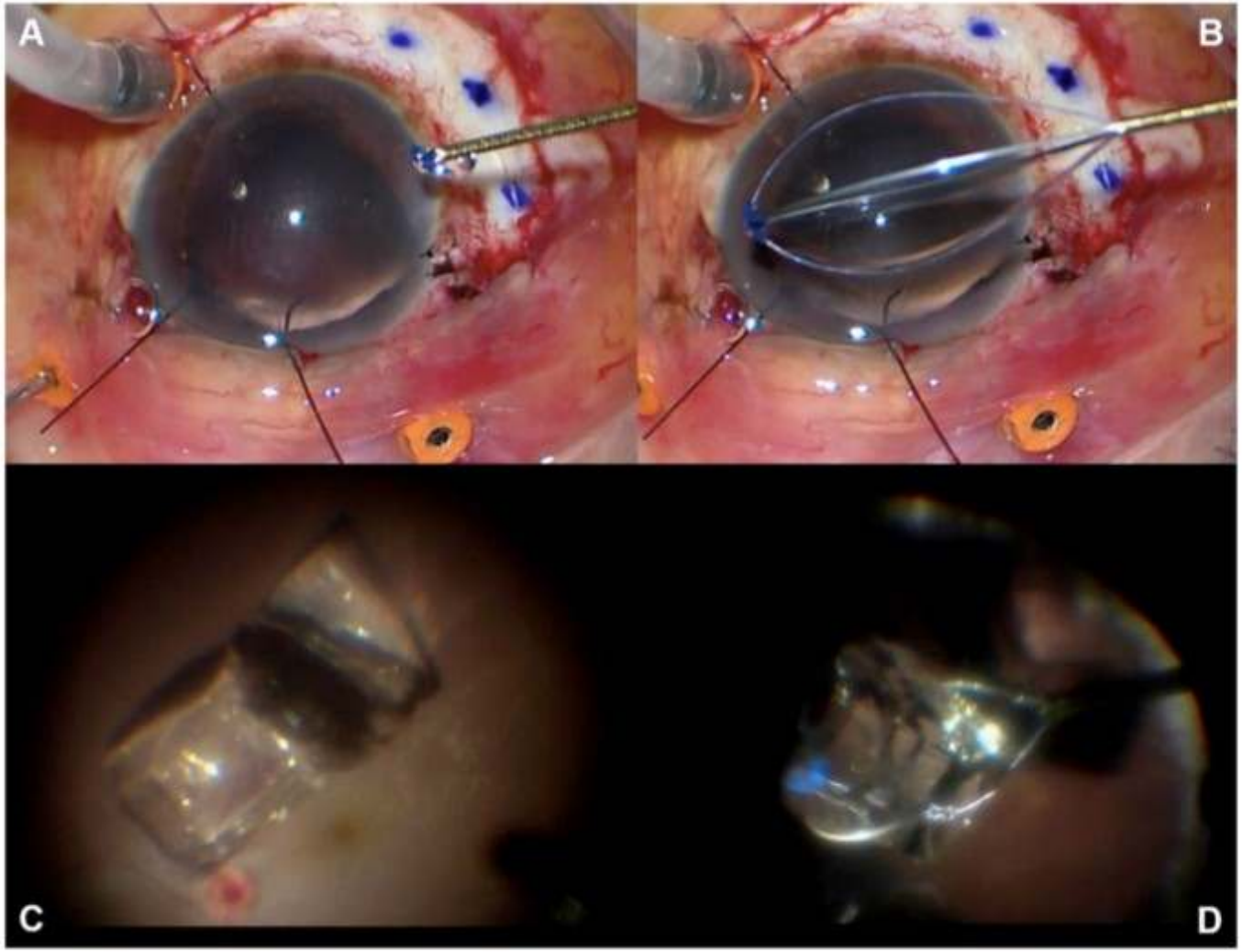


Fig. 4. (A, B). Nitinol stone basket (NSB) in the closed and open position. (C, D). Two glass IOFBs on the retina surface are visualized. Both were securely captured with the NSB and removed through the pars plana.

Alternate Management

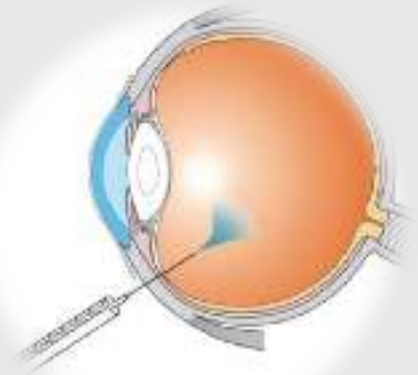
Randomised controlled trial of prophylactic antibiotic treatment for the prevention of endophthalmitis after open globe injury at Groote Schuur Hospital

- 10-15% IOFB develop endophthalmitis by more virulent organisms
- Presence of signs of infection → Systemic antibiotics
- I.V. vancomycin +/- ceftazidime 1-3 days
- Followed by oral ciprofloxacin 10-14 days

Conclusions: The incidence of endophthalmitis with prophylaxis was 2-3%. Selected patients with open globe injuries (without high-risk features) may receive either intravenous cefazolin and oral ciprofloxacin, or oral cefuroxime and oral ciprofloxacin as prophylaxis against acute endophthalmitis-the latter regimen has the advantage of shortening patients' hospital stays and reducing costs. Non-inferiority study-design limitations should be taken into account, however.

Du Toit N, Mustak S, Cook C. Randomised controlled trial of prophylactic antibiotic treatment for the prevention of endophthalmitis after open globe injury at Groote Schuur Hospital. Br J Ophthalmol. 2017 Jul;101(7):862-867

Role of intravitreal antibiotics



Clinical Trial > Indian J Ophthalmol. 2003 Mar;51(1):39-44.

Role of prophylactic intravitreal antibiotics in open globe injuries

Results: The incidence of endophthalmitis was higher in group II (7 of 38 eyes; 18.42%) compared to group I (2 of 32 eyes; 6.25%). Both the patients who developed endophthalmitis despite prophylactic intravitreal antibiotics in group I had an initially undetected intraocular foreign body (eyelash) in the vitreous cavity.

Conclusions: Prophylactic intravitreal broad spectrum antibiotic injection decreases the risk of post-traumatic endophthalmitis.

Prognosis - Guarded

- Posterior segment IOFB
- Non-magnetic FB
- Failed surgeries
- Lens damage
- Siderotic and copper FB - Prognosis is guarded

NPL as presenting visual acuity

› Graefes Arch Clin Exp Ophthalmol. 2009 Apr;247(4):477-83. doi: 10.1007/s00417-009-1035-4. Epub 2009 Jan 27.

Visual outcomes of vitreoretinal surgery in eyes with severe open-globe injury presenting with no-light-perception vision

Conclusion: Patients with severe open-globe injury and NLP occasionally recover LP or better vision. These patients may regain useful vision after vitreoretinal surgery if prompt referral and intervention is attempted and if the spontaneous visual recovery occurs within the first week after OGR.

› Retina. 2013 Feb;33(2):380-6. doi: 10.1097/IAE.0b013e318263cefb.

Open globe ocular trauma: functional outcome of eyes with no light perception at initial presentation

Conclusion: Visual recovery to light perception or better on postoperative Day 1 increases the likelihood of having a long-term improvement in VA. Pars plana vitrectomy may be beneficial in such eyes if posterior segment abnormalities are noted.

› J Fr Ophtalmol. 2020 Jun;43(6):517-524. doi: 10.1016/j.jfo.2019.11.006. Epub 2020 Feb 26.

[Functional results and prognostic factors in open-globe ocular trauma with presenting visual acuity of no-light perception]

Conclusion: In the case of open globe trauma with no light perception on presentation, a functional recovery is possible if there is no irreversible anatomical damage.

Counselling

- In group
- Brutal counselling if poor prognosis
- Need for multiple surgery
- Be frank about prognosis
- Chances of Phthisis

Take home

- ***Thorough history and meticulous examination***
- Gentle B scan to avoid expulsion of intraocular contents
- CT scan in all cases of penetrating ocular injuries
- ***High index of suspicion - Rule out an elusive IOFB***
- Prognosis depends on site, size and chemical composition of IOFB

Take home

- Determine whether an IOFB is indeed present
- Determine whether the injury is high risk
- Discuss the condition and management options with the patient
- Wound repair and FB removal as primary or staged surgery

Thank you