Thirty Years Experience with Shunt Procedures (Setons)

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Introduction

- This is BY NO MEANS an *Evidence Based,* nor is it a *Controlled* Study!!
- This merely is a personal impression based on over 50 glaucoma shunt procedures performed since the early 1980s

Introduction

- Setons are synthetic devices meant to maintain a patent drainage fistula.

Introduction

- In the past Millennium, setons used a silastic tube with an internal diameter of 0.3 mm to drain aqueous from the AC to a remote reservoir.

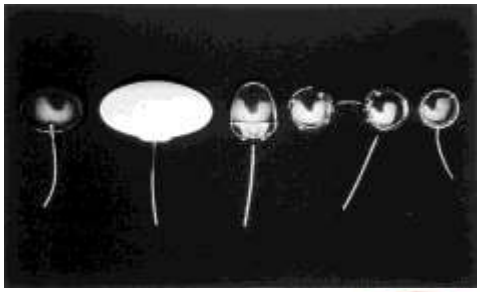
Introduction

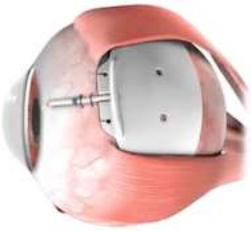
- The idea developed by **Molteno** in 1969 was to carry the aqueous from the vicinities of the limbus to a wider area close to the equator.

Introduction

- This reservoir was kept open by one or more acrylic plates (Molteno, Krupin-Denver, Bearveldt…etc)
- Schocket used an encircling #20 silicone band for a reservoir.

Molteno and Bearveldt Shunts





Schocket Tube Shunt

.Schocket Tube Shunt

- Anterior Chamber Tube Shunt To Encircling Band (ACTSEB)
- A silicone or silastic tube is extended from the anterior chamber to a 360° encircling silicone band, as used in retinal detachment repair, which functioned in developing the reservoir for aqueous drainage.

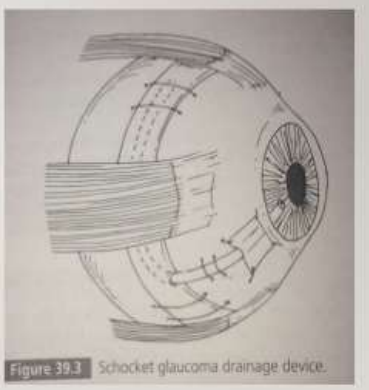


Figure 39.3 Schocket glaucoma drainage device.

Schocket Tube Shunt

- Several surgical modifications were introduced to avoid early post-operative hypotony and flat AC.
- Either a 2 step operation was performed where the tube was left outside the AC. Then 6 weeks later the tube was introduced into the AC.

Schocket Tube Shunt

- Or a suture (absorbable /non-absorbable) was used to ligate the tube for 4-6 weeks.

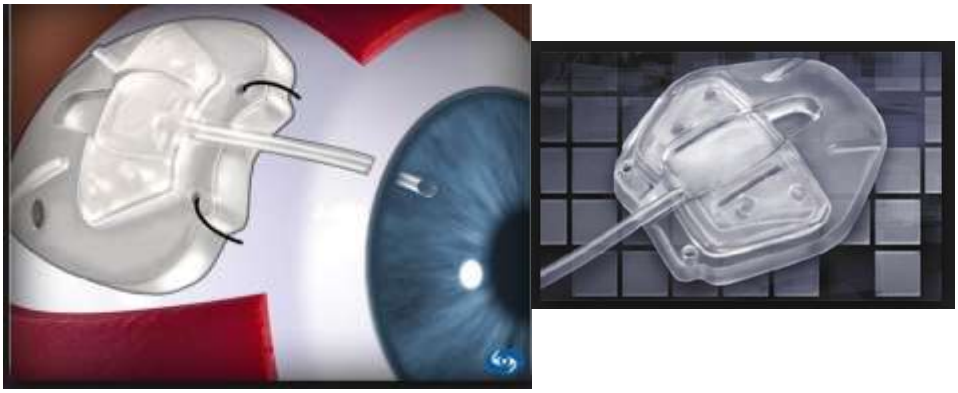
The idea was to delay aqueous outflow until a fibrous capsule develops around the reservoir to check the outflow.

Schocket Tube Shunt

The irony about this concept was that it tried to utilize the **main cause of failure** of the procedure to make it succeed !!

Ahmed Valve

- Then came the Ahmed Valve.
- The basic difference was the presence of a valve at the tube-reservoir junction.
- This valve opened only to a pressure more than 7 mm Hg.
- The aim was to prevent early post-operative hypotony and/or flat AC.



My personal experience is confined to 2 particular devices :

- In the 80s I implanted the ***Schocket*** device.
- A decade later I switched to the ***Ahmed*** valve.

Personal Impression and reasons for abandoning these procedures:

1. Lengthy procedure.
2. Extensive dissection of conjunctiva and hence extensive fibrosis.
3. Disturbance of EOM balance.
4. Tube complications.

Tube Complications:

1. **Inside AC :**
   - Migration forwards or backwards
   - Iris rubbing
   - Obstruction of internal opening
   - Corneal endothelial touch
2. **Outside AC:** Extrusion, erosion, exposure.

Myth

Then comes the greatest **MYTH** of all !!

The concept of a **triphasic IOP curve**:

1. At first low IOP (free outflow)
2. Followed by a "**hypertensive phase**" of elevated IOP (encapsulation of reservoir)
3. Then the final phase of steady controlled IOP due to percolation of aqueous through the fibrous capsule??!!

Hypertensive Phase

- Hypertensive Phase is a period of elevated IOP that occurs in the first 3 months after surgery.
- Encapsulation of the reservoir is a constant event.
- The 2 step techniques counted on this.!

Hypertensive Phase

- Demanding or expecting that the fibrous tissue will behave according to our will is not sensible.
- We want it to proliferate at first to avoid hypotony, then after reaching a reasonable IOP we want it to stop proliferation.

Hypertensive Phase

- Attempts to control fibrous encapsulation of the reservoir (**MMC, Supratenon placement, 2 step operation, steroids**….etc) are usually useless.
- Attempts to dissect the fibrous capsule with or without antimetabolites usually fail.
- Too much dissection and disturbance of EOM and Tenon.
- Too much antimetabolite usage.
- Fibrous tissue always regrows.

In my experience with the Schocket and Ahmed valves, those patients who escaped the early complications always ended up with a thick fibrous capsule around the reservoir and re-elevation of the IOP.

To cover up for the failure we had to resume the anti-glaucoma medication and to give it a nick-name "***qualified success***" !!

When this also failed, cyclo-destructive procedures were the last resort.

MIGS

As we stepped into the Third Millennium

a new concept evolved: **MIGS**

- Devices became smaller.
- Manipulations became less extensive.

MIGS

- Newer procedures can be divided into 2 main categories:

1. Ab-externo procedures.
2. Ab-interno procedures.

Ab-Externo Procedures

The Ex-Press mini glaucoma shunt:

- 2.4 to 3mm length.
- 50 – 200 micron lumen.
- 400 micron external diameter.
- MRI compatible stainless steel.

Ex-PRESS® Shunt Model R-50

Beveled tip for easy insertion

External lumen	400µm
Internal lumen size	**50µm**
Device length	2.96 mm
Tip shape	Beveled
Back plate shape	Uniform
USA Ordering Info (SKU)	R-50 PL-40053

Ex-PRESS® Shunt Model P 50/200

Vertical Channel for Posterior Flow

External lumen	400µm
Internal lumen size	**50µm / 200µm**
Device length	2.64 mm
Tip shape	Decreased bevel angle
Back plate shape	Vertical channel
USA Ordering Info (SKU)	P-50 PL-47053 P-200 PL-47203

Ex-PRESS™ R

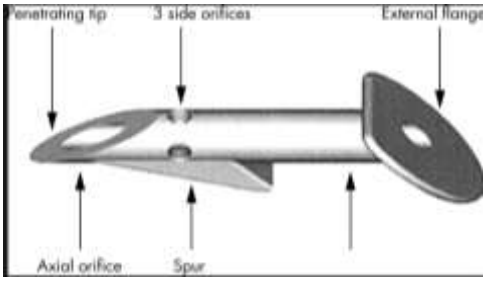
Pointed tip for easy insertion

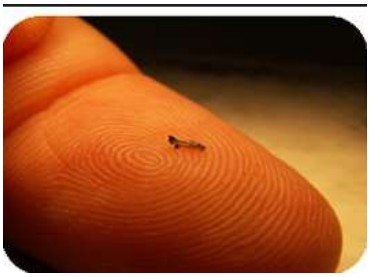
- Length: 2.96 mm
- Back plate shape: uniform
- Lumen size: 50µm

Ex-PRESS™ X

Used for excessive flow & complex cases

- Length: 2.42 mm
- Tip shape: round & short
- Back plate shape: split
- Available in various lumen sizes





Ab-Externo Procedures

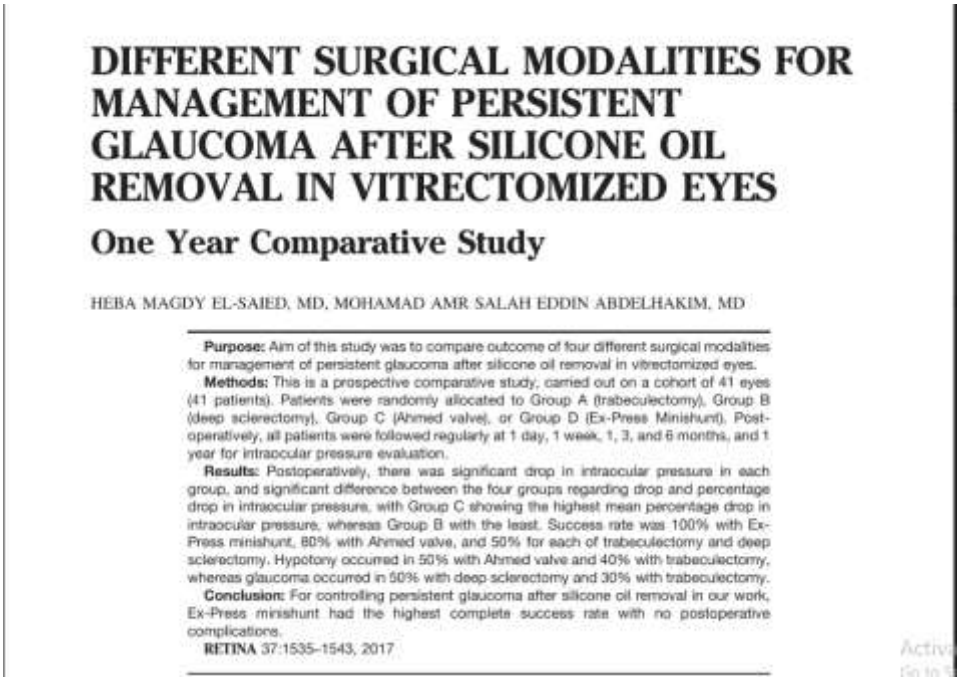
- At first it was implanted subconjunctival but this led to hypotony and flat AC.

(Similar to the old “Schei” procedure)

- When the procedure was modified and the tube was inserted under a scleral flap complications became much less.

Ab-Externo Procedures

- A study was carried out in our department.
- Published in “Retina” journal 2017.
- Out of 4 different procedures the XPress mini-shunt had the highest success rate and least complications.



DIFFERENT SURGICAL MODALITIES FOR MANAGEMENT OF PERSISTENT GLAUCOMA AFTER SILICONE OIL REMOVAL IN VITRECTOMIZED EYES

One Year Comparative Study

HEBA MAGDY EL-SAIED, MD, MOHAMAD AMR SALAH EDDIN ABDELHAKIM, MD

Purpose: Aim of this study was to compare outcome of four different surgical modalities for management of persistent glaucoma after silicone oil removal in vitrectomized eyes.

Methods: This is a prospective comparative study, carried out on a cohort of 41 eyes (41 patients). Patients were randomly allocated to Group A (trabeculectomy), Group B (deep sclerectomy), Group C (Ahmed valve), or Group D (Ex-Press Minishunt). Postoperatively, all patients were followed regularly at 1 day, 1 week, 1, 3, and 6 months, and 1 year for intraocular pressure evaluation.

Results: Postoperatively, there was significant drop in intraocular pressure in each group, and significant difference between the four groups regarding drop and percentage drop in intraocular pressure, with Group C showing the highest mean percentage drop in intraocular pressure, whereas Group B with the least. Success rate was 100% with Ex-Press minishunt, 80% with Ahmed valve, and 50% for each of trabeculectomy and deep sclerectomy. Hypotony occurred in 50% with Ahmed valve and 40% with trabeculectomy, whereas glaucoma occurred in 50% with deep sclerectomy and 30% with trabeculectomy.

Conclusion: For controlling persistent glaucoma after silicone oil removal in our work, Ex-Press minishunt had the highest complete success rate with no postoperative complications.

RETINA 37:1535–1543, 2017

Ab-Externo Procedures

The **InnFocus Microshunt** is another device belonging to the Ab-Externo group and is implanted under a scleral flap 1x1 mm., with or without MMC.

Ab-Externo Procedures

- Ab-externo implants are similar to trabeculectomy in that conjunctival dissection and a scleral flap are performed.
- These implants address the problem of closure of the sclerotomy.

Ab-Externo Procedures

- However the main cause of failure of trabeculectomy is the episcleral fibrous proliferation.
- This seals the scleral flap or encapsulates the bleb.
- Ab-externo procedures cannot solve this problem except by MMC, which is not different from trabeculectomy

Ab-Interno Shunts

- **iStent** from the AC to Schlemm's canal lumen.
- **XEN gel implant** from the AC to the subconjunctival space.
- **CyPass microstent** from the AC to the suprachoroidal space.
- **MicroOptx Brown Glaucoma Implant** from the AC to the tear film !??

Ab-Interno Shunts

- Ab-interno implants are introduced through a clear corneal incision 180 degrees from the site of implantation.
- The conjunctiva and episclera at the site of filteration are not disturbed.

Ab-Interno Shunts

- The concept of the **iStent** is most physiological.
- It by-passes the main site of aqueous outflow resistance which is the TM and inner wall of SC.
- The procedure itself needs high skill.
- Successful placement of the stent in the lumen of SC is difficult to verify.

  (a drop of blood or a stream of fluid)
- The stent is microscopic in size and can be easily occluded.

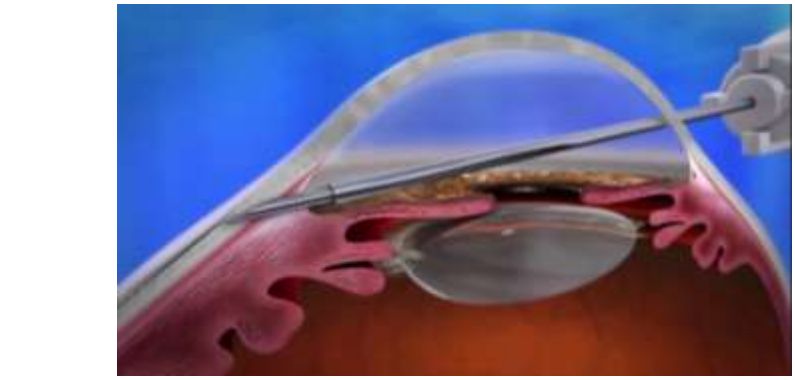
- The iStent cannot be inserted in eyes with closed angles or abnormal angles.
- It cannot be used in case of elevated episcleral venous pressure.

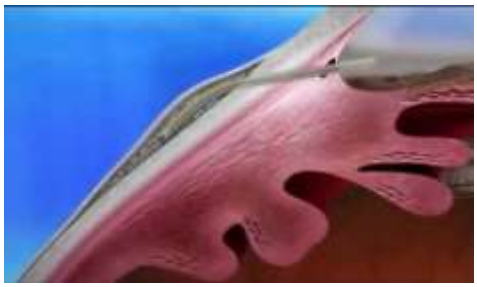
- Moreover the iStent is mainly indicated in combination with Cataract Surgery or in Pseudo-phakic eyes to allow enough space for visualization and manipulation.

- The iStent Inject (Model G2) and the Hydrus Microstent (made of nickel-titanium alloy) are other models of tubes shunting aqueous from the AC to Schlemm's canal.

Ab-Interno Shunts

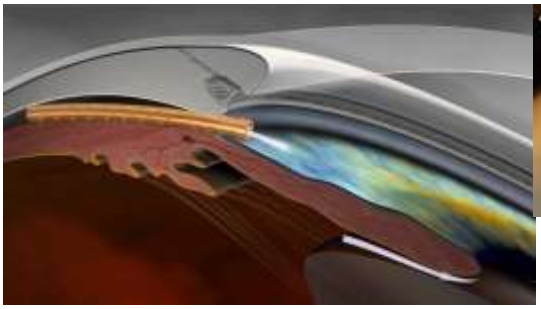
- The **XEN** implant is a soft gel tube from the AC to the subconjunctival space.
- Here, too is a full thickness scleral shunt with all the drawbacks of full thickness procedures.

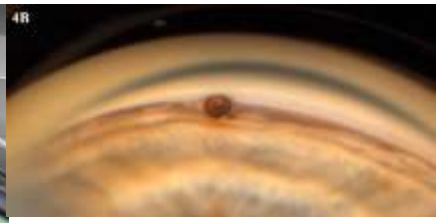




Ab-Interno Shunts

- The **CyPass** microstent connects the AC to the suprachoroidal space.
- The concept seemed intriguing.
- Unfortunately the implant induced progressive corneal endothelial cell loss and the manufacturer "Alcon" had to withdraw it from the global market in 2018 in spite of the fact that it had received FDA approval?!





- The **MINIject** and the **iStent-Supra (G3)** are more recent supraciliary shunts that may have a better chance than the **CyPass**.

- The **MicroOptx Brown Glaucoma Implant** is still in the stage of bench research and animal trials.
- Infection is the nightmare of such devices but this new device is expected to over-come such risk ???

Conclusion

- After 40 years of performing various glaucoma procedures from the days of iris-inclusion and Schei procedures to the subscleral trabeculectomy and deep sclerectomy, and after 30 years of trying shunts and stents, I have become more and more convinced that:
- ***If a sound and neatly performed subscleral trabeculectomy (+/- MMC) does not work from the first time nothing else will*** **!!**

THANK YOU