Abstracts

Edited by Dr. Tahir Mahmood

Low-Dose Mitomycin C as a Prophylaxis for Corneal Haze in Myopic Surface Ablation

Thornton I, Puri A, Xu M, Krueger RR
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Although it was introduced experimentally in refractive surgery more than 15 years ago, mitomycin C (MMC) was introduced clinically only recently as a topical adjunctive therapy to overcome the development of corneal haze alter photorefractive keratectomy (PRK). The rationale for its use relies on its potent cytostatic effect, blocking deoxyrihonucleic acid and ribonucleic acid replication, and protein synthesis. Although effective, MMC has been shown to produce notable complications in scleral and corneoscleral procedures, including peripheral keratolysis and scleral melting. Although these effects have not been shown to occur in cases of topical MMC use with surface laser ablation, some concern still exists for subclinical effects resulting from MMC toxicity to keratocytes, endothelial cells, and intraocular structures. Reports of keratocyte apoptosis, endothelial cell dropout, and detection of MMC in the anterior chamber have been reported, leading to the question of possible long-term effects. The initial topical dosage of MMC after surface laser ablation, 0.02% for two minutes, has been proposed empirically based on its historical use in filtering procedures for glaucoma and pterygium excisions at slightly higher concentrations that later were reduced. Consequently, both histologic and clinical studies are now being conducted to consider the effectiveness, safety, and mechanism of MMC use to explore the best concentration and exposure time. Most investigators have attempted to use the same concentration, 0.02%, but with shorter times to reduce the potential toxicity of longer exposures.

The purpose of this study was to evaluate the efficacy of low-dose (0.002%) mitomycin C (MMC) vs no prophylactic MMC (control) in reducing corneal haze after surface laser ablation.

Ninety-two eyes with no MMC application and 83 eyes with 0.002% MMC application during laser epithelial keratomileusis (LASEK) were analyzed in a retrospective chart review with one month, two months, three months, six months, one year, and two years of postoperative follow-up. Postoperative haze, visual acuity, and efficacy ratio (EFFR) then were analyzed statistically.

The no-dose MMC and low-dose MMC groups were statistically similar except for a thinner corneal pachymetry ($P < .001$), higher spherical equivalent error ($P = .006$), and smaller ablation zone ($P = .009$) in eyes not treated with MMC when subjected to univariate analysis. Multivariatc analysis was used to overcome the preoperative statistical differences among the two groups. Eyes treated with low-dose MMC (0.002%) demonstrated statistically less haze at all postoperative time points and in each myopic subgroup ($P < .001$). The postoperative uncorrectcd visual acuity (UCVA) and EFFR, however, showed no difference between the groups, except for better EFFR with MMC at one month ($P < .001$) and two months ($P = .034$).

Authors concluded with the remarks that low-dose MMC (0.002%) in eyes after LASEK results in less corneal haze than in eyes not receiving this agent. Concerns regarding the potential toxicity of MMC make a 10-fold less concentration more desirable in refractive surgery. Further comparative study of low- vs higher-dose MMC is recommended to characterize its clinical benefit fully

Incidence of cataract surgery from 1980 through 2004: 25-year population-based study

Erie JC, Baratz KH, Hodge DO, Schleck CD, Burke JP
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There is continued interest in estimating trends in the magnitude of cataract surgery within the United States population. As the U.S. population ages, it is estimated that the number of persons with cataracts will rise to approximately 30 million by 2020, an increase of 50%. Treatment for cataracts already accounts for a substantial proportion of vision related Medicare costs. Further growth in the number of cataract

surgeries required to meet an increasing cataract burden will affect future health care spending.

Few population-based studies have reported cataract surgery incidence rates in the US or in other countries, and none has a study period long enough to adequately span the conversion from extracapsular cataract extraction (ECCE) techniques to phacoemulsification. Incidence data for cataract surgery are useful in planning future eye-care delivery needs and are advantageous over cross- sectional prevalence data in more accurately estimating changes in annual demand. An efficient source of obtaining cataract surgery incidence data is the Rochester Epidemiology Project (REP). The REP databases record all patient-physician encounters within a stable, well-defined geographic area for which the REP has complete data capture. The usefulness of the REP databases in providing accurate population based data has been reported.

The purpose of this study was to estimate sex- and age-specific incidence rates of cataract surgery in a defined United States population and evaluate the change in incidence over time.

During the study period, 10245 cataract extractions were performed in 7141 residents of all ages. Overall, the age-adjusted cataract surgery incident rate per 100000 residents was 548 (95% confidence interval [Cl], 534-561) for women, 462 (95% Cl, 447-478) for men, and 511 (95% Cl, 501-521) for all residents. The incidence of cataract surgery increased 500% among women and 467% among men during the study period (P<.001). Overall, the incidence of cataract surgery was highest in residents 70 years and older (3538 surgeries [95% Cl, 3322-3764] per 100000 residents).

Authors concluded with the remarks that population-based study found a substantial increase in incident cataract surgery among Olmsted County residents during the 25-year study period. The rate of cataract surgery increased in a nearly linear fashion during a period when phacoemulsification replaced extracapsular cataract extraction in the community.

Outcomes of radiofrequency in advanced keratoconus

Lyra JM, Trindade FC, Lyra D, Bezerra A
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Surgical correction of keratoconus using thermal energy has long been a challenge for ophthalmologists. Several researchers have attempted to treat keratoconus by applying heat to its apex, thus flattening it and creating firm scar tissue and leukoma.

Applying hot cautery causes massive collagen destruction and corneal tissue melting. Thermokeratoplasty for keratoconus was abandoned because of complications and poor predictability. In the mid-1970s, thermokeratoplasty was modified and reintroduced by Gasset and Kaufman. Their technique consisted of the insertion of a 115°C probe at the apex of the cone. However, other authors report considerably lower success rates and a high incidence of morbidity after thermokeratoplasty.

Radiofrequency was recently reintroduced to correct hyperopia. It consists of the delivery of radio frequency energy through the corneal stroma using a probe tip. Corneal tissue resistance to the passage of radiofrequency energy heats the collagen, causing it to shrink. Temperatures ranging from 65°C to 75°C denature corneal tissue in a controlled and stable way. The tip is inserted deep into the corneal stroma (80%) to create a uniform cylinder. To correct hyperopia, the spots are placed in the circumference of the mid cornea and midperipheral cornea (6.0, 7.0, and 8.0 mm optical zones). The resulting collagen shrinkage has a "belt-tightening" effect, increasing the curvature of the central cornea. This approach does not rely on the heated tip used by Fyodorov and others in their thermokeratoplasty techniques.

The purpose of this study was to evaluate the use of radiofrequency energy to correct advanced keratoconus.

In this prospective comparative study, radiofrequency was applied to 25 eyes of 21 consecutive patients. One group comprised patients with a K-reading between 54.0 diopters (D) and 58.0 D; 8 thermal spots were placed at the 4.0 mm optical zone. The other group comprised patients with a K-reading greater than 58.0 D; 16 spots were applied at the 4.0 mm and 5.0 mm optical zones. The minimum follow-up was 18 months in all patients. Differences between preoperative and postoperative uncorrected visual acuity, best spectacle-corrected visual acuity (BSCVA), manifest refraction, and K-readings were clinically and statistically evaluated.

At end of the 18-month follow-up, the mean BSCVA in the 8-spot group improved from 20/100 (0.71 ± 0.25 logMAR) preoperatively to 20/40 (0.32 +

0.11 logMAR) and in the 16-spot group, from 20/200 (1.03 ± 0.30 logMAR) to 20/60 (0.62 ± 0.22 logMAR). The mean manifest refractive spherical equivalent (MRSE) improved from -7.70 D ± 5.20 (SD) preoperatively to -6.82 ± 4.41 D after 18 months in the 8-spot group and from -11.33 ± 6.70 to 8.38 ± 5.12D, respectively, in the 16-spot group. The mean best contact lens-corrected visual acuity was 20/30 (0.18 ± 0.24 logMAR) in the 8-spot group and 20/40 (0.31 ±0.19 logMAR) in the 16-spot group. A dense corneal scar was seen in 1 patient in the 16-spot group at the 6-month follow-up.

Authors concluded with the remarks that radiofrequency appeared safe for the treatment of advanced keratoconus. Contact lens fitting was stable in all cases.

Intracorneal rings for keratoconus and keratectasia

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Noninflammatory corneal thinning disorders, such as keratoconus, pellucid marginal corneal degeneration (PMCD), and keratoglobus, are characterized by progressive corneal thinning and are among the most common abnormalities refractive surgeons encounter. With the advancement of thinning, the cornea becomes more irregular and ectatic. To date, the therapeutic options for patients with corneal ectasia have been limited to spectacles and contact lenses, while in advanced stages of the disease the accepted approach is penetrating keratoplasty (PKP). Despite the good results of PKP in keratoconus, there are reported complications such as allograft rejection, significant endothelial cell loss (especially when the life expectancy is long), irregular astigmatism, side effects caused by long-term use of topical corticosteroids (eg, secondary glaucoma, cataract), and recurrence of keratoconus. The literature reports several alternative methods to treat keratoconus such as thermal keratoplasty, epikeratoplasty, photorefractive keratectomy, laser in situ keratomileusis (LASIK), and deep lamellar keratoplasty. Recently, intrastromal corneal ring segments have been designed to achieve refractive adjustment by flattening the cornea.

The changes in corneal structure induced by additive technologies can be roughly predicted by the Barraquer thickness law; that is, when material is added to the periphery of the cornea or an equal amount of material is removed from the central area, a flattening effect is achieved. In contrast, when material is added to the center or removed from the corneal periphery, the surface curvature is steepened. The corrective result varies in direct proportion to the thickness of the implant and in inverse proportion to its diameter. The thicker and the smaller the device, the higher the corrective result.

Intrastromal corneal ring segments were designed to achieve refractive adjustment by flattening the cornea. Recently, they have been used to reshape keratoconic corneas to improve uncorrected visual acuity, best corrected visual acuity, and contact lens tolerance and to delay or prevent the need for keratoplasty. Intracorneal ring segments have several distinct and important advantages. New thicknesses and different ring sizes and the use of femtosecond lasers to dissect channels inside the cornea will likely improve the surgical outcomes. This article reviews the latest data published or presented at meetings on the correction of keratoconus and keratectasia by intracorneal ring segments.