Introduction and Objective: Mid-infrared erbium lasers are effectively utilized for dental hard tissue treatment. We intend to develop a new all-solid-state laser for dental treatment. Recently, a wavelength-tunable, nanosecond-pulsed Cr:CdSe laser was developed by RIKEN (Wako, Japan), which enables laser oscillation around 2.9 µm. The aim of the present study was to evaluate the effects of Cr:CdSe laser on dental hard tissues.

Method: We used wavelengths of 2.76-3.00 µm and an energy output of 0.28-2.0 mJ (fluency: 1.6-11.2 J/cm²/pulse; pulse duration: approximately 250 ns; beam diameter: approximately 150 µm). Enamel, dentin, and cementum plates were irradiated with the Cr:CdSe laser at 10 Hz without water irrigation. After irradiation, morphological changes, ablation depth, and thickness of the thermally affected layer of the irradiated surfaces were analyzed using stereomicroscopy, scanning electron microscopy (SEM), and light microscopy of nondecalcified histological sections.

Results: The nanosecond-pulsed Cr:CdSe laser irradiation effectively ablated dental hard tissues with no visible thermal damage such as carbonization and major melting and cracks; the width of the thermally affected layer was approximately 20 µm. The efficacy of ablation gradually increased from 3.00 µm toward 2.76 µm, with 2.76 µm revealing the highest ablation efficacy on dentin.

Conclusions: The nanosecond-pulsed Cr:CdSe laser demonstrated excellent ablation effects on dental hard tissue, and the wavelength dependence of its ablation effect on dentin in the range of 2.76-3.00 µm was remarkable. These results indicate the potential of the wavelength-tunable Cr:CdSe laser as a novel laser system for dental treatment.

Educational Objectives
- Describe the effects of the nanosecond-pulsed Cr:CdSe laser on dental hard tissues.
- Specify the wavelength dependence of the ablation effect of Cr:CdSe laser in the range of 2.76-3.00 µm on dentin.
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Disclosure: Dr. Lin has reported no commercial affiliations or personal conflicts of interest relative to this presentation.
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