Understanding the Nuances of the Glued IOL

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Introduction

The glued IOL which was first described by us in Dec 2007, is a new concept aimed at fixing a PCIOL in eyes with no capsule. In this article, we aim to shed more light on this fascinating concept and also try to address some unanswered questions. The glued IOL technique (Fig 1 A- D) consists of making two partial thickness scleral flaps exactly 180 degrees apart followed by a sclerotomy with a 22 gauge needle 1mm from the limbus. A 25 gauge Microsurgical technology MST (USA) forceps passed through the sclerotomy grasps the IOL haptic which is then brought out onto the ocular surface (Fig 1 A). Tunnels are made at the edge of the flap with 26 Gauge needle (Fig 1 B) into which the two haptics are then tucked for additional stability (Fig 1 C). The scleral flaps are then glued back into place using biological glue.(Fig 1 D). The IOLs that can be used are the 3 piece foldable IOL's with slightly firm haptics or a non foldable IOL.

Fibrin glue

The glue that we use is a quick-acting surgical fibrin glue sealant derived from human blood plasma (Tisseel, Baxter, USA), with both hemostatic and adhesive properties. Fibrin glue is composed of two separate solutions of fibrinogen or Factor 1 and thrombin. Fibrinogen is activated by thrombin to form fibrin monomers. Activated Factor XIII polymerizes fibrin monomers to form a stable fibrin clot, thus mimicking the last stages of the clotting cascade. Aprotinin delays fibrinolysis, the process that leads to the breakdown of blood clots. The commercially available fibrin glue that we used is virus inactivated and is checked for viral antigen and antibodies with polymerase chain reaction; hence the chances of transmission of infection are very low.

Stability of the IOL haptic

As the flaps are manually created, the rough apposing surfaces of the flap and bed heal rapidly and firmly around the haptic, being helped by the fibrin glue early on. The major uncertainty here is the stability of the fibrin matrix in vivo. Numerous animal studies have shown that the fibrin glue is still present at 4 - 6 weeks. Because post-operative fibrosis starts early, the flaps become stuck secondary to fibrosis even prior to full degradation of the glue. The ensuing fibrosis acts tom a firm scaffold around the haptic which prevents movement along the long axis (Fig 2 A). To further make the IOL rock stable, we have started tucking the haptic tip into the scleral wall through a tunnel. This prevents all movement of the haptic along the transverse axis as well (Fig 2 B). The stability of the lens first comes through the tucking of the haptics in the scleral pocket created. The tissue glue then gives it extra stability and also seals the flap down. Externalization of the greater part of the haptics along its curvature stabilises the axial positioning of the IOL and thereby prevents any IOL tilt.

IOL memory and tilt

Another concern to be addressed is the change in the properties of the biomaterial when the haptics are placed in a stretched position in vivo. The 2 factors that contribute to the ability of IOL loops to maintain their original symmetrical configuration are loop rigidity, the

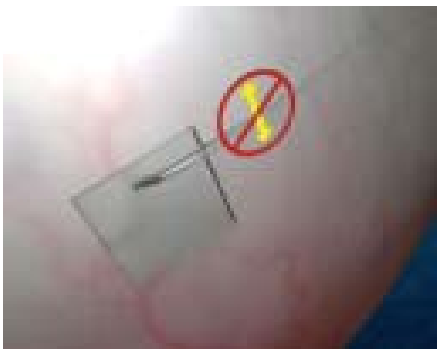
Figure 1:: Surgical technique of the glued IOL
A- IOL haptic grasped with a Microsurgical technology MST forceps (USA)

B- 26 gauge needle creates a scleral pocket at the edge of the flap

C- IOL haptic tucked into the scleral pocket

D- Fibrin glue applied under the scleral flaps

Figure 2: Stability of the IOL
2 A- Long axis movement is prevented by the tissue glue



2 B- Transverse axis movement is prevented by the scleral tuck

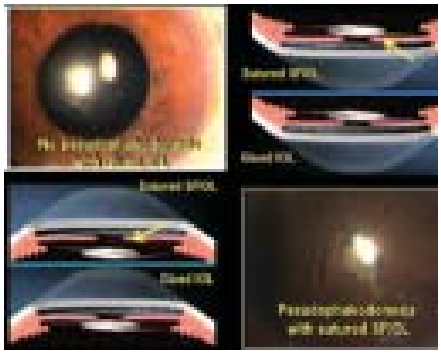


Figure 3: : Pseudophakodonesis absent in glued IOL whereas it is present in sutured scleral fixated IOL's

Figure 4: UGH syndrome present in sutured scleral fixated IOL's but not in glued IOL's

resistance of the haptic to external forces that act to bend the loops centrally- and loop memory-the ability of the loops to reexpand laterally to their original size and configuration. Loop rigidity is seen as the centrifugal force vector of the haptics which resists compression by the capsular bag in an in-the-bag IOL. Loop memory is responsible for the gently stretched haptics following the globe curvature and creating a centripetal force which, along with the intralamellar scleral tuck, stabilizes the IOL. These two concepts can be understood by compressing or stretching the haptics in vitro. Yet another issue to be addressed is IOL centration and tilt. We followed up both clinically and with anterior segment OCT. IOL centration was measured with dilated pupil on retroillumination slit lamp photographs processed with Matlab version 7.1. IOL tilt was assessed using the anterior segment OCT and also by assessing the change in the third and fourth purkinje images. Difference in the

topographic (Orbscan) and manifest refraction was also found to be constant in all eyes during the entire postoperative period, which was suggestive of minimal new IOL induced astigmatism. In our study, centration of the IOL was good with no detection of IOL tilt. Post-operative follow up anterior segment OCT also showed perfect scleral flap adhesion as early as day 1 which continued to be so at one week and one month. 2 weeks continuous immersion of the IOL with haptics on stretch in a water bath with BSS maintained at body temperature didn't show any change in measurements from pre to post immersion. Neither was there any change with drying after 2 weeks.

Pseudophakodonesis

We also did cadaver studies on glued IOL versus sutured scleral fixated IOL. We applied graded pressure using first a Mercury barometer and then known weights placed on both the IOLs. We saw that the glued IOL showed on par / better results as compared to the sutured SFIOL. Though we did see iridodonesis as in many in-the-bag IOLs, we noticed that there was a lack of pseudophakodonesis (Fig 3). The steady configuration of this IOL as compared to the sutured SFIOLwould result in less endophthalmodonesis and hence decreased complications such as post -op retinal detachment, cystoid macular edema etc.

IOL implantation in eyes that lack posterior capsular support has been accomplished in the past by using iris-fixated IOL, anterior chamber IOL and transscleral IOL fixation through the ciliary sulcus or pars plana. Surgical expertise, prolonged surgical time, suture-induced inflammation, suture degradation, and delayed IOL subluxation or dislocation due to broken suture are some of the limitations in sutured scleral-fixated IOL. It is also difficult and time-consuming, requiring minute and perfect adjustment of suture length and tension to ensure good centration of the scleral-fixated IOL. The other advantage of the glued IOL is that in case of intra operative capsular loss, one does not need not to have an entire inventory of special SFIOLs with eyelets, unlike with sutured SFIOLs. We expect less incidence of UGH syndrome with glued IOL as compared to sutured SFIOL (Fig 4). This is because, in the former the IOL is well stabilized and adherent to the scleral bed, thereby having decreased intra-ocular mobility whereas in the latter, there is increased possibilty of IOL movement or persistent rub of the haptic over the ciliary body.

Indications

Glued IOL can be done in all these situations as well as in other difficult situations. We have implanted multifocal glued IOL with both Rezoom, Restor and Tecnis IOLs. This makes it possible to offer the accommodative IOL advantage to even patients with an absent capsule. These IOLs cannot be implanted via any other mode including suturing. The modified prolene PVDF haptic in these IOLs helps in being more stiffer as well as having superior memory. Sutured scleral fixated IOLs in pediatric eyes have been known to be associated with problems. We have had very good results in multiple complicated pediatric glued IOL situations such as homocystinuria with subluxation, aniridia with cataractous subluxated lens, Weil Marchesani syndrome with microspherophakia and glaucoma etc. In dislocated posterior chamber PMMA IOL, the same IOL can be repositioned thereby reducing the need for further manipulation.

Conclusion

To sum up, even though our early results have been promising, we agree that long term follow up will be needed to disclose the safety and stability of the technique. Truth is an event, and only through experience can the veracity of a truth be verified.

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