Surgical Technique

# Modified sewing machine technique for iridodialysis repair, intraocular lens relocation, iris coloboma repair, Cionni ring fixation, and scleral-fixated intraocular lens

*Karamsetty Venkata Ravi Kumar*

The purpose of this study is to report the modification of sewing machine technique for iris dialysis repair (MSMT) and its usefulness in managing other conditions such as intraocular lens (IOL) subluxation, iris coloboma, Cionni ring for zonular dialysis, and for scleral-fixated IOL. MSMT was based on sewing machine principle using a prethreaded 26G/30G needle with prolene suture for minimally invasive iris dialysis repair in a closed chamber manner. So far, eight patients (trauma – 3, surgical complication – 5) underwent this procedure. This technique is further modified to extend its use for IOL relocation – 2, iris coloboma repair – 3, and Cionni ring fixation for zonular dialysis – 2, SFIOL – 5 patients. All 20 patients had good visual recovery and cosmetic outcome with minimal morbidity. To conclude, MSMT offers cost -effective, minimally invasive, easy to learn procedure with a potential to tackle several problems related with cataract surgery and iris defects, which even an average cataract surgeon can learn to perform when required. Further comparative studies with conventional techniques with large sample size are required to standardize this procedure.

**Key words:** Cionni ring, intraocular lens complications, intraocular lens relocation, iridodialysis repair, iris coloboma repair, modified sewing machine technique, scleral-fixated intraocular lens, sewing machine technique

**Video Available on:**
www.ijo.in

**Access this article online**

**Website:**
www.ijo.in

**DOI:**
10.4103/ijo.IJO_1320_17

**Quick Response Code:**

Iris dialysis can be congenital, spontaneous, traumatic, or iatrogenic, i.e., as a result of surgical complication. Spontaneous reattachment of the iris can occur with atropine instillation and bed rest. This is due to the mydriatic effect from atropine, absorption, and organization of fibrinous exudates in the hemorrhage and the reaction to the trauma.[1] A small dialysis can be left untreated. A large iris dialysis can lead to symptoms of photophobia, flashes of light, monocular diplopia, and poor cosmoses, and hence require surgical correction. The purpose of this study is to report the modification of sewing machine technique for iris dialysis repair (MSMT) and its usefulness in managing other conditions such as IOL subluxation, iris coloboma, Cionni ring for subluxated cataracts, and for scleral-fixated IOL.

SMT for iris dialysis repair was based on sewing machine principle of suture loop formation for stitching, using a prethreaded 26G long hypodermic needle with 10/0 prolene suture for minimally invasive iris dialysis repair in a closed chamber. This technique was developed by us independently and was first presented in 26th APACRS Singapore in 2013. It was also published by us in Delhi Journal of Ophthalmology 2014.[2]

Comprehensive Ophthalmologist, Anasuya Rao Eye Clinic, Vijayawada, Ex-C.M.O. Rotary Eye Hospital, Vuyyuru, Andhra Pradesh, India

Correspondence to: Dr. Karamsetty Venkata Ravi Kumar, Anasuya Rao Eye Clinic, 1-1-58, B R P Road, Islampet, Krishna District, Vijayawada - 520 001, Andhra Pradesh, India. E-mail: vravikumark@gmail.com

Manuscript received: 26.12.17; Revision accepted: 22.04.18

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The instruments and material required for the procedure are 23G microrhexis forceps, 15 No. BP blade, 20G MVR, 2.6-mm crescent, 9/0 or 10/0 prolene suture, 26G 1½ inch hypodermic needle, or 30G dental needle septoject (BF Mulholland Ltd. UK). The main steps of our original SMT for iris dialysis[2] are as follows [Video 1]:

- Retrograde threading of 10/0 prolene suture into 26G needle. Creation of partial thickness scleral tunnel parallel to and all along the iris dialysis (2 mm away from the limbus). Pupil constriction by pilocarpine injection through a side port made with 20G MVR blade 180° degree opposite to iris dialysis. Creation of suture loops all along the dialysis by passing prethreaded 26G needle with the suture through the root of iris dialysis and scleral tunnel from inside out. Cutting the loops of prolene and tying the adjacent free ends to each other so that the knots get buried into scleral tunnel. Finally, closure of conjunctiva using 10/o nylon or vicryl or using bipolar cautery [Fig. 1]. The step-wise intra- and postoperative pictures of iris dialysis repair using SMT are shown in Fig. 2.



**Cite this article as:** Ravi Kumar KV. Modified sewing machine technique for iridodialysis repair, intraocular lens relocation, iris coloboma repair, Cionni ring fixation, and scleral-fixated intraocular lens. Indian J Ophthalmol 2018;66:1169-76.

This technique was further modified using 30G 25-mm long dental needle (Septoject, BF Mulholland Ltd., UK) [Fig. 3] instead of 26G needle. The dental needle with scalpel tip design has better penetration with minimal trauma to tissue and suture can be threaded from both sides of the hub. After creating suture loops as described earlier, first free end of the suture is passed through the loops and tied with the second free end of suture so that only one knot is sufficient for entire iris dialysis repair. This one knot MSMT for iris dialysis repair was done in two patients [Fig. 4].

The MSMT was further used to repair the iris defects such as iris coloboma both congenital and acquired as a result of iatrogenic complication during surgery. In this procedure, we pass the prethreaded needle through one of the corneal side ports placed at 4 and 8 o' clock positions; bites are taken through the peripheral edges of iris coloboma near pupillary margin. The suture is passed through opposite corneal side port and held on by forceps. Now the needle is partially withdrawn and one more bite is taken through the adjacent colobomatous area and the suture is pulled to opposite side. The needle is withdrawn after cutting the suture loop; the suture is placed so that both freed ends of the suture are on the same side. A slip knot [Fig. 5] is tied by making four throws using the two free ends of the suture and pushed into the anterior chamber and tied so that coloboma is closed. Using microscissors, the suture is cut at the knot on the iris.

The MSMT technique can also be used for relocation of subluxated IOLs. A partial thickness scleral flap is created 2 mm × 2 mm away from the limbus as shown in the figure. The prethreaded suture needles is first passed through sclera via a partial thickness tunnel made 2 mm away from limbus two times to form two suture loops in AC. Then, optic of the subluxated IOL is held firm through the side port and the haptic is guided into the suture loops gently. The free ends of the suture are pulled from outside so that the haptic is pulled toward the scleral tunnel and knot is tied in the tunnel from outside [Fig. 6].

MSMT is also useful to tie the Cionni ring while operating subluxated cataracts or accidental zonular dialysis. Initially, the capsule is stabilized with capsule care after performing the capsulorhexis. Slow motion Phaco is done and if necessary anterior chamber maintainer is used to do the cortical wash. A partial thickness scleral tunnel is made 2 mm away from the limbus at the site of the zonular weakness [Fig. 7]. Prethreaded 30G needle is passed through the tunnel from outside to

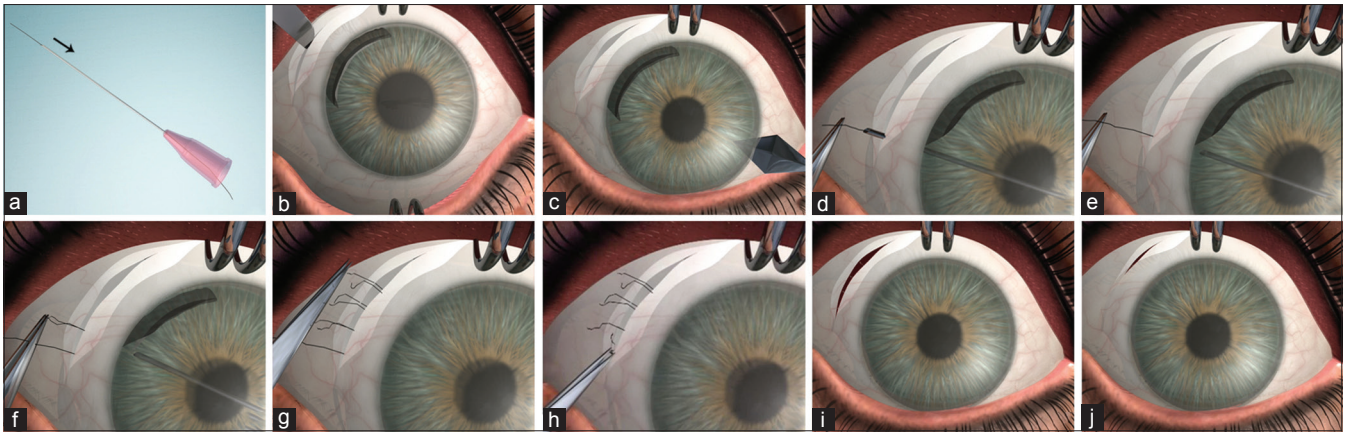


**Figure 1:** Diagrammatic representation of sewing machine technique for iris dialysis repair (a) Threading of 10/0 suture into 26G 1½ inch long hypodermic needle (b) Scleral tunnel parallel to iris dialysis (c) Creation of side port opposite to dialysis (d-f) Creation of Suture loops (g) cutting of suture loops (h) Tying of adjacent free ends (i) Burying of knots into scleral tunnel (j) conjunctival closure

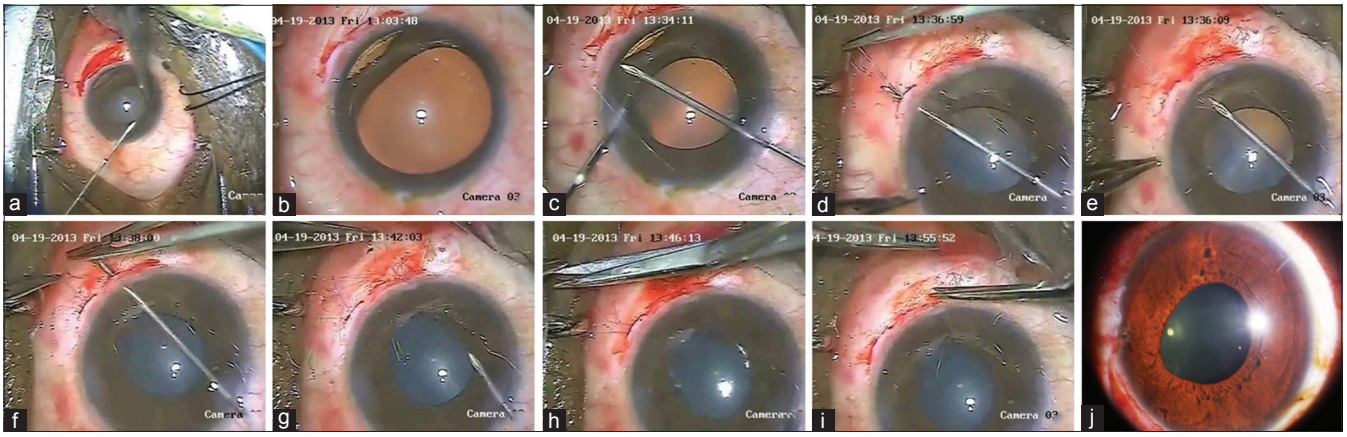


**Figure 2:** Intraoperative photos of SMT for iris dialysis repair (a) threading of suture into 26G needle (b) Scleral tunnel parallel to dialysis (c-g) creation of suture loops (h and i) cutting of suture loops, tying of adjacent free ends and burying knots into scleral tunnel (j) final appearance after iris-dialysis repair

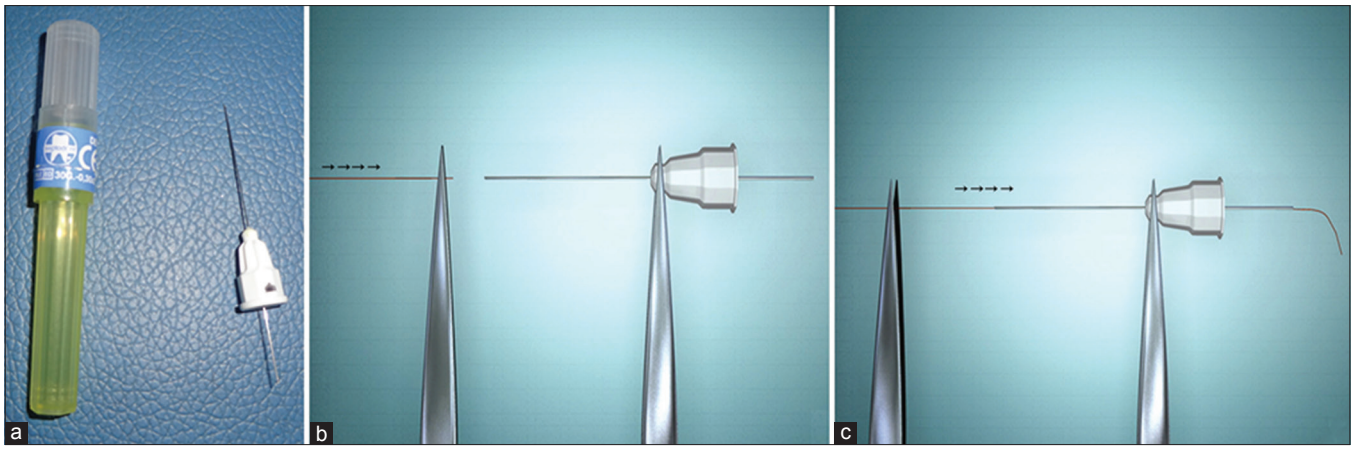

**Figure 3:** (a) Septoject 30G, 25-mm dental needle (BF Mulholland Ltd, UK.) Used for modified sewing machine technique (b and c) retrograde threading of 10/0 prolene suture into Septoject after cutting the suture needle using plain tying forceps

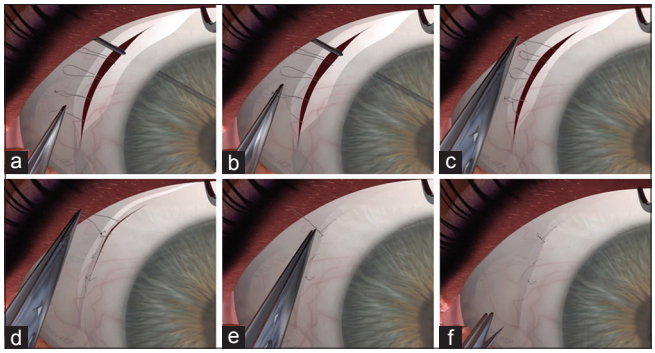

**Figure 4:** Diagrammatic representation of modified sewing machine technique for iris dialysis repair – one knot method (a) creation of suture loops parallel to iris dialysis (b) Passing the first free end through the suture loops (c) Pulling both free ends together to tighten the loops (d-f) tying both free ends and burying the knot into the scleral tunnel

inside, underneath the iris and above the capsular bag. The suture loop is pulled from the main phaco incision and needle is partially withdrawn, a second bite is taken in the tunnel and again the suture is pulled out. Now we have both free ends of the suture at the main incision with a suture loop at the tunnel. The eyelet of the Cionni ring is tied with both free ends of the suture and ring inserted into the bag. The suture loop outside the scleral tunnel is pulled, cut, and tied so that knot gets buried into the tunnel after stretching the capsular bag. A foldable IOL is implanted into the bag using injector.

Scleral-fixated IOL can also be done using MSMT in the manner described above by making two suture loops exactly 180° opposite to each other as shown in the Fig. 8. While managing a small zonular dialysis intraoperatively, a single haptic can also fixated to sclera in the same manner using a three-piece foldable IOL making the job easier. So far, 20 patients underwent this procedure; iris dialysis – 8 (trauma – 3, surgical complication – 3), IOL relocation – 3, iris coloboma repair – 3, Cionni ring fixation – 1, and SFIOL – 5 patients [Table 1].

## Results

All patients did well postoperatively with good structural and visual recovery apart from good cosmoses. One patient underwent cataract extraction with IOL implantation and iris dialysis repair by SMT in the same sitting. Pupil was peaked postoperatively. Hence, we have repeated the SMT for iris dialysis again after 1 week without any disturbance to IOL and achieved round pupil with satisfactory result.

**Table 1: The number of patients who underwent modified sewing machine technique according to their clinical condition**

| Clinical condition | Number of patients in whom MSMT performed | Remarks/etiology |
|---|---|---|
| Iris dialysis | 8 | Postoperative complication - 5, posttrauma - 3 |
| Iris coloboma | 3 | Congenital coloboma - 2, iatrogenic coloboma - 1 |
| IOL relocation | 3 | Subluxated IOLs |
| Cionni ring | 1 | Posttraumatic subluxated cataracts |
| SFIOL | 5 | Aphakia - 3, single haptic fixation - 2 due to partial zonular dialysis |

IOLs: Intraocular lenses, SFIOL: Scleral fixated IOL, MSMT: Modified sewing machine technique

## Discussion

Repair of large iris defects is a surgical challenge. Several forms of techniques have been employed in these cases. Key reported a method of iris dialysis repair in 1932,[1] in which the torn fibers of the iris are pinned to into corneal substance at the iris angle by means of a Ziegler knife. This method is dependent for its success on an extremely elastic and almost uninjured iris and on the fibers catching in the small deep wound made by the knife needle. The operative treatment of iridodialysis can be traced to the operation of Crotchet, in 1892, who revised the operation of iridencleisis,[1] a procedure for making an artificial pupil by displacement of the iris in a keratome incision. Various other techniques have been described for iridodialysis repair in the past.[3-7] In 1932, Goldfeder reported a technique consisting of making a small keratome incision, the iris margin being caught with a small iris hook and a few

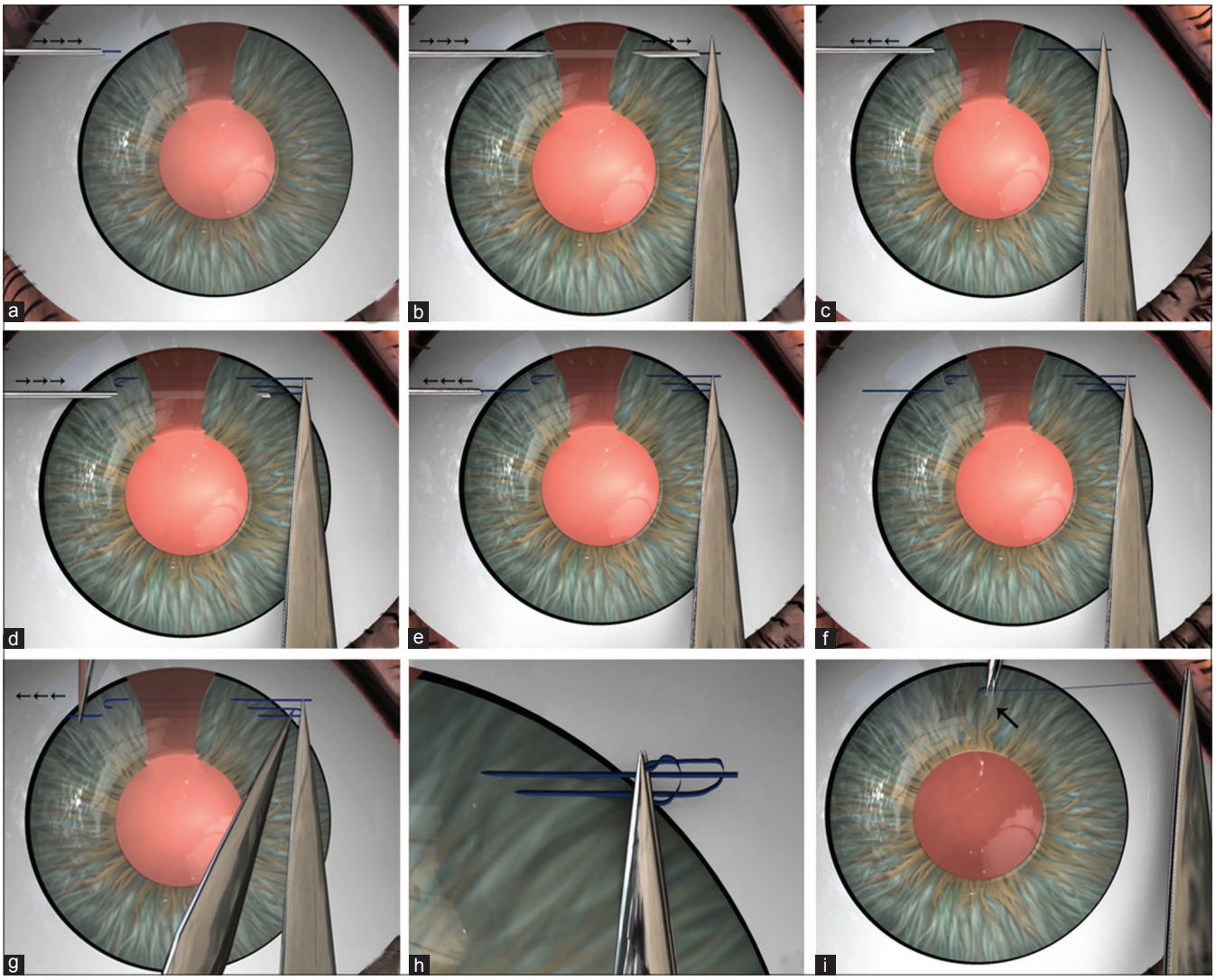


**Figure 5:** Diagrammatic representation of modified sewing machine technique for iris coloboma repair (a) iris coloboma (b) passing of prethreaded dental needle through both leaflets of iris coloboma (c) partial withdrawal of needle (d) taking a second bite (e and f) complete withdrawal of the needle (g) cutting the suture loop (h) making a slip knot (i) cutting the knot close to iris

fibers thus incarcerated in the wound.[1] Ozdek and Özmen described hang back technique, in which suture is tied and the knot is left in the anterior chamber.[8] Hoffman described iridodialysis repair through a scleral pocket by Mac cannel sutures ab externo.[3,9] Khokhar *et al*.[10] have recently reported the "Stroke and Dock technique." In this article, we describe a method of iris dialysis repair which is based on the principle on which sewing machine works. This technique shows how loops are made with sewing machine while stitching. Although we developed this technique independently and presented in 2013 APACRS conference Singapore[11] and reported in 2014,[2] later we came to know that a similar idea was also conceptualized by Stefen safaran[12] using a trek needle with an eye at the tip, gortex suture, and sclera flap. However, our technique uses hypodermic needles such as 26G needle or 30G dental needles and a prolene suture without scleral flaps. Danohmaneye[13] also published a video online describing similar technique like ours in YouTube. However, he used a 27G hypodermic needle suture loops. He did not make any scleral tunnel, but simply rotated the sutures into the eye after the surgery which has a risk of suture erosion through conjunctiva later. He did not show or discuss any extension of this concept for other complex cases. We could not find any published literature in peer-reviewed journal from this author. Unlike this technique, our MSMT for iris dialysis repair can be completed with only one knot at the end which is also buried in the scleral tunnel overcoming the risk of suture erosion at a later date. Our technique with few modifications as suggested above can be used to tackle other complex conditions such as subluxated IOL, iris coloboma, SFIOL, and Cionni ring fixation for zonular dialysis. To the best of our knowledge, nobody has reported such a technique for above conditions, and hence, we called it as an innovative cost-effective technique which can help the surgeon to tackle several problems when required in simple and easy way. The incidence of IOL decentration[14] after cataract surgery ranges from 0.032% to 0.6% within 10 years Subluxation or dislocation could be because of entire capsule dislocation or haptic decentration. Gimbel *et al*.[15] suggested that Preoperatively weak zonular fibers, surgical trauma to the zonular fibers, capsule contraction syndrome, and postoperative trauma

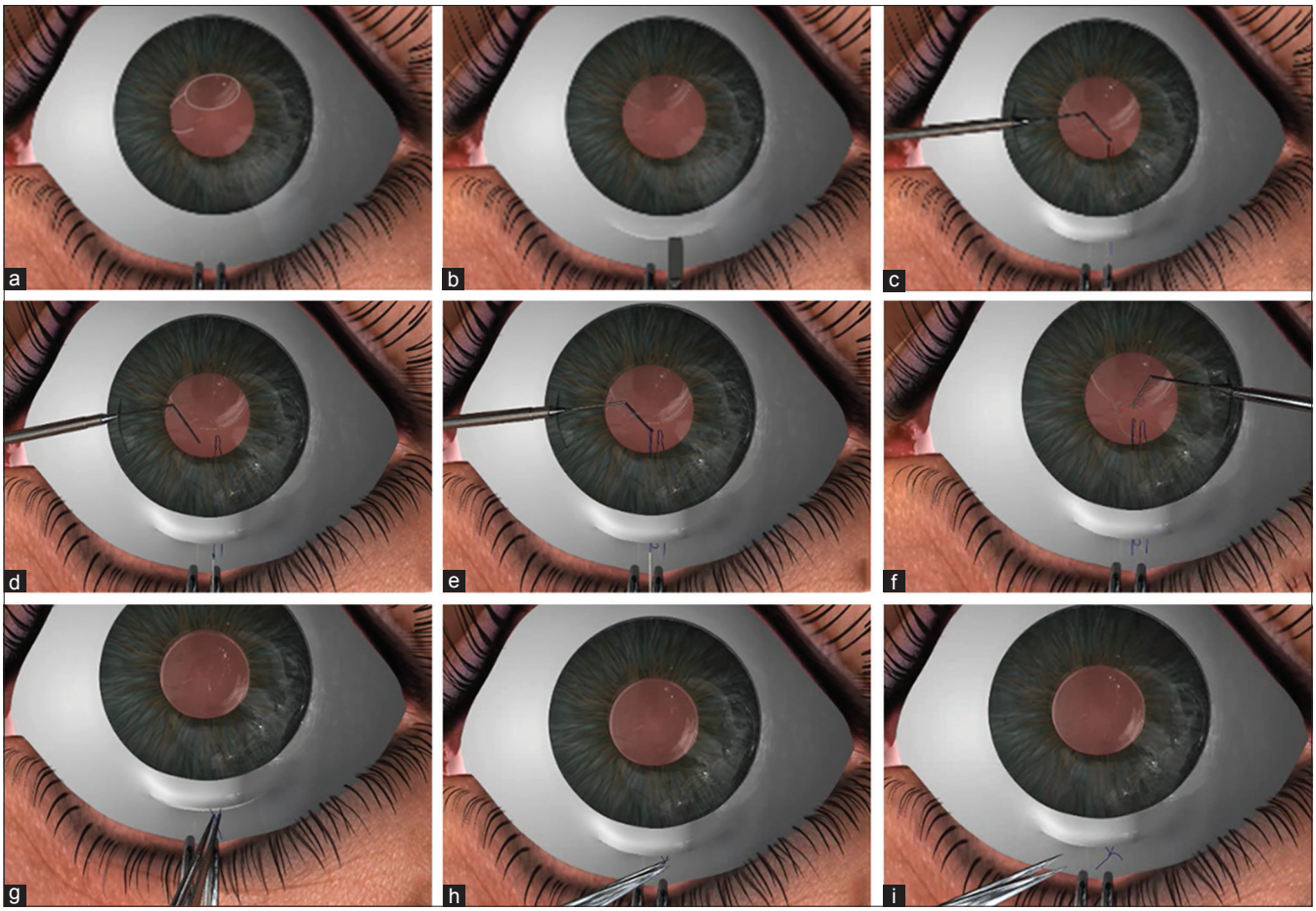


**Figure 6:** Diagrammatic representation of modified sewing machine technique for intraocular lens relocation. (a) subluxated intraocular lens (b) partial thickness scleral tunnel (c) repositioning of intraocular lens (d and e) formation of two suture loops in acromioclavicular (f) guiding the haptic through the suture loops (g) centration of intraocular lens by pulling the free ends of the suture outside the sclera (h, i) tying the free ends of the suture and burying the knot in the tunnel

could result in postoperative IOL decentration and capsule dislocation. IOL exchange is usually performed for subluxation along with entire capsule, which needs large incision and intraocular manipulation and sometimes cutting of IOL which is more traumatic to the corneal endothelium. Other options for capsule fixation include capsule anchor fixation[16] and flexible hemi-ring capsule bag fixation.[17] Scleral fixation of the IOL haptics for decentered IOLs was first described by Oshika.[18] Several innovative surgical techniques were later described for scleral fixation of subluxated IOL haptic such as scleral suture loop fixation,[19] haptic externalization through clear cornea and scleral fixation,[20] scleral fixation using suture retrieval through a sclera tunnel,[21] and similar techniques.[22,23] Recently, Can *et al*.[24] described cow hitch knot technique that promises more stability and prevention of slippage of haptic during manipulation. This technique needs a special Can ciliary sulcus guide and more expertise to manipulate suture needle from above and below the haptic into the guide, the to-and-fro movements of needle to make the cow hitch makes the surgery more complex and time taking. Thus, all these techniques have a long learning curve; need to maintain special devices in the library stock which is not financially viable in all setups and time-consuming. However, our MSMT for relocation of subluxated IOL described above is simple, easy to perform, and needs only a hypodermic 30G needle and a suture to perform in a very short period. Since two suture loops are made to hold the haptic in a closed chamber fashion, chances of haptic slippage is minimized, less time-consuming, economical, and easy to perform by any cataract surgeon. The only problem with our technique is late suture knot degradation which may be overcome with use of 9/0 prolene suture. With our technique, the existing IOL can be preserved whatever type that might have been used previously and whatever might be the cause of subluxation, thus making this as universal technique to correct any subluxated IOL due to any cause.

The conventional techniques of sutured scleral-fixated IOL for aphakia[24-28] and Cionni ring fixation[29-31] for zonular dialysis for capsular bag stabilization involves the creation of scleral flaps and the passing 10/0 prolene sutures with needles in railroad fashion, passing needle of suture from one end into hypodermic needle passed from ab-externo from other side. These techniques are time taking and have a long learning curve. They give good results when done as a planned surgery, but complications[32] with these techniques are not rare when performed as unplanned surgery like intraoperative zonular dialysis. Sometimes suture passes through corneal tissue when passing from corneal stab incision as in Cionni ring fixation which makes the entire surgery messy and needs repetition

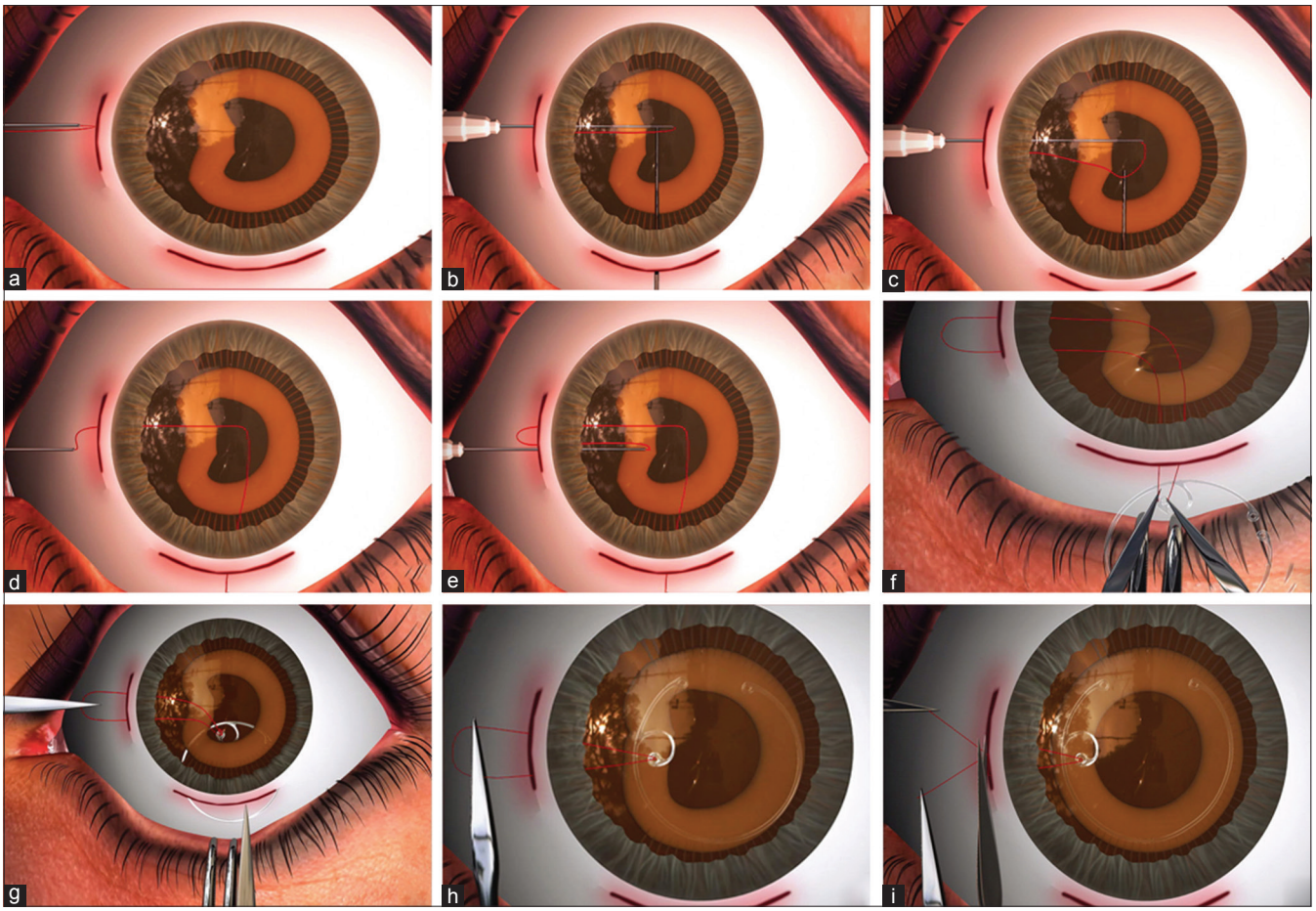


**Figure 7:** Diagrammatic representation of modified sewing machine technique for Cionni ring fixation. (a) Zonular dialysis (b) passage of dental needle through scleral tunnel (c) pulling the suture out (d and e) formation of two loops (f) tying of the suture to eyelet (g-i) insertion of Cionni ring and tying the knot into the tunnel

of whole procedure from the beginning. Whereas, our MSMT is simple, easy, and less time-consuming as there is no need to make sclera flaps, instead we do only scleral tunnel and no need to suture the flaps at the end as the knot get buried in sclera tunnel. As the needle is cut prior and suture is prethreaded, only one suture is sufficient for entire surgery and even to tie both eyelets when modified capsular tension ring with two eyelets is used making this more economical also. This is easy to perform even as unplanned surgery depending on the need. The main difference between our technique and conventional techniques is suture knots are placed on both sides of the sclera in our technique. This, we feel, may give additional strength to the eyelet though it has a risk of knot degradation.

Several surgical techniques were described for congenital iris coloboma repair such as Mccanel suture technique,[33] modified Mccanel suture technique,[34] Siepser modification of Mccanel suture,[35,36] and modified iris repair technique.[37] All these techniques have a learning curve with more intraocular manipulation and need the expertise to minimize the tissue damage. Coming to the application of MSMT for iris coloboma repair, after completion of cataract surgery, the two leaflets of iris coloboma are snipped at their base. Two stab incisions are made on the temporal and nasal side of the cornea at 4 and 8 o' clock positions, prethreaded 30G dental needle with the suture is passed through one stab incision and two leaflets of iris coloboma and free end is grasped and pulled from opposite corneal stab incision using microforceps. Now the needle is partially withdrawn and the second bite is taken from adjacent iris leaflets and again the loop is pulled from opposite stab incision. The loop is cut and needle withdrawn. Now both free ends of suture loop which have passed through the leaflets of iris coloboma are on one side. A slip knot is made outside the cornea looping four times one free end to other outside the eyeball. The knot is pushed inside and tension adjusted to approximate the sutures to make the pupil round. This technique also has the advantage of using the same sutures to place two or three knots if required to completely close the coloboma for cosmetic effect. Whereas, the other techniques need one new suture for every knot to be taken. Thus, our MSMT[38] is not only easy but also economical for iris coloboma repair and can also be used for iatrogenic iris coloboma repair due to intraoperative complication during cataract surgery or traumatic iris coloboma repair.

The problems faced by us while doing this procedure are difficulty in threading the suture into the hypodermic needle, hemorrhage at the scleral entry site, and peaking of the pupil in one case. These are considered as minor problems and can be overcome with practice. Threading the suture can be made easier by straitening the suture before starting the procedure and cutting the needle and doing it under the microscope.

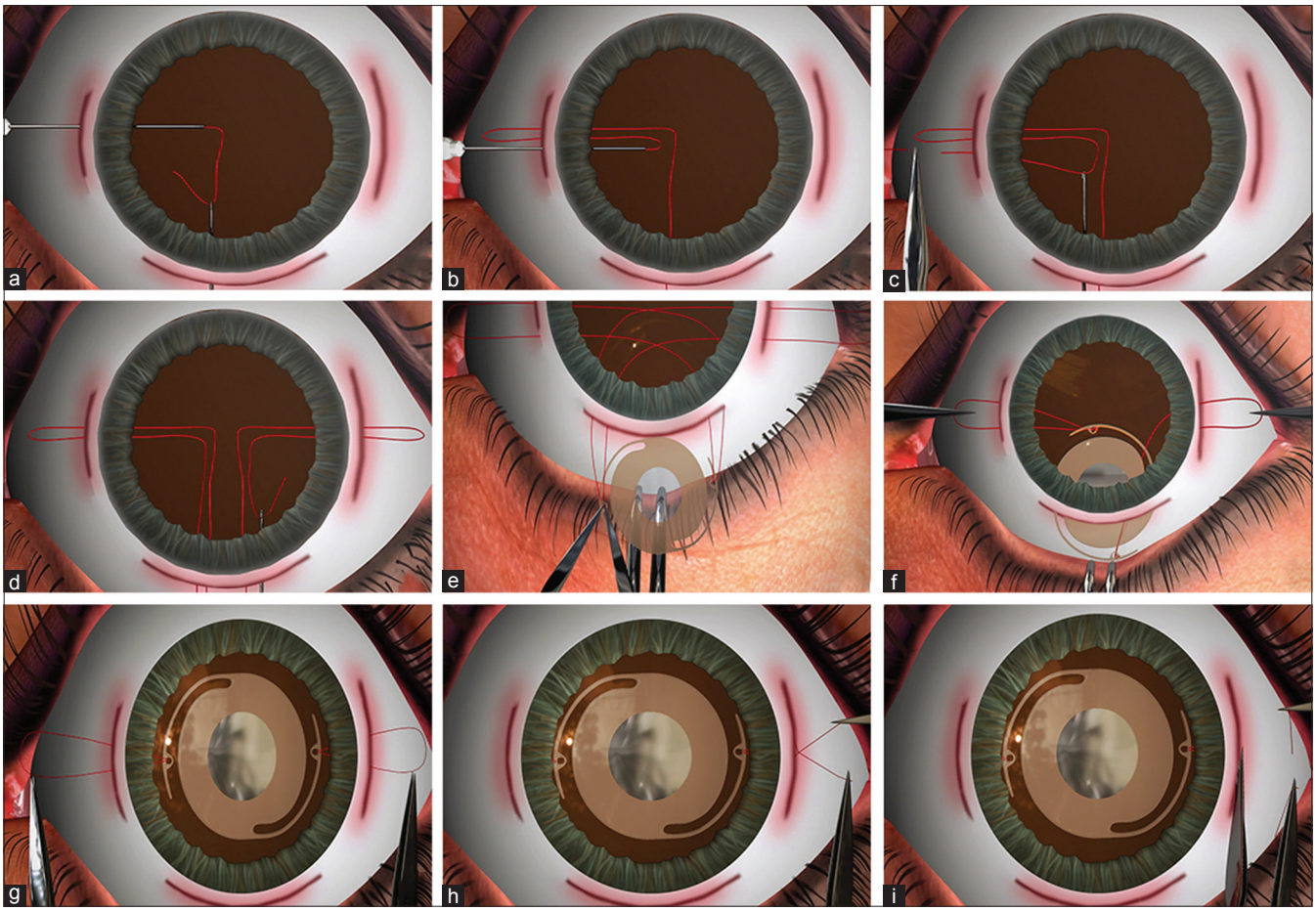


**Figure 8:** Diagrammatic representation of modified sewing machine technique for scleral-fixated intraocular lens. (a-d) creation of suture loops using dental needle on both sides (e and f) eyelets of aniridia scleral-fixated intraocular lens being tied free ends of the suture and implanted through main incision (g) adjusting the intraocular lens centration (h) tying the free ends of the suture (i) pushing knot into the tunnel

Hemorrhage can be managed conservatively. If pupil distortion is more, we can repeat the whole procedure as we did in one case.

The demerits of our technique is that this is still a blind procedure while passing the prethreaded needle inside out through sclera tunnel for iris dialysis repair. This may be overcome by passing a 26G needle from outside to inside which can act as guide for prethreaded needle and also as a support while taking a bite at the peripheral iris. Small sample size and lack of long-term follow-up and noncomparative case series are some more drawbacks of our study. As this is a novel concept in this direction, future randomized comparative studies may help us to know the advantages of our technique over previous ones and help us better understand the technique and to standardize this procedure. Until then, it is better for every ophthalmologist to be aware of all the techniques to manage complex cases so that he or she may use one, when need arises. To the best of our knowledge, nobody has reported such a technique for above conditions and hence we call it as an innovative cost-effective technique which can help the surgeon to tackle several complex situations in simple and easy way.

## Conclusion

The MSMT is an easy, simple, economical, and minimally invasive method of iridodialysis repair which every cataract surgeon, even in peripheral centers, can perform safely when required. This technique combines the advantages of all previous techniques and overcomes several problems of all the previous techniques. This technique has the advantages of being safe, atraumatic with minimal instrumentation requirement, good cosmetic result postoperatively, single sitting procedure, repeatable if needed, has minimal learning curve, can be safely performed by all cataract surgeons. This technique can also be extended for other clinical conditions such as iris coloboma repair, repair of subluxated IOL, Cionni ring fixation, and SFIOL.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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