Diagnosis of fungal infection in rabbit corneas using Raman spectroscopy

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Corneal infections are vision threatening diseases caused by microorganisms, usually by bacteria or fungi. Corneal infections often lead to impairment in sight or even blindness without suitable and prompt treatment. Rapid and accurate diagnosis is critical to begin appropriate treatment; however, in about 50% of patients it is impossible to make a diagnosis of the pathogen. The conventional slit lamp examination cannot achieve make definite diagnosis. An ophthalmologist usually needs to take a tiny tissue and stain it to identify the category. In addition, traditional microbiology culturing is required to culture the organism for diagnosis. However, these methods are time consuming, for example fungi often require more than 2 weeks and often produce no results. We report the use of spontaneous Raman spectroscopy in diagnosing corneal infection caused by three prevalent types of fungi, including Candida, Aspergillus, and Fusarium. Raman spectroscopy was conducted first on fungal spores from different species and the spectra showed significant differences. The spectra of rabbit corneas infected by different fungi were then obtained with a larger laser focus. Using multi-variable analysis, infected corneas can be distinguished from healthy corneas rapidly, non-invasively and with high accuracy.

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