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KERATOKYPHOSIS

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Keratokyphosis is a procedure of lamellating refractive corneal surgery in which the radius of curvature of the corneal surface is altered without application of the freezing process. The principle of this operation method consists in placing either a plano-concave or plano-convex lens on the cornea, depending on the correction desired, and then removing a corneal lamella with the microkeratome.

A new microkeratome has been developed in which the applanated surface is firmly fixed with the lower suction ring at the corneal limbus and cannot be moved. The oscillating blade lies in the cut surface during the cutting procedure and moves between the two fixed corneal lamellae. For better fixation of the upper corneal lamella, this is held fast by the applanation surface through a second suction ring. This construction makes it possible to use insets curved as desired instead of the flat applanation surface and to thus obtain correspondingly shaped corneal surfaces. In addition, to improve the cutting quality, the oscillating blade with which the corneal lamella is removed is made of sapphire instead of steel.

We have now carried out several experiments to examine the section quality of the severed lamellae. In order to standardize the experimental conditions as precisely as possible, freshly enucleated porcine eyes were cut with the newly developed microkeratome as follows: the circular applanation form in the microkeratome had a diameter of 8.6 mm and a depth of 0.3 mm. Before the microkeratome was fixed to the eye, a 23-gauge cannula was inserted behind the muscular attachment into the posterior chamber of the eye and then advanced through the pupil into the anterior chamber. Physiological saline solution was infused into the eye from a reservoir until the intraocular pressure rose to 20

mmHg. During the measuring procedure, intraocular pressure was determined with the aid of a pressure transducer and registered with the aid of a recorder.

After removal of the corneal lamella, the defect was stained with fluorescein, photographed and measured. A glass plate with engraved scale was fixed directly over the eye during the photographing procedure. For all cuts and with both microkeratomes, the diameter of the lesion in the feed direction was greater than that perpendicular to the feed direction. Depending on the lens applied, the difference ranged between 73 μ and 218 m. With the Barraquer microkeratome, the difference was 180 μ. This difference is the expression of frictional forces that arise during the cutting procedure. If the respective standard deviation is used as the measure of precision, this is lowest for the lamellae cut with the Barraquer microkeratome. In relation to the proyected radius, it was larger at 4.5% than the 1.4 to 2.8 standard deviations of the lamellae severed with the Berlin microkeratome. The reason for this is that, except for the central part intended for the lens, the applanation form in the Berlin microkeratome is kept identical, while application of the Barraquer microkeratome requires individual selection of the suitable suction ring for each eye with the aid of an applanation lens.

The severed corneal lamellae were fixed with a glutaraldehyde/paraformaldehyde mixture according to Karnowski. The feed direction of the microkeratome was marked on the corneal lamellae. The corneas were subsequently embedded in Epon and cut in the axial section corresponding to the feed direction of the microkeratome. Then a coordinate measurement of the axial section was performed with a universal measuring microscope.

The cutting experiments on porcine eyes show that the reproducibility of the section size and layer thickness of plane–parallel lamellae is greater with the Berlin microkeratome than with the Barraquer microkeratome. All corneal lamellae that were cut with a plane-convex or plane-concave lens showed and undercorrection of the values measured as compared to those calculated. The measured values ranged between 62% and 86% with the use of plane-convex lenses and between 47% and 56% with the use of plane-concave ones. Measurements of the thickness during fixation indicate that the fixative causes swelling of the corneal lamellae. The tissue swelling cannot be determined, however, for lenticularly cut corneal lamellae.

Thus the decisive question of whether the calculated and the actual changes in the power of refraction correspond can only be answered by operating on living animals.