

MULTIPHOTON IMAGING MICROSCOPY OF DENTAL PIECES AS A TOOL IN FORENSIC SCIENCES

Juan M. Bueno,¹ Rosa M. Martínez-Ojeda,¹ Francisco J. Ávila,¹ Ana C. Fernández-Escudero,² Manuel López-Nicolás,³ and María D. Pérez-Carceles²

¹Laboratorio de Óptica, ²Dept. Medicina Legal y Forense, ³Dept. Odontología,
Universidad de Murcia, 30100 Murcia, Spain

E-mail: bueno@um.es

KEYWORDS: Dentin, enamel, multiphoton microscopy, forensic

It is known that tooth formation has been widely used to predict age and assess maturity [1]. Moreover, multiphoton (MP) microscopy (both two-photon excitation fluorescence (TPEF) and second harmonic generation (SHG)) has been reported to be a very useful tool to identify the different components of the tooth [2]. However to our knowledge, this imaging technique has hardly been used in forensic odontology applications. Here we analyze the changes in MP signals of the tooth as a function of age as a possible tool for forensic age estimation.

The major components of the tooth were imaged with a home-made MP microscope [3]. A set of human dental pieces from subjects with different ages (from 19 to 64 years) were used. Each tooth was sectioned into two parts along the buccolingual and longitudinal axis with a diamond saw and stored in saline solution. The internal open section of the sample was placed in an upside-down position in a bottom-glass dish for MP imaging. As expected, enamel presents only TPEF signal. However, dentine provides both TPEF and SHG strong signals. This difference in MP responses allowed an accurate visualization of the dentine-enamel junction. Moreover, the combination of both contributions in the dentin area was shown to vary with age. In particular, differences up to 35% in the ratio TPEF/SHG were found when comparing dental pieces of elderly subjects and teenagers.

This information confirms the usefulness of this technique in forensic age estimation after disasters (natural or manmade) with a lack of comprehensive fingerprint database. Courts and other government authorities might also benefit from this tool when the official age of individuals under special circumstances is required for legal or medical reasons.

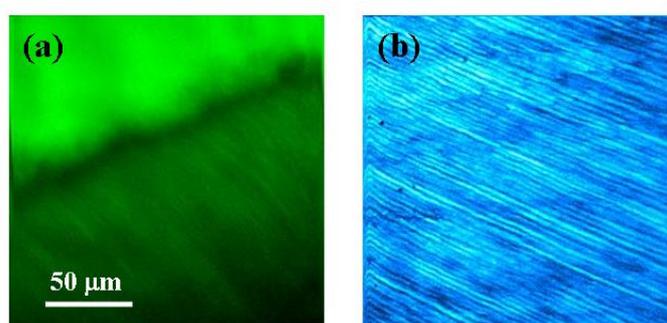


Figure 1: (a) Dentin-enamel junction, TPEF image. (b) Dentin, SHG image.

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[2] Chen *et al.*, *J. Biomed. Opt.* **12**, 064018 (2007).

[3] Bueno *et al.*, *J. Biomed. Opt.* **15**, 066004 (2010)

Acknowledgments: This work has been supported by Spanish grants FIS2016-76163-R and 19897/GERM/15.