

Lasers in Dentistry XIII

Peter Rechmann
Daniel Fried
Editors

21–22 January 2007
San Jose, California, USA

Sponsored and Published by
SPIE—The International Society for Optical Engineering

Volume 6425



The International Society
for Optical Engineering

Proceedings of SPIE—The International Society for Optical Engineering, 9780819465382, v. 6425

SPIE is an international technical society dedicated to advancing engineering and scientific applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Lasers in Dentistry XIII*, edited by Peter Rechmann, Daniel Fried, Proceedings of SPIE Vol. 6425 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 1605-7422
ISBN 9780819465382

Published by
SPIE—The International Society for Optical Engineering
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone 1 360/676-3290 (Pacific Time) · Fax 1 360/647-1445
<http://www.spie.org>

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at <http://www.copyright.com>. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 1605-7422/07/\$18.00.

Printed in the United States of America.

Contents

vii *Conference Committee*

SESSION 1 LASERS IN CARIES DETECTION: DIAGNOSTIC IMAGING

- 642502 **Multimodal imaging system for dental caries detection** [6425-01]
R. Liang, V. Wong, M. Marcus, P. Burns, P. McLaughlin, Eastman Kodak Co. (USA)
- 642503 **Three-dimensional tooth imaging using multiphoton and second harmonic generation microscopy** [6425-02]
M.-H. Chen, National Taiwan Univ. (Taiwan) and National Taiwan Univ. Hospital (Taiwan);
W.-L. Chen, Y. Sun, P. T. Fwu, M.-G. Lin, C.-Y. Dong, National Taiwan Univ. (Taiwan)
- 642504 **Laser scanning confocal microscopy and laser tweezers based experiments to understand dentine-bacteria interactions** [6425-03]
S. C. Peng, National Univ. of Singapore (Singapore); S. Mohanty, P. K. Gupta, Raja Ramanna Ctr. for Advanced Technology (India); A. Kishen, National Univ. of Singapore (Singapore)
- 642505 **Optical imaging of hard and soft dental tissues using discretely swept OFDR-OCT** [6425-04]
H. Kakuma, The Univ. of Tokyo (Japan); K. Ohbayashi, Kitasato Univ. (Japan); Y. Arakawa, The Univ. of Tokyo (Japan)
- 642506 **Digital image assessment of metallic post morphological detection through trans-illumination of composite materials** [6425-05]
E. C. Lins, F. L. E. Florez, A. C. R. Figueiredo, V. S. Bagnato, Instituto de Fisica de São Paulo (Brazil)
- 642507 **Excitation-emission fluorescence spectroscopy and time-gated Raman microscopy analysis of dental tissues** [6425-06]
M. Mukhin, Marquette Univ. (USA); S. Sen, N. Kouklin, A. Skliarov, Univ. of Wisconsin, Milwaukee (USA); D. B. Dhuru, A. M. Iacopino, Marquette Univ. (USA); V. V. Yakovlev, Univ. of Wisconsin, Milwaukee (USA)

Pagination: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication.

SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

- 642508 **A new multi-wavelength optical-plethysmograph for quantitative determination of pulpal hemoglobin content and oxygen level using green and near-infrared LEDs** [6425-07]
S. Kakino, Z. Miwa, A. Kirimoto, K. Ohuchi, S. Takatani, Y. Takagi, Tokyo Medical and Dental Univ. (Japan)

SESSION 2 LASERS AND COMPOSITES

- 64250B **Fiber-reinforced composite analysis using optical coherence tomography after mechanical and thermal cycling** [6425-10]
B. B. C. Kyotoku, Univ. Federal de Pernambuco (Brazil); A. K. S. Braz, Univ. de Pernambuco (Brazil); R. Braz, A. S. L. Gomes, Univ. Federal de Pernambuco (Brazil)
- 64250C **Aged composite resins ablation under different parameters of Er:YAG laser: ablation rate and morphological aspects** [6425-11]
R. de Fátima Zanirato Lizarelli, L. T. Moriyama, F. L. E. Florez, D. P. Jacomassi, Univ. of São Paulo (Brazil); J. E. P. Pelino, UNICSUL (Brazil); V. S. Bagnato, Univ. of São Paulo (Brazil)

SESSION 3 LASERS IN PERIODONTOLOGY AND SOFT TISSUE SURGERY

- 64250E **Comparison of violet diode laser with CO₂ laser in surgical performance of soft tissues** [6425-13]
H. Hatayama, Sumitomo Electric Industries, Ltd. (Japan); J. Kato, Tokyo Dental College (Japan); A. Inoue, Sumitomo Electric Industries, Ltd. (Japan); G. Akashi, Y. Hirai, Tokyo Dental College (Japan)

SESSION 5 LASERS IN DENTAL HARD TISSUE

- 64250G **Er:YAG laser micro-preparation of hard dental tissue** [6425-15]
T. Dostálová, Charles Univ. Prague (Czech Republic); H. Jelínková, M. Němec, P. Koranda, Czech Technical Univ. (Czech Republic); M. Miyagi, K. Iwai, Sendai National College of Technology (Japan); Y.-W. Shi, Fudan Univ. (China); Y. Matsuura, Tohoku Univ. (Japan)
- 64250H **Surface modification of dental tissues by KrF excimer laser radiation** [6425-16]
M. Sivakumar, V. Oliveira, R. Vilar, Instituto Superior Técnico (Portugal)
- 64250I **Real-time near-IR imaging of laser-ablation crater evolution in dental enamel** [6425-17]
C. L. Darling, D. Fried, Univ. of California, San Francisco School of Dentistry (USA)
- 64250J **Scanning ablation of root caries with acoustic feedback control** [6425-18]
K. Fan, D. Fried, Univ. of California, San Francisco (USA)
- 64250K **Effect of sample storage conditions on Er:YAG laser ablation of enamel, dentin, and bone** [6425-19]
W. J. Selleng, Laser Dental of Colorado Springs (USA)
- 64250L **Investigation of ultrashort-pulsed laser on dental hard tissue** [6425-20]
T. Uchizono, K. Awazu, Osaka Univ. (Japan); A. Igarashi, J. Kato, Y. Hirai, Tokyo Dental College (Japan)

- 64250M **Effect of water spray during laser ablation on dental hard tissue** [6425-21]
H. W. Kang, American Medical Systems (USA) and The Univ. of Texas at Austin (USA);
I. RizoIU, BioLase Technology (USA); A. J. Welch, The Univ. of Texas at Austin (USA)
- 64250N **Assessment of root caries removal by Er,Cr:YSGG laser** [6425-22]
V. R. Geraldo-Martins, M. M. Marques, School of Dentistry, Univ. of São Paulo (Brazil)

SESSION 5 LASERS IN ENDODONTICS

- 64250O **High speed imaging of an Er,Cr:YSGG laser in a model of a root canal** [6425-23]
R. Verdaasdonk, Univ. Medical Ctr., Utrecht (Netherlands); J. Blanken, Private dental clinic (Netherlands); H. van Heeswijk, R. de Roode, J. Klaessens, Univ. Medical Ctr., Utrecht (Netherlands)

POSTER SESSION

- 64250Q **The sound of dental tissue ablation as a possible parameter for conservative dentistry** [6425-25]
F. R. P. Robles, F. M. Mendes, A. B. Matos, Dental School, Univ. of São Paulo (Brazil)
- 64250R **Er:YAG laser irradiation on dentin: FT-Raman and SEM studies** [6425-26]
L. E. S. Soares, UNIVAP (Brazil) and School of Dentistry, UNIVAP (Brazil); R. A. Bitar, UNIVAP (Brazil); A. Brugnera, Jr., F. A. A. Zanin, Vale do Paraíba Univ. (Brazil); E. B. P. S. Resende, W. A. A. Jara, A. A. Martin, UNIVAP (Brazil)
- 64250S **Near-IR and PS-OCT imaging of developmental defects in dental enamel** [6425-27]
K. Hirasuna, D. Fried, C. L. Darling, Univ. of California, San Francisco (USA)
- 64250T **Near-infrared image-guided laser ablation of artificial caries lesions** [6425-28]
Y.-C. Tao, K. Fan, D. Fried, Univ. of California, San Francisco School of Dentistry (USA)
- 64250U **Polarization sensitive optical coherence tomography for quantifying the severity of natural caries lesions on occlusal surfaces** [6425-29]
D. Fried, P. Ngaotheppitak, C. L. Darling, C. M. Ho, Univ. of California, San Francisco (USA)
- 64250V **Oral pathology diagnosis by means of micro-Raman spectroscopy on biopsies and blood serum** [6425-30]
F. Zenone, Univ. Federico II Napoli (Italy); M. Lepore, Seconda Univ. di Napoli (Italy);
G. Perna, P. Carmone, Univ. di Foggia (Italy); I. Delfino, Univ. della Tuscia (Italy);
G. M. Gaeta, Seconda Univ. di Napoli (Italy); V. Capozzi, Univ. di Foggia (Italy)
- 64250X **Influence of gel/LED-laser application on cervical microleakage of two barrier materials used for endodontically treated teeth whitening** [6425-32]
M. A. Marchesan, F. Barros, S. Porto, S. Zaitter, A. Brugnera, Jr., M. D. Sousa-Neto, Univ. of Ribeirão Preto (Brazil)
- 64250Y **Investigation of photo-bleaching through transmittance method in pigmented solution: understanding possible mechanisms and advantages for photo dental whitening** [6425-33]
F. L. E. Florez, E. C. C. C. Lins, Univ. de São Paulo (Brazil); P. Portero, Univ. Estadual Paulista (Brazil); R. Z. Lizarelli, Univ. de São Paulo (Brazil); O. B. Oliveira, Jr., Univ. Estadual Paulista (Brazil); V. S. Bagnato, Univ. de São Paulo (Brazil)

- 64250Z **Colorimetric evaluation of composite materials with different thickness by reflectance spectroscopy** [6425-34]
P. P. Portero, Univ. Estadual Paulista (Brazil); F. Florez, V. Bagnato, Univ. of São Paulo (Brazil); O. B. de Oliveira, Jr., L. de Castro Monteiro Loffredo, Univ. Estadual Paulista (Brazil)
- 642510 **Organic dye penetration quantification into a dental composite resin cured by LED system using fluorescence spectroscopy** [6425-35]
R. de Fátima Zanirato Lizarelli, M. E. Silva, Jr., E. C. C. Lins, M. M. Costa, Univ. of São Paulo (Brazil); J. E. P. Pelino, UNICSUL (Brazil); V. S. Bagnato, Univ. of São Paulo (Brazil)
- 642511 **Background interference on the color of dental composite materials with different thickness by digital contrast** [6425-36]
E. C. Lins, Instituto de Física de São Carlos (Brazil); F. L. E. Florez, Instituto de Física de São Carlos (Brazil) and Faculdade de Odontologia de Araraquara (Brazil); P. P. Portero, Faculdade de Odontologia de Araraquara (Brazil); R. F. Z. Lizarelli, Instituto de Física de São Carlos (Brazil); O. B. Oliveira, Jr., Faculdade de Odontologia de Araraquara (Brazil); V. S. Bagnato, Instituto de Física de São Carlos (Brazil)

Author Index

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology (USA)
R. Rox Anderson, Wellman Center for Photomedicine (USA),
Massachusetts General Hospital (USA), and Harvard School of Medicine
(USA)

Program Track Chairs

Reza Malek, Mayo Clinic (USA)
Keith Black, Cedars-Sinai Medical Center (USA)

Conference Chairs

Peter Rechmann, University of California, San Francisco (USA)
Daniel Fried, University of California, San Francisco (USA)

Program Committee

Aldo Brugnera, Jr., Universidade do Vale do Paraíba (Brazil)
John D. B. Featherstone, University of California, San Francisco (USA)
David M. Harris, Bio-Medical Consultants, Inc. (USA)
Boris B. Majaron, Jozef Stefan Institut (Slovenia)
G. L. Powell, The University of Utah (USA)
George K. Stookey, Indiana University (USA)
Joel M. White, University of California/San Francisco (USA)
Harvey A. Wigdor, Advocate Illinois Masonic Medical Center (USA)

Session Chairs

- 1 Lasers in Caries Detection: Diagnostic Imaging
Daniel Fried, University of California, San Francisco (USA)
- 2 Lasers and Composites
Daniel Fried, University of California, San Francisco (USA)
- 3 Lasers in Periodontology and Soft Tissue Surgery
Peter Rechmann, University of California, San Francisco (USA)
- 4 Lasers in Dental Hard Tissue
Peter Rechmann, University of California, San Francisco (USA)
- 5 Lasers in Endodontics
Peter Rechmann, University of California, San Francisco (USA)

Poster Session

Daniel Fried, University of California, San Francisco (USA)

Peter Rechmann, University of California, San Francisco (USA)