Harmonic generation microscopy of dental sections
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In this presentation we are demonstrating the use of third harmonic generation (THG)[1] and second harmonic generation (SHG)[2] in imaging dental sections. Teeth are the hardest and most indestructible part in human body. The porous structures and collagen within the dental sections greatly facilitate observation based on THG and SHG, respectively.

Strong SH has been found on various biological specimens, such as collagen, potato starch, and skeletal muscles. These materials all possess periodical nano-structures that are often referred as (nonlinear) bio-photonic structures. In particular, collagen is an extra-cellular structural protein and is a major component of bone, cartilage, skin, and other tissues. Collagen fibrils have a triple-helical structure and it has been shown that this structure enables collagen to generate SH from a wide range of wavelengths in the infrared region. For comparison, microtubule structures within dentin, due to its large index mismatch with surrounding, can be clearly seen with THG imaging.

Figure 1: (a) SHG image acquired near the dentinoenamel junction (b) corresponding THG image (c) THG and SHG spectra measured at dentin and (d) enamel near the dentinoenamel junction. Note the much weaker intensity of THG and the lack of SHG from enamel.