A big disadvantage that trabeculectomy/ tunnel trabeculectomies have is the need for conjunctival peritomy. Surgical sub-conjunctival dissection heals with scarring and sub-conjunctival fibrosis which can lead to increased risk for failure of filtration. Creation of flap takes time and needs careful dissection. Flaps may have complications such as tearing, laceration, buttonholing, variability in thickness and suture related complications. Tunnel trabeculectomies involve creation of a limbal/ fornix based conjunctival flap followed by a triplanar self sealing tunnel incision. A scleral groove 1-2 mm behind the limbus is tunnelled into clear corneal stroma with a crescent knife. Anterior chamber (AC) is entered with a keratome and posterior lip of the corneal incision punched upto 0.5 to 1 mm of the flap margin. A peripheral iridectomy (PI) is made and conjunctival flap closed. Creating a flap/ tunnel requires clearing the site of conjunctiva and Tenon's for good exposure. This provokes scarring at exactly the site of filtration where scarring should be avoided at all costs, viz directly above the flap/ tunnel. All the above procedures where a conjunctival flap is raised are therefore associated with greater risk of scar induced failure. Also, in all of these, the creation of the flap/ tunnel is multi-step, the scleral flap/ tunnel is triplanar and the PI increases post-operative inflammation.
**Stab Incision Glaucoma Surgery** or SIGS is a new guarded filtration procedure that one of us (Soosan Jacob) described which aims at getting rid of many of these disadvantages, while simultaneously making surgery easier and faster. A 2.8 mm bevel-up keratome creates a sclero-corneal tunnel in a single step. The tunnel is then intentionally compromised by punching the posterior corneal lip.

The technique consists of first making the AC firm by instilling viscoelastic with a 26 G needle introduced at the limbus. A site with mobile conjunctiva is selected and the conjunctiva slid forwards with a blunt instrument. The keratome is used to make a stab incision through the conjunctiva directly into lamellar sclera starting about 2.5 mm behind the limbus and avoiding major blood vessels. While holding the globe firmly at the limbus, a superficial lamellar scleral tunnel is then dissected with careful side to side movements till the limbus. At the ideal plane of dissection, the blade is just visible through the conjunctiva. One mm of lamellar cornea is dissected into to enter the AC horizontally. Downwards pressure on the posterior corneal lip should be avoided while entering the AC to prevent a trapdoor hinging. The blade is then withdrawn gently in a single smooth movement without allowing aqueous leak through the incision. The entire tunnel is thus created in a single step with a single instrument. Viscoelastic is injected into the AC through the paracentesis/ SIGS tunnel. With the globe rotated downwards, a Kelly's Descemet's punch (1mm) is slid along the tunnel into the AC and the posterior lip of the corneal section engaged and punched. Additional punches are taken posteriorly in clear cornea till the limbus. The punch should face downwards while punching and the iris should be pushed away with viscoelastic. The AC is then gently irrigated through the tunnel to wash away excess viscoelastic and the punched and thereby compromised SIGS tunnel is checked for leakage by side port
irrigation. End point is free flow of fluid on irrigation. Additional punches towards the limbus are taken in case of inadequate leak. However it is not extended beyond the limbus to avoid excessive leak and post-operative shallow AC. A peripheral iridectomy (PI) need not be done in cases of open angle glaucoma. In cases with angle closure, peripheral anterior synechiae, shallow AC or a tendency to intra-operative iris prolapse into the SIGS tunnel, a basal PI is done by grasping the iris with non-toothed forceps and excising with Vannas scissors. The single, small, 2.8 mm conjunctival cut is then sutured with a running or figure-of-eight suture. BSS is injected through the side-port to cause physiological hydrostatic ballooning of the bleb (Fig 1A-J, 2 A-C). Slight bleeding that might occur during keratome pass for SIGS tunnel construction does not interfere with surgery and gets washed away on BSS irrigation and bleb formation.

**Fig 1 A-** The conjunctiva is slid forwards and a 2.8 mm keratome used to create a single step biplanar entry into the anterior chamber. **B-** The blade should be just visible through the conjunctiva to avoid premature entry into angle of AC. A scleral-corneal tunnel is created by dissecting into 1 mm clear cornea. **C-** A small pledget soaked in MMC 0.02% is placed within the scleral tunnel for 2 minutes followed by a thorough rinse. **D-** The blade is then reintroduced into the tunnel and the AC is entered to the full horizontal extent of the blade.
E- A Kelly's Descemet's punch (1mm) punches the posterior corneal lip upto the limbus, thereby intentionally compromising the tunnel. F- The punched out tissue is seen kept on the cornea. More punches are taken till the limbus as seen from the clear cornea above. G- Viscoelastic is washed away. H- Adequate leakage is checked for by irrigating through the side port. I- Conjunctiva is sutured with a single figure of eight 10-0 nylon suture with knot buried. J- Bleb is formed by more physiological hydrostatic ballooning from side port irrigation.

SIGS can also be combined with Mitomycin-C (MMC) by dissecting the tunnel into lamellar cornea, applying intra-tunnel MMC, rinsing well and then entering the AC. Sub-conjunctival MMC is not required as there is no sub-conjunctival dissection. SIGS may also be combined easily with phaco by first making the SIGS stab incision, followed by phaco and IOL implantation. The SIGS tunnel is self-sealing before it being intentionally compromised, hence it does not interfere with phaco in any way. The posterior corneal lip of the tunnel is punched only after implanting the IOL and before removing viscoelastic. The SIGS tunnel should not intersect with phaco incisions.

Advantages of SIGS include complete elimination of sub-conjunctival dissection, thereby decreasing risk of failure from scarring. As the conjunctiva is slid forwards before entering the sclera, the single conjunctival incision is only 2.8 mm and is located well away from the scleral tunnel. Virgin conjunctiva is maximized for possible future surgeries. The scleral tunnel is biplanar and therefore less likely to seal than a triplanar incision. The ostium is not taken into sclera, hence a controlled leak is possible. This together with separated scleral and conjunctival entries decreases chances of post-operative shallow AC. Posteriorly directed flow is obtained with less chances of overhanging bleb. PI is not routinely done
except in indicated cases as the ostium is well away from the iris root. Post-operative inflammation is therefore less. Hydrostatic bleb elevation facilitates physiological expansion of sub-conjunctival drainage channels. Lack of scleral sutures decreases suture related complications as well as induced astigmatism. In the extreme event of an expulsive hemorrhage it is easier to rapidly close the SIGS tunnel. In case of any difficulty such as premature entry into angle of the AC (keeping the scleral portion of the tunnel shallow avoids this) or trapdoor hinging of the posterior corneal lip (avoided by avoiding posterior pressure on internal lip), it is easy to convert to conventional trabeculectomy by slightly enlarging the conjunctival incision, sweeping conjunctiva off the tunnel and making relaxing cuts on either side of the tunnel.

Fig 2: A- Arrow marks the ostium. B- Ostium seen on slit view. C- ASOCT along longitudinal axis shows the flap and the ostium.

Many more videos available in Youtube channel: Dr. Soosan Jacob