



New and Emerging Techniques - Surgical

Rapid Review

Intracapsular Tension Ring

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**Australian
Safety
and Efficacy
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Review of New and Emerging Techniques – Surgical

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**Royal Australasian
College of Surgeons**

Rapid Review Summary

Intracapsular Tension Ring

- It is estimated by the World Health Organisation that 12 to 15 million people go blind from cataracts and 8 million cataract operations are carried out world-wide each year.
- Cataract operations remove the diseased lens and replace it with an artificial intraocular lens.
- Intracapsular Tension Rings are used to provide stabilisation of the capsular bag and the intraocular lens both during and after surgery, and to prevent capsular bag shrinkage.
- Intracapsular Tension Rings have been used in patients with loose or broken zonules (ligaments that suspend the lens), which may have been weakened or broken due to trauma or disease.
- Morcher Intracapsular Tension Rings are available in Australia, at a cost of approximately \$240.

Background

The World Health Organization estimates that 12 to 15 million people go blind from cataracts and that 8 million cataract operations are carried out worldwide each year.¹ Such operations involve surgical removal of the opacified lens and substitution with an artificial intraocular lens. During cataract surgery, after removal of the cataract the loss of the zonular structures may result in inadequate support of the artificial intraocular lens.² Shrinkage of the capsular bag and opening after such cataract surgery may also result in movement of the intraocular lens away from the centre (decentration), and tilting and deformation of the lens may also occur.³

In 1993, the first capsular tension ring for humans was designed by Witschel and Legler.⁴ Morcher⁵ subsequently marketed this design. These rings are designed to reduce shrinkage and collapse of the capsular bag and to help maintain the position of the intraocular lens.

The Technology

There are two types of intracapsular tension rings. Equator rings are designed for maintenance of the capsular contour, while tension rings stretch the posterior capsule.

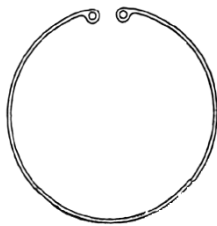


Figure 1. The Morcher-style intracapsular ring (from Cionni and Osher²)

Capsular tension rings are used to provide intra- and post operative stabilization of the capsular bag and the intraocular lens. Such rings consist of an incomplete loop, made out of a flexible polymethyl methacrylate filament with eyelets at each end.

These loops help to avoid capsular collapse, and maintain the circular contour of the bag, which may make it easier to place the intraocular lens.

tension ring.² This is similar to the original Morcher design, but has an extra fixation element or hook (Figure 2), which wraps around the edge of the surgical tear made in the anterior part of the capsule of the lens (capsulorrhexis) and rests on the anterior surface of the capsule rim (Figure 3). This hook is sutured to the sclera in order to provide further fixation.

A modified design was used by Cionni in order to further stabilise the position of the

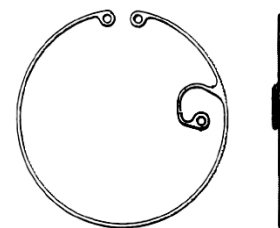


Figure 2. Cionni and Osher's modified tension ring² (front and side views).

Tension rings that are designed to be sutured to the sclera may also provide further stabilization. Lam describes the suturing of a normal tension ring to the sclera in a patient with severe zonular deficiency.⁶

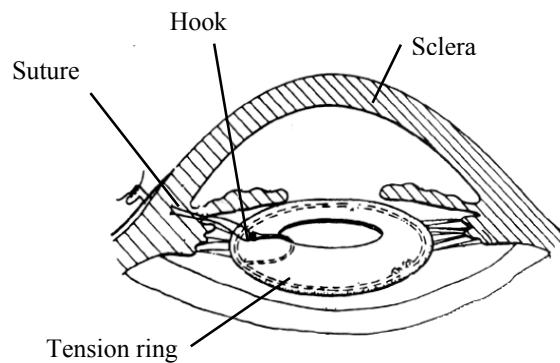


Figure 3. Cionni and Osher's modified tension ring after placement in the capsular bag, showing the hook wrapping around the edge of the capsulorrhexis and suturing to the scleral wall² (*N.B. labels added*).

Patient Group

The capsular tension rings have been used in patients with loose or broken zonules.⁷ Such zonules may be weakened or broken due to blunt or surgical trauma, or due to inherent zonular weakness (e.g. pseudoexfoliation) as discussed by Menapace.⁸ Groessl describes the use of a capsular tension ring during cataract surgery in a patient with Weill-Marchesani syndrome (in which zonular degeneration occurs)⁹, which was successful. Dietlein *et al.* have also tried using this in a child with Marfan's syndrome, in whom there was bilateral subluxation of the crystalline lens.¹⁰ Despite implantation of the tension ring, the capsular bag moved upward during surgery, and there was still capsular bag shrinkage. This may be because of several factors. Secondary lens epithelial proliferation and capsule shrinking are much more marked in young children than in adults older than 50 years, for whom the tension ring was designed. The authors also suggest that the degree of zonular dialysis in Marfan's syndrome may be more severe than that reported in case studies of tension ring implantation in adults, and that the correct sizing of the intracapsular ring is crucial but difficult (as the rings have been designed for use in adults). The sizing of the ring was an issue in this patient, as a radial capsulorrhexis tear developed in the capsular bag because the capsular bag was too small for the intracapsular tension ring.

Current Treatment and Alternatives

In order to increase the stability of intraocular lenses, sutured anterior or posterior chamber intraocular lenses have been developed. However, the use of posterior chamber lenses significantly increases the surgical time, and there may be post-operative axial tilt of the intraocular lens. Anterior chamber lenses may have complications with post-operative corneal decompensation, chronic cystoid macular oedema, or secondary glaucoma.⁷

Current Research Evidence

Safety

Although the potential complications of capsular tension rings have not been well described, it has been suggested by Lang that these may be similar to the complications associated with the use of intraocular lenses.¹¹ These include retinal tears, rhegmatogenous retinal detachment, cystoid macular oedema, direct retinal trauma from mobile intraocular lenses and vitreous haemorrhage. Lang *et al.* have also reported one case in which the endocapsular ring became posteriorly dislocated – this was treated by vitrectomy and removal of the tension ring.¹¹

The use of a large capsular tension ring in growing eyes may impair the eyes' axial growth (compared to growth in an aphakic eye or in an eye with a smaller ring) as shown by Kugelberg's study of capsular tension ring and intraocular lens implantation in newborn rabbits.¹² The authors concluded that it is important to determine the best dimensions for intraocular lenses in growing eyes before implantation in infants becomes more common.

Efficacy

In a study of *ex vivo* pig eyes, Lee found that the difference between the maximum and minimum diameters of the capsular bags was substantially smaller in specimens in which a capsular tension ring had been used compared to those in which one had not been used.³ Lee also studied rabbit lenses *in vivo*, and found that the lens size decreased (indicating lens distortion) in those implants without capsular tension rings but not in those in which a capsular tension ring had also been implanted.

Studying cadaveric pig eyes, Sun *et al.* found that the capsular tension ring maintained the circular contour of the capsular bag, and the positioning of the capsular bag.¹³ This was despite the fact that the zonules had been cut in one quadrant of the meridian to artificially simulate zonular weakness.

In Gimbel *et al.*'s⁷ study of 14 patients undergoing cataract surgery in whom there were loose or broken zonules, all of the patients had a centred intra-ocular lens at follow up (two to eight months), and resisted contractures of the capsular bag.

However, there is some debate about the efficacy of tension rings in preventing capsular shrinkage. Faschinger and Eckhardt describe two patients in whom the implantation of a capsular tension ring did not prevent capsule shrinkage, and did not protect against occlusion of the anterior capsule opening (which can cause a deterioration in visual acuity).¹⁴ The authors suggest that this may be due to the presence of multiple risk factors for capsular bag shrinkage in these patients, which provided sufficient forces to overcome the strength of the tension ring. Strenn *et al.*¹⁵ have also reported significant ($P < 0.001$) decreases in the anterior chamber depth, iris-lens distance and capsular bag circumference in a study of 19 tension ring and intraocular lens implants.

Cost

The Morcher style Intracapsular Tension Ring is available in Australia at a cost of approximately \$240.

Summary

Intracapsular tension rings appear to have some use during cataract surgery to provide additional zonular support of the lens, helping to maintain the central position of the lens post-operatively, and may also assist in intra-operative placing of the lens. However, there is conflicting evidence as to whether these rings prevent the occurrence of capsular bag shrinkage, and the use of these rings may not be appropriate in children as there appears to be the potential for retardation of the eye's axial growth (although whether this is a direct result of the intracapsular ring is not clear). With further research into the occurrence and dynamics of capsular bag shrinkage and growth retardation, intracapsular rings have the potential to significantly assist in intraocular lens placement. Intracapsular Tension Rings are already in use in Australian health care.

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