

# The International Journal of Periodontics & Restorative Dentistry

Official Journal of the Academy of Osseointegration

## Editors-in-Chief:

Gustavo Avila-Ortiz, DDS, MS, PhD  
Oscar Gonzalez-Martin, DDS, MSc, PhD

## Editorial Consultants:

Akira Aoki, DDS, PhD  
Sofia Aroca, DMD, PhD  
Shayan Barootchi, DMD, MS  
Urs C. Belsler, DMD  
Nitzan Bichacho, DMD  
Francesco Cairo, DDS  
Jae-Kook Cha, DDS, MS, PhD  
Leandro Chambrone, DDS, MSc, PhD  
Vivianne Chappuis, DDS, Prof Dr Med Dent  
Stephan J. Chu, DMD, MSD, CDT  
Jan Cosyn, DDS, MSc, PhD  
Emilio Couso-Queiruga, DDS, MS  
Luca De Stavola, DMD, MOM, SSO  
Vincent Fehmer, MDT  
Manrique Fonseca, Dr Med Dent, MAS  
Helena Francisco, DDS, MSc, PhD  
German O. Gallucci, DMD, PhD  
Maria L. Geisinger, DDS, MS  
William V. Giannobile, DDS, DMSc

Luca Gobatto, DDS, MS  
Ueli Grunder, DMD  
Adam Hamilton, BDS, DCD  
Joseph Kan, DDS, MS  
John Kois, DMD, MSD  
France Lambert, DDS, MS, PhD  
Pascal Magne, DMD, PhD  
George A. Mandelaris, DDS, MS  
Pamela McClain, DDS  
Michael K. McGuire, DDS  
Brian L. Mealey, DDS, MS  
Paulo Fernando Mesquita de Carvalho, DDS, MS  
Konrad H. Meyenberg, Dr Med Dent  
Craig M. Misch, DDS, MDS  
Ricardo Mitrani, DDS, MSD  
Alberto Monje, DDS, MS, PhD  
Nadja Naenni, PD, Dr Med Dent  
Rodrigo Neiva, DDS, MS  
Giorgio Pagni, DDS, MS  
Gianluca Paniz, DDS, MS, PhD  
Javier Perez Lopez, CDT  
Mia Rakic, DDS, PhD  
Ausra Ramanauskaite, DDS, Dr Med Dent, PhD  
Giulio Rasperini, DDS

Andrea Ravida, DDS, MS, PhD  
Andrea Ricci, DDS  
Isabella Rocchietta, DDS, MSc  
Mario Rocuzzo, DDS  
Paul S. Rosen, DMD, MS  
Irena Sailer, Prof Dr Med Dent  
Atsushi Saito, DDS, PhD  
Mariano Sanz, MD, DDS, Dr Med  
Ignacio Sanz-Martin, DDS, MSc  
Ignacio Sanz Sánchez, DDS, MS, PhD  
E. Todd Scheyer, DDS  
Sergio Spinato, DDS  
Martina Stefanini, DDS, PhD  
Clinton D. Stevens, DDS  
Lorenzo Tavelli, DDS, MS  
Tiziano Testori, MD, DDS  
Daniel S. Thoma, Prof Dr Med Dent  
Istvan Urban, DMD, MD, PhD  
Diego Velasquez-Plata, DDS, MSD  
Mario Veltri, DDS, PhD, Cert Perio  
Arnold S. Weisgold, DDS  
Giovanni Zucchelli, DDS, PhD  
Otto Zuhrt, DDS, PhD

## Publisher

Christian W. Haase

## Publisher Emeritus

Dr hc H. W. Haase

## Editor Emeritus & Founding Editor

Myron Nevins

## Managing Editor

Kristen Henningson

## Production

Nicole McMillan

## Subscription Manager

Michelle Hartman

Publishers of Foreign Language Editions:  
Italian edition: [www.quintessenzaedizioni.com](http://www.quintessenzaedizioni.com)  
Japanese edition: [www.quint-j.co.jp](http://www.quint-j.co.jp)  
Spanish edition: [www.quintessence.es](http://www.quintessence.es)

POSTMASTER: Please send address changes to  
Quintessence Publishing Co, Inc, 411 N Raddant Road,  
Batavia, IL 60510, USA.

Copyright © 2024 by Quintessence Publishing Co, Inc.  
All rights reserved. No part of this journal may be re-  
produced or transmitted in any form or by any means,  
electronic or mechanical, including photocopying,  
recording, or any information and retrieval system,  
without permission of the publisher through the Copy-  
right Clearance Center. Single photocopies of single  
articles may be made for personal use as allowed by  
national copyright laws. Please contact the Copyright  
Clearance Center for permission requests and to pay  
fees: [www.copyright.com](http://www.copyright.com). The journal's ID number  
(ISSN) is 0198-7569.

The views expressed herein are those of the individual  
authors and are not necessarily those of the publisher  
or the Academy of Osseointegration (AO). Information  
included herein is not professional advice and is not  
intended to replace the judgment of a practitioner with  
respect to particular patients, procedures, or practices.  
To the extent permissible under applicable laws, the  
publisher and AO disclaim responsibility for any injury  
and/or damage to persons or property as a result of  
any actual or alleged libelous statements, infringe-  
ment of intellectual property or other proprietary or  
privacy rights, or from the use or operation of any  
ideas, instructions, procedures, products, or methods  
contained in the material therein.

The publication of an advertisement does not con-  
stitute on the part of the journal, publisher, or AO a  
guaranty or endorsement of any aspect of the quality

or value of the advertised products or services or  
of any of the representations or claims made by the  
advertisers.

Manuscript submission:  
[www.manuscriptmanager.net/rdp](http://www.manuscriptmanager.net/rdp)

Printed in the United States

The International Journal of Periodontics & Restorative  
Dentistry is abstracted and/or indexed in MEDLINE,  
Current Contents/Clinical Medicine, and Science  
Citation Index.

The International Journal of Periodontics & Restorative  
Dentistry is published bimonthly in English and Italian,  
quarterly in Spanish, and annually in Japanese by the  
Quintessence International Publishing Group.

## Editorial, Advertising, and Subscriptions:

Quintessence Publishing Co, Inc  
411 N Raddant Road, Batavia, IL 60510  
Tel: (630) 736-3600 • Fax: (630) 736-3633  
Toll-free (US/Canada): (800) 621-0387  
Advertising: [russell@quintessence-publishing.com](mailto:russell@quintessence-publishing.com)  
Subscriptions: [mhartman@quintbook.com](mailto:mhartman@quintbook.com)  
[www.quintessence-publishing.com](http://www.quintessence-publishing.com)

In North America, the regular subscription rate is  
\$298 per year; institutional rate is \$805. The international  
rate (outside North America) is \$338 regular; \$845  
institutional. International subscribers add \$40 to  
international rate for air mail. Special student rate is  
\$238 (\$278 international) (verification of student status  
required on submission of subscription order). Single  
copies \$54 prepaid. Claims for missing issues will be  
serviced only within 6 months of publication date.  
Otherwise, single-copy price will be charged on missing  
issues. Subscription inquiries should be sent to the  
publisher or agents of the language edition desired.

ISSN 0198-7569 (print)  
ISSN 1945-3388 (online)