

CONTROLLING THE REFRACTIVE STATE OF THE HUMAN EYE

The true professional seeks to reduce the need for his or her services and to allay to the greatest degree the effects, both physical and psychological, to which the human body is heir.

The desire to rid oneself of glasses is universal and nowhere more evident than among the myopic population. Researchers and practitioners also share this objective although these groups are more realistic than laymen and recognize that there are limitations to the techniques employed and results to be expected.

In approaching this problem of control, one should keep in mind that control is not synonymous with cure, or the physical elimination of the defect, however desirable this objective may be. Control should be understood as the attempt to prevent the onset of a defect or refractive error, to slow down or retard, and in some specific cases to reverse the progress of an existing error, and to eliminate or reduce non-refractive anomalies which frequently accompany refractive errors.

Why so much emphasis has been placed on myopia and so little on the control of hyperopia and astigmatism, this writer has never been able to understand. Is it a "holdover" from the time-honoured era of the hunter whose livelihood depended on distance acuity and for whom near point activity was secondary? Is myopia a greater obstacle to a successful and enjoyable lifestyle than is hyperopia? Is not the myope a favoured individual in today's near-centered civilization?

The literature contains numerous papers treating the subject of the "Control of Myopia." Nutrition and dietary treatment, undercorrection, full Rx, prisms, drugs, bifocals, vision training have all had their pro-

ponents. Some success has been claimed for all these methods but in light of present day knowledge it is untenable to expect that these techniques can be universally applied.⁽¹⁾

Vision training seemed for a time to be an answer but the results of the Baltimore project,⁽²⁾ forty years ago, indicated that the refractive state cannot be changed by such procedures although visual acuity or the ability to interpret blur circles may be improved in some individuals. However, vision training may be of value in cases of hyperactivity of accommodation as could be prisms and bifocal prescriptions and drugs. Clinicians should not hesitate to apply those procedures which have proven useful in the past ^(1,12) but must exercise discretion and professional judgement in selecting those patients likely to benefit from the application of such procedures in order to avoid raising false hopes as to the eventual outcome. Needless to say, such professional decisions have to be based on more than a "quickie examination."

The clinical observations that many long-time hard contact lens wearers manifest a change in their refractive state and that these changes, in the majority of cases, are in the direction of decreased minus power, were first reported by Morrison⁽³⁾ in 1957. This led to false conclusions that "hard contact lenses" would control the development of myopia or at least retard its progress. This observation, which one colleague described as "orthokeratology by accident",⁽⁴⁾ led to the development of "orthokeratology" which is defined as "a programmed attempt to change the refractive state by the application of specifically designed contact lenses."⁽⁵⁾

Changes in the refractive state

which are observed appear to arise from a moulding effect on the cornea and perhaps from some other changes in the media which as yet remain unexplained.⁽⁷⁾

But if hard lenses seem to produce a decrease in minus refractive states, why has the opposite trend not been observed in hyperopic refractive states? Is it because fewer hyperopes seek contact lenses and trends are more difficult to establish, or is there a true structural, anatomical or physiological difference between hyperopic and myopic eyes? Would the myopic eye be a softer eye or a less rigid eye? Does the explanation reside in true genetic differences or weak chromosomes more easily influenced by environmental factors?

Most fitters fit on "K" or flatter and the cornea tends to shape to the base curve, favoring a reduction of corneal curvature. The same philosophy applied to hyperopes would increase the hyperopia. Thus, to reduce the hyperope, a steeper than "K" fitting would be necessary. A perusal of the literature does not indicate any such study has ever been done. Perhaps it should! Some individual or institution might accumulate such data on hyperopes as a first step in solving this riddle.

Although the initial procedures proposed for the control of myopia did provoke some controversy as to their objectives and efficacy, none created the stir and violent opposition as did the application of orthokeratology. Dangers and risks to the health of the eye were emphasized and orthokeratology practitioners were accused of unethical, unprofessional practice, not to mention outright quackery.

Fortunately, this unreasonable attitude has changed to one of enquiry, of investigation to evaluate the

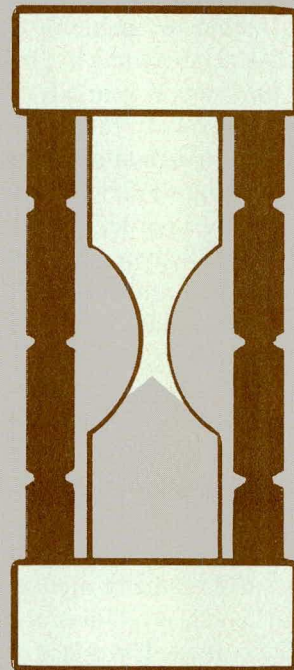
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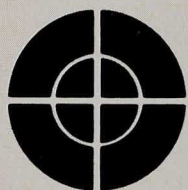
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clinical risk and results of the orthokeratology procedures.

It is strange that throughout this "O.K." battle, medical practitioners were practising surgical procedures with far more risk than that involved in orthokeratology. Such a procedure would be the removal of the crystalline lens but this is applicable to very high myopic errors and contact lenses or spectacles would be necessary in any case so why undergo the surgery? Moreover, Duke Elder suggests this is a very risky procedure to be used only rarely.

The Barraquer technique or corneal lamellar stromectomy has been used now for some 20 years. It consists of the removal of a thin layer of the stroma which is then frozen and its thickness reduced and curvature altered on a lathe in order to reduce the convexity of the cornea in myopia, or to increase its curvature in hyperopia, then replaced on the patient's cornea.^(8,9)

A second surgical procedure is keratophakia. It is applicable to hyperopes only because it results in an increased curvature of the cornea.^(8,9) It requires a donor cornea which is frozen and lathed to the shape of a small diameter meniscus lens. A thin lamella is removed from the recipient cornea. The donor cornea is placed on the recipient cornea and the lamella is placed over it and sutured back in place. There is always the risk of rejection of the donor cornea and possible visual damage. A safer procedure is to apply the donor cornea directly to Bowman's membrane after removal

of the epithelial from the recipient cornea. If the graft does not take, little harm will result as the graft is external, not intralamellar.

The most recent procedure is a Russian technique of radial keratotomy⁽¹⁰⁾ whereby some 32 (more or less) shallow radial incisions are made on the cornea from the optic cap outwards resulting in a flattening of the cap. It is a high-risk procedure due to possible infection and the unproven long range efficacy of the surgery and unknown possible complications.⁽¹⁰⁾

Whatever the procedure used, no true or permanent control can be hoped for until our knowledge of the aetiology of refractive states is better known and understood and the true effects of corporeal development, environment and heredity are appreciated to the fullest extent.

The establishment of an efficient system of control will depend as much on basic research including longitudinal epidemiological studies as upon the cumulative data and astute observations from clinical practice by interested practitioners who, although admitting the need for basic research, are not prepared to wait for the researchers. In their desire to meet an immediate challenge, the patient in the chair, they routinely use every procedure proven useful in preventing the onset or progress of new or existing conditions.

It is in this latter aspect that optometrists must direct their efforts if they are to be true primary care practitioners providing the high

level of care available only where professional standards are met. Readers are encouraged to avail themselves of the reference list because it is only by offering a higher level of vision care that the professional practitioner will be able to combat effectively the "chain" or "discount house" practice.

G.M.B.

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