

Optimizing astigmatism outcomes in MSICS: The impact of incision architecture

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Introduction:

Surgically induced astigmatism (SIA) is a major determinant of refractive outcomes after Manual Small-Incision Cataract Surgery (MSICS), and is strongly influenced by the architecture and closure of the scleral tunnel. Optimizing wound construction and minimizing corneal distortion remain essential for achieving better visual rehabilitation.

Methods: In this prospective study, 25 eyes undergoing MSICS for age-related cataract were included and divided into three groups according to scleral tunnel closure technique: Group A (sutureless, n=9), Group B (single-suture, n=8), and Group C (three-suture, n=8). All tunnels were created using standardized parameters of depth (approximately 50% scleral thickness) and length (6–7 mm). Preoperative keratometry was compared with measurements obtained at 1 month postoperatively. SIA was calculated using vector analysis. Intraoperative parameters including tunnel stability, wound leakage, and need for additional sutures were also recorded.

Results: All surgeries were uneventful with no major complications. A clear gradient of increasing astigmatism was observed across the three groups. Group A (sutureless) demonstrated the lowest mean SIA (0.80 ± 0.35 D), with 70% of eyes showing astigmatism ≤ 1.0 D and minimal corneal distortion, confirming good self-sealing tunnel architecture. In contrast, Group B (single suture) showed a marked increase in SIA (1.45 ± 0.50 D), with 65% of eyes presenting astigmatism between 1.5 and 2.0 D, often associated with pronounced localized steepening along the suture axis. Group C (three sutures) exhibited the highest levels of astigmatism, with a mean SIA of 2.30 ± 0.60 D notably, 75% of eyes had astigmatism ≥ 2.0 D and 50% exceeded 2.5 D, reflecting significant corneal deformation induced by multiple tension vectors. The increase in SIA across groups was statistically significant ($p < 0.01$).

At 1 month, although 85% of eyes achieved keratometric stability, refractive predictability was clearly superior in the sutureless group, while higher variability persisted in multi-suture cases.

Discussion: This study demonstrates a clear association between scleral tunnel closure technique and SIA after MSICS, with a progressive increase in astigmatism as the number of sutures rises. Sutureless closure resulted in the lowest SIA, likely due to better preservation of corneal biomechanics and a more uniform distribution of wound tension, as highlighted in recent reviews of MSICS outcomes (1). In contrast, sutures introduce localized mechanical forces that induce meridional steepening, an effect that becomes more pronounced with multiple sutures, consistent with findings from comparative studies on incision and closure techniques (2). Furthermore, increased refractive variability observed in sutured groups aligns with broader evidence showing that wound architecture is a key determinant of postoperative astigmatism in MSICS (3). From a practical perspective, these findings support minimizing suture use whenever adequate tunnel stability is achieved. The main limitations remain the small sample size and short follow-up.

Conclusion: The scleral tunnel closure technique significantly impacts postoperative corneal astigmatism. Sutureless closure provides the lowest SIA and most favorable refractive outcomes, while the use of multiple sutures increases astigmatism in a proportional manner. Careful tunnel construction combined with minimal suturing is critical to reduce refractive variability after MSICS.

References:

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