

A New Look at Refractive Vision

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The quest for the optimal method to correct various refractive errors continues. In studying different contact lens designs and refractive procedures we are constantly evaluating different approaches to patient management. Recognizing that the cornea is a dynamic and vibrant anatomic structure, we must include other parameters in the equation of the "perfect contact lens fit" or "the best surgical procedure."

This current issue of *IMAJ* contains an article on the subject [1]. Fulga et al. [1] shed considerable light on the relationship between lactate dehydrogenase levels and corneal metabolism. They found that the use of a peripheral contact lens design to increase and enhance tear flow and exchange under the contact lens led to improved corneal metabolism. However, when evaluating a particular contact lens or procedure, it is essential to also examine those variables that will have an impact on the anatomical and physiological changes. Concluding that a certain contact lens design is healthier for the eyes than another – in this case the novel design of the periphery of a rigid gas-permeable lens described by Fulga et al. – based on only one parameter in the equation could be misleading.

On the assumption that there is a vast difference between long and short-term contact lens wear with regard to damage to the eyes, it is important to assess all aspects. If the cornea is exposed to extended wear of contact lenses that lack extended-wear contact lens material, or if a gradual and progressive wearing schedule to allow the cornea to adapt to the rigid lens is not adhered to, the cornea will be overwhelmed. A direct result is a deleterious effect on the integrity and sensitivity of the cornea's innervation in maintaining the high metabolic rate of the epithelium [2–4].

Some of the sequelae or corneal changes that the authors rightfully mention are associated with prolonged contact lens wear. These include corneal deformation, capillary infiltration of the peripheral cornea, giant papillary conjunctivitis, among others. Not only would it be interesting to study their etiology, but it would be chal-

lenging to find a correlation between LDH levels and GPC for example, since the cause of GPC is thought to be immunological while the contact lenses are considered to be allergens. This allergenicity is demonstrated by a sample of scrapings from the papillae, which will show lymphocytes, plasma cells, mast cells, eosinophils and basophils, suggesting an antigen-antibody mechanism. Thus, patients who replace their lenses frequently are at a lower risk of developing GPC than those who replace their lenses after longer intervals [5].

The correlation between pinquecula and the long-term effect of contact lens wear has not been conclusively proven, although its pathophysiology has been attributed to both ultraviolet and environmental exposure. Moreover, any investigation of the long-term effect of contact lens wear should incorporate a new lens design, one that will reflect and not affect corneal thickness. Previous studies have indicated that long-term contact lens wear could cause a decrease in corneal thickness and cause surface irregularity [6]. Chronic rigid gas-permeable contact lens-induced hypoxia is associated with altered glucose lactate metabolism in the cornea [7]. Perhaps a lens periphery designed to enhance corneal metabolism will nullify the effect of the lens. Since studies of anatomical changes have shown a clear correlation between corneal damage and contact lens wear [8–13], the development of a new and different contact lens design might well be the solution.

Also associated with contact lens wear are changes in the level of polymorphonuclear leukocytes due to an alteration in the tear film integrity and levels of inflammatory mediators, and damage to the mucin layer of the ocular surface epithelium [14,15]. As the authors pointed out, some of the corneas had been detrimentally affected by the lens. It indeed would be interesting to look at the correlation between LDH levels and different corneal insults as compared to LDH levels during active contact lens wear when the cornea is intact. Moreover, evaluating

GPC = giant papillary conjunctivitis
LDH = lactate dehydrogenase

corneal changes should include comprehensive studies of the physiological and anatomical changes, employing the routine tools that we currently use on a daily basis. For example, the level of LDH is an important part of the puzzle in terms of physiological changes. Anatomical changes are no less important, and the use of corneal topography, pachymetry, fluorescein, and arc-scan will help determine a certain contact lens fit. Thus, a new peripheral contact lens design could be the answer that we are all searching for. As for the rigid gas-permeable contact lens, further studies are necessary to evaluate its effect on our ocular system.

In the last few decades of the twentieth century, ophthalmic surgeons applied various procedures, including surgery, to correct refractive errors such as myopia, hypermetropia and astigmatism. The use of advanced technology to perfect these procedures has culminated in LASIK, the application of laser technology using the excimer laser. In this procedure a microkeratome is used to create a flap 160 microns thick. Then, guided by computer analysis, the excimer laser emits its energy with exact precision onto the cornea. The laser, which is a form of heat, reshapes the stroma according to the information fed into the computer, while at the same time taking the curvature of the cornea into account.

Not all candidates are suitable however, and appropriate selection is important. Also, certain factors must be considered prior to the procedure, the most important being corneal thickness and structure, which can be measured by pachymetry, topography, and orbital scan. Corneal thickness is an essential player in the decision-making process since it has to retain a thickness of at least 250 microns after the procedure.

Today, after 7 years of experience in laser vision correction it is clear that healing and recovery of vision follow the same course as in other biological systems. Postoperative refraction indicates that 98% of the patients remain on the myopic side of the correction, mainly for the sake of patient comfort. Since hypermetropia shift will hinder their ability to adapt to their new refractive status, surgeons routinely under-correct myopia to avoid a shift to hypermetropia. Personal satisfaction is reported to be very good in 95% of the patients. As with any surgical procedure there may be complications or subjective dissatisfaction. Appropriate selection of patients is of utmost importance and the surgeon performing the LASIK procedure must apply expertise, use common sense, and adhere to fixed rules to avoid erroneous selection of candidates.

Laser technology has advanced meteorically with the development of scanning small-spot beam systems as opposed to broad-beam systems. In view of its promising

future and potential for improving postoperative visual performance even further, a considerable research effort is currently underway to develop customized procedures for each patient. The goal is a vision better than 6/6 uncorrected and free of aberration. Munnerlyn et al. [16], using a geometric approach to analyze corneal surface shapes, created a "shape subtraction model." With this model the tissue of an appropriate profile is subtracted using an excimer laser to produce the desired surface curvature. Despite the fact that only 50–85% of patients achieve 6/6 vision, 90% of the patients are satisfied.

As for the future, the next generation will benefit from an individualized customized laser refractive surgery that, controllable and predictable, will contribute to the final shape of the cornea and assure a vision that tops 6/6.

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