

Simple and Low Cost Production of Capsular Tension Ring



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Abstract

We describe a simple procedure to produce low cost capsular tension ring (CTR). This device requires minimal specialized equipment and can be reliably produced in virtually any eye clinics around the world. While significantly less expensive, the hand-made CTR looks, feels, and performs comparably to commercially available version. **Thai J Ophthalmol 2014; January-June 28(1): 20-23.**

Keyword: Capsular Tension Ring

No Author has a financial or proprietary interest in material or method mentioned

Introduction

Endocapsular support devices such as the capsular tension ring (CTR) allow safe and effective small incision phacoemulsification in the eye with weak capsulozonular apparatus. Early reports on the device are promising.¹⁻³ However, commercially available CTRs add significant financial burdens to the cost of cataract surgery. We report details of our efforts to produce effective, low cost, hand-made CTR.

Indications for CTR include zonular weakness or instability, zonular dialysis of less than 4 clock hours, or floppy capsular bag. These conditions often associated with pseudoexfoliation⁴, trauma, post-vitrectomized eyes, Marfan syndrome, homocystinuria, and hypermature cataract. Less commonly, defective zonules are found in Weil-Marchesani syndrome, microspherophakia, intraocular neoplasm, retinitis pigmentosa⁵, and aniridia. Because it generates expanding forces on the capsulozonular complex, CTR is contraindication in the presence of non-continuous capsulorrhexis, anterior radial or posterior capsular tears.

CTR helps supporting weak zonules, redistributing tension within the capsular bag, expand the capsular equator, and centering mildly subluxed capsular bag.⁶ Working together, these beneficial biomechanical forces lead to safer phacoemulsification and better postoperative optical outcomes. However, we must realize that a CTR does not cure progressive zonular loss⁷, prevents capsular fibrosis or phimosis, or recenters a severely decentered capsular bag. Careful patient selection is therefore essential to the success of the surgery.

Technique

We constructed a template to mold the hand-made CTR by attaching two guide wires to the 3 ml

syringe with the space of 2.5 mm between them. (Figure 1B) We wrapped 5-0 polypropylene suture (Prolene, Ethicon: Somerville, New Jersey) to the template according to Figure 2. The entire set up was autoclaved at 137 degree Celsius for 5 minutes in order to fix the polypropylene. The central connection was cut to disassemble the template and create open-ring CTRs. (Figure 1C-D) We found that half of the 5-0 Prolene produced 7 hand-made CTRs. Eyelets were further refined by compression under glass slides. Excess tail ends were trimmed using #15 blade. The sharp edge on the eyelets was smooth using handheld cautery. (Figure 1E) The rings were then compressed between two glass slides and autoclaved and ready to be used in surgery.

The hand-made CTR produced as described cost about \$2 each. All of required equipments and materials can be readily found in most eye clinics. (Figure 1A) The dimension and rigidity was measured to be comparable to the commercially available devices. (Figure 1F)

Discussion

We have used hand-made CTR on 4 consecutive patients with zonular dehiscence who underwent phacoemulsification. The capsule was inserted either before or after nucleus disassembly using McPherson's forceps. By stabilizing the capsular bag during the procedure, the device enables a surgeon to safely remove the crystalline lens, maintain the integrity of the capsular bag, and securely place a PCIOL. The device also reduces postoperative intraocular lens decentration.

One theoretical disadvantage of the hand-made CTR is the unknown half-life of polypropylene inside the eye. One study reported scanning electron microscopic evidences of degradation in the polypropylene suture taken from broken sutured intraocular

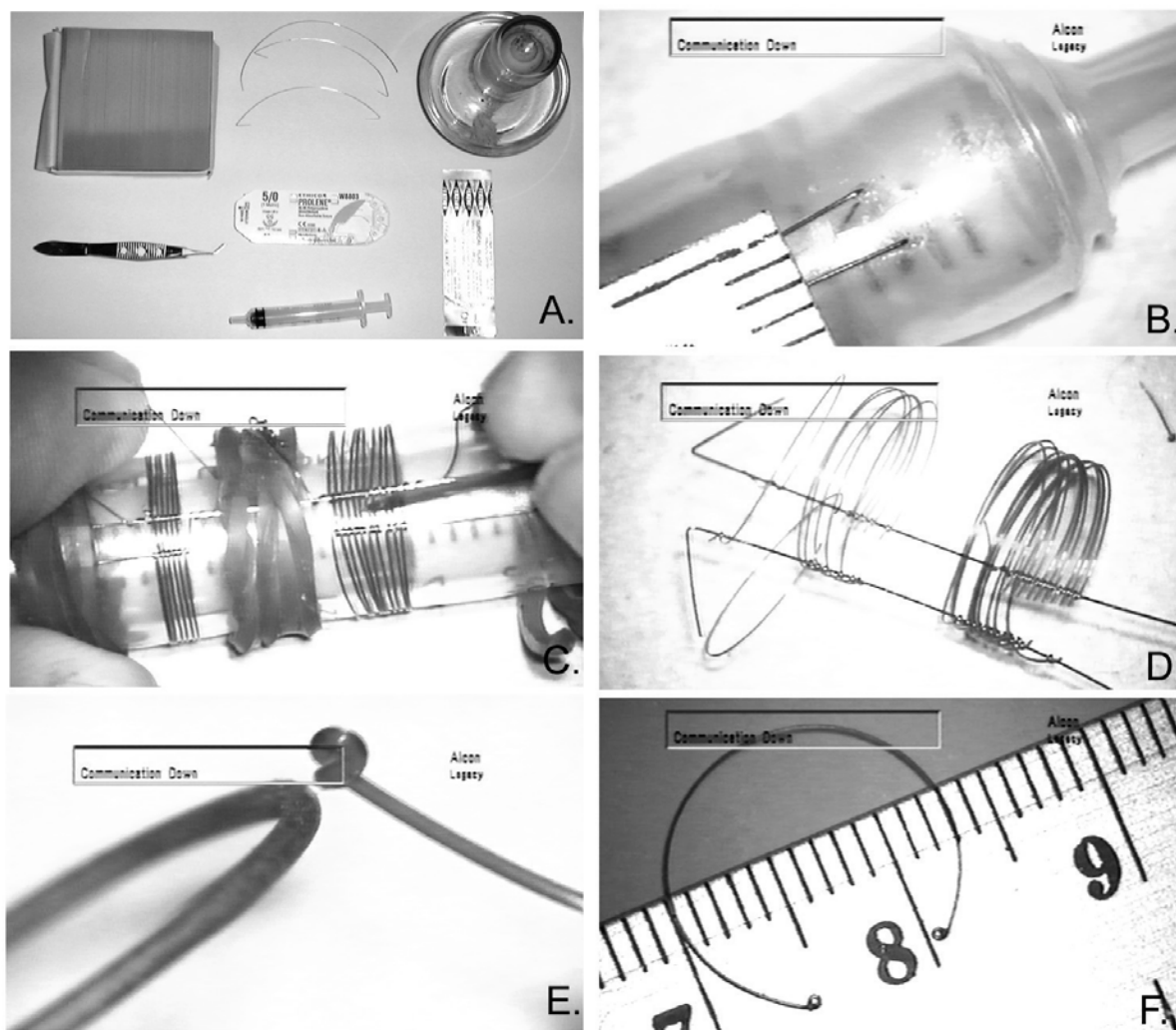


Figure 1. Details of the production of hand-made capsular tension rings.

lens (IOL) after 6.5 years.⁸ However, actual experiences with sutured IOL suggest that polypropylene sutures continue to maintain IOL stability after 20 years.

We believe the hand-made CTR reduces the economic barrier to performing a safe, efficient, and effective phacoemulsification in the setting of compromised or partially absent zonules. Previously, visually impaired patients with this condition were

frequently forced to undergo more complicated, invasive, and riskier surgeries. To address this disparity, we hope the hand-made CTR will give surgeons and patients the freedom to choose and benefit from advances in small incision cataract surgery. As is the case of the commercial PMMA-based CTR, a long term follow up study is needed to evaluate effectiveness of the hand-made polypropylene-based device.

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