

عنوان مقاله:

Detection and Characterization of Human Teeth Caries Using ۲D Correlation Raman Spectroscopy

محل انتشار:

مجله فیزیک و مهندسی پزشکی، دوره 9، شماره 2 (سال: 1398)

تعداد صفحات اصل مقاله: 12

نویسنده:

Y El-Sharkawy - Department of Biomedical Engineering, Military Technical Collage, Cairo, Egypt

خلاصه مقاله:

Background: Carious lesions are formed by a complex process of chemical interaction between dental enamel and its environment. They can cause cavities and pain, and are expensive to fix. It is hard to characterize in vivo as a result of environment factors and remineralization by ions in the oral cavity. Objectives: The development of a technique that gives early diagnosis which is non-invasive, is of crucial importance for public health. Raman spectroscopy is a technique that can fulfil these requirements. The main goal of this work was to use Raman spectroscopy to differentiate between normal and carious human teeth in vivo. The samples used in this study were collected by traditional human teeth. Material and Method: An in vivo Raman spectroscopy system and specialized fiber optic probe has been designed to obtain spectra from tissue. These probes are filtered to reduce the background signal from the fiber optics and the collection fiber utilizes beam steering to optimize the collection effectiveness. Results: In order to detect any demineralization and carious versus sound pit and fissure enamel, the spectral data sets are analyzed by the proposed scheme to demonstrate the utility of generalized ۲D correlation spectra. Potential applications of this ۲D correlation approach are then explored. The Raman spectra in the normal tissue showed the presence of vibrational bands in $۴۳۷.۸۷\text{ cm}^{-۱}$, $۵۸۱.۸۹\text{ cm}^{-۱}$, $۹۵۳.۸۹\text{ cm}^{-۱}$ and $۱۰۵۴.۷۳\text{ cm}^{-۱}$ with smaller intensity than in the carious spectra. Image construction from the peak intensity produced chemical maps of apatite concentration. Conclusion: Such two-dimensional correlation spectra emphasize spectral features not readily observable in conventional one-dimensional spectra. No correlation is observed in mode-to-mode intensity fluctuations indicating that the changes in mode intensities are completely independent. Theoretical calculations provide convincing evidence that the fluctuations are not the result of diffusion, orientation or local electromagnetic field gradients but rather are the result of subtle variations of the excited-state lifetime, energy and geometry of the molecule and producing a signature response for carious detection.

کلمات کلیدی:

Raman Spectroscopy, ۲D Correlation, Characterization of Human Teeth

لینک ثابت مقاله در پایگاه سیویلیکا:

<https://civilica.com/doc/1892149>

