IMPROVING REFRACTIVE OUTCOMES IN KERATOCONIC EYES


Two recent meta-analyses help inform management strategies.

BY ABDULKADER ALMOSA, BS, BGS, AND ZAINA AL-MOHTASEB, MD

VISUAL AND TOPOGRAPHIC OUTCOMES AFTER CORNEAL ALLOGENEIC INTRASTROMAL RING SEGMENTS FOR KERATOCONUS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Friedrich M, Auffarth GU, Soiberman U, Augustin VA, Khoramnia R, Son HS[1]

Industry support for this study: None

ABSTRACT SUMMARY

This systematic review and meta-analysis evaluated visual, refractive, and topographic outcomes after the implantation of corneal allogeneic intrastromal ring segments (CAIRS) in keratoconic eyes. The investigators screened major medical literature databases and included 14 peer-reviewed clinical studies comprising 442 eyes total. The primary outcome was the change in patients' corrected distance visual acuity (CDVA), with secondary outcomes including their uncorrected distance visual acuity (UDVA), spherical equivalent (SE), refractive cylinder, keratometry parameters, higher-order aberrations (HOAs), and postoperative complications.

Pooled analysis demonstrated a mean improvement in patients' CDVA and UDVA of 0.37 logMAR and 0.43 logMAR, respectively—approximately 4 Snellen lines. The SE improved by 4.59 D, and maximum keratometry was reduced by 4.49 D. Reductions were also observed in mean keratometry values and total HOAs, and the thinnest pachymetry reading remained relatively stable. One reported severe adverse event (0.2%) involved acute graft rejection and required CAIRS explantation. Overall, complication rates were low, with rare reports of CAIRS extrusion, opacification, or loss of CDVA.

STUDY IN BRIEF

- A systematic review and meta-analysis of 14 clinical studies (442 eyes) found that the implantation of corneal allogeneic intrastromal ring segments (CAIRS) significantly improved the uncorrected and corrected distance visual acuity of patients with keratoconus and reduced their keratometric values with a low rate of complications.

WHY IT MATTERS

CAIRS are a minimally invasive, tissue-based alternative to synthetic intrastromal corneal ring segments and keratoplasty in select keratoconus patients. The improvements in visual, refractive, and topographic outcomes combined with a favorable safety profile demonstrated in this study suggest that CAIRS could offer a way to improve the vision of patients with keratoconus while also reducing their dependence on contact lenses.

DISCUSSION

To our knowledge, this meta-analysis provides the most comprehensive quantitative assessment to date of CAIRS outcomes in patients with keratoconus. The magnitude of visual acuity improvement and corneal flattening compared favorably with previously reported outcomes for synthetic intrastromal corneal ring segments (ICRSs), but CAIRS may offer greater biocompatibility and be associated with a lower risk of long-term complications.[2] A key advantage of CAIRS is their customizability, which allows tailoring of segment shape, thickness, and arc length to individual cone morphology. This flexibility might be particularly beneficial in eyes that have asymmetric or decentered cones.

The certainty of evidence in this meta-analysis was limited by the predominance of small, nonrandomized case series and relatively short follow-up durations. Additionally, variability in nomograms, preparation techniques, hydration status of the implant, and the use of prior or concurrent CXL contributed to heterogeneity across studies. Long-term follow-up

and randomized controlled trials comparing CAIRS with ICRSs, CXL, and keratoplasty are needed to guide patient selection and optimize surgical planning.

Despite the aforementioned limitations, the findings of this meta-analysis support CAIRS as a safe and effective option for visual rehabilitation in appropriately selected keratoconus patients. The intervention might help delay or obviate the need for corneal transplantation.

SAFETY AND EFFICACY OF POSTERIOR CHAMBER PHAKIC IMPLANTABLE COLLAMER LENSES IN PATIENTS WITH KERATOCONUS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Alkhabbaz AA, Karam MH, Pollmann AS, et al[3]
Industry support for this study: None

ABSTRACT SUMMARY

This systematic review and meta-analysis evaluated the safety and efficacy of posterior chamber ICL implantation (both the Visian and EVO models, STAAR Surgical) in patients with keratoconus. Five electronic medical literature databases were searched. Primary outcomes included changes in patients' CDVA, UDVA, and manifest cylinder. Secondary outcomes included SE, refractive cylinder, HOAs, endothelial cell density, IOP, vault, and adverse events.

The inclusion criteria were met by 16 studies published between 2008 and 2023. All were observational and included patients with stable keratoconus, most commonly mild to moderate disease. The meta-analysis found a significant improvement (10 Snellen lines) in patients' UDVA and a substantial reduction in SE and refractive astigmatism following ICL implantation. Adverse events were not significant and included elevated IOP and ocular dryness. Only one IOL was explanted. Overall evidence quality for primary and secondary outcomes was rated as moderate.

DISCUSSION

To our knowledge, this is the first study that systematically examined all the evidence on ICL use in patients with keratoconus. The largest gains were observed in patients' UDVA and the reduction of high myopia and astigmatism. These findings highlight the lens implant's ability to address the lower-order aberrations that commonly limit this population's BSCVA.

The ICL cannot correct the irregular astigmatism or HOAs inherent to keratoconus. Even so, a substantial proportion of eyes gained 1 or more lines of CDVA, likely reflecting improved retinal image quality from intraocular correction and reduced aniseikonia. The low rate of complications and acceptable postoperative vault measurements further support the safety of this approach in appropriately selected patients.

It is important to note that all included studies were observational, with heterogeneous protocols for patient selection, keratoconus staging, and ICL sizing. Follow-up duration, moreover, was relatively short, limiting conclusions about long-term safety outcomes such as cataract formation and endothelial cell loss. In addition, there are currently no standardized nomograms for ICL power calculation in keratoconic eyes.

These limitations notwithstanding, the study supports ICL implantation as a refractive intervention for stable keratoconus. Based on the evidence, the lenses may be most effective as part of a staged approach to keratoconus management, with ICRSs placed to improve corneal regularity and the phakic IOL subsequently implanted to correct residual myopia and regular astigmatism in carefully selected eyes with stable disease.[4] Future prospective comparative studies and longer-term follow-up are required to define the optimal role of ICLs relative to other surgical and nonsurgical options, including

STUDY IN BRIEF

- A systematic review and meta-analysis of 16 observational studies involving 397 eyes found that posterior chamber ICLs (both the Visian and EVO models, STAAR Surgical) significantly improved the uncorrected distance visual acuity, spherical equivalent, and refractive astigmatism of patients with keratoconus. The incidence of adverse events was low.

WHY IT MATTERS

Patients with keratoconus often have high, complex refractive errors that are poorly corrected with spectacles. Contact lens intolerance, moreover, is common in this population. LASIK and PRK typically are not viable options for these patients, resulting in dependence on scleral contact lenses for functional vision. ICL implantation could be a safe and effective refractive alternative for carefully selected patients with stable keratoconus.

combined and staged treatment strategies. ■

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