A device to measure Electrical Impedance Sensing (EIS): an objective device tool to discriminate Dry Eye, Penfigoid and Sjogren Diseases

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The objective of this work was to design, build and test a detector that discriminates between normal human eyes and those suffering from dry eye disease (it is estimated that 20% of the world's population suffers from this pathology) using electrical impedance spectral techniques (EIS). For this purpose, we have designed, built and tested a sensor that is applied on the cornea surface accompanied by its corresponding electronics.

The sensor is constructed of biocompatible materials, gold (live) of 0.42 mm diameter, surrounded by a surgical stainless-steel cylinder of 1.3 mm internal diameter and 2.5 mm external diameter (neutral) embedded in a biocompatible resin. The impedance measured is between the live, the neutral, through the tear layer and the cornea.

The electronics excite the sensor with a chirp on voltage and the current is approximately 1 micro-ampere with a series load resistor. The electronics also senses the voltage on the sensor. Finally, it calculates the current flowing through the series circuit, which results in the resistance and capacitance of the sensor as a function of frequency.

This information is used to discriminate on average between normal eyes and eyes with pathologies as seen in the Figure for dry eye, Pemphigoid and Sjogren's pathologies. A clear discrimination is seen between these conditions.