14 Robinson's computerized model of eye muscle mechanics revised.

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The computerized model of static eye-muscle mechanics developed by Robinson[1] was revised extensively and improved. An extensive literature study yielded additional information on the average diameter of the eye as related to age, on the average location of the insertions and origins of the eye muscles, and on the average cross-sectional area and length of the eye muscles. These data were used in the computerized model. In line with our previous force-length measurements of isolated human eye muscles[2-4], the relation between force and length of a non-contracting eye muscle was now described with an exponential relation, and the relations between force and length of an innervated, contracting eye muscle at varying levels of innervation were represented by a series of linear relations with equal slope constant. The spring constants of two muscles of a pair of innervated, contracting antagonists, like medial and lateral rectus muscles, had been found in our measurements to be approximately equal, and this was changed accordingly in the computerized model. Several parameters, like the relation between the two innervations of two muscles of a pair of antagonists in different directions of gaze, were free in the original model, *i.e.*, they were not derived from *in vivo* measurements. These were either replaced by a derivation from hard data or made redundant. Elaborating on previous work by Miller *et al*[5,6]. and by ourselves[7], we quantified the possible effects of sideslip of eye muscles in eye movements out of the plane of action of the muscle and the resulting different directions of pull: we found little difference between a version of the model with eye muscles pulling in a direction that remained constant relative to the orbit, and a version with eye muscles pulling in a direction that remained constant relative to the eye. These versions of the model did not differ significantly in their predictions of the angles of squint in a trochlear palsy, something already described by Clement[8]. Amazingly, the excyclotropia caused by the modelled trochlear palsy did not vary much in ad- as compared to abduction in both versions of the model. The model with eye muscles pulling in a direction that remained constant relative to the globe was only slightly more compatible with the findings in a large clinical series[9]. Uncertainty in the computerized model remains about the spring constants of innervated, contracting oblique and vertical rectus muscles relative to the spring constant of innervated horizontal rectus muscles, and about the spring constant in passive rotation of the eye caused by attached adnexa. Here, more *in vivo* measurements are needed. Finally, the model was made binocular so that surgery and other interventions could be modelled in both eyes simultaneously. The ease of operation was improved, the algorithms were made faster and the computerized model was adapted for use on a Hewlett Packard 100LX Palmtop PC (an IBM PC compatible pocket computer). Information on the programs can be obtained from the author.

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15 Macular relocation: A surgical approach for age-related macular degeneration?

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With the average age of the population increasing, age-related maculopathy has become one of the most threatening diseases of the eye. Very limited therapy is available for the exudative or neovascular form. No therapy can be offered for the atrophic form. The pathology is usually located in the macular area where the retinal pigmented epithelium is no longer functional and the choriocapillaris may develop vascular abnormalities such as neovascular membranes.

An animal model was utilized to study mobilization and relocation of the retina. After lentectomy and vitrectomy, the retina was completely separated from the RPE by subretinal infusion of BSS. A 360° peripheral retinotomy was performed and the retina was rotated up to 60° around the optic nerve head. Morphological studies revealed relative intactness of the retina and RPE. Cases of age-related maculopathy with severe subretinal hemorrhage were treated with this technique. Rotations of 45° were achieved. One patient experienced visual improvement from 1/200 to 20/80. Rotated images persisted for approximately eight months post-operatively so that external muscle surgery was considered. However, rotated visual perception of the one-eyed patient resolved completely and spontaneously after one year of follow-up.

The rationale of this therapy is to relocate the macula to an area where the RPE appears less diseased and therefore may allow some recovery of central vision.

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