

Access this article online
Quick Response Code:

Website: www.e-tjo.org
DOI: 10.4103/tjo.tjo_26_18
Videos Available on: www.e-tjo.org

Forceps-assisted, 10-0 monofilament nylon, suture-guided capsular tension ring insertion in subluxated cataracts

Harinder Singh Sethi, Mayuresh Naik

Abstract:

Capsular tension ring (CTR) and iris hooks have proved to be useful devices in cataract surgery in cases of zonular weakness and dialysis. We would like to describe the use of monofilament 10-0 nylon (MFN)- guided CTR insertion in a subluxated cataractous lens. Here, the MFN is passed through the distal trailing eyelet of the CTR (simple or Morcher's depending on the size of the defect and subluxation) for controlled insertion of the distal eyelet of the CTR beneath the anterior capsulorhexis margin and safe retrieval of CTR in case of an iatrogenic posterior capsular tear during CTR insertion or phacoemulsification.

Keywords:

Capsular tension ring, subluxated lens, suture

Introduction

Phacoemulsification has many challenges in patients with significant zonular weakness. These patients are at an increased risk of intraoperative and postoperative complications including vitreous prolapse, capsular rupture, retained lens material, and postoperative intraocular lens (IOL) dislocation. Capsule tension rings (CTRs) maintain the circular contour of the capsular bag during cataract surgery and prevent vitreous prolapse into the anterior chamber in cases of zonular dialysis. The CTR is an intraoperative aid in cases of zonular weakness and zonular dialysis; they increase the likelihood of successful uncomplicated phacoemulsification as well as successful in-the-bag implantation of the IOL.

Hara *et al.* first described the insertion of a ring into the capsular bag fornix (equator)

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

to support the zonular apparatus in 1991.^[1,2] The CTR can be implanted with the help of forceps with or without guiding sutures; it can also be inserted with the help of injectors. These injecting devices have made the CTR implantation procedure easier, faster, and safer.^[3,4] Instructions for CTR insertion, the difficulties related to their insertion, and measures to prevent difficulties have been described previously by many authors.^[3-9] The incidence of posterior capsular tear in cataract has been estimated to be 0.5%–16%.^[11-13]

We have described forceps-assisted monofilament 10-0 nylon (MFN) suture-guided CTR insertion for controlled release of distal eyelet of CTR beneath anterior capsulorhexis and safe retrieval of CTR in case of an iatrogenic posterior capsular tear during CTR insertion or phacoemulsification.

Inclusion criteria

We included participants with a subluxated cataractous lens with <6 o'clock h (<180°) of zonular deficiency.

How to cite this article: Sethi HS, Naik M. Forceps-assisted, 10-0 monofilament nylon, suture-guided capsular tension ring insertion in subluxated cataracts. Taiwan J Ophthalmol 2020;10:127-30.

Department of
Ophthalmology,
Vardhaman Mahavir
Medical College and
Safdarjung Hospital,
New Delhi, India

Address for correspondence:

Dr. Mayuresh Naik,
Department of
Ophthalmology,
Vardhaman Mahavir
Medical College and
Safdarjung Hospital,
Ring Road, Ansari Nagar,
New Delhi - 110 029, India.
E-mail: mayureshnaik@gmail.com

Submission: 14-04-2018
Accepted: 26-02-2019
Published: 22-07-2019

Exclusion criteria

We excluded participants with subluxated cataracts >180° of zonular deficiency; any retinal or corneal pathology; and glaucoma.

Surgical technique

Ethical clearance was obtained from the Ethical Clearance Committee, Institutional Review Board. Peribulbar anesthesia is preferred over topical anesthesia, to avoid excess stress on the weak/absent zonules and any undue complications related to patient eye movement during surgery.

After corneal side port incision, the anterior chamber was deepened with 1.4% sodium hyaluronate Healon GV® (Johnson and Johnson). A dispersive viscoelastic was used to tamponade the area of zonular dialysis (viscotamponade) [Videos 1 and 2].

It is often prudent to complete the capsulorhexis with the Utrata's forceps to avoid excessive stress on the capsule and provide greater control. Iris/capsule hooks are introduced and are hooked around the capsulorhexis margin to help stabilize and centralize the bag. In this case, iris hooks have been introduced through incisions at 8, 9, and 10 o'clock.

MFN was passed through the distal eyelet of the CTR (simple or Morcher's depending on the size of the defect and subluxation). Tying a knot in the two loose ends of monofilament nylon suture is not necessary and may add more time. It is unlikely that the sutures will slip if they are held for a long time. The proximal end of CTR is then cautiously introduced below the rhexis margin. The CTR is then slowly pushed and dialed into the capsular bag. The trailing/distal eyelet is placed into the bag with the help of a Sinsky hook or forceps. The rest of the MFN suture loop entails out of the main 2.8-mm incision. Phacoemulsification/lens removal uses a small pupil such that the loose suture ends entail out of the main 2.8-mm incision.

Phacoemulsification (using small pupil techniques) can then be performed using low-flow parameters and a reduced infusion bottle height. The foldable IOL is centered after it is inserted. Finally, one arm of the suture loop is cut near the pupillary border, and the suture is removed by pulling the other arm of the suture out near the corneal wound. Viscoelastic material was aspirated, and the wound was hydrated [Videos 1 and 2].

Results

We have used this technique in ten cases of phacoemulsification with subluxated cataractous lens with <5 o'clock h of zonular deficiency

(seven posttraumatic, two pseudoexfoliation syndrome, and one high myopia). The CTR was implanted after capsulorhexis in all cases. Phacoemulsification was completed without intraoperative iris or capsular damage or vitreous loss (assessed with triamcinolone acetamide injection into the anterior chamber at the end of the case), and the IOL was placed in the capsular bag in all the eyes. After verifying the IOL was centered, loose suture ends were cut and suture removed subsequently.

Discussion

The CTR is a useful multipurpose device that supplements the armamentarium currently available for IOL placement in complicated cases. It is one of the most important innovations in anterior segment surgery^[3,4,6] in recent times.

Various methods of CTR injection and placement have been described. The CTR can be either inserted using McPherson's forceps manually,^[3,8,9] MST rhexis forceps (Microsurgical Technology),^[10] an IOL dialer through the fishtail technique,^[11] CTR injectors, or the Silver-Sapphire system.^[12] Alternatively, they can be sutured in place under a scleral flap in the area of zonular dehiscence.

Various injecting devices have been developed and marketed by Ophtec and Geuder (suitable for both Ophtec and Morcher CTRs). In these devices, the injector has a small hook for the distal/trailing eyelet of the CTR. The plunger is released once the hook locks onto the eyelet, which loads the CTR. Only the curved tip is exposed after the CTR is loaded into the injector. The injector is directed laterally beneath the anterior capsule leaflet providing an acute "angle of attack" for the CTR when it is being extruded.^[5] These devices have made the previously-demanding procedure of CTR insertion easier, faster, and safer;^[3,4] however, they are also costly rare in developing countries.

Premature release of the trailing end above the capsulorhexis margin may result in sudden lateral movement of the CTR, which may hit the ocular wall in the area of the ciliary body and push the entire capsular bag in the opposite direction resulting in an extension of the zonular dialysis.^[8] This is more likely while inserting the CTR with forceps unless undertaken with utmost care. This is one of the most common problems seen during manual insertion of CTR. The fishtail injection technique has similar problems wherein both "prongs" of the CTR open up unguided intracamerally with resulting chances of posterior capsular rupture and zonular dialysis. Hence, it is imperative that there should be some guide for safe insertion and removal of the CTR in such event.

MFN-guided CTR insertion with the suture in the proximal leading eyelet has already been described previously. Moreno-Montañés *et al.*^[13] placed a safety suture in the proximal/leading eyelet before phacoemulsification to serve as a rescue technique in the event of posterior capsule rupture (PCR). If the capsular bag were to rupture during surgery, then the CTR could be removed with the suture in the leading eyelet. Angunawela and Little^[11] described the fishtail technique for CTR insertion to reduce the risk of extending dialysis. Subsequently, a modification “fishtail on a line” technique was described by Rixen and Jordan^[14] to prevent overbending of the CTR in the fishtail technique. However, Page proposed that the fishtail technique and the later modifications alter the form of the intended insertion design and do not give the surgeon direct control over the leading eyelet as it passes through areas of potential capsule entanglement. Page^[15] found that gentle traction applied on the suture with a microforceps could guide the leading eyelet centrally and may mitigate the risk for extending the dialysis or creating an iatrogenic dialysis. However, there are some issues that still remain to be addressed here. First, the optimal time to place the ring is challenging to master; it should be placed as early as needed during surgery but as late as possible, i.e., sufficiently early enough to provide adequate support for continuation of surgery but as late as possible in the procedure to prevent any capture of the residual cortex or epinucleus with the CTR.

Ahmed *et al.*^[16] suggested that to minimize further zonular stresses or damage/capsular destabilization, the ideal timing for CTR placement is after lens extraction and decompression of the capsular bag. However, Fine *et al.*^[17] suggested that the greatest advantage of the CTR is the ability to insert it before phacoemulsification and thus distribute any localized forces that are directed onto the capsular bag to the entire zonular apparatus. Although iris hooks or capsule hooks can be used to support the anterior capsulorhexis margin in the subluxated quadrant, they give minimal support to the anterior capsular apparatus. They offer negligible support to equatorial and posterior zonular fibers that still receive the major brunt of the phacoaspiration forces when the epinucleus and cortex are removed from the equatorial fornices. Thus, combining the use of CTR with the iris/capsular hooks supports anterior capsular rim, equatorial capsular apparatuses, and keeps the posterior capsule taut during phacoaspiration.

In most cases, it is imperative that the CTR be inserted as soon as capsulorhexis is completed. In such cases, it becomes cumbersome to exert traction on a suture over the proximal CTR eyelet, especially during the CTR insertion due to the limited working space in the intracameral area. Second, despite using the utmost care

while insertion, there are plausible chances that the distal trailing eyelet may open either into the sulcus or over the iris and cause unwanted iris trauma or displacement of the capsular bag in the opposite direction. It is in these cases that a suture is passed through the distal eyelet to enable the surgeon to gently retract the eyelet and place it safely below the anterior edge of the capsulorhexis. Third, since the suture over the distal trailing eyelet enters into the eye last, there are minimal chances of suture entanglement in the intracameral space either with the CTR itself or with other instruments. Since the suture can be easily brought out of the wound to the side, it does not hinder the phacoemulsification procedure. Fourth, in case of a PCR during CTR insertion or during phacoemulsification, the MFN suture would enable the surgeon to gently and safely retrieve the CTR. In fact, it is much easier to retrieve a CTR using the suture over the distal trailing eyelet than using the suture over the proximal leading eyelet. Finally, in the event of a severe zonular dialysis, the suture will help to secure the CTR, and the capsular bag until a three-piece IOL can scaffold the subluxated cataractous lens.^[18]

In conclusion, Forceps-assisted, MFN suture-guided CTR insertion for controlled release of the distal eyelet of the CTR beneath the anterior capsulorhexis margin permits safe, in-the-bag, implantation of CTR. It also has the additional advantage of safe retrieval of the CTR in case of an iatrogenic posterior capsular tear during CTR insertion or phacoemulsification.

What was known

CTRs maintain the circular contour of the capsular bag during cataract surgery and prevent vitreous prolapse in the anterior chamber in cases of zonulysis. The use of a CTR as an intraoperative aid in cases of zonular weakness and dialysis increases the likelihood of completion of successful uncomplicated phacoemulsification, and in many cases, successful in-the-bag implantation of the IOL. MFN over the proximal leading eyelet may be used to prevent iatrogenic zonular damage at insertion.

What this paper adds

In the event that the distal trailing eyelet of the CTR opens up into the sulcus or over the iris, a suture passed through the distal eyelet could efficiently enable the surgeon to gently retract the eyelet and place it safely below the anterior edge of the capsulorhexis. Since the suture goes along with distal eyelet goes into the eye last, there are minimal chances of suture entanglement during CTR insertion. Since the suture can be easily brought out of the wound to the side, it facilitates no hindrance to the phacoemulsification procedure. In case of a PCR during CTR insertion or during phacoemulsification, the suture would enable the surgeon to gently and safely retrieve the CTR.

Statement of justification

The use of MFN while inserting a CTR in place is an effective and safe method for controlled insertion of distal eyelet of CTR beneath anterior capsulorhexis and safe retrieval of the CTR in case of an iatrogenic posterior capsular tear during CTR insertion or phacoemulsification of subluxated cataractous lenses.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

References

1. Hara T, Hara T, Yamada Y. "Equator ring" for maintenance of the completely circular contour of the capsular bag equator after cataract removal. *Ophthalmic Surg* 1991;22:358-9.
2. Hara T, Hara T, Sakanishi K, Yamada Y. Efficacy of equator rings in an experimental rabbit study. *Arch Ophthalmol* 1995;113:1060-5.
3. Menapace R, Findl O, Georgopoulos M, Rainer G, Vass C, Schmetterer K. The capsular tension ring: Designs, applications, and techniques. *J Cataract Refract Surg* 2000;26:898-912.
4. Lanzetta P, Chiodini RG, Polito A, Bandello F. Use of capsular tension ring in phacoemulsification. Indications and technique. *Indian J Ophthalmol* 2002;50:333-7.
5. Cionni RJ, Osher RH. Endocapsular ring approach to the subluxed cataractous lens. *J Cataract Refract Surg* 1995;21:245-9.
6. Gimbel HV, Sun R, Heston JP. Management of zonular dialysis in phacoemulsification and IOL implantation using the capsular tension ring. *Ophthalmic Surg Lasers* 1997;28:273-81.
7. Gimbel HV, Sun R. Clinical applications of capsular tension rings in cataract surgery. *Ophthalmic Surg Lasers* 2002;33:44-53.
8. Eleftheriadis H. Capsular tension ring insertion technique tips. *J Cataract Refract Surg* 2002;28:1091-2.
9. Jacob S, Agarwal A, Agarwal A, Agarwal S, Patel N, Lal V. Efficacy of a capsular tension ring for phacoemulsification in eyes with zonular dialysis. *J Cataract Refract Surg* 2003;29:315-21.
10. Johansson B, Lundström M, Montan P, Stenevi U, Behndig A. Capsule complication during cataract surgery: Long-term outcomes: Swedish Capsule Rupture Study Group report 3. *J Cataract Refract Surg* 2009;35:1694-8.
11. Angunawela RI, Little B. Fish-tail technique for capsular tension ring insertion. *J Cataract Refract Surg* 2007;33:767-9.
12. Sethi HS, Saxena R, Sinha A. Use of the unfold silver/Sapphire system to inject capsular tension ring during phacoemulsification in cases with subluxated cataract. *J Cataract Refract Surg* 2006;32:1256-8.
13. Moreno-Montañés J, Heras H, Fernández-Hortelano A. Extraction of endocapsular tension ring after phacoemulsification in eyes with pseudoexfoliation. *Am J Ophthalmol* 2004;138:173-5.
14. Rixen JJ, Oetting TA. Fishtail on a line technique for capsular tension ring insertion. *J Cataract Refract Surg* 2014;40:1068-70.
15. Page TP. Suture-guided capsular tension ring insertion to reduce risk for iatrogenic zonular damage. *J Cataract Refract Surg* 2015;41:1564-7.
16. Ahmed II, Cionni RJ, Kranemann C, Crandall AS. Optimal timing of capsular tension ring implantation: Miyake-apple video analysis. *J Cataract Refract Surg* 2005;31:1809-13.
17. Fine IH, Hoffman RS, Packer M. Timing of CTR implantation. *J Cataract Refract Surg* 2006;32:1075.
18. Agarwal A, Jacob S, Agarwal A, Narasimhan S, Kumar DA, Agarwal A, *et al*. Glued intraocular lens scaffolding to create an artificial posterior capsule for nucleus removal in eyes with posterior capsule tear and insufficient iris and sulcus support. *J Cataract Refract Surg* 2013;39:326-33.