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FACTORS OF DEPENDANCE REGARDING STABILITY OF RESULTS IN KM

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The quality of our surgical refractive techniques is value and brought into question by the results of refractive correction as well as visual acuity and the stability of both.

That in mind I would like to propose several hypotheses based upon information taken from 50 myopic cases and 100 hypermetropic KM cases, all of which come from my personal files.

There are two conditions, which the surgeon currently has little control over:

THESE ARE:

1. Tension within the disc
2. Interface instability.

Both of these conditions lead to unpredictable refraction and unpredictable visual acuity. One should attempt to avoid both.

Tension within the lathe-treated disc may occur due to:

a) Difference in arc lengths
b) tight adaptation of borders, or
c) wings.

The disc is to be sutured to the same spot from where it had been removed before the change of the surface parallel curves were effected.

The wings sutured tightly to the corneal step may force the disc to take its former shape, there by prohibiting a tension-fee alignment of the new curves.

This prohibitive procedure creates spaces within the interface, which are readily filled with serous exsudate. Fluid also enters this interface due to capillary powers.

The wings basically meant for a better and tighter adaptation and for closure of the wound may themselves be a reason for tension within the disc and for instability of refraction.

The better the adaptation by the wings, the less the computerized curves can fulfill their purpose.

The surgeon should allow the difference of arc lengths of the new internal radii as compared to the original surface-parallel curves, ie. RI minus ED, to expand.

The drawing originally taken from Dr. Barraquer's manual and altered here for illustration makes this point clear.

Point A is to be aligned with point B, PA is longer than PB by the amount c.

Point P has to move down. This can only be achieved free of tension if there is space for it. The size of this space may range between 0,12 - 0,2 mm, depending on the steepness of the cutting radius.

ER is only 18/100 mm thick. This may seem to be a small quantity, but the mechanical sequellae may play a significant role.

If we assume there to be an elasticity module of 0,4 a tension of about 0,7 grms/mm^2, i.e. 27 grms is constantly exerted over the area of the disc.

If the sutures are loose, one may observe ectasia of the borders of the lenticule. If they are tight, the adaptation zone bulges.

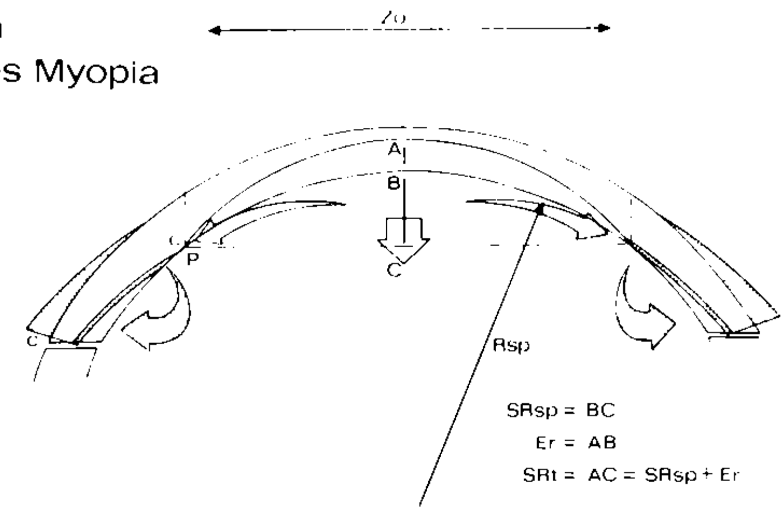
A similar situation occurs in hypermetropia due to the arc length differences which exist between RTA - RT and RB - ED.

In addition to this somewhat more mathematical and mechanical consideration, the above said is apparent if we look at an operated eye in coaxial light.

Shows a myopic case. One can see the circular bulging of the sutured area.

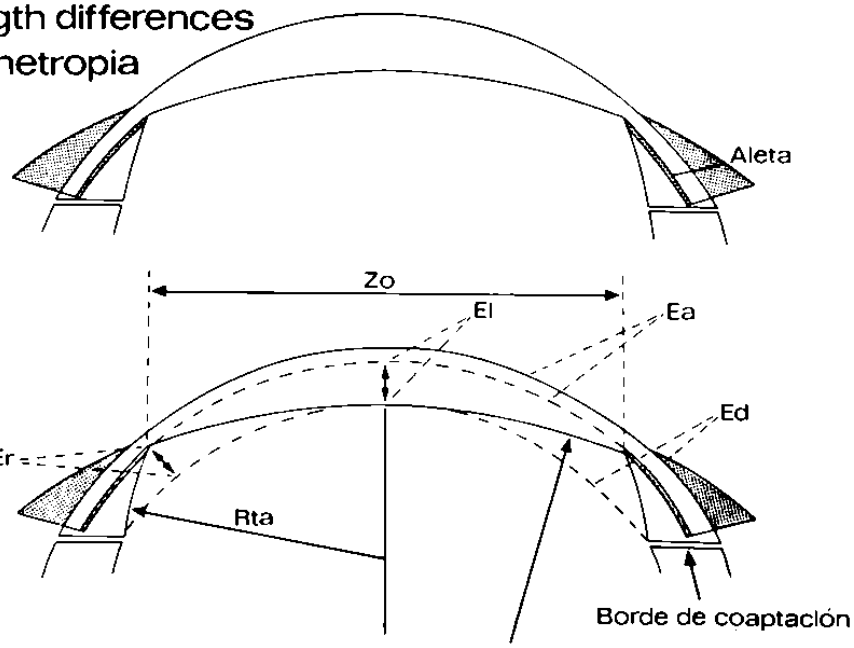
Shows no bulging of the alignment zone. In this case the wings were shortened by c/2.

Arc length differences Myopia



$$\frac{C'}{2} = \frac{ZO}{Fcc\cdot(RT+CH)}\cdot \arcsin\,(RT+CH)\cdot\pi \qquad \left(\frac{ZO}{Fcc\cdot(RB-ED')}\right)\cdot \arcsin\,(RB-ED')\cdot\pi$$

Arc length differences Hypermetropia



Similarly illustrates the same situation using a slit lamp photograph.

The interface itself may be the origin of instability of refraction and visual acuity.

The surgeon must combat both, irregular cuts and cells or detritus in the interface. Even the most meticulous operative techniques can not prevent cells of corneal or conjunctival epithelium from emerging within the separated corneal layers. As a result these cells grow and multiply exponentially producing metabolic products, which then appear as whitish infiltrations of the parenchyma.

Two possible explanations may account for the appearence of cells and detritus within the parenchyma:

1. The knife of the mikrokeratom forces under a presure of 0,7 kg/cm during the incision these cells of corneal origin into both sides of the parenchyma. This results in the growth of cells and the production of metabolic wastes in the interface.

2. Capillary suction around the entire incision draws detritus as well as cells of possible conjunctival origin into the interface within those areas where negative pressure occurs.

   In myopia they gather in the center.

   In hypermetropia they gather in the sulcus, which is around the optical zone.

The media, which is found within the newly formed spaces and which is ideal for the rapid growth of cells permits these cells to grow almost in a culture. This is true in myopia in regard to the optical zone. The better the surgery, i.e. the better the adaptation of the borders, the greater the amount of exsudate and of cells under the optical zone.

Looking with the broad slit of slit, lamp at the interface containing such cells, we see white patches which, when in the optical zone, impede acuity of vision considerably and cause blurring. If, during surgery, cells are brought into the interface, and if, before closing the wound, there exists the possibility that capillary action draws cells and detritus into the interface, current practice concerning wings and wound adaptation have to change.

The theory that cells are introduced into the interface surgery is supported by the fact that epithelial cells do not show any tendency to grow into tissues anywhere in the body, unless they are traumatically brought there. They don't activily move but grow by continuity.

If both of these hypotheses are valid, it follows that the cells and detritus have to be removed from the parenchyma of the cut tissue and that the form of the adaptation edges has to be changed.

The surgeon could, however, prevent these problems by reducing the ED by 1/100 mm in myopia and 2/100 mm in hypermetropia.

This he could achieve by using a baseparallel cut.

The adaptation edges would then have to be cut down to 25/100th mm by a RB-parallel cut. The diameter of the disc has to be diminished by the amount of the arc length differences.

This would allow the borders to slide.

The interface would have to be throughly cleaned. The double-running suture would be usefull in all cases, even in myopia, in preventing capillarity. By employing these techniques, predictably satisfactory results could be achieved.

These two slides distinctly make clear the contrast between the slit lamp view of regular myopic case with unchanged borders and that of myopic case with cut down borders.

One can see a smoother curve on the cornea.

The wings obtrued more obviously in hypermetropic KM cases.

The wings in a similar case create a surface which looks quite normal.

In the last 50 of 150 cases I followed the above stated procedures. I am now able to report in respect of these 50 cases stabil refractions and water-clear corneas.