

Basic Ophthalmology

Including Clinical Evaluation

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Edition



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Instruments in Ophthalmology

INTRODUCTION

Ophthalmology deals with delicate as well as precision surgery of a relatively small and highly specialized system. The instruments used in ophthalmic surgeries, hence, need to be precise, efficient, light weight and well controlled for a given surgical task.

Choice of Metal

Ophthalmology instruments underwent a big change with the advent of the operating microscope, with the need for lighter instruments with non-reflective surfaces is the necessity. So, titanium is the choice of metal, which is lighter than steel, and has a matte finish.

- Drawback-titanium alloys cannot maintain sharp edges.

Commonly used ophthalmic instruments can be grouped as under:

- I. Lid speculums
- II. Forceps
- III. Hooks and retractors
- IV. Needle holders
- V. Callipers
- VI. Knives and knife-needles and blades
- VII. Scissors
- VIII. Clamps
- IX. Other instruments
- X. Additional instruments for cataract surgery
- XI. Additional instruments for intraocular lens implantation
- XII. Additional instruments for glaucoma surgery
- XIII. Additional instruments for lid surgery
- XIV. Additional instruments for lacrimal sac and orbital surgery
- XV. Additional instruments for enucleation and evisceration
- XVI. Ophthalmic surgical devices

LID SPECULUM

Visualization is a big challenge in the field of ophthalmic surgeries. Speculums are essential for exposure and visualization, in both intraocular and extraocular surgeries. A variety of speculums are available, out of which the most used are:

1. Universal eye speculum
2. Guarded eye speculum
3. Wire speculum

1. Universal Eye Speculum

Identification: As the name suggests, it can be used on either side. It has a spring and two limbs, and a screw to adjust the limbs. It is fixed to the eyelids in such a way that screw should face outward and forward.

Uses: It is used to separate both eyelids for good exposure of the eyeball mainly during extraocular operations, e.g.

- Pterygium excision
- Squint operation
- Evisceration and enucleation
- Debridement and cautery of corneal ulcer
- To give subconjunctival or sub-Tenon's injection
- Removal of corneal foreign body
- Removal of conjunctival cyst or mass
- During suture removal.

Drawbacks:

1. Upper eyelashes causes obstruction in the field of operation.
2. Causes rise in intraocular pressure (IOP) during operation.

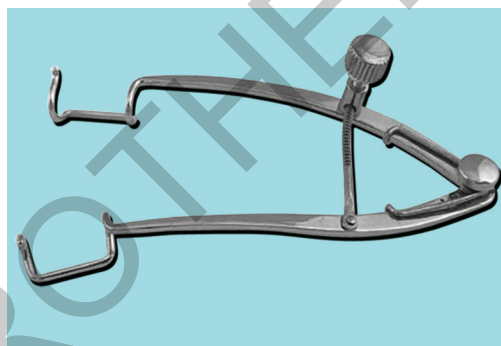
2. Guarded Eye Speculum

Identification: As the name reflects, the upper limb of the speculum is having a guard plate which keeps the eyelashes of the upper lid away from the field of operation. So, two instruments are required.

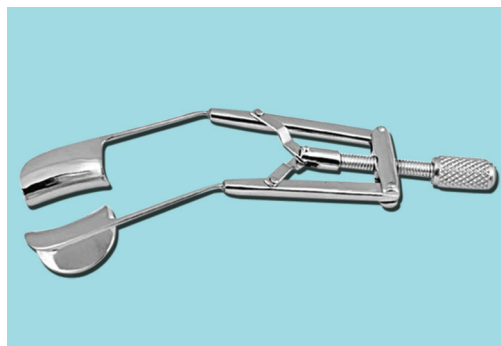
Uses: It is especially useful in squint operation in children and in pterygium operation.

Disadvantages

- Operating field is reduced
- It is heavier, hence gives more pressure on the globe.



Universal eye speculum



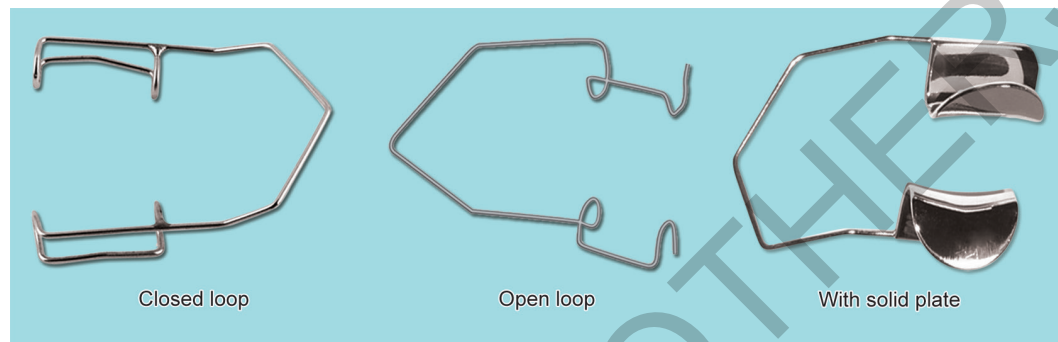
Guarded eye speculum

3. Wire Speculum

Identification: It is made up of a stainless steel wire and there is no screw. It is of universal type.

It is very light and hence gives little pressure on the eyeball.

Uses: It can be used safely during intraocular operations as well as extraocular operation.



Wire speculum

FORCEPS

Artery Forceps (Hemostat)

Identification: This is a medium-sized, fully serrated forceps with catch. It may be straight or curved. The curved forceps are used more frequently.

Uses:

- To hold lid stitches and superior rectus stitch, and then to fix the suture ends with head towel.
- To crush lateral canthus in lateral canthotomy.
- For hemostasis during dacryocystorhinotomy (DCR) or dacryocystectomy (DCT), especially if the angular vein is damaged.
- Fasanella-Servat operation in ptosis (to clamp conjunctiva, tarsal plate, Muller's muscle, and levator muscle).
- To hold muscle stump during enucleation.
- To make irrigating cystitome from a 26-gauge needle.
- To hold whole lacrimal sac prior to excision in DCT.



Artery forceps (hemostat)

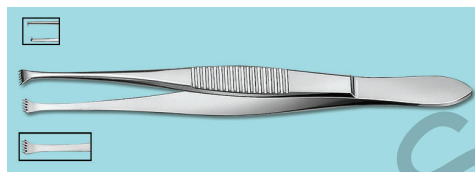
Fixation Forceps (Eyeball Fixation Forceps)

Identification: It is a medium size forceps with 2:3 teeth (maybe 3:4) at its tip.

Method: The conjunctiva and episcleral tissue are firmly held at 6 o'clock position within 3–4 mm of limbus with left hand. It may be used at other part around the limbus (e.g., 3 o'clock, 9 o'clock, etc.).

Uses:

- To fix the eyeball during operative procedures, such as cataract surgery, paracentesis, pterygium surgery, needling, etc.
- To catch superior rectus muscle, other tissues.
- To lift bulbar conjunctiva.
- Used in forced duction test (FDT) in case of squint.

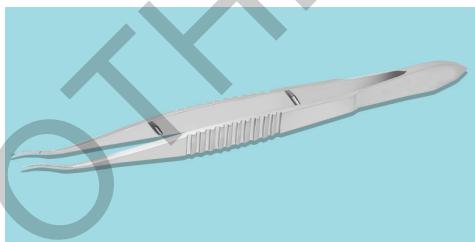


Fixation forceps

Corneoscleral Forceps (Lim's Forceps/ Colibri-Forceps)

Identification: This forceps has very fine teeth (1×2) at the tip.

Uses: To hold cornea or scleral edge for cataract surgery, glaucoma, corneal and/or scleral tear repair and keratoplasty.



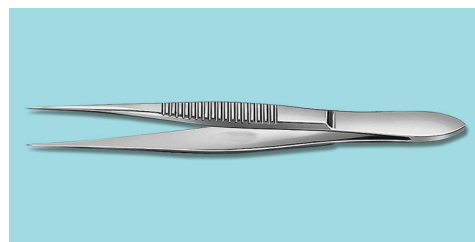
Lim's forceps

Plain Dissecting Forceps

Identification: It is an ordinary straight forceps without any teeth at its tips. The ends are little blunt, and on their inner surface, for better grip fine serrations are given.

Uses

- To hold the bulbar conjunctiva during its dissection.
- To hold episcleral tissue during its dissection.
- It is also used during suturing of conjunctiva.
- To hold conjunctiva during subconjunctival injection.
- It may be used to hold small sponge swabs.



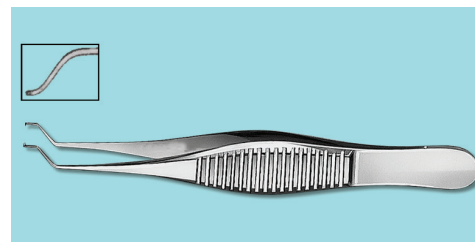
Plain dissecting forceps

Iris Forceps

Identification: It is a small light-weight forceps with 1:2 teeth on the inner side of its tips.

If the limbs are closed, teeth cannot be seen or felt. The shape of the forceps may be straight, curved or angular.

Uses: To grasp the iris tissue in various types of iridectomies.



Iris forceps

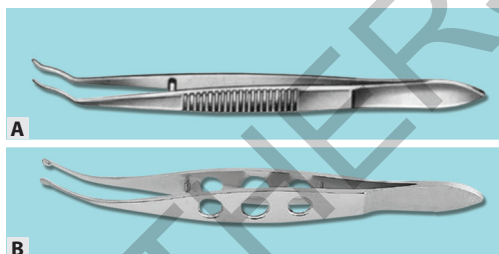
Intracapsular Forceps

Identification: There are two types of intracapsular forceps:

1. **Elschnig's:** It has no tooth, and is double curved with blunt tips.
2. **Arruga's:** It has also no tooth, and is single curved. Its tips are more blunt (knob-like) and have cups on their inner surfaces.

Uses:

- Intracapsular cataract extraction
- To remove capsular tags in extracapsular cataract extraction (ECCE)
- As a suture tier
- To hold suture ends during suture removal
- To remove clots from the anterior chamber as in clotted hyphema
- To remove caterpillar hair.



Intracapsular forceps: A. Elschnig's; B. Arruga's

Advantages of intracapsular forceps in cataract extraction:

- No assistant is required.
- It is cheap and quick procedure—useful for camp surgery.

Disadvantages:

- It is not preferred in intumescent or hypermature morgagnian cataract, where the capsule may be torn.
- It is a difficult procedure for the beginners.

St. Martin's Forceps

Identification: It is a straight small but stout forceps with 1:2 teeth at its fine tip.



St. Martin's forceps

Uses: Both instruments have similar uses:

- To hold the cornea and sclera lips during corneoscleral suturing after cataract surgery.
- It is also used in trabeculectomy operation.
- It may be used to catch the iris for iridectomy.

Superior Rectus Holding Forceps

Identification: It is a stout forceps with double curvature (S-shaped) at its ends. It has 1:2 teeth at its tip. Its curvature at the tip is to fit with the curvature of the globe.

Uses: It is used to catch the superior rectus muscle belly in cataract, glaucoma, keratoplasty or other surgery.



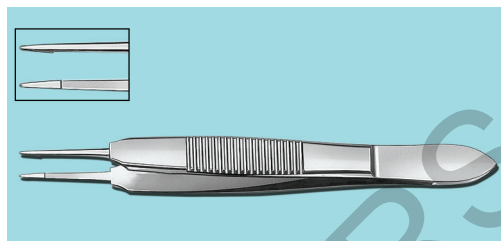
Superior rectus holding forceps

Suture Tier Forceps

Identification: It is a small straight or curved forceps with long fine limbs. It does not have any tooth at its tip. The tips are made stout by extra thick platform.

Uses:

- To hold the suture ends during tying the sutures after proper tightening.
- To hold the cut ends of the suture during its removal.
- May be used to catch the margin of incised conjunctiva during suturing.
- To remove caterpillar hair.

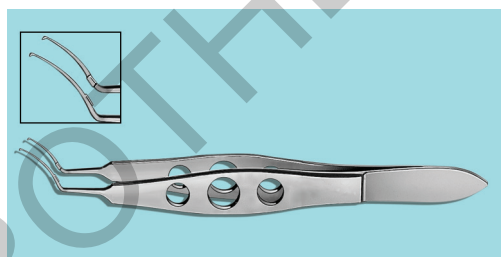


Suture tier forceps

Capsulorhexis Forceps (Utrata Forceps)

Identification: It is a fine long forceps with curved sharp tip without any tooth.

Uses: To perform continuous curvilinear capsulorhexis (CCC) in case of manual SICS or in phacoemulsification.



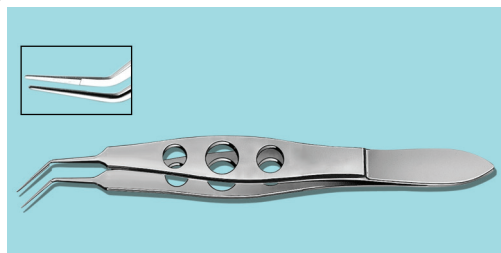
Capsulorhexis forceps (Utrata)

McPherson's Forceps

Identification: It is a fine medium-size toothless forceps with an angulation at about 7–8 mm from its tip.

Uses:

- It is used to hold the intraocular lens during its placement in the posterior chamber.
- It is used to catch and remove the loose anterior capsule after completion of capsulotomy.
- It may be used as a suture tier during suturing with 10-0 nylon.



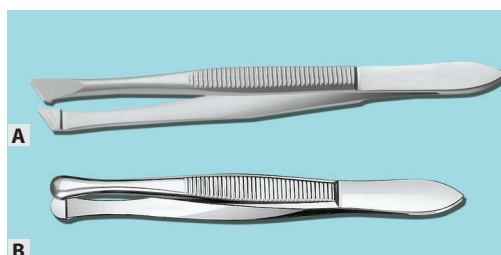
McPherson's forceps

Epilation Forceps (Cilia Forceps)

Identification: It is a small stout forceps with blunt flat ends. Near the tip, the inner surfaces are reinforced by extra-thick platform which may be rhomboidal or elliptical.

Uses:

- To remove the offending, misdirected eyelashes in trichiasis.
- To remove the involved eyelash in sty.



A. Rhomboidal tip; B. Elliptical tip

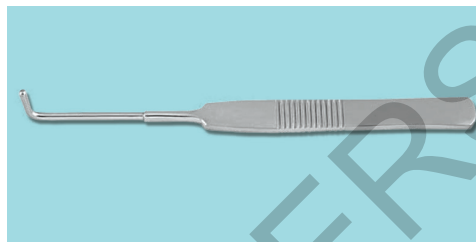
HOOKS AND RETRACTORS

Lens Expressor (Lens Hook)

Identification: It has a flat corrugated handle with a curved, olive-pointed blunt tip. The plane of the flatness of the handle is perpendicular to the plane of curvature of the limb.

Uses:

- During intracapsular extraction of the lens,
- In case of extracapsular cataract operation—to deliver the nucleus.
- Milking out the cortical materials with the knee or bend of the instrument in ECCE.
- *It may be used to hook the extraocular muscles.*
- *It may also be used as a fine tissue retractor, particularly in DCR operation.*



Lens expressor (hook)

Desmarre's Retractor

Identification: It is available in two sizes—small (pediatric) and large (adult).

Uses:

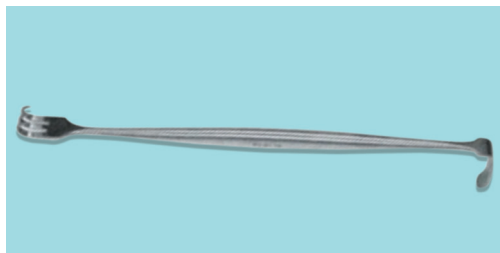
- To retract the lids during examination in cases of blepharospasm.
- Removal of foreign body and corneoscleral sutures.
- For examination of superior fornix by double eversion.



Desmarre retractor

Cat's Paw Lacrimal Wound Retractor

Identification: This is a fork like instrument used to retract skin during lid and lacrimal surgery.



Cats paw retractor

McNamara's Spoon (Lens Spatula)

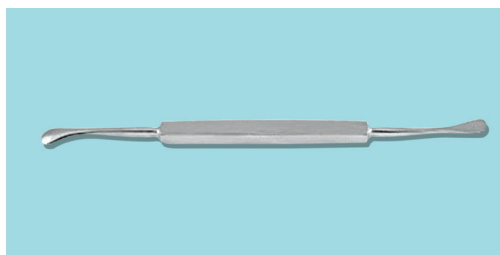
Identification: It is a straight long instrument with two flat spoons or spatula at the two ends. One of the spoons may be perforated at its center.

Uses:

In intracapsular cataract extraction

Advantages:

- No instrument is introduced into the anterior chamber, so endothelial damage is less.



Lens spatula

- Useful in cataract surgery—as this method works best in hypermature cataract (in cataract number of hypermature cataract is more).
- No assistant is needed.

Disadvantages:

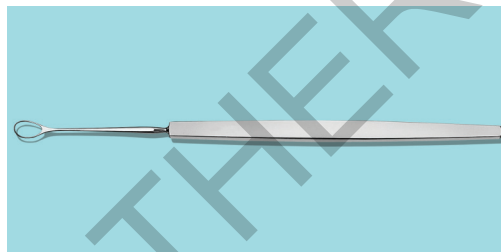
- Not a very good method for immature cataract.
- Chance of vitreous loss is more.
- A difficult technique.

Vectis (Wire Vectis)

Identification: It is a ring of wire (round or oval) at the end of an arrow limb, attached to a handle.

Uses:

- To remove a subluxated or dislocated lens.
- To deliver the nucleus in ECCE and SICS with irrigating vectis.



Wire vectis

Iris Repositor

Identification: It is an elongated “S” or “Z”-shaped instrument with a stout handle and two long narrow flattened extremities.

Uses:

- To reposit the iris after nucleus delivery in ECCE.
- To reposit the iris after iridectomy.
- To retract the iris during cryoprobe application over the anterior surface of the lens in ICCE.
- To bring air from posterior chamber to anterior chamber during cataract surgery or endothelial keratoplasty.
- To break the adhesions in synechiae (synechiolysis).
- To bring back the folded conjunctiva to cover the wound.
- Lamellar dissection of the cornea in lamellar keratoplasty



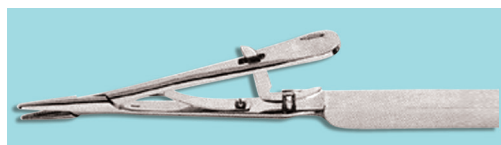
Iris reposer

NEEDLE HOLDERS

Silcock's Needle Holder

Identification: This stout instrument has two limbs (one short and one long) and a catch. The short limb has a concave impression at its end for giving pressure with thumb.

Uses: This is to hold the needle, and an upward stroke with thumb on short limb will automatically release the needle.

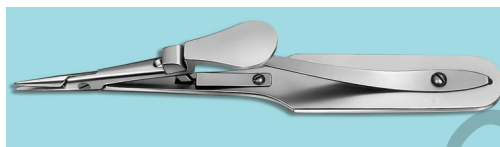


Silcock's needle holder

Arruga's Needle Holder

Identification: This stout instrument also has two limbs and a catch similar to Silcock's type.

Uses: It is used to hold the needle (larger needles).



Arruga's needle holder

CALLIPERS

Calliper (Castroviejo's)

Identification: It is a measuring calliper in which the measurement (in mm) is adjusted by spring action of a screw. The measuring ends are pointed like a compass, and the scale is fixed to the opposite end.

Methods: The exact measurement is taken by adjusting the spring action of the screw which is indicated by the pointed end on the scale.



Calliper

Uses:

- To measure the size of the cornea, as in buphthalmos, congenital hereditary endothelial dystrophy (CHED), megalocornea, microcornea, etc.
- To use in various surgeries, e.g. Phacoemulsification, trabeculectomy, squint operation, keratoplasty, tosis surgery, foreign body removal.
- To measure white-to-white diameter in phakic IOL or in case of ACIOL implantation.
- To measure the distance from the limbus for intravitreal injections.
- To measure the length for any purpose.

KNIVES AND KNIFE-NEEDLES AND BLADES

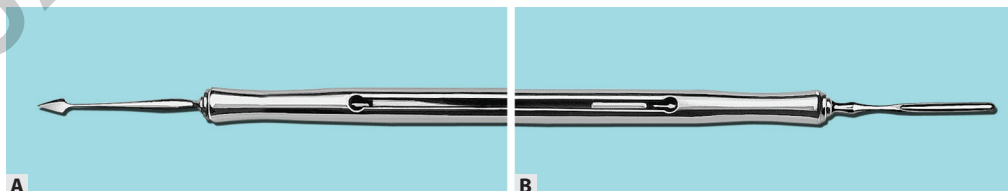
Foreign Body Spud and Needle

Identification: The spud has a straight narrow limb with blunt tip with a handle. One surface of the limb is flat and the other is convex.

The needle is tiny scoop with sharp pointed tip on a narrow limb with a handle. These two instruments may be available with one handle—one on either end.

Uses:

- The spud is used to remove the superficial corneal foreign body.
- The needle is used to remove the embedded foreign body from the cornea



A. Foreign body spud; B. Foreign body needle.

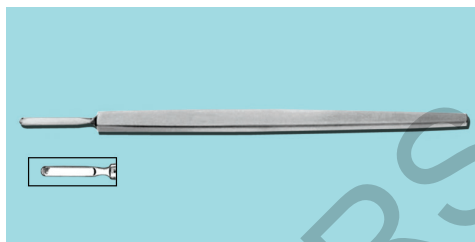
Tooke's Knife (Sclerocorneal Splitter)

Identification: It is a short, flat blade with semicircular cutting edge at its tip. It is beveled on both sides at its distal end. It is attached to a stout handle with short neck.

Note: Rougine has a long neck, the blade is more flat and beveled on one side.

Uses:

- For splitting the sclerocorneal junction during trephining operation in glaucoma.
- Used to clear the sclerocorneal junction or episcleral tissue in cataract or trabeculectomy.
- May be used for lamellar dissection of the sclera.



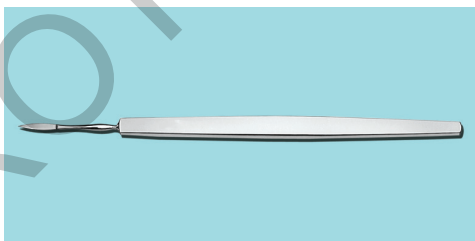
Tooke's knife

Beer's Knife

Identification: It is a large triangular knife with a sharp pointing cutting edge.

Uses:

- It is used to give incision on palpebral conjunctival side of the chalazion after fixing it with forceps.
- Beer's knife may be used to give incision over skin in any lid surgery.



Beer's knife

Side-Port Blade

Identification: It has a thin, long straight blade, at the end of a neck and attached to a polycarbonate handle. Sometimes, it has got 15° angulation. The maximum width of the blade is to pass a 20 G needle.

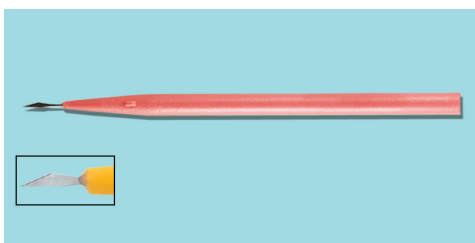
It is also available as a disposable blade in pre-sterile pack which may be reused.

Uses:

To make the side-port (to enter into the anterior chamber from the side of main incision) in cataract surgery.

Indication of side-port:

- For paracentesis
- To inject viscoelastic substance
- To inject trypan blue dye



Side-port blade (15 degrees)

- To clean subincisional lens cortex by irrigation aspiration cannula
- To manipulate second instrument (like phaco-chopper, Sinsky hook, etc.) in case of phacoemulsification

Crescent Knife

Identification: It is blunt tipped with beveled up end, 45° bend having cut-splitting action at tip and both sides. Its size ranges from 1.0 mm to 2.6 mm.

Use: Used for making tunnel incision or self-sealing valve incision in manual SICS in phacoemulsification and trabeculectomy.

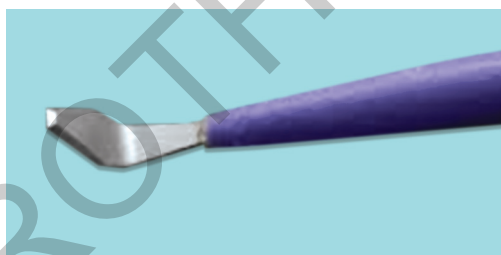


Crescent knife

Enlarger Keratome

Identification: It is a rectangle shaped with 45° angulation and blunt tip. It comes in sizes of 4.1 mm, 5.1 mm and 5.5 mm.

Use: To enlarge the incision during nucleus delivery in SICS.



Enlarger keratome

Lacrimal Sac Dissector and Curette

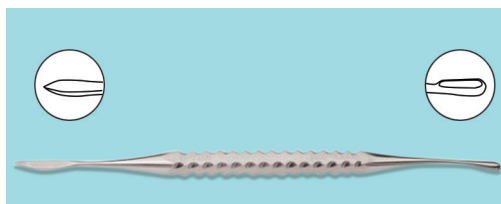
It has one blunt end tip dissector and other end used for curettage in lacrimal sac surgery.

Rougine

Identification: It is rectangular blade attached by a narrow neck to a corrugated handle. The blade is sharp at its distal end which is beveled on one surface, the other surface being plane. It is basically a small periosteal elevator.

Uses:

- To dissect and disinsert the medial palpebral ligament to find out cleavage between lacrimal sac and the lacrimal fossa.
- Dissection of the lacrimal sac from the medial wall and the floor of the lacrimal fossa, by separating the periosteal tissue surrounding the sac.
- It is used both in DCT and DCR operation.



Lacrimal sac dissector and curette



Rougine

Scalpel Handle (Bard-Parker Handle)

Identification: It is a flat handle with a short grooved neck. Handle No. 3 is used in ophthalmic surgeries. The blades are fitted with the neck No. 11 or No. 15 (No. 11 is triangular blade and No. 15 has curved elliptical tip).

Uses

- **Ab externo** corneoscleral section for cataract surgery.
- Trabeculectomy operation.
- Skin incision as in DCR, ptosis or other lid surgeries.
- To dissect the pterygium head from the cornea.
- To give incision in chalazion operation.
- For suture removal after cataract operation or keratoplasty.

Advantages in cataract operation

- It is a “guarded” section. As there is slow release of aqueous, the chance of quick decompression of the globe is almost nil.
- It is “stepped”, i.e., biplanar or triplanar incision—so wound security is better.
- Easier for the beginners.

Disadvantages

- Conjunctival flap is usually necessary before giving section.
- It is time-consuming.



Scalpel handle and blades

Cystitome or Capsulotome

Identification: It is a needle knife made by bending the disposable 26G or 30G hypodermic needle with tip sharp on both edges.

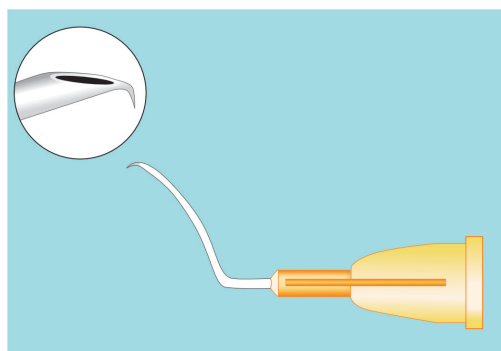
Use: Anterior capsulotomy or capsulorrhexis is performed during ECCE.

Blade Breaker

Identification: It is an instrument to break the razor blade. It is of medium size, with two jaw-like plates at its tip to catch the razor blade firmly. At least eight blade fragments can be made from a single razor blade.

Advantages

- It is cheaper than any other knife-blade.
- It is sharper than No. “11” or No. “15” blade.



Cystitome or capsulotome

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Renu Jogi obtained her MBBS degree from Christian Medical College, Vellore, Tamil Nadu, and MS degree from Devi Ahilya University, Indore, Madhya Pradesh, India. She was Ex-Associate Professor in Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh, and Pandit Jawaharlal Nehru Memorial Medical College, Raipur, Chhattisgarh. She has vast experience and knowledge in the field of ophthalmology. She has presented the material in a lucid and easily understandable language as per the requirements of the readers.



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