Analysis of the Spectral Reflectance in Fibrin and Fibrin-Agarose Corneal Constructs
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Introduction
Creation of three-dimensional scaffolds that mimic the structure of the human cornea is a major bioengineering challenge. Since very few biomaterials are able to fulfill the optical requirements of the native corneal stroma, in vitro reproduction is very difficult. In previous works we report the designed of a novel biomaterial based in a mixture of human fibrin and agarose that allowed us to analyse some optical coefficients 1. Our goal in this work is to evaluate the spectral distribution of an artificial corneal stroma substitute based on fibrin and fibrin with 0.1% agarose concentration.

Materials and Methods
Two types of bioengineered corneal stroma substitutes were developed in the laboratory using human fibrin stromas and human fibrin and 0.1% agarose stromas, both with human keratocytes immersed within (an average of 250,000 cells were added). After 28 days in culture using specific culture media, the optical properties of the artificial corneal tissues were analyzed by determining the spectral radiance of these tissues using white and black backgrounds with a spectroradiometer PR-704 (Photoresearch) under geometry CIE 45° d illuminating conditions. Optical coefficients were calculated from the spectral reflectance on days 1, 14 and 28 data using Kubelka-Munk’s equations within the visible spectrum (400-700 nm). The statistical analysis was computed by using SPSS 15.0 software.

Results
The results show that the transmittance gets higher in both fibrin and fibrin-agarose constructs in the manner that the wavelength is increased and with the time of culture. The values of the transmittance are higher for those fibrin constructs that those of fibrin-agarose. The constructs of corneal stroma present a transmittance that exceeds 90% throughout most of the visible spectrum and increases toward larger wavelengths. The changes with time of culture are important from one sample to another. The fibrin constructs display significant differences with time of culture. This could be explained by the difference growth of cells between the two materials. Further experiments with a extended time of culture most be performance to analysed if the transmittance values continue over time.

Discussion and Conclusions
The ability to transmit almost all the incident light in the visible part of the spectrum is one of the properties of the cornea. The theories that explain the corneal transparency focus on the propagation of the light in the extracellular matrix of the stroma. In the stroma corneal substitutes the attenuation of light is caused by optical absorption and scattering just like in the native cornea.


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