Abstract

This thesis focuses on the development of a predictor of vision gain in patients with keratoconus after the surgery for implantation of intracorneal rings. Keratoconus is characterized by an arrangement or abnormal growth of collagen fibers in the cornea that causes significant loss of vision in the patient. In recent years, surgical procedure for implantation of intracorneal rings has been chosen to correct this disease. However, both the best technique and the best nomogram for the implementation of these rings are currently unknown. This thesis is mainly focused on solving this problem, in aiming at helping ophthalmologists to plan the number, type, and the optimal location of these rings in order to get the maximum possible gain in vision after implantation.

In particular, this thesis describes and develops models which are capable of predicting certain information based on knowledge obtained from recent registers in patients, and their application in surgery of keratoconus. These models belong to the field of Machine Learning. Machine Learning has been successfully used in many fields of application to different problems, including the detection of keratoconus, but; to this author's knowledge, has not yet been used for the prediction of the patient's vision improvement after implantation of rings. Therefore, this thesis implies a great novelty in planning this type of surgery.

The main contributions of this thesis are: the development and validation of a model to predict the vision gain in terms of corneal curvature (K1) and astigmatism in patients with keratoconus; a rigorous study of the refractive, topographic or biomechanical variables that have relevance in the prediction of recovery of vision after surgery and finally, the development of a user interface for clinical application using the optimal model developed in this thesis.