

INFLUENCE OF COLLAGEN CHIRALITY ON SECOND HARMONIC GENERATION IMAGING OPTIMIZATION

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Second Harmonic Generation (SHG) signal presents polarization-sensitivity (PS) characterized by the first-order hiperpolarizability tensor [1]. PS-SHG techniques have been useful to optimize SHG signals [2], to explore organization [3], and to detect pathological disorders [4] in collagen-based tissues. Moreover, the arrangement of collagen molecular chains gives rise to particular internal configurations associated with the chiral structure that can generate circular dichroism SHG (CD-SHG) and might affect the SHG response of the SHG [5]. Since the success of an accurate and objective diagnosis depends on the quality of the acquired images, these might be optimized. The aim of this work is to enhance PS-SHG imaging through the Mueller-matrix (MM) formalism and explore the relationship between CD-SHG and the maximum PS.

SHG imaging was carried out using a PS-SHG microscope [6]. Imaged samples corresponded to collagen-based ocular tissues. Sets of SHG images were acquired for four independent polarization states. From these images, the spatially-resolved first row of the MM was computed. These MM elements were then used to calculate the CD-SHG maps and to reconstruct the images with the best and lowest quality based on pre-determined metrics. Results show that, independently of the metric used, the best reconstructed SHG image presents a better quality than the original ones (see Fig. 1, histological section of human sclera). In particular, SHG images for maximum transmittance disclose details and features unseen before. In addition, the higher the CD-SHG values the higher the polarimetric performance (Fig 1, right plot), what might be closely related to collagen chirality.

The improved visualization of collagen tissues could be of particular interest in clinical diagnosis since it can help in the early detection of pathologies related to collagen denaturation and surgery follow-ups.

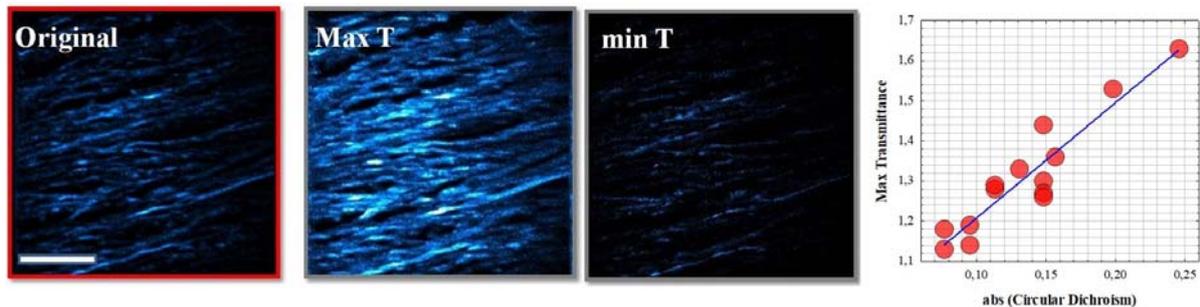


Fig. 1: Reconstructed SHG images for maximum and minimum transmittance (T). Right plot shows the linear correlation between CD-SHG (absolute values) and maximum transmittance. Scale bar: 50 μm .

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