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Efficiency and Plume Dynamics for Mid-IR Laser Ablation of Cornea[1] AROSHAN JAYASINGHE, BORISLAV IVANOV, M. SHANE HUTSON, Dept of Physics & Astronomy, Vanderbilt University — This paper reports ablation experiments on porcine corneal tissue using the Vanderbilt Mark III Free Electron Laser (FEL) and a tabletop Raman-shifted Alexandrite laser. These experiments were designed to test previous models that suggested wavelength and intensity dependent ablation mechanisms. In one test, we compare ablation efficiency and plume dynamics for two FEL wavelengths (λ=2.77, 6.45 μm) chosen such that different components of the tissue matrix act as the primary chromophore (water or protein respectively), while keeping the total absorption constant. We find small differences in ablation efficiency (with slightly more efficient ablation at 2.77 μm); no difference in shockwave propagation; and slightly more particulate matter in the plume at 6.45 μm. In a second test, we find that the Raman-shifted Alexandrite laser has similar ablation efficiency to the FEL in the 6-7 μm range – despite a $\sim$500-fold higher intensity. Although these results do not confirm the previous model predictions, the findings do suggest that the Raman-shifted laser can be a viable alternative to the FEL for surgical applications.

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