

## ABSTRAK

**Latar Belakang:** Bedah fakoemulsifikasi telah berkembang menjadi prosedur bedah refraktif mata yang mengutamakan presisi prediksi hasil refraksi. Tantangan prosedur fakoemulsifikasi pada penyandang katarak dengan miopia tinggi (*Axial Length* (AL) > 26.0 mm) adalah instabilitas area zonula yang disebabkan oleh mencairnya badan vitreus. Implantasi *Capsular Bag Tension Ring* (CTR) kedalam kantong lensa pada saat operasi fakoemulsifikasi merupakan upaya untuk mengatasi instabilitas tersebut. Untuk menilai efektifitas CTR dalam kantong lensa, dilakukan implantasi dua jenis CTR yang berbeda diameternya kemudian dinilai perbedaan kinerja masing-masing CTR serta kemungkinan jangka panjang.

**Metode:** Penelitian ini merupakan uji klinis prospektif (randomized controlled trial/RCT). Jumlah sampel 26 mata untuk kelompok CTR 1311 dan 25 mata untuk kelompok CTR 1210. Data dibandingkan antar kelompok berupa nilai *spherical equivalent* (SE), *mean absolute error*, selisih perhitungan gaya pegas CTR, prediksi diameter kantong kapsul lensa, kedalaman bilik mata depan (BMD) dan simetri sudut iridokorneal pasca operasi. Data dianalisis dengan menggunakan SPSS Statistics. Perbedaan dianggap bermakna bila  $p < 0,05$ . Dilakukan finite element analisis untuk mendapatkan nilai gaya kontraksi kapsul pada ekuator kantong lensa, yang merupakan tolok ukur penilaian kinerja masing masing CTR.

**Hasil:** Kedua jenis CTR mampu menghasilkan dan mempertahankan SE yang sama pada 1 bulan dan 3 bulan pasca operasi ( $p=0,829$  dan  $p=0,962$ ). Perbedaan *mean absolute error* pada bulan ke 3 antara kedua kelompok CTR tidak bermakna secara statistik ( $p=0,932$ ). Perhitungan kedalaman BMD berdasarkan rumus IOLc, menunjukkan bahwa ELP pada CTR 1210 tidak stabil hingga 1 bulan pasca operasi ( $p=0,038$ ), namun pada 3 bulan pasca operasi ditemukan tidak ada perbedaan yang bermakna ( $p=0,084$ ). CTR 1210 (gaya pegas  $1.591 \pm 0.134$  mN) tetap mampu mencapai diameter kantong kapsul lensa yang sama dengan CTR 1311 karena gaya pegas kedua kelompok CTR melewati ambang gaya kontraksi kapsul lensa di ekuator (1.23 mN). Efisiensi kinerja gaya pegas CTR 1311 lebih stabil dalam hal distribusi gaya di dalam kantong kapsul lensa namun, CTR 1210 mampu menghasilkan luaran sudut iridokorneal pasca operasi yang lebih besar pada mata kanan sudut nasal dan temporal ( $p=0,034$  dan  $p=0,032$ ) dan mata kiri sudut ( $p=0,04$  dan  $p=0,965$ ).

**Kesimpulan:** Kedua CTR memiliki kemampuan yang sama untuk mencapai optimalisasi penglihatan. Efisiensi kinerja CTR 1311 untuk menjaga kestabilan area zonula lebih baik dari CTR 1210, namun CTR 1210 memiliki keamanan yang lebih baik dari CTR 1311.

**Kata Kunci:** *capsular tension ring*, fakoemulsifikasi, miopia tinggi, optimalisasi penglihatan, stabilitas area zonula.

## ABSTRACT

**Introduction:** Phacoemulsification surgery has become a refractive procedure that emphasizes on the precision and prediction of refractive outcomes. The challenge of ophacoemulsificatio in cataractous eyes with high myopia (AL) > 26.0 mm) is the instability of the zonular area caused by liquefaction of the vitreous body. Capsular Bag Tension Ring (CTR) implantation during phacoemulsification surgery is considered as an attempt to overcome this instability. To assess the effectiveness of the CTR in the capsular bag, two types of CTR with different diameters were implanted and the performance differences of each CTR was assessed.

**Method:** This study was a randomized and controlled trial (RCT). The research samples consisted of 26 eyes in the CTR 1311 group and 25 in the CTR 1210 group. Subsequently, the collected data was compared between 2 groups in the form of prediction value of spherical equivalent (SE), mean absolute error, the difference of CTR forces, lens capsular bag diameter, anterior chamber depth (ACD), and iridocorneal angle symmetry postoperatively. The data were analyzed using SPSS Statistics. The difference was considered significant when  $p < 0.05$ . Finite element analysis was performed to obtain the value of the capsule contraction force at the equator of the lens, which is the threshold for each CTR to overrule the contraction force at the equator.

**Results:** Both CTR 1311 and CTR 1210 produced and maintained the same spherical equivalent outcome in the first and third months after phacoemulsification ( $p=0.829$  and  $p=0.962$ ). The mean absolute error on the 3rd month between both groups was not statistically different ( $p=0.932$ ) Depth of the anterior chamber, calculated using the IOLc formula, showed that the ELP by CTR 1210 was unstable during the first month ( $p=0.038$ ) compared to the CTR 1311. no significant difference was found at the third-month post-phacoemulsification ( $p=0.084$ ). Despite the lower spring force ( $1.591 \pm 0.134$  mN) CTR 1210 has the capability to reach the same capsular bag diameter as CTR 1311. This explains that both CTR diameters produce a spring force exceeding the capsular bag contraction threshold at the equator which was measured at 1.23mN. CTR 1311 performs more efficiency regarding a more stable force distribution along the capsular bag, however CTR 1210 is more gentle and maintain a wider nasal to temporal iridocorneal angle in the right eye ( $p=0.04$  and  $p=0.965$ )

**Conclusion:** Both CTRs were capable to reach vision optimization. The efficiency of CTR 1311 in maintain zonular area stability after surgery is better than CTR 1210, regarding safety measures, CTR 1210 is better than CTR 1311.

**Keywords:** capsular tension ring, phacoemulsification, high myopia, vision optimalization, zonular area stability.