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## Contents

### Columns & Departments

- **Editorial** .......................................................... 557  
  Collective Efforts to Combat Early Childhood Caries

- **President’s Column** .......................................... 559  
  The Butterfly Effect and Dentistry

- **News & Updates** .................................................. 561  
  Task Force to Prepare National Advocacy Strategy on ECC ........................................ 561
  New Resource on Oral Health Best Practices for Seniors ............................................ 561
  Vancouver Symposium to Highlight Digital Learning Needs  
  of Dental Students ................................................ 562
  Management of Systemic Inflammation by Dentists and Physicians: New Guidelines .......... 564

- **CDSPI Reports** .................................................. 569  
  CDSPI Introduces the Qtrade Investor Online Brokerage Service

- **The JCDA Interview** ............................................ 571  
  A Microbiologist in the World of Dentistry

- **Point of Care** .................................................... 575  
  How do I manage a suspected oral vascular malformation? ........................................ 575
  How do I perform a first dental visit for an infant or toddler? ................................. 577

- **Classified Ads** .................................................. 603

- **Advertisers’ Index** .............................................. 609

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APPLIED RESEARCH

Retrospective Review of Voluntary Reports of Nonsurgical Paresthesia in Dentistry
Andrew S. Gaffen, Daniel A. Haas

Effect of Timing and Technique of Post Space Preparation on Sealing Ability of Remaining Root Filling Material: In Vitro Microbiological Study
Fabiana Soares Grecca, Ângela Rezende Gomes Rosa, Maximiliano Schünke Gomes, Clarissa Fatturi Parolo, Jules Renan Dutra Benfica, Luis Carlos da Fontoura Frasca, Marisa Maltz

PROFESSIONAL ISSUES

Probiotics for Oral Health: Myth or Reality?
Laetitia Bonfait, Fatiha Chandad, Daniel Grenier

CLINICAL PRACTICE

Treatment Options for Teeth with Open Apices and Apical Periodontitis
Denise Pontes Raldi, Isabel Mello, Sandra Márcia Habitante, Jose Luiz Lage-Marques, Jeffrey Coil

Management of Erythema Multiforme Associated with Recurrent Herpes Infection: A Case Report
Rafael Lima Verde Osterne, Renata Galvão de Matos Brito, Isabela Alves Pacheco, Ana Paula Negreiros Nunes Alves, Fabricio Bitu Sousa

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Collective Efforts to Combat Early Childhood Caries

In September, I attended the annual meeting of the Canadian Academy of Pediatric Dentistry (CAPD). Dr. Louis-René Charette, the CAPD president, was most gracious in allowing me to meet my goals of learning about the specific issues currently important to the members of his organization and exploring how the CAPD can work more closely with JCDA in the future. During my time at the meeting, I was particularly impressed by how this organization has developed as an effective national voice on matters related to pediatric dentistry.

The issues that CAPD advocates for resonate particularly strongly with me, as I have a strong interest in public policy matters and have spent much of my time as a clinician treating children. If you visit the CAPD website (www.capd-acdp.org) and click on the “Hot Topics” button, you will find 2 issues highest on the academy’s advocacy agenda — early childhood caries (ECC) and the desirability of every child finding a “dental home” by 1 year of age.

CAPD is particularly concerned about the increasing prevalence of ECC in Canada. ECC is a disease of multifactorial causes that requires new and innovative means of prevention and treatment. The dental profession needs allies from outside our sector to combat this condition. We certainly have common cause with our medical colleagues in this area, and CAPD has worked very hard to develop strong links with the Canadian Pediatric Society (CPS) on this topic. During the annual meeting, Dr. Ross Anderson delivered a report to the membership from the oral health section of the CPS, and the report was very well received.

The energy and innovation in combating ECC was also evident in the continuing education sessions at the CAPD meeting. Dr. Rocio Quiñonez of the University of North Carolina spoke passionately about her Baby Oral Health Program (BOHP), one that she hopes can be viewed as a model of care for dental practitioners. The BOHP (www.bohp.unc.edu) offers practical tools to help implement a preventive oral health care program for infants, toddlers and their caregivers in a dental practice.

In another session, Dr. Rosamund Harrison, Dr. Clive Friedman and his staff team demonstrated the technique of motivational interviewing (www.motivationalinterview.org). What impressed me was the gentleness of this approach in dealing with parents of children with ECC. We all know well the feelings of guilt experienced by parents in these circumstances. So you can imagine that a technique, based on acceptance rather than judgment, is particularly suited to guiding parents toward healthier decisions relating to the oral health of their children.

It is never too early to guide new parents gently on the path to optimal oral health for their children. Many parents contact CDA with questions about their children’s oral health. Perhaps with more partnerships, CDA can further develop its online resource section on pediatric oral care for members of the public.

For practitioners, in this month’s Point of Care section, Dr. Felicity Hardwick answers the question, “What can we hope to achieve with the 1-year dental visit?” (p. 577). In a complementary audiovisual presentation in the electronic version of JCDA, Dr. Hardwick walks us through the actual technique that we can use to optimize the outcome of the first dental visit.

I believe the widespread adoption of this practice-building intervention can improve the oral health of our youngest and most vulnerable children. Unfortunately, research has shown that Canadian dentists are in the early stage of adopting the practice of the 1-year visit, which is encouraged by CDA.

Organized dentistry in Canada is taking the problem of ECC very seriously. For example, Drs. Harrison and Hardwick and a group of colleagues produced an excellent DVD on ECC prevention on behalf of the British Columbia Dental Association. Also, Dr. Friedman is chairing a newly constituted CDA task force on the prevention of ECC (p. 561). Rome will not be built in a day, but I am gratified to see some of our profession’s best minds engaged in combating such an important public health issue.
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The Butterfly Effect and Dentistry

In 1972, meteorologist Edward Lorenz delivered a speech with the provocative title “Predictability: Does the Flap of a Butterfly’s Wings in Brazil Set Off a Tornado in Texas?” His ideas would become popularly known as the “butterfly effect,” the concept that the flap of a butterfly’s wings would be enough to alter the course of the weather forever. In dentistry (as well as the weather), geographically remote and seemingly unrelated events can eventually have a profound effect on the dental profession in Canada.

This phenomenon came to mind recently as I attended the FDI World Dental Congress in Singapore as a member of CDA’s official delegation. Participating at this event reaffirmed for me the importance of staying globally connected — aware of where the butterflies are, so to speak. While in the past we may have been advised to think locally and act globally, now we must also think globally and act locally. By this I mean that CDA needs to look beyond our borders, to observe developments in dentistry in other countries and determine how these trends and events will affect the professional lives of Canadian dentists.

Canada is one of over 190 member associations from 134 countries in FDI, which represents more than 1 million dentists worldwide. FDI’s vision is to lead the world toward optimal oral health by advancing and promoting the practice of dentistry through the transfer of knowledge. It strikes me that its vision parallels CDA’s new strategic direction, which focuses on knowledge and advocacy. As the respective international and national leaders of dentistry, FDI and CDA are examining similar issues.

A good example of this synergy is the Global Caries Initiative, a series of regional conferences organized by FDI to help understand the issues and promote prevention and oral health as a component of overall health, with the ultimate goal of eradicating caries in children under 3 years of age. This project views caries as a public health issue and searches for practical ways to improve techniques for early identification and intervention in the disease process.

Canadian dentistry is also aware of the seriousness of early childhood caries (ECC) and, having scanned the global environment, has taken complementary action. In this month’s Editorial (p. 557), Dr. O’Keefe discusses the recent activities of the Canadian Academy of Pediatric Dentistry in this area. As well, CDA’s Committee of Clinical and Scientific Affairs has created an ECC task force to review the situation in Canada and make recommendations on how to advocate on this issue (p. 561). So, not only can we serve as a resource to FDI on ECC, we can also learn from FDI’s efforts and successes around the world and apply this knowledge to Canada.

Whether the issue is caries, amalgam or fluoride, knowledge exchange truly flows in both directions. In fact, there is a high respect within FDI for Canada’s contributions to the global dental profession. Dr. Burton Conrod of Sydney, Nova Scotia, has just completed his term as FDI president and he made public health a priority issue for the organization. Dr. Conrod’s legacy will be carried on as other Canadians hold positions of importance on several FDI committees and CDA’s contributions to FDI position statements continue to be valued.

Global knowledge exchange is an essential element of CDA’s ongoing participation within FDI. With this in mind, we held formal meetings with representatives from many national dental associations in Singapore to exchange ideas, discuss challenges and identify solutions to common issues. Such open lines of communication are critical to our capacity to properly scan the global professional environment and effectively serve our members.

The world of the 21st century is rapidly shrinking, and the “butterfly effect” will surely touch dentistry in many areas. CDA must continue to play an active role globally through our participation at FDI to help our members manage a changing profession locally. Our commitment to global public health should remain a priority, so that we can also deliver on our promise of optimal oral health at home.

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Task Force to Prepare National Advocacy Strategy on ECC

CDA's Committee on Clinical and Scientific Affairs has created a task force to facilitate the development of a national advocacy strategy that will address the issue of early childhood caries (ECC) in Canada. The task force is currently preparing a report that will outline how CDA can work effectively with stakeholders to promote oral health for infants and children to help prevent ECC.

Dr. Clive Friedman of London, Ontario, is chair of the ECC task force. He hopes that the group's efforts will expose some of the negative trends associated with this childhood disease. “Despite CDA’s recommendation that children visit a dentist by their first birthday, many dentists aren’t seeing children until age 3, by which time it is often too late,” he says. Dr. Friedman also notes that ECC continues to be the greatest untreated disease of childhood in this country and that the long waiting times for anesthesia to treat ECC are unacceptable.

Members of the task force (Drs. Rosamund Harrison of Vancouver, Sarah Hulland of Calgary, Robert Schroth of Winnipeg and guest Maryam Amin of Edmonton) will review reports and recommendations from recently held national conferences on ECC and survey the provincial dental associations to determine what health promotion and disease prevention activities and programs are currently in place in each province.

The group will also stay in close contact with the Office of the Chief Dental Officer, Canadian Association of Public Health Dentistry, Canadian Academy of Pediatric Dentistry and the Pediatric Oral Health Section of the Canadian Pediatric Society, to exchange relevant information on ECC.

The task force plans to submit its final report to the Committee on Clinical and Scientific Affairs later this year. 

“Despite CDA’s recommendation that children visit a dentist by their first birthday, many dentists aren’t seeing children until age 3, by which time it is often too late.”

— Dr. Clive Friedman

New Resource on Oral Health Best Practices for Seniors

CDA's Committee on Clinical and Scientific Affairs (CCSA) has developed a new resource that compiles the best practices for dental and oral care for seniors. *Optimal Oral Health for Frail Older Adults: Best Practices Along the Continuum of Care* is designed for dentists and other health care professionals and caregivers responsible for the oral health of seniors.

The new document includes links to pertinent guidelines, training resources, patient information forms and fact sheets that are helpful to those who provide oral care for seniors in private practice or in long-term care facilities.

To confront the critical issues facing seniors’ oral health care in Canada, CDA brought together corporate and clinical leaders in 2005 to identify key issues, develop a national vision and take action on the significant challenges inherent in promoting optimal oral health for the elderly. The national forum report *Taking Action on Seniors’ Oral Health Care* prompted CDA to take action in 4 areas: education, research, strategic planning and delivery of care. The new resource stems from the ongoing efforts of the CCSA in focusing on issues related to seniors’ oral health care.

The document can be found on CDA’s website at: www.cda-adc.ca/en/dental_profession/practising/best_practicesSeniors/default.asp.
The University of British Columbia (UBC) will host a digital learning symposium on April 13–14, 2010, in
Vancouver, immediately before the Pacific Dental Conference.

The symposium is the result of a grant from the Canada–California Strategic Initiative Program recently
awarded to Dr. Karen Gardner of UBC and Dr. Sam Huang of the University of California San Francisco. The
primary goal of the event is to introduce dental school faculty, dental associations and governing bodies
to the novel ways dental students are incorporating digital learning into their dental studies and how
digital technologies affect students’ understanding of dentistry, their lifelong learning practices and their
expectations as they move into clinical practice.

The first day of the symposium will feature a hands-on digital training session directed by Dr. Michelle
Lamberson of UBC’s Office of Learning Technology. The following day will consist of presentations on the
dental virtual classroom, international peer review in web-enabled platforms, educational theory as it
applies to digital learning and the growing use of digital dental study clubs. The symposium will culminate
in the integration of these concepts with the digital technologies demonstrated during the first day’s
session.

The impetus for the April symposium stems from Drs. Gardner and Huang’s involvement with a col-
laborative digital learning project called the International Peer Review for Dental Students in BLOG format.
This project, which also includes dental schools from Britain, Australia and China, encourages dental
students to learn from their peers around the world by using modern information technologies to compare
different approaches to dental procedures.

“It seems clear that dental students will expect to continue employing this type of digital, col-
laborative mode of learning after graduation,” explains Dr. Gardner. “The symposium will allow
dental schools and associations to keep pace with the rapid evolution of digital learning and hope-
fully work together to meet the needs of new dentists.”

For details on the symposium or to learn more about the ongoing digital learning projects at UBC, contact
Dr. Gardner at drkg@interchange.ubc.ca.
Dr. Maret Truuvert watched proudly as her granddaughter, Trina Macrae, received her DMD degree during McGill University’s faculty of dentistry convocation ceremony last May. What makes this event particularly noteworthy is that with Trina’s graduation, Maret believes her family became the first to have 3 generations of women dentists in Canadian dentistry.

Maret graduated from the University of Toronto (U of T) in 1956, specialized in pediatric dentistry and taught for many years in the U of T faculty of preventive dentistry. Her daughter Piret graduated from U of T in 1978, while her mother was on staff. They practised side-by-side for 12 years until, tragically, Piret and her husband Ian Macrae were killed in a car accident in 1990 when Trina was a young girl.

Although she had always wanted to be a dentist as a child, Trina spent a few years pursuing other academic interests while trying to figure out her career path. However, Trina believes that her strong family influence helped in her decision to choose dentistry, “Many of my colleagues at McGill had family members who were dentists and I think that people who choose a career in dentistry often have role models who bring them insight into the profession.”

Trina’s grandmother also chose her profession carefully. Maret is originally from Estonia and fled with her family to Sweden in 1944, just before Soviet occupation. An excellent student, Maret was interested in medicine, but felt that the demands of being a physician would be difficult to combine with having a family. She was accepted to both medicine and dentistry at Stockholm University and has never regretted choosing dentistry as her career.

Maret hopes that Trina will experience the same fulfillment in her dental career that both she and Piret enjoyed. “I loved dentistry and tried to make a difference in that I preached prevention more that anything. My daughter was very much like me in many ways, so I was sure that she would be good for the profession and the profession would be good for her. And as my granddaughter is almost a copy of my daughter, the same goes for her.”

Trina is already demonstrating the same aptitude and enthusiasm for dentistry as her elders. She received numerous awards at graduation and is currently performing an internship at Sunnybrook Hospital in Toronto. While she is still making decisions about the focus of her future dental career, she hopes to become involved in organized dentistry and public health.

Growing up surrounded by female dentists influenced Trina’s views on dentistry. “I grew up in a family of female dentists whose colleagues were female dentists,” says Trina. “As a young child I was under the impression that almost all dentists were female!” While in general Trina does not perceive gender barriers in the profession, she understands that attitudes have changed dramatically since her grandmother practised dentistry.

Her grandmother remembers that women were quite emancipated in Sweden in the 1950s, so Maret was surprised to find a different way of thinking when she arrived in Canada. About 20% of Maret’s graduating class in Sweden were women, but she recalls that when she graduated from U of T in 1956, only 3% of Canadian dentists were women.

Despite facing some social and institutional challenges as a female dentist, Maret never felt like an outsider with her predominantly male classmates, and the first dentist she worked with was very accepting of women dentists. Today, approximately 28% of Canadian dentists are women, thanks in part to early role models like Maret Truuvert.

Maret is invited to the U of T convocation ceremony every year to present the Preventive Dentistry Award, an award established in 1991 by Piret’s classmates in her honour. Attending these convocation ceremonies gives Maret the opportunity to observe the gradual gender differences between graduating classes. “While the annual changes are hardly perceptible, over the years the difference is enormous. The only constant is the quality of the graduates: they are all very bright young people,” she concludes.
Management of Systemic Inflammation by Dentists and Physicians: New Guidelines
By Anthony M. Iacopino, DMD, PhD

A relationship between periodontal disease and atherosclerotic mechanisms responsible for cardiovascular disease and cerebrovascular disease is now generally accepted. Perhaps the best evidence of this acceptance is the recent shift in discussions on this relationship from causality to recommendations for interprofessional co-management of patients with cardiovascular disease and cerebrovascular disease. The Journal of Periodontology and the American Journal of Cardiology recently published a consensus paper1 that is the first formal call for changes in practice and new models of care that bring the dental and medical professions closer together in a health and wellness approach targeting risk reduction for systemic inflammation.

The organization of health professions into specialties and subspecialties according to body organs and systems has been pragmatic rather than scientific. The human body is a single unit composed of related biologic processes such that abnormalities of almost any of its parts have profound effects on other body parts and processes. The best example of this is the common and complex relationship of chronic inflammatory diseases and conditions. It has been argued for some time that dental professionals must become more involved in screening and referral for chronic inflammatory diseases, as well as in reinforcement of health and wellness messages centred on healthy lifestyle choices. Similarly, a call has gone out to medical professionals2 to become more involved in screening and referral for patients with poor oral health, and to provide their patients with information on how poor oral health can cause or exacerbate chronic inflammation.

Although there may still be some debate regarding the strength of the evidence for oral–systemic connections, and although not all health care professionals and researchers have fully accepted the findings of some of the evidence on which these recommendations are based, all health professionals should be aware of the recommendations of the dental and medical consensus panel, as these may guide the future standards of patient care. The most relevant recommendations on periodontitis and atherosclerotic disease are as follows:

Clinical recommendations for patients with periodontitis:
• patients should be informed that they may be at increased risk for atherosclerotic disease
• patients with one known major atherosclerotic risk factor, such as smoking or immediate family history or history of dyslipidemia, should consider a medical evaluation if they have not had one in the past 12 months
• patients with 2 or more atherosclerotic risk factors should be referred for medical evaluation if they have not had one in the past 12 months
• medical evaluation of patients with periodontitis should include assessment of atherosclerotic risk including past coronary or stroke events and family histories of premature atherosclerotic disease or sudden death, diabetes mellitus, hypertension or dyslipidemia
• medical evaluation of patients with periodontitis should include a complete physical examination and annual measurement of blood pressure at rest
• medical evaluation of patients with periodontitis should include a blood lipid profile and blood glucose measurement
• patients with periodontitis and one or more abnormal serum lipid findings should be advised to make multiple lifestyle changes to reduce atherosclerotic risk
• patients with periodontitis in whom target lipid levels are not achieved with lifestyle changes should be prescribed drug therapy for elevated lipids
• all patients with periodontitis who smoke tobacco should be encouraged to discontinue the habit because it is a major risk factor for atherosclerotic disease and periodontitis
• all patients with periodontitis and elevated blood pressure should be treated to normal blood pressure target levels
• all patients with periodontitis and elevated blood pressure should undertake lifestyle changes
• all patients with periodontitis and elevated blood pressure not controlled to target levels with lifestyle changes should be treated with pharmacologic therapy
• patients with periodontitis who are also prescribed calcium channel blockers for hypertension or any other indication should be monitored for worsening of periodontitis in association with gum hyperplasia
• patients with periodontitis who meet criteria for metabolic syndrome should be identified and treated for all risk factors for atherosclerotic disease, beginning with lifestyle changes aimed at weight reduction

Clinical recommendations for patients with atherosclerotic disease with or without a previous diagnosis of periodontitis:
• periodontists and physicians managing patients with existing or newly diagnosed atherosclerotic disease should closely collaborate to optimize atherosclerosis risk reduction and periodontal care
• periodontal evaluation should be considered for patients with atherosclerotic disease who have signs or symptoms of gingival disease, significant tooth loss and unexplained elevations of inflammatory biomarkers
• periodontal evaluation of patients with atherosclerotic disease should include a comprehensive examination of periodontal tissues as assessed by visual signs of inflammation and bleeding on probing, loss of connective tissue attachment detected by periodontal probing measurements and bone loss assessed radiographically
• periodontists and physicians managing patients with untreated or uncontrolled periodontitis should focus on reducing and controlling bacterial accumulations and eliminating oral inflammation.

References

Dr. Iacopino is dean and professor of restorative dentistry, and director of the International Centre for Oral–Systemic Health, at the faculty of dentistry, University of Manitoba, Winnipeg, Manitoba. Email: iacopino@cc.umanitoba.ca.

The views expressed are those of the author and do not necessarily reflect the opinions or official policies of the Canadian Dental Association.
Dr. Jim Yuan Lai, discipline head of periodontology at the University of Toronto faculty of dentistry, was invested as a Commander in the Order of St. John in recognition of his many years of volunteer service with St. John Ambulance.

Dr. Lai first became involved with St. John Ambulance as a teenager and quickly progressed through the ranks. He started out as a cadet member, then became a medical first responder and finally served as a first aid and CPR instructor. Eventually, he became more involved with volunteer management, serving as a divisional superintendent for 2 years and as Toronto Area Commissioner for 7 years, managing over 400 volunteers in the latter role. He has also spent 3 years as a member of the Board of Directors.

Reflecting on his recent honour to the Order of St. John, Dr. Lai believes that his experiences with St. John Ambulance have enhanced his ability to perform his academic role. "I spent 24 years as a volunteer, leader and board director and this is where I gained practical experience in teaching, administration, leadership and conflict resolution — all valuable skills that I require on a regular basis."

The Order of St. John is one of the 5 national orders in the Canadian Honours System along with the Order of Canada, the Order of Military Merit, the Order of Merit of the Police Forces and the Royal Victorian Order.

The Canadian Pain Society (CPS) will be hosting its annual conference from May 12 to 15, 2010, in Calgary, Alberta, and is looking for dental professionals who might be interested in attending the event or delivering clinically focused, research-driven presentations at its scientific session.

The CPS conference is an ideal forum for researchers and health care professionals to exchange information on the mechanisms, assessment and management of pain. Under the theme "Unravelling the Mystery of Pain – Nature vs. Nurture," topics to be discussed will include experimental models of acute and chronic pain, the neuropharmacology of pain and analgesia, and the biopsychosocial and spiritual context of pain experience.

Canadian dentistry has a long and proud tradition of involvement within the field of pain and oromotor control research. This was evident during a satellite symposium held before the General Session of the International Association for Dental Research in July 2008 in Toronto, where 3 prominent scholars in oral and trigeminal neurosciences based at Canadian dental schools were recognized — Drs. Barry Sessle, James Lund and Alan Hannam.

The goal of the CPS is to foster and encourage research on pain mechanisms and syndromes and to help improve the management of patients with acute and chronic pain by bringing together basic scientists and health professionals of various disciplines and backgrounds who have an interest in pain research and management. Membership is made up of physicians, dentists, nurses, physiotherapists, psychologists and other health care workers. Dentists can choose to become members of several CPS subgroups, including the recently created acute pain special interest group.
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**Obituaries**

Giblon, Dr. Jerome H.: A 1959 graduate of the University of Toronto, Dr. Giblon of Willowdale, Ontario, passed away May 6.

Hickman, Dr. Wilfred V.: Dr. Hickman of Grimsby, Ontario, passed away April 4. He graduated from the University of Toronto in 1952.

MacRae, Dr. Patrick: A graduate of the University of Alberta, Dr. MacRae of Edmonton passed away July 30.

Pelton, Dr. H. Robert: A 1953 graduate of the University of Toronto, Dr. Pelton of Sudbury, Ontario, passed away in July.

Porterfield, Dr. Robert D.: Dr. Porterfield of Guelph, Ontario passed away May 29. He graduated from the University of Toronto in 1950.

Shugart, Dr. Charles R.: Dr. Shugart of Etobicoke, Ontario, passed away June 25. He graduated from the University of Toronto in 1951.

Truscott, Dr. George N.: A 1952 graduate of McGill University, Dr. Truscott of Ottawa passed away June 12.

Winnick, Dr. Alan N.: Dr. Winnick of Toronto passed away July 13. He graduated from the University of Toronto in 1960.

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**Nova Scotia Dental Association Elects New President**

Dr. Paul Cameron was recently elected as president of the Nova Scotia Dental Association (NSDA) for 2009–10. A 1989 graduate of Dalhousie University, Dr. Cameron has been a solo general practitioner for 20 years in his hometown of Antigonish, Nova Scotia.

Dr. Cameron served on the NSDA’s Clinical Practice and Professional Development committees and its Governing Council prior to his presidency. He was an original member of the Senior’s Oral Health Care project in the province and he also contributed to the Canadian Collaboration of Clinical Practice Guidelines in Dentistry.

One of the main themes of Dr. Cameron’s term is professionalism. “There is a public expectation that dentists will uphold the highest standards of ethical and professional behaviour in all their actions and activities. I would like to see all dentists striving to provide the best possible dentistry for their patients while they work toward raising their own personal levels of professionalism.”

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**NLDA Names New President**

Dr. Marina Sexton of Norris Point, Newfoundland, was recently elected president of the Newfoundland and Labrador Dental Association (NLDA) for 2009–10.

Upon graduation from Dalhousie in 1980, the St. John’s native set up practice in Norris Point in Gros Morne, Newfoundland, where she is currently the sole dentist in the area.

Dr. Sexton is a strong proponent of the province’s dental program for children, particularly as it relates to those living in rural Newfoundland. During her NLDA presidency, Dr. Sexton will work to expand this program to include the teenage population.
CDSPI has formed a strategic alliance with Qtrade Investor — Canada’s leading independent online brokerage. As a result, dental professionals and their families are provided with another critical aspect of a complete wealth management offering — online brokerage services.

“This is an exciting step forward in CDSPI’s ongoing commitment to help dentists succeed financially,” says Michael Holmes, vice-president of investment services at CDSPI. “Through Qtrade Investor, CDSPI is able to make a premier self-managed brokerage service available to those in the dental community who wish to manage a portion of their investments on their own,” he adds.

By using Qtrade Investor, you will have access to Canada’s #1 rated online brokerage platform with leading-edge investment tools and research, straight-to-market order execution, preferred pricing exclusively for CDSPI and outstanding customer service. You can access Qtrade Investor through CDSPI’s website at www.cdspi.com/qtrade.

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Dr. Daniel Grenier is a professor at Laval University’s faculty of dentistry. He is also the director of the Oral Ecology Research Group, a research centre based at Laval. In this month’s JCDA, Dr. Grenier contributes an article on the potential benefits of probiotics for oral health (see p. 585). JCDA spoke with Dr. Grenier to learn more about his research and his experiences as a microbiologist working within a faculty of dentistry.

JCDA: You are a professor at the faculty of dentistry at Laval University, yet your formal training is not in dentistry. How did you become involved in the field of dental research?

Dr. Daniel Grenier: It all began with my undergraduate studies in microbiology. I was offered a research internship at Laval University’s faculty of dentistry through a grant from the Medical Research Council of Canada (now the Canadian Institutes of Health Research). For a microbiologist, the oral cavity represented a perfect study model, given the impressive diversity of microorganisms found in the mouth. In the 1980s, knowledge in oral microbiology was still embryonic, so becoming involved in dental research would allow me to contribute to the developing knowledge base on a problem affecting a large proportion of the population, and possibly make my mark. Over the course of my career, I worked with some of the most active microbiology researchers in Canada, who were role models and who instilled in me a passion for oral microbiology and oral health.

JCDA: Are there any specific benefits or challenges working within a faculty of dentistry?

Dr. Grenier: For an oral microbiology researcher, working within a faculty of dentistry is extremely beneficial because this environment allows me to have direct contact with clinical professors and students who are dealing with actual problems encountered in the clinic. The discussions that take place help my team and I modify our ongoing projects or initiate new ones to better address the oral problems affecting people.

Working within a dental faculty also gives us an opportunity to use the results that we obtain through basic research to develop projects with a clinical scope in order to verify our theories. We benefit from having access to many samples due to the large number of patients that come to the clinic. Finally, through graduate programs such as the periodontics program at Laval we are able to create a multidisciplinary team that includes students in basic sciences as well as clinical dental students.

My greatest challenge is trying to show young dentists in training all the positive aspects of a career in research. My goal is to identify highly motivated students and convince them to become involved in research early in their studies, because they will become the next generation of dental researchers.

JCDA: You have been the director of the Oral Ecology Research Group since 2000. What are the group’s current studies or areas of research? Is your team comprised mainly of dentists or general scientists?

Dr. Grenier: The Oral Ecology Research Group was created in 1989 by Luc Trahan, a professor in the faculty of dentistry who had a longstanding involvement in dental research. We are one of the few research centres at Laval that has managed to retain its accreditation for 20 years.
The group currently includes 9 professor members, who must devote at least 50% of their workload to research: 5 from the faculty of dentistry, 3 from the science and engineering faculty and 1 from the faculty of dentistry at the University of Montreal. Most of the members are basic researchers; only 1 member is a clinician. The group also includes approximately 25 graduate students and 5 postdoctoral students and associate members. Our challenge in the coming years will be to convince young professors joining our faculty to become involved with our research centre and in our research activities.

The group’s activities encompass 3 main research themes. The first involves everything to do with oral ecology and oral infections. Here we marry the basic sciences (microbiology, biochemistry, immunology) to the clinical and more applied contexts of dentistry. Among other things, we are interested in the etiology of oral infections and we are trying to identify therapeutic targets for prevention and treatment. Within that area we are also studying the systemic consequences of periodontal disease, particularly the link to premature births and preeclampsia. Oral infections were long considered to be confined to the mouth, but we now know that what happens in the oral cavity has repercussions on the patient’s overall health.

Our second theme deals with infection control in dental offices. We are interested in the risks of transmitting infections in dental clinics as much as possible.

Our third research theme is more recent and came about as a result of our expertise in the fermentation of sugars by cariogenic bacteria. We applied this knowledge to other bacteria, notably the lactic bacteria used in the dairy industry. With the help of molecular biology, researchers are working to develop bacteria that are more effective and resistant to the bacteriophages that can infect them, potentially leading to significant economic losses for the dairy industry.

JCDA: In your opinion, how important are international collaborations? What are the benefits and challenges of such collaborations?

Dr. Grenier: Any collaboration, whether international or not, is very beneficial in research. My research activities have progressed more quickly thanks to collaborative efforts that allowed me to acquire various research tools such as human cell lines and bacteria carrying mutations, or to benefit from cutting-edge technologies and equipment that were not available at our centre.

As for international collaboration, I have established many contacts in the last 12 years with researchers in Japan, particularly at the faculty of dentistry at the University of Tokushima. Over the years we have published about 15 articles together, and 3 postdoctoral researchers have done internships in my laboratory.

More recently, I developed a partnership with a team of chemists in Italy who are working on
isolating molecules from plant extracts. After reading some of my publications, they contacted me to find out if I would be interested in using my study models to evaluate the therapeutic potential of their molecules for oral infections. Two Italian doctoral students joined my laboratory last year to initiate this collaboration, and we have recently received a research subsidy from Quebec’s Department of Economic Development, Innovation and Export Trade for this project.

**JCDA:** With over 150 peer-reviewed articles to your credit, what do you hope that dentists, or members of the public, can take away from your research?

**Dr. Grenier:** For a long time my research focused on fundamental elements aimed at developing a better understanding of the mechanisms associated with the pathogenesis of oral infections. In particular, these studies allowed me to identify therapeutic targets for the development of new medications or oral hygiene products.

As circumstances would have it, part of my research for the last 4 or 5 years has involved more clinical applications and I realize that the profession as a whole and more individual dentists are interested in my work. More specifically, I am trying to demonstrate the therapeutic potential for periodontal diseases of natural substances like polyphenols isolated from cranberries and licorice. I hope that one day some of these substances will be found in oral hygiene products or used in certain treatments for patients. This is a long-term project, but everything is progressing quickly and has already led to research contracts with dental companies.

**JCDA:** How do you think the future of “knowledge translation” will unfold? How can we devise ways to better translate research findings and scientific articles into practical applications?

**Dr. Grenier:** For a long time, knowledge translation for researchers was limited to publishing in the best peer-reviewed scientific journals or making presentations at scientific conferences. This notion has evolved and we now seek new ways to put the results obtained in laboratory research into practice, to facilitate commercialization of our discoveries or to modify current treatments in oral health. We must try to demonstrate that our laboratory work can lead to benefits for the population, which ultimately supports our work through taxes.

For my part, I try to share the results of my work not only at scientific conferences, but also with dentists — the primary users of our research outcomes — through continuing education courses. I also think it is important to report our research results in general articles for members of the profession and the public. For this reason, we should not neglect the importance of more far-reaching communication methods, like professional journals and general interest magazines.

Ms. Natalie Ouellette is coordinator of French translation at the Canadian Dental Association.
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Point of Care

The "Point of Care" section answers everyday clinical questions by providing practical information that aims to be useful at the point of patient care. The responses reflect the opinions of the contributors and do not purport to set forth standards of care or clinical practice guidelines. Readers are encouraged to do more reading on the topics covered. If you would like to contribute to this section, please contact editor-in-chief Dr. John O’Keefe at jokeefe@cda-adc.ca.

**Question 1**

How do I manage a suspected oral vascular malformation?

**Background**

Current classifications of vascular abnormalities can help the practitioner to establish the correct diagnosis. Accurate diagnosis is essential because treatments vary according to the nature of the lesion. In 1982, Mulliken and Glowacki introduced the first simple classification scheme. They subdivided vascular abnormalities into hemangiomas and vascular malformations, which are distinguished by clinical, histochemical and cytological findings, as well as the depth of the lesion and the characteristics of flow (Table 1). An understanding of the relevant terminology can help the practitioner to precisely identify the vascular entity and thus to provide appropriate treatment.

Most hemangiomas appear after birth, but 30% are present at birth. They grow by rapid proliferation and tend to involute during childhood. These malformations are caused by failure of differentiation in the early stages of embryogenesis. Hemangiomas develop by endothelial hyperplasia and enlarge by cellular proliferation. They are categorized as superficial, deep or compound and are usually extraosseous. They are 3 to 5 times more common among females than among males. Hemangiomas are only rarely associated with death, but they can cause psychosocial trauma because of alteration in the patient’s appearance. In this regard, it is noteworthy that 60% of such lesions occur in the head and neck region.

Vascular malformations are less common than hemangiomas. They do not exhibit cellular hyperplasia but develop by progressive ectasia of abnormal vessels lined by flat endothelium on a thin basal lamina. Vascular malformations are classified as either simple or combined. Simple lesions are further classified as low-flow or high-flow. Low-flow lesions are capillary, venous or lymphatic. High-flow lesions are arterial in nature and may present with a bruit and thrill.

Both simple and combined lesions are present at birth and tend to grow proportionately with the patient’s growth. Vascular malformations never proliferate or involute, but growth may be accelerated during trauma, pregnancy and puberty. Their expansion can cause significant physical deformity, and there is a potential for fatal hemorrhage. This type of lesion may be associated with decreased perfusion because of shunting of blood to the malformation. Some reports show that both sexes are affected equally, while others indicate a

<table>
<thead>
<tr>
<th>Hemangiomas</th>
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<tr>
<td><strong>Classification by depth of lesion</strong></td>
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<tr>
<td>Superficial</td>
</tr>
<tr>
<td>Deep</td>
</tr>
<tr>
<td>Compound</td>
</tr>
<tr>
<td><strong>Classification by stage at presentation</strong></td>
</tr>
<tr>
<td>Congenital hemangioma (present at birth)</td>
</tr>
<tr>
<td>• Rapidly involuting</td>
</tr>
<tr>
<td>• Non-involuting</td>
</tr>
<tr>
<td>• Non-progressive</td>
</tr>
<tr>
<td>Infantile hemangioma (appearing after birth)</td>
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</tbody>
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<tr>
<th>Vascular malformations</th>
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<tr>
<td><strong>Simple lesions</strong></td>
</tr>
<tr>
<td>Low-flow</td>
</tr>
<tr>
<td>• Capillary (port-wine stain)</td>
</tr>
<tr>
<td>• Venous</td>
</tr>
<tr>
<td>• Lymphatic (lymphangioma)</td>
</tr>
<tr>
<td>High-flow</td>
</tr>
<tr>
<td>• Arterial</td>
</tr>
<tr>
<td><strong>Combined lesions</strong></td>
</tr>
<tr>
<td>Ateriovenous</td>
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<tr>
<td>Lymphovenous</td>
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<tr>
<td>Other combinations</td>
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*Adapted from Ethunandan and Mellor with permission from Elsevier.*

Table 1 Classifications of hemangiomas and vascular malformations
female predominance by a ratio of 2:1. About 51% of vascular malformations occur in the head and neck region, and they are usually extensive, which makes treatment very difficult.

Clinical Evaluation

An accurate history and a thorough physical examination are key to accurate diagnosis (Table 2). Clinical clues to vascular lesions of bone, which may not be readily apparent on clinical examination, include pericoronal bleeding, mobility of the teeth and occlusal abnormalities. The typical radiographic appearance of this type of lesion is a poorly defined radiolucent area often described as resembling a honeycomb or soap bubbles.

A radiographic investigation should be undertaken before performing any dental extraction. This is important because although these lesions are rare, a vascular malformation of the maxillofacial region can give rise to a dental emergency, including the possibility of death, if the lesion is inadvertently disturbed. Such emergencies typically occur after a dental extraction in cases when the practitioner was previously unaware of the existence of the malformation.

Diagnostic Investigations and Treatment

The treatment of a vascular malformation depends on the type and extent of the lesion (Fig. 1). When a vascular malformation is suspected, further investigations are needed to facilitate management. Computed tomography and magnetic resonance imaging can help to clarify the extent of the lesion, any bony involvement and the associated major vessels.

Super-selective arteriography (Fig. 2) is essential in identifying contributory vessels and mapping out the lesion.

Management strategies for vascular malformations include no treatment, embolization, surgical resection and combined treatment. Embolization consists of occluding the vessels that supply the lesion. Access is usually gained through femoral catheterization. Materials such as ethylene vinyl alcohol copolymer dissolved in a dimethyl sulfoxide liquid embolic agent (Onyx, Micro Therapeutics, Inc., Irvine, CA), muscle, sterile compressed sponge (Gelfoam, Pfizer, New York, NY), cya-

Table 2  Simplified diagnostic approach to congenital vascular lesions

<table>
<thead>
<tr>
<th>Was the lesion present at birth?</th>
<th>Yes: vascular malformation</th>
<th>No: hemangioma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has there been rapid proliferation?</td>
<td>Yes: hemangioma</td>
<td>No: vascular malformation</td>
</tr>
<tr>
<td>Is involution present?</td>
<td>Yes: hemangioma</td>
<td>No: vascular malformation</td>
</tr>
<tr>
<td>Lesions present in adulthood</td>
<td>Residual hemangioma</td>
<td>Vascular malformation</td>
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*Adapted from Ethunandan and Mellor with permission from Elsevier.*
noacrylate, metal coils and collagen have been used in embolization of such lesions. Successful treatment usually requires complete removal of the vascular malformation (Fig. 3), to prevent recurrence. Treatment in the maxillofacial region may be complicated, as the benefits of complete removal must be weighed against the resulting severe disfigurement and functional difficulties. For lesions in the oral and maxillofacial region, treatment may be performed by an oral and maxillofacial surgeon, an otolaryngology specialist or a plastic surgeon with the help of an interventional radiologist.

THE AUTHORS

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Dr. Ian R. Matthew is assistant professor and oral surgery chair in the department of dentistry, University of British Columbia, Vancouver, British Columbia.

QUESTION 2

How do I perform a first dental visit for an infant or toddler?

Background

The increasing prevalence of early childhood caries is a cause for concern. However, the small number of pediatric dental specialists across Canada means that clinicians working in general dental offices are also needed in the fight against this preventable disease. Parents often complain that they are unable to obtain appropriate care when they notice problems with their children’s teeth. All too often, dental offices decline to see children under 3 years of age. This message is usually conveyed to parents by the team member who answers the phone, who may be unaware of recent guidelines highlighting the need to educate the entire office team (not only the dentist) about including infants and toddlers in the population served by general dental offices. This article provides a few guidelines on providing a child’s first dental visit as part of everyday practice.

In November 2001 the Board of Governors of the Canadian Dental Association (CDA) adopted the following recommendation: “CDA encourages the assessment of infants, by the dentist, … within 6 months of the eruption of the first tooth or by one year of age.” A survey of general dentists across western Canada has revealed that although most respondents were aware of the CDA recommendation, a substantial proportion did not see children under the age of 2 years. Among those who did not accept young children into their practices, almost half cited difficulties in managing the patients because of their age and potential behavioural challenges as their main concern. Interestingly, several dentists felt that nurses and physicians should play a role in preventing early childhood caries. However, it may be unrealistic to expect medical colleagues to become involved in managing this problem when many in the dental profession refuse to do so.

Conducting a Child’s First Dental Visit

The first dental visit consists of a great deal of “preamble,” a very short examination and some follow-up with the parent. Much of the preamble can be completed by the office staff working at the
The child is then allowed to play while the dentist and parent discuss any issues that may have been raised by the examination. If the child has a healthy mouth, this discussion is usually limited to ways of keeping the mouth healthy. If dental caries were noted, the topic will be possible causes and methods of treatment.

If decay is found during the first dental visit, the parent may have strong feelings of guilt. The dental team must be sensitive to this possibility and should take pains to avoid a judgmental attitude; rather, the team should be supportive, by suggesting ways in which the parent can help to treat and prevent further disease. Similarly, during the initial interview, open-ended questions are preferred, for example, “How often do you brush your child’s teeth?” rather than “Are you brushing your child’s teeth?”

When any type of decalcification or decay is noted, the treatment options will range from application of fluoride to minor restorative treatment and referral for more extensive treatment; referral is also appropriate at any stage when the dentist feels uncomfortable providing the treatment that is required. It is especially important that any necessary treatment be started immediately; treatment should not be delayed until the child is able to cooperate.

The author

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References

For more details on conducting a child’s first dental visit, please see the accompanying PowerPoint presentation at: www.cda-adc.ca/jcda/vol-75/issue-8/577.html.
Nonsurgical cases of paresthesia in dentistry are seen almost exclusively after inferior alveolar nerve block injection and appear to affect the lingual nerve more frequently than the inferior alveolar nerve. Ongoing uncertainty remains concerning not only the mechanism of injury in these cases, but also the possible contributory roles of various etiologic factors such as local anesthetic formulation.

**Objectives:** The purpose of this retrospective study was to analyze cases of nonsurgical paresthesia that were voluntarily reported to the Professional Liability Program (PLP) associated with the Royal College of Dental Surgeons of Ontario over 10 years, from 1999 to 2008 inclusive, to see if the findings were consistent with those from 1973 to 1998 from this same source.

**Materials and Methods:** All cases of nonsurgical paresthesia reported to the PLP from 1999 to 2008 inclusive were reviewed. All relevant variables available from this data source, including patient age and gender, volume and formulation of local anesthetic, injection site and technique, site of neurologic injury, presence of pain on injection and type of dental procedure, were examined. Statistical analysis was used to test the null hypothesis that the particular local anesthetic itself had no effect on the frequency of reporting of cases of nonsurgical paresthesia.

**Results:** From 1999 to 2008 inclusive, 182 cases of nonsurgical paresthesia were reported to the PLP. All but 2 cases were associated with mandibular block. Where only 1 anesthetic drug was used, articaine was implicated in 109 cases, prilocaine in 29 cases, lidocaine in 23 cases and mepivacaine in 6 cases. There was no significant gender predilection. The lingual nerve was affected more than twice as frequently as the inferior alveolar nerve. During 2006–2008 alone, 64 cases of nonsurgical paresthesia were reported to the PLP. This projects to a reported incidence of 1 in 609,000 administrations of all local anesthetics, if one assumes that the type of injection is not a factor. For the 2 local anesthetic drugs available in dental cartridges as 4% solutions, i.e., articaine and prilocaine, the observed frequencies of reporting of paresthesia were significantly greater than expected (χ², exact binomial distribution; p < 0.01) based on the distribution of local anesthetic use by Ontario dentists.

**Discussion:** The results of this study are consistent with and support the initial studies looking at nonsurgical paresthesia in dentistry in Ontario. Articaine and prilocaine were associated with rates significantly higher than expected based on their market share. Notably, these 2 local anesthetics are available in Canada solely as 4% solutions in dental cartridges, the highest such concentration marketed in this country. This suggests that it may not be the drug per se, but the higher dose combined with mechanical insult that predisposes the nerve to permanent damage. As such, dentists must consider the risks and benefits of the routine use of 4% solutions for mandibular block anesthesia.
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Effect of Timing and Technique of Post Space Preparation on Sealing Ability of Remaining Root Filling Material: In Vitro Microbiological Study

Fabiana Soares Grecca, DDS, MSc, ScD; Ângela Rezende Gomes Rosa, DDS; Maximiliano Schünke Gomes, DDS, MSc; Clarissa Fatturi Parolo, DDS, MSc, ScD; Jules Renan Dutra Bemfica; Luís Carlos da Fontoura Frasca, DDS, MSc, ScD; Marisa Maltz, DDS, MSc, ScD

Endodontic treatment is a common step in prosthetic rehabilitation. It is indicated not only in cases of pulpal alteration, but also when intraradicular retainers are required. The procedures for preparing the post space are critical, and care is required to maintain the root canal seal and the aseptic conditions achieved with endodontics. Otherwise, a pathway may be created for bacterial invasion and re-infection of the root canal system.

Objective: To evaluate the effect of timing (immediate versus delayed) and technique of post space preparation on the sealing ability of the residual root canal obturation against coronal bacterial leakage. The null hypothesis was that the timing and technique of post space preparation would have no influence on the sealing ability of the remaining apical filling.

Materials and Methods: Sixty-six single-rooted teeth were decoronated at the cementoenamel junction. The canals were prepared according to a step-back technique and were filled with thermoplasticized gutta-percha and AH Plus endodontic sealer (Dentsply De Trey). The root segments were randomly assigned to 8 groups. The positive controls (n = 3) were instrumented but not obturated. The negative controls (n = 3) were instrumented, obturated and sealed with Cavit (3M ESPE). In the other 6 groups (n = 10 each), the post space was prepared either immediately after obturation or 7 days later using LA Axxes burs (SybronEndo) (groups 1 and 2), heated pluggers (groups 3 and 4) or solvent delivered with a hand file (groups 5 and 6). The external surface of all roots was rendered waterproof with nail varnish. Custom-made dual-chamber devices were used to evaluate leakage.

The coronal third of the prepared root canal was kept in contact with artificial saliva contaminated with Enterococcus faecalis, and the root apex was submerged in tryptic soy agar medium. The root assemblies were stored at 37 °C and were monitored daily for 90 days. The occurrence of turbidity in the medium was deemed to indicate bacterial leakage, from which failure of the seal was inferred. The Kaplan–Meier method was used to estimate survival curves for each experimental group, with “death” of a specimen deemed to have occurred at the time when bacterial turbidity was first observed. Log-rank testing was used to compare survival curves at the 5% significance level.

Results: Throughout the experimental period, there was no significant difference (p = 0.094) among the preparation techniques, either immediate or delayed, in terms of prevention of bacterial leakage. However, during the initial 20 days, maintenance of the seal was excellent for the roots for which heated pluggers were used immediately after obturation (group 3), as none of the specimens prepared in this way exhibited bacterial leakage (turbidity of medium). From a clinical perspective, this period corresponds to the time required for post space preparation and cementation of the intraradicular retainer.

Conclusions: In this study, there were no significant differences among the techniques or timing of post space preparation in terms of the sealing afforded by the remaining root filling material. The null hypothesis was therefore rejected. On this basis, it can be concluded that the presence of residual root canal obturation delays but cannot prevent bacterial invasion into root canals exposed to the oral environment.
Comparison of Indications

Treats Sensitivity.
Relieves tooth sensitivity, cavity protection, helps protect from acid wear/erosion. Gradually builds protective barrier and insulates the nerve. Specially formulated to relieve tooth sensitivity to cold, heat, acids, sweets, or contact.

Prevents Gingivitis.
Prevention of gingivitis, plaque, cavities and tartar.

Treats Sensitivity AND Fights Gingivitis.
Fights gingivitis, plaque, tartar, prevention of cavities, builds increasing protection against painful sensitivity. Provides long lasting antibacteria activity and fights plaque acid for 12 hours.

Recommend Crest® PRO-HEALTH™ with stabilized stannous fluoride and sodiumhexametaphosphate. The only toothpaste indicated to treat both sensitivity and gingivitis.

Recognized by the Canadian Dental Association, Crest Pro-Health has been shown to prevent tooth decay, reduce gingivitis and tooth hypersensitivity, and whiten the surface of teeth, when used as a conscientiously applied program of oral hygiene and regular professional care.

Crest PRO-HEALTH is for adults and children 12 years and older. Do not swallow. Kills bad breath bacteria.

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Probiotics for Oral Health: Myth or Reality?

Laetitia Bonifait, DEA; Fatiha Chandad, PhD; Daniel Grenier, PhD

ABSTRACT

For some decades now, bacteria known as probiotics have been added to various foods because of their beneficial effects for human health. The mechanism of action of probiotics is related to their ability to compete with pathogenic microorganisms for adhesion sites, to antagonize these pathogens or to modulate the host’s immune response. The potential application of probiotics for oral health has recently attracted the attention of several teams of researchers. Although only a few clinical studies have been conducted so far, the results to date suggest that probiotics could be useful in preventing and treating oral infections, including dental caries, periodontal disease and halitosis. This article summarizes the currently available data on the potential benefits of probiotics for oral health.

Each day, every human being ingests a large number of living microorganisms, predominantly bacteria. Although these organisms are naturally present in food and water, they can also be deliberately added during the processing of foods such as sausages, cheese, yogourt and fermented milk products. For several decades now, bacteria called probiotics have been added to some foods because of their beneficial effects for human health. The bacteria in yogourt and fermented milk products constitute the most important source of probiotics for humans. The vast majority of probiotic bacteria belong to the genera Lactobacillus, Bifidobacterium, Propionibacterium and Streptococcus. Several clinical studies have already demonstrated the effectiveness of certain probiotics in the treatment of systemic and infectious diseases such as acute diarrhea and Crohn disease. Other studies have suggested potential applications in the treatment of cardiovascular disease, urogenital infections, oropharyngeal infections and cancers. Probiotics may also prove useful in addressing problems arising from the excessive use of antibiotics, specifically the appearance of bacterial resistance. To date, however, the potential beneficial effects of probiotics for oral pathology have had only limited study.

Characteristics of Probiotics

Probiotics are defined as living microorganisms, principally bacteria, that are safe for human consumption and, when ingested in sufficient quantities, have beneficial effects on human health, beyond basic nutrition. This definition has been approved by the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO). The establishment of standards and guidelines constituted an essential step in the acceptance of probiotics as legitimate health-related products. To be called a probiotic, a bacterial strain must be fully characterized. The genus and species of the microorganism must be identified according to internationally accepted methods, and its nomenclature...
corroborated by reference to the Approved Lists of Bacterial Names. In addition, both in vitro and in vivo studies must be conducted to demonstrate the mechanism of action of the probiotic, to allow prediction of its scope of applicability and its potential side effects. The FAO and the WHO have recommended that probiotic bacterial strains be characterized by their spectrum of resistance to antibiotics, their metabolic and hemolytic activities, their capacity to produce toxins, their infectious power in immunosuppressed animal models and their side effects in humans. Probiotics that have been so characterized are then submitted to randomized clinical studies. The results of such studies should demonstrate an improvement in participants’ health and quality of life.

**How Probiotics Work**

Several mechanisms have been proposed to explain how probiotics work (Fig. 1). For example, these bacteria secrete various antimicrobial substances such as organic acids, hydrogen peroxide and bacteriocins. In addition, they compete with pathogenic agents for adhesion sites on the mucosa. Probiotics can also modify the surrounding environment by modulating the pH and/or the oxidation–reduction potential, which may compromise the ability of pathogens to become established. Finally, probiotics may provide beneficial effects by stimulating nonspecific immunity and modulating the humoral and cellular immune response. A combination of probiotic strains is often used to increase these beneficial effects.

**Application of Probiotics to Oral Health**

**Probiotics of Interest**

Given the widespread emergence of bacterial resistance to antibiotics, the concept of probiotic therapy has been considered for application in oral health. Dental caries, periodontal disease and halitosis are among the oral disorders that have been targeted. An essential condition for a microorganism to represent a probiotic of interest for oral health is its capacity to adhere to and colonize various surfaces of the oral cavity.

Lactobacilli constitute about 1% of the cultivable oral microflora in humans. The species most often found in saliva are *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus fermentum*, *Lactobacillus plantarum*, *Lactobacillus rhamnosus* and *Lactobacillus salivarius*. *L. acidophilus*, *L. casei*, *L. fermentum* and *L. rhamnosus* are found in dairy products, but there is no evidence that these species are present in the oral cavity as a result of frequent consumption of dairy products (leading to temporary colonization), nor is there evidence that the oral environment represents their natural and permanent habitat. Sookkhee and colleagues isolated 3,790 strains(628,834),(969,892) of lactic acid bacteria from 130 individuals and found that the isolates identified as *Lactobacillus paracasei* ssp. *paracasei* and *L. rhamnosus* had a high capacity to antagonize important oral pathogens, including *Streptococcus mutans* and *Porphyromonas gingivalis*.

*Weissella cibaria* (formerly classified in the genus *Lactobacillus*), a Gram-positive facultative anaerobic lactic acid bacterium that has been isolated from humans, is present in fermented foods and is considered a potential probiotic agent. *W. cibaria* secretes a significant quantity of hydrogen peroxide, as well as a bacteriocin that acts against Gram-positive bacteria. This bacterial species has the capacity to coaggregate with *Pusobacterium nucleatum* and to adhere to epithelial cells. These properties could enable *W. cibaria* to effectively colonize the oral cavity and limit the proliferation of pathogenic bacteria.

Recently, Haukojoa and colleagues assessed the survival in saliva and adherence to oral surfaces of various probiotics used by the dairy industry (specifically, species of both *Lactobacillus* and *Bifidobacterium*). All of the strains tested survived well in saliva, but they varied widely in their capacity to adhere to the surface of teeth and oral mucosa. More specifically, species in the genus *Lactobacillus* had an adherence capacity superior to that of the *Bifidobacterium* species. Moreover, it has been reported that people who have consumed yogourt containing *L. rhamnosus* on a daily basis host this microorganism in the saliva for up to 3 weeks after discontinuing yogourt consumption. However, contradictory results were obtained by Yli-Knuuttila and colleagues, who reported that a strain of *L. rhamnosus* colonized the oral cavity only temporarily and that consistent
consumption of the probiotic would be necessary for long-term beneficial effects. Together, these results suggest that the probiotics used in consumer products could colonize the oral cavity.

**Probiotics and Dental Caries**

Dental caries is a multifactorial disease of bacterial origin that is characterized by acid demineralization of the tooth enamel. It appears following changes in the homeostasis of the oral ecosystem leading to proliferation of the bacterial biofilm, composed notably of streptococci from the mutans group. To have a beneficial effect in limiting or preventing dental caries, a probiotic must be able to adhere to dental surfaces and integrate into the bacterial communities making up the dental biofilm. It must also compete with and antagonize the cariogenic bacteria and thus prevent their proliferation. Finally, metabolism of food-grade sugars by the probiotic should result in low acid production. The advantage of incorporating probiotics into dairy products lies in their capacity to neutralize acidic conditions. For example, it has already been reported that cheese prevents demineralization of the enamel and promotes its remineralization.

Comelli and colleagues reported that of 23 bacterial strains used in the dairy industry, *Streptococcus thermophilus* and *Lactobacillus lactis* ssp. *lactis* were the only ones with the capacity to integrate into a biofilm present on a hydroxyapatite surface and to interfere with development of the cariogenic species *Streptococcus sobrinus*. More recently, it was demonstrated that isolates of *W. cibaria* had the capacity to inhibit, both in vitro and in vivo, biofilm formation by *S. mutans* and to prevent proliferation of this bacterial strain. In other studies, one strain of *L. rhamnosus* and the species *L. casei* inhibited in vitro growth of 2 important cariogenic streptococci, *S. mutans* and *S. sobrinus*. More recently, Petti and colleagues reported that yogourt containing *S. thermophilus* and *L. bulgaricus* had selective bactericidal effects on streptococci of the mutans group. Several clinical studies have demonstrated that regular consumption of yogourt, milk or cheese containing probiotics led to a decrease in the number of cariogenic streptococci in the saliva and a reduction in dental plaque. More specifically, Nikawa and colleagues reported that consumption of yogourt containing *Lactobacillus reuteri* over a period of 2 weeks reduced the concentration of *S. mutans* in the saliva by up to 80%. Comparable results were obtained by incorporating probiotics into chewing gum or lozenges.

In one recent study, the prevalence of *Lactobacillus gasseri* and *L. fermentum* in the oral cavity was greater among healthy participants than among patients with chronic periodontitis.

In 2001, Näse and colleagues published the results of a long-term (7-month) study of 594 children 1 to 6 years of age that evaluated the effects on dental caries of consuming milk supplemented with a strain of *L. rhamnosus*. The authors concluded that children consuming milk containing this probiotic, particularly those 3–4 years of age, had significantly fewer dental caries and lower salivary counts of *S. mutans* than controls. These promising results suggest a potentially beneficial application of probiotics for the prevention of dental caries.

**Probiotics and Periodontal Disease**

Periodontal disease is classified into 2 types: gingivitis and periodontitis. Gingivitis is characterized by inflammation limited to the unattached gingiva, whereas periodontitis is a progressive, destructive disease that affects all supporting tissues of the teeth, including the alveolar bone. The main pathogenic agents associated with periodontitis are *P. gingivalis*, *Treponema denticola*, *Tannerella forsythia*, and *Aggregatibacter actinomycetemcomitans*. These bacteria have a variety of virulent characteristics allowing them to colonize the subgingival sites, escape the host’s defence system and cause tissue damage. The persistence of the host’s immune response also constitutes a determining factor in progression of the disease.

In one recent study, the prevalence of lactobacilli, particularly *Lactobacillus gasseri* and *L. fermentum*, in the oral cavity was greater among healthy participants than among patients with chronic periodontitis. Various studies have reported the capacity of lactobacilli to inhibit the growth of periodontopathogens, including *P. gingivalis*, *Prevotella intermedia* and *A. actinomycetemcomitans*. Together, these observations suggest that lactobacilli residing in the oral cavity could play a role in the oral ecological balance.

Krasse and colleagues assessed the beneficial effect of *L. reuteri* against gingivitis. After 14 days of ingesting the probiotic incorporated into chewing gum, the oral cavity of patients with a moderate to severe form of gingivitis had been colonized by *L. reuteri* and the plaque index had been reduced. Although the exact mechanisms of action of *L. reuteri* remain to be elucidated, previous studies have suggested at least 3 plausible possibilities: first, *L. reuteri* is known for its secretion of 2 bacteriocins, reuterin and reutericyclin, that inhibit the growth of a wide variety of pathogens; second, *L. reuteri* has a strong capacity to adhere to host tissues, thereby competing with pathogenic bacteria; and third, the recognized anti-inflammatory effects of *L. reuteri* on the intestinal mucosa, leading to inhibition of secretion of
proinflammatory cytokines, could be the foundation for a direct or indirect beneficial effect of this bacterium on people with periodontal disease. However, additional studies with larger patient cohorts are needed to confirm the long-term potential of L. reuteri in preventing and/or treating gingivitis.

Riccia and colleagues recently studied the anti-inflammatory effects of Lactobacillus brevis in a group of patients with chronic periodontitis. The treatment, which involved sucking on lozenges containing L. brevis over a period of 4 days, led to improvements in the targeted clinical parameters (plaque index, gingival index, bleeding on probing) for all patients. In that study, a significant reduction in salivary levels of prostaglandin E₂ (PGE₂) and matrix metalloproteinases (MMPs) was also observed. The authors suggested that the beneficial anti-inflammatory effects of L. brevis could be attributed to its capacity to prevent the production of nitric oxide and, consequently, the release of PGE₂, and the activation of MMPs induced by the nitric oxide. However, L. brevis may also be antagonistic, leading to a reduction in the quantity of plaque and therefore an improvement in the gingival index.

During the fermentation process in milk, Lactobacillus helveticus produces short peptides that act on osteoblasts and increase their activity in bone formation. These bioactive peptides could thereby contribute to reducing the bone resorption associated with periodontitis.

Recently Shimazaki and colleagues used epidemiological data to assess the relationship between periodontal health and the consumption of dairy products such as cheese, milk and yogourt. The authors found that individuals, particularly nonsmokers, who regularly consumed yogourt or beverages containing lactic acid exhibited lower probing depths and less loss of clinical attachment than individuals who consumed few of these dairy products. A similar effect was not observed with milk or cheese. By controlling the growth of the pathogens responsible for periodontitis, the lactic acid bacteria present in yogourt would be in part responsible for the beneficial effects observed. Longitudinal studies are required, however, to clarify the observed relationship between regular consumption of products containing probiotics and periodontal health.

Sunstar (Etoy, Switzerland) recently began marketing the first probiotic specifically formulated to fight periodontal disease. Gum PerioBalance contains a patented combination of 2 strains of L. reuteri specially selected for their synergetic properties in fighting cariogenic bacteria and periodontopathogens. Each dose of lozenge contains at least 2 × 10⁹ living cells of L. reuteri Prodentis. Users are advised to use a lozenge every day, either after a meal or in the evening after brushing their teeth, to allow the probiotics to spread throughout the oral cavity and attach to the various dental surfaces. Additional studies are required to evaluate the long-term effects of using these products.

**Probiotics and Halitosis**

Halitosis has many causes (including consumption of particular foods, metabolic disorders, respiratory tract infections), but in most cases it is associated with an imbalance of the commensal microflora of the oral cavity. More specifically, halitosis results from the action of anaerobic bacteria that degrade salivary and food proteins to generate amino acids, which are in turn transformed into volatile sulphur compounds, including hydrogen sulphide and methanethiol. Kang and colleagues reported the capacity of various strains of W. cibaria to inhibit the production of volatile sulphur compounds by F. nucleatum. They concluded that this beneficial effect resulted from the production of hydrogen peroxide by W. cibaria, which inhibited the proliferation of F. nucleatum. These authors also found that gargling with a solution containing W. cibaria was associated with a net reduction in the production of hydrogen sulphide and methanethiol and consequently a reduction in bad breath.
surface of the tongue among people with halitosis. Conversely, another species, Streptococcus salivarius, was detected most frequently among people without halitosis and is therefore considered a commensal probiotic of the oral cavity. S. salivarius is known to produce bacteriocins, which could contribute to reducing the number of bacteria that produce volatile sulphur compounds. The use of gum or lozenges containing S. salivarius K12 (BLIS Technologies Ltd., Dunedin, New Zealand) reduced levels of volatile sulphur compounds among patients diagnosed with halitosis.

Conclusions

Probiotics represent a new area of research in oral medicine, the examination of the close relationships between food and oral health. Preliminary data obtained by various research laboratories have been encouraging, but numerous randomized clinical studies will be required to clearly establish the potential of probiotics in preventing and treating oral infections. Such studies will allow identification of the probiotics that are best suited to oral use, as well as the most appropriate vehicles: food products (cheese, milk, yogourt) or supplements (chewing gum, lozenges). The existence of probiotics in the indigenous oral microflora of humans warrants exploration because these bacteria offer the advantage of being perfectly adapted to the human oral ecosystem.

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References


Treatment Options for Teeth with Open Apices and Apical Periodontitis

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ABSTRACT

Three clinical cases involving teeth with open apices and apical periodontitis were treated using different protocols. The first case was managed with intracanal calcium hydroxide paste for 12 months before obturation with gutta-percha and sealer. In the second case, an apical plug of mineral trioxide aggregate (MTA) was used before obturation with gutta-percha and sealer and treatment was completed during 2 appointments. In the third case, the tooth, which had a divergent root canal system, was completely obturated with MTA and treatment was also completed over 2 appointments. In all 3 cases, signs of bone healing were observed after treatment.

The major challenges associated with endodontic treatment of teeth with open apices are achieving complete debridement, canal disinfection and optimal sealing of the root canal system. In the absence of a natural apical constriction, the production of mineralized tissue in the apical region is important to create an apical barrier and allow 3-dimensional adaptation of obturating material within the root canal system. Calcium hydroxide has been commonly used as an intracanal dressing to induce hard tissue deposition in necrotic teeth with open apices. The calcium hydroxide is renewed periodically until an apical barrier is formed. The time needed to form an apical barrier is unpredictable and depends on the size of the apical foramen, the presence of infection and the host.

Mineral trioxide aggregate (MTA) is a powder consisting of fine hydrophilic particles that bind in the presence of moisture. Set MTA provides a good seal and excellent marginal adaptation. In vivo studies have confirmed biocompatibility of this material and have shown a hard tissue inductive effect. MTA can be used as an apical plug allowing for prompt obturation of the root canal.

In this paper, we present 3 clinical cases of teeth with open apices and associated apical periodontitis and describe 3 protocols used to treat them.

Case 1

A 16-year-old girl suffered subluxation trauma of her maxillary front teeth at 10 years of age. The patient, who was first seen at an emergency appointment, presented with pain originating from tooth 11, which was sensitive to percussion and palpation. During intraoral examination, a sinus tract was found between teeth 11 and 12. A radiographic image revealed
that teeth 11 and 12 had open apices and apical periodontitis. Tooth 12 had an intracanal post, inadequate root canal obturation and overextension of gutta-percha points. Tooth 11 contained a radiopaque material in the root canal, suggestive of an intracanal paste (Fig. 1a).

After administration of local anesthetic (1.8 mL 2% lidocaine with 1:100,000 epinephrine [Alphacaine, DFL Indústria e Comércio S.A., Rio de Janeiro, Brazil]), a rubber dam was placed and an access cavity was prepared in tooth 11. To remove the intracanal paste, the canal was lightly cleaned mechanically using hand K-files (Dentsply Maillefer, Ballaigues, Switzerland) to the working length, which was determined radiographically. The root canal was irrigated with 1% sodium hypochlorite (NaOCl), then dried with paper points (Dentsply/Tulsa Dental, Tulsa, OK). Calcium hydroxide (2.5 g [Farmácia de Manipulação Fórmula e Ação, São Paulo, Brazil]), mixed with saline to a toothpaste consistency, was placed in the canal using an amalgam carrier (Moyco Union Broach, York, PA). The access cavity was sealed with Cavit (3M, ESPE, Saint Paul, MN) placed over a sterile cotton pellet left in the pulp chamber. One tablet of acetaminophen 750 mg was prescribed for postoperative pain.

At a second appointment, root canal retreatment of tooth 12 was initiated; a surgical approach after endodontic retreatment was planned. After administration of local anesthetic (1.8 mL 2% lidocaine with 1:100,000 epinephrine [Alphacaine]) and application of a rubber dam, an access cavity was prepared in tooth 12 and the post was removed using ultrasonics. The canal was irrigated with 1% NaOCl. The gutta-percha points were retrieved via the root canal using #70 and #80 Hedström files (Dentsply Maillefer) (Fig. 1b and 1c). The canal was lightly instrumented using hand K-files (Dentsply Maillefer) at the working length, while irrigating with...
1% NaOCl. After a final flush with NaOCl, the canal was rinsed with 5 mL 17% EDTA (ethylenediamine tetra-acetic acid) to remove the smear layer. After drying the canal with paper points, calcium hydroxide (2.5 g [Farmácia de Manipulação Fórmula e Ação]), mixed with saline to a toothpaste consistency, was placed in the canal with an amalgam carrier. The access cavity was sealed with Cavit. Diclofenac (50 mg, 3 times a day for 3 days), a nonsteroidal anti-inflammatory drug, was prescribed to manage postoperative pain.

After 1 week, the patient was asymptomatic and her sinus tract had healed. Calcium hydroxide was removed from both teeth by rinsing with 1% NaOCl. After drying the root canals with paper points, a paste of calcium hydroxide (2.5 g [Farmácia de Manipulação Fórmula e Ação]) and 2 mL of polyethylene glycol 400 was placed as an intracanal dressing. This dressing was renewed every 2 months and a radiograph was taken to ensure thorough filling of the root canal with the dressing, as well as to monitor development of a hard tissue barrier. This procedure was repeated over a year, until a hard tissue barrier was detected using a size 40 K-file (Dentsply-Maillefer).

At 1 year, the canals of both teeth were flushed with 5 mL of 1% NaOCl followed by 5 mL of 17% EDTA, then dried with paper points. Obturation was completed by lateral compaction, using gutta-percha (Dentsply-Maillefer) and AH Plus sealer (Dentsply Maillefer, Konstanz, Germany) (Fig. 1d). The access cavity in tooth 11 was sealed with a cotton pellet and glass ionomer (Ketac Cem, 3M do Brazil, São Paulo, Brazil) and tooth 12 was sealed with a temporary crown. The patient was referred for permanent restoration of these teeth. As the sinus tract had healed, the patient was asymptomatic and there was evidence of hard tissue healing of the apical periodontitis at the time of obturation, a surgical approach was not necessary. Follow-up radiographs were taken after 6 months, 1 and 2 years (Fig. 1e).

Case 2

A 30-year-old woman complaining of severe pain in her right mandibular area reported that she had had root canal treatment of tooth 47 when she was 13 years old. Clinical examination revealed gingival swelling in the region of tooth 47. Radiography revealed inadequate root canal treatment and apical periodontitis associated with the tooth (Fig. 2a).

At the first appointment, the obturation material was removed with Hedström files while irrigating with 1% NaOCl. After irrigating the canal with 5 mL of 17% EDTA and drying with paper points, calcium hydroxide (2.5 g [Farmácia de Manipulação Fórmula e Ação]) mixed with saline to obtain a toothpaste consistency was placed as an intracanal dressing. After 2 weeks, this dressing was flushed out of the canal with 1% NaOCl. The canal was dried with paper points (Dentsply/Tulsa Dental), a master gutta-percha point (Dentsply-Maillefer) was selected and adjusted to 3 mm short of the working length. An MTA plug (White MTA-Angelus, Angelus, Londrina, Brazil) was placed with a small amalgam carrier and adapted to the apical canal walls using the pre-adjusted gutta-percha point (Fig. 2b). The position of the MTA plug was checked radiographically and a wet cotton pellet was placed on top of it before sealing the access cavity with Cavit. Lateral compaction of gutta-percha and AH Plus sealer over the set apical MTA was completed at a second appointment 1 week later (Fig. 2c).
After root canal treatment, the patient was referred for permanent restoration of this tooth. At follow-up appointments (at 1, 2 and 5 years) the patient had no symptoms and radiographs showed increasing hard tissue formation in the apical area (Fig. 2d).

Case 3
A 28-year-old woman had suffered subluxation trauma of tooth 11 at 7 years of age. The tooth presented as an uncomplicated crown fracture with normal mobility and darkening of the clinical crown. Radiographic examination revealed a very immature tooth with a wide open apex and apical periodontitis (Fig. 3a).

The clinical protocol was similar to that in the 2 previous cases. After 4 weeks with an intracanal dressing (2.5 g of calcium hydroxide [Farmácia de Manipulação Fórmula e Ação] mixed with 2 mL of polyethylene glycol 400), the root canal was rinsed with 5 mL of 1% NaOCl, then with 5 mL of 17% EDTA. After the canal was dried with paper points (Dentsply/Tulsa Dental), an MTA (ProRoot Dentsply/Tulsa Dental) mixture was placed in the root canal with an amalgam carrier and condensed apically using large paper points. As the root canal was very wide, a decision was made to fill the entire canal with MTA (Fig. 3b). A cotton pellet moistened in saline was placed over the MTA in the pulp chamber and the access cavity was sealed with Cavit and later restored with composite. At 9 months follow-up, a radiograph showed early bone healing (Fig. 3c).

Discussion
The teeth described in these 3 cases had different degrees of open apices and associated apical periodontitis. None of the patients had a medical condition that would interfere with either the treatment plan or the outcome of the treatment.

When treating nonvital teeth, a main issue is eliminating bacteria from the root canal system. As instruments cannot be used properly in teeth with open apices, cleaning and disinfection of the root canal system rely on the chemical action of NaOCl as an irrigant and calcium hydroxide as an intracanal dressing.9

NaOCl is known to be toxic, especially in high concentrations. When rinsing immature teeth with open apices, there is an increased risk of pushing the irrigant beyond the apical foramen. Therefore, it is advisable to use less concentrated NaOCl, which is less toxic.10 In all 3 cases, 1% NaOCl was used.

Calcium hydroxide pastes were used in all cases because of their antimicrobial activity and to prevent MTA extravasation into the periapical area.11 Different vehicles can be used depending on the length of time the dressing will remain in the canal. When the period was up to 2 weeks, saline was used as the vehicle. For more extended periods, polyethylene glycol was used as the vehicle because calcium hydroxide ions are released more slowly and the medication can remain active in the canal for longer periods.12 A 17% EDTA rinse was carried out before placement of the intracanal dressing to remove the smear layer and facilitate diffusion of calcium hydroxide through the dentin and before obturation to ensure better removal of calcium hydroxide.13

In case 1, apexification was reached and osseous healing occurred. Although calcium hydroxide has been shown to be a good material for treating immature teeth, various studies have revealed some disadvantages to using this material, such as long treatment time, the
need for multiple appointments and several radiographs and possible canal infection as the crown is sealed with only temporary materials over a long period. The treatment time for our apexification procedure was approximately 12 months. A recent prospective clinical study showed that the mean time necessary for the formation of an apical barrier with this technique is more than 12 months. The barrier formed using calcium hydroxide for apexification may be porous and has sometimes even been found to contain small amounts of soft tissue. In our case, even after tactile and radiographic checking of the barrier, the first gutta-percha point was pushed beyond the apex on tooth 12 during obturation and had to be discarded. Also, due to the width of the canals, adaptation of gutta-percha to the apical area was difficult.

Because of MTA’s excellent biological properties and ability to create a good seal, it has been recommended for creating an artificial barrier in the apical area of teeth with open apices, thus compressing treatment time to 1 or 2 visits. The cell’s response to MTA and the mechanism of deposition in barrier formation are unknown and require further investigation. MTA was used in case 2 as an apical plug and in case 3 as the filling material. In case 2, a 2-mm MTA plug was placed in the apical area of the root canal and conventional obturation was performed. Placement of the MTA plug facilitated obturation of the root canal without overextension of the filling material. In case 3, because the tooth was very immature and adaptation of a gutta-percha master point would be very difficult, the root canal was completely obturated with MTA. MTA consists of fine hydrophilic particles that set in the presence of moisture in approximately 4 hours. In case 2, final obturation was carried out at a subsequent visit to avoid dislocation of the MTA plug beyond the apex. In both cases 2 and 3, a moist cotton pellet was left over the MTA to facilitate setting.

Follow-up radiographs in all 3 cases showed osseous healing and, during clinical examination, the patients were asymptomatic. The results obtained with MTA in cases 2 and 3 seem to be similar to those of other studies. The choice of treatment regimen for teeth with open apices depends on the individual case and operator experience and familiarity with handling the various materials. Patient availability for follow-up appointments should be considered as well if multiple sessions are required.

Conclusions

The 3 cases reported here all revealed signs of bone healing, regardless of the treatment protocol used. The authors have no declared financial interests in any company manufacturing the types of products mentioned in this article.

References

Management of Erythema Multiforme Associated with Recurrent Herpes Infection: A Case Report

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ABSTRACT

Erythema multiforme is an acute mucocutaneous disorder, characterized by varying degrees of blistering and ulceration. We report a case of recurrent herpes-associated erythema multiforme managed with prophylactic acyclovir. An 11-year-old boy had lesions in the oral cavity and lips, which had been diagnosed as erythema multiforme minor. Four months later, the patient had desquamative gingivitis with erythematous lesions and necrotic areas in the skin. This episode was not related to drug intake, which suggests that the erythema multiforme was a result of herpetic infection. This hypothesis was supported by positive serology for herpes simplex virus. Five months later, the patient returned with new oral, skin and penis mucosal lesions. The diagnosis was confirmed as herpes simplex virus-associated erythema multiforme major. The episode was treated with acyclovir, and acyclovir was used prophylactically for 7 months to control the disease.
The disease is more common in males than females in a ratio of 3:2.7

Recently, erythema multiforme has been classified as minor, major, Stevens-Johnson syndrome or toxic epidermal necrolysis, where erythema multiforme minor is the mildest type of lesion and toxic epidermal necrolysis the most severe2,3 (Table 1).

Erythema multiforme is associated with an acute onset and, usually, mild or no prodromal symptoms. Fever, lymphadenopathy, malaise, headache, cough, sore throat and polyarthralgia may be noticed as much as 1 week before the onset of surface erythema or blisters.8 Lesions may appear as irregular red macules, papules and vesicles that collapse and gradually enlarge to form plaques on the skin. Moreover, crusting and blistering sometimes occur in the centre of the skin lesions, resulting in concentric rings resembling a “bull’s eye” (target lesion). On the other hand, oral lesions are usually erythematous macules on the lips and buccal mucosa, followed by epithelial necrosis, bullae and ulcerations with an irregular outline and a strong inflammatory halo. Bloody encrustations can also be seen on the lips.2,3

In this report, we discuss the case of an 11-year-old boy who was clinically diagnosed with erythema multiforme associated with herpes infection. The disease was controlled by the prophylactic use of acyclovir to prevent further recurrence.

**Case Report**

An 11-year-old boy visited the stomatology clinic at the Federal University of Ceará with complaints of painful ulcers and hemorrhagic crusts on the lips. He reported having pharyngitis and a fever 1 week previously. The patient had started treatment with azithromycin and amoxicillin, after which he developed ulcers and a hemorrhagic crust on the lower lip. An oral examination identified ulcerative lesions involving the bilateral buccal mucosa and the labial mucosa.

<table>
<thead>
<tr>
<th>Category of erythema multiforme</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythema multiforme minor</td>
<td>Typical target lesions, raised atypical target lesions, minimal mucous membrane involvement and, when present, at only 1 site (most commonly the mouth). Oral lesions; mild to severe erythema, erosions and ulcers. Occasionally may affect only the oral mucosa. &lt; 10% of the body surface area is affected.</td>
</tr>
<tr>
<td>Erythema multiforme major</td>
<td>Cutaneous lesions and at least 2 mucosal sites (typically oral mucosa) affected. &lt; 10% of the body surface area involved. Symmetrically distributed typical target lesions or atypical, raised target lesions or both. Oral lesions usually widespread and severe.</td>
</tr>
<tr>
<td>Stevens-Johnson syndrome</td>
<td>Main difference from erythema multiforme major is based on the typology and location of lesions and the presence of systemic symptoms. &lt; 10% of the body surface area is involved. Primarily atypical flat target lesions and macules rather than classic target lesions. Generally widespread rather than involving only the acral areas. Multiple mucosal sites involved, with scarring of the mucosal lesions. Prodromal flu-like systemic symptoms also common.</td>
</tr>
<tr>
<td>Overlapping Stevens-Johnson syndrome and toxic epidermal necrolysis</td>
<td>No typical targets; flat atypical targets are present. Up to 10%–30% of the body surface area affected. Prodromal flu-like systemic symptoms common.</td>
</tr>
<tr>
<td>Toxic epidermal necrolysis</td>
<td>When spots are present, characterized by epidermal detachment of &gt; 30% of the body surface and widespread purpuric macules or flat atypical targets. In the absence of spots, characterized by epidermal detachment &gt; 10% of the body surface, large epidermal sheets and no macules or target lesions.</td>
</tr>
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</table>

*Adapted from Al-Johani et al.3 with permission from Elsevier, with additional information from reference 2.*
The patient reported that a similar incident had occurred 2 years previously. Currently, he had no skin injuries, and the clinical features suggested erythema multiforme minor. Accordingly, he was treated for his symptoms, and the lesions healed within 14 days.

Four months later, the patient returned to the stomatology clinic with a diffuse gingivitis manifested as pure desquamative gingivitis (Fig. 2). He had also developed eruptions and erythematous lesions with necrotic areas on his trunk and legs (Fig. 3), and a single vesicle lesion was seen on the perilabial skin. On that occasion, the patient denied drug therapy, and it was suggested that a herpetic infection had triggered the erythema multiforme. Serology tests confirmed that the patient was positive for HSV (IgG and IgM positive), and he was treated with a 7-day course of acyclovir (1,000 mg/day), a topical dexamethasone elixir and acetaminophen. With this combined course of treatment, the disease was controlled.

Five months later, the patient returned with new oral lesions characterized by diffuse ulcerations in the oral mucosa, involving the bilateral buccal mucosa and the labial mucosa, and hemorrhagic crusts on the vermilion zone of the lips (Fig. 4). These lesions limited his oral hygiene and intake of food, but intravenous rehydration was not necessary. The patient also presented with target lesions of a regular round shape on his legs, arms, hands and trunk (Fig. 5). Mucosal ulcerations on the penis were also found, and the patient reported that they had appeared after unprotected exposure to the sun.

At this point, the disease was diagnosed as erythema multiforme major associated with HSV, and the patient was treated with a 10-day course of acyclovir (1,000 mg/day), acetylsalicylic acid and a topical dexamethasone elixir. After 14 days of treatment, skin and oral lesions were controlled. Because of the recurring episodes, acyclovir was given prophylactically for 7 months, starting with 800 mg/day and reduced in the last month to 400 mg/day. Renal and liver functions were monitored during the course of treatment, and no abnormalities were found. In addition, no oral or skin lesions developed during the 7 months of treatment, and the disease is currently under control.

**Discussion**

Erythema multiforme is an acute, sometimes recurrent, mucocutaneous condition of uncertain etiopathogenesis that can follow the administration of drugs or
infections. Infection with HSV is the most common feature in the development of erythema multiforme minor. Herpes-associated erythema multiforme (HAEM) can be found several days or weeks following an episode of HSV. Both HSV types 1 and 2 have been shown to precipitate HAEM, and health history, clinical observations and prospective studies indicate that most cases of erythema multiforme are preceded by infection with HSV, although it is important to emphasize that HSV infection may be clinically silent. HSV DNA has been detected in 60% of patients clinically diagnosed with recurrent HAEM and in 50% of patients with recurrent idiopathic erythema multiforme using polymerase chain reaction (PCR) of skin biopsy specimens. Another study revealed that the cutaneous lesions of patients with HAEM were infected with HSV-1 in 66.7% of cases, HSV-2 in 27.8% of cases and with both HSV types in 5.6% of cases. Typically, an erythema multiforme (minor or major) lesion begins 10–14 days following the clinical manifestations of an HSV infection. The lip is the most common site of preceding HSV infection in cases of HAEM. In the present case, the serology for HSV was positive, confirming that the erythema multiforme was associated with an HSV infection. However, it is important to emphasize that HSV was identified only during the second episode of the disease and that HAEM was confirmed at the third episode.

Several studies have demonstrated that the pathogenesis of HAEM is consistent with a delayed hypersensitivity reaction. The disease begins with the transport of HSV DNA fragments by circulating peripheral blood mononuclear CD34+ cells (Langerhans cell precursors) to keratinocytes, which leads to the recruitment of HSV-specific CD4+ T<sub>eff</sub> cells. The inflammatory cascade is initiated by interferon-γ (IFN-γ), which is released from the CD4+ cells in response to viral antigens, and immunomediated epidermal damage subsequently begins. PCR has been employed to detect the presence of HSV DNA in HAEM lesions and tissues, and HSV genes can also be identified with reverse transcriptase PCR or immunohistochemistry using antibodies to specific viral genes. Detection of IFN-γ in HAEM lesions can also be used as evidence of virus involvement. Serology to identify HSV-1 and HSV-2 and to detect specific IgM and IgG antibodies may confirm a suspected history of HSV infection, although it is not necessary for diagnosis.

The diagnosis of HAEM is clinical and is easier when the patient develops target lesions with a preceding or coexisting HSV infection. The finding of typical skin or oral lesions (or both) in a patient with suspected HAEM supports the clinical diagnosis. In our case, diffuse ulcerations in the oral mucosa involving the buccal mucosa, the labial mucosa and hemorrhagic crusts on the lips as well as the classic skin lesions were seen. Pronounced systemic signs and symptoms (cutaneous and mucosal lesions) suggested the diagnosis of erythema multiforme major. Histopathologic examination revealed a pattern that is characteristic of erythema multiforme, but is not pathognomonic. Subepithelial or intraepithelial vesiculation is usually seen in association with necrotic basal keratinocytes, and subepithelial edema and intense inflammatory infiltration (lymphocytes, neutrophils and often eosinophils) are present; again, these features are characteristic of erythema multiforme, but not pathognomonic. Often, the inflammatory infiltrate is arranged in a perivascular orientation that is typically seen in erythema multiforme. Changes affecting both the epithelium and supporting connective tissue were seen in the present case. All the symptoms together, including the clinical and histologic features as well as the patient’s HSV-positive status and symptom recurrences, confirmed the diagnosis of HAEM.

Treatment of erythema multiforme depends on the severity of the clinical features. Mild forms usually heal in 2–6 weeks; local wound care, topical analgesics or anesthetics for pain control and a liquid diet are often indicated in these situations. For more severe cases, intensive management with intravenous fluid therapy may be necessary. Oral antihistamines and topical steroids may also be necessary to provide symptom relief. Systemic corticosteroids have been used successfully in some patients, but evidence to support their use for erythema multiforme is limited.

Recurrences are seen in approximately 20%–25% of erythema multiforme cases. Although the disease resolves spontaneously in 10–20 days, patients may experience 2–24 episodes a year. The mean duration of the disease is 10 years (range 2–36 years). HAEM is often effectively managed with acyclovir (200 mg, 5 times a day for 5 days), but only if the therapeutic scheme is started in the first few days. If erythema multiforme keeps recurring, a continuous low dose of oral acyclovir is necessary. Oral acyclovir has been shown to be effective at preventing recurrent HAEM, and the protocols may include 200–800 mg/day for 26 weeks. If acyclovir treatment fails, valacyclovir can also be prescribed (500 mg twice a day). The latter has greater oral bioavailability and is more effective at suppressing recurrent HAEM. During the second and third episodes in this case, the patient was treated with acyclovir (1,000 mg/day), and prophylactic use of acyclovir was prescribed to prevent recurrences. The dosage of an antiviral medication may be reduced once the patient is free of recurrences for 4 months, and the drug may eventually be discontinued. In our case, the patient was treated for 7 months with acyclovir, starting with 800 mg/day followed by a reduction in the last month to 400 mg/day.
Conclusion

An important step in the management of erythema multiforme is recognition and withdrawal or prevention of contact with the causative agent. Although its etiology is not yet well defined, the relationship between erythema multiforme and herpetic infection seems certain. In the case reported here, erythema multiforme triggered by HSV infection was diagnosed, and the disease was controlled with continuous oral acyclovir therapy to prevent recurrences. Patients should be informed about the condition and the importance of preventing recurrences.

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ONTARIO - Toronto West: Part time associate for replacement of associate leaving. Busy, fully booked from day one, opportunity to practise dentistry in a well established office, one that thrives from a positive environment and a foundation based on values. Modern technologies, exposure to cosmetics, implants, Cerec technology and the ability to refer from within to our many specialists. If you are a team player, fax: 1-866-602-1162. D6375

PRINCE EDWARD ISLAND: Oral surgeon required. Well-established 30+ year practice in Prince Edward Island where you can also enjoy world famous golfing and a peaceful lifestyle. Seeking associate for all aspects of busy OMS, with opportunity to assume leadership. Hospital privileges available. Please email: habbi@islandtelecom.com. Phone: (902) 892-2970 office, (902) 892-8337 home. D1548

QUÉBEC – Région de l’Outaouais – Gatineau: Recherche dentiste visant l’excellence pour pratique de groupe multidisciplinaire et acharnante. Excellent emplacement, beaucoup de nouveaux patients par mois, très faible pourcentage de RAMQ. On recherche un dentiste bilingue ayant de l’entregent avec une personnalité sympathique, dynamique et s’acharnant en équipe. Une hygiéniste et assistant seront à votre disposition. Envoyez vos coordonnées à: centredentairelimbour@videotron.ca à l’attention de Isabelle Tremblay. D6251


UNITED STATES - Illinois, Texas, and Massachusetts: A unique and exciting opportunity is available for general dentists in the U.S. Earn between 250-350k per year with paid malpractice and health insurance while working in a great environment. The group is owned and operated by Canadians and will look after all immigration needs. Must have started or be prepared to complete US boards. Email: dwolle@gmail.com, fax: (312) 274-0760. D2456

YUKON - Whitehorse: Yo! Come join us in our 9 chair dental clinic. Enjoy a general practice with a full range of digital needs. We are located in the southern lakes, a beautiful outdoor recreation area. Contact Warren by phone: (867) 668-3152 or email: warrenpearson26@hotmail.com. D1828

Positions Wanted

ONTARIO - Greater Toronto Area: Oral surgery comfortably performed on your patients in the familiar surroundings of your own office. Why lose valuable income by referring elsewhere? Your patients will appreciate the convenience. 25 years of experience. Based on 50:50 fee split. Call: (416) 484-6442. D6456

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LEARN VIRTUALLY ANYTIME ANYWHERE: With NEI Conferences. Technologically advanced CDE courses are all presented in a vacation environment and are all tax-deductible. The flexible year-round open registration allows you to choose travel destinations and dates that are convenient for you, ANYTIME - ANYWHERE. Have travel plans or planning to travel? Looking for a conference-to-go? Visit us at: www.neiconferences.com. D3429

Equipment Sales & Service

FOR SALE: Sirona Orthophos 3 digital panoramic unit. This unit has had a new tube head installed, been examined from top to bottom, and been upgraded by Patterson. They will warrant it for one year. The unit was appraised at $50,000 and I will let it go for $42,000 plus shipping. Where else could you find a digital pan with a brand new tube head for this price? I can be reached at: (780) 352-5113 or by email at: timmahoney@incentre.net. D6446
EQUIPMENT FOR SALE: Two Operatories and Pan/Developer 2 M&CC Operatories with Marus chairs/delivery units/lights/stools, Gendex x-ray unit, Gendex Pan, Whemer Ceph, AT2000 developer, Dentsply Triad system, 5 Phatelus highspeeds with fiber optics, various smaller equipment. Phone: (778) 426-0989.

Advertisers’ Index

3M ESPE ..................552
A-dec ..................567
Business Development
Bank of Canada ........590
CDA Funds ..............610
CDSP . .....574, 580–1, 611
GlaxoSmithKline ........558
ITRANS .................602
Ivoclar Vivadent ........612
P&G Professional
Oral Health ........553, 556, 584
Pacific Dental
Conference ............582
Quantum ...............568
Straumann ...............554
Sunstar .................550
Vident ..................570
VOCO ..................560
Wiley-Blackwell ........596
CDA Funds

CDA Funds can be used in your CDA RSP, CDA RIF, CDA Investment Account, CDA RESP and CDA IPP.

CDA Fund Performance (for period ending August 31, 2009)

<table>
<thead>
<tr>
<th>Fund Type</th>
<th>MER</th>
<th>1 year</th>
<th>3 years</th>
<th>5 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CDA Canadian Growth Funds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggressive Equity Fund (Altamira)</td>
<td>1.00%</td>
<td>-1.6%</td>
<td>-6.4%</td>
<td>1.1%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Common Stock Fund (Altamira)</td>
<td>0.99%</td>
<td>-17.3%</td>
<td>0.6%</td>
<td>7.3%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Canadian Equity Fund (Trimark)</td>
<td>1.50%</td>
<td>-10.3%</td>
<td>-4.1%</td>
<td>1.6%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Dividend Fund (PH&amp;N)†</td>
<td>1.20%</td>
<td>-10.5%</td>
<td>-2.7%</td>
<td>3.3%</td>
<td>9.2%</td>
</tr>
<tr>
<td>High Income Fund (Sceptre)†</td>
<td>1.45%</td>
<td>-19.3%</td>
<td>-4.5%</td>
<td>4.9%</td>
<td>n/a</td>
</tr>
<tr>
<td>TSX Composite Index Fund (BGICL)†</td>
<td>0.67%</td>
<td>-18.6%</td>
<td>-1.0%</td>
<td>7.5%</td>
<td>n/a</td>
</tr>
</tbody>
</table>

| **CDA International Growth Funds**             |      |        |         |         |          |
| Emerging Markets Fund (Brandes)                | 1.77%| 10.9%  | 8.5%    | 10.9%   | 9.8%     |
| European Fund (Trimark)†                       | 1.45%| -22.6% | -8.9%   | -0.9%   | -4.3%    |
| International Equity Fund (CC&L)               | 1.30%| -18.2% | -8.3%   | -2.8%   | -4.3%    |
| Pacific Basin Fund (CI)                        | 1.77%| -3.3%  | -1.1%   | 2.6%    | -5.9%    |
| US Large Cap Fund (Capital Intl)†              | 1.46%| -14.9% | -10.4%  | -6.2%   | n/a      |
| US Small Cap Fund (Trimark)                    | 1.25%| -4.0%  | -5.6%   | 0.6%    | n/a      |
| Global Fund (Trimark)                          | 1.50%| -20.6% | -7.1%   | -1.6%   | 2.1%     |
| Global Growth Fund (Capital Intl)†             | 1.77%| -11.1% | -4.1%   | 1.5%    | n/a      |
| S&P 500 Index Fund (BGICL)†                    | 0.67%| -16.2% | -7.1%   | -4.1%   | -4.7%    |

| **CDA Income Funds**                           |      |        |         |         |          |
| Bond and Mortgage Fund (Fiera)                 | 0.99%| 5.9%   | 4.5%    | 3.6%    | 4.8%     |
| Bond Fund (PH&N)                               | 0.65%| 8.0%   | 5.2%    | 5.5%    | 6.4%     |
| Fixed Income Fund (McLean Budden)†             | 0.97%| 7.4%   | 4.6%    | 4.7%    | 5.6%     |

| **CDA Cash and Equivalent Fund**               |      |        |         |         |          |
| Money Market Fund (Fiera)                      | 0.67%| 1.5%   | 2.8%    | 2.6%    | 2.9%     |

| **CDA Growth and Income Funds**                |      |        |         |         |          |
| Balanced Fund (PH&N)                           | 1.20%| -5.2%  | 0.1%    | 3.2%    | 3.2%     |
| Balanced Value Fund (McLean Budden)†           | 0.95%| -2.5%  | 0.3%    | 3.6%    | 5.1%     |

| **CDA Corporate Class Funds**                  |      |        |         |         |          |
| Canadian Bond Fund Corporate Class (CI)        | 1.10%| 5.0%   | 4.1%    | n/a     | n/a      |
| Corporate Bond Fund Corporate Class (CI)       | 1.25%| 3.5%   | n/a     | n/a     | n/a      |
| Income and Growth Fund Corporate Class (CI)    | 1.45%| -4.4%  | 1.5%    | n/a     | n/a      |

| **CDA Managed Risk Portfolios (Wrap Funds)**   |      |        |         |         |          |
| Index Fund Portfolios                          |      |        |         |         |          |
| CDA Conservative Index Portfolio (BGICL)†      | 0.85%| -3.3%  | 1.1%    | 3.4%    | 3.3%     |
| CDA Moderate Index Portfolio (BGICL)†          | 0.85%| -7.6%  | -0.4%   | 3.8%    | 3.9%     |
| CDA Aggressive Index Portfolio (BGICL)†        | 0.85%| -12.0% | -1.8%   | 4.1%    | 3.6%     |

| Income/Equity Fund Portfolios                  |      |        |         |         |          |
| CDA Income Portfolio (CI)†                     | 1.65%| -0.4%  | 1.7%    | 4.0%    | 5.0%     |
| CDA Income Plus Portfolio (CI)†                | 1.65%| -4.9%  | 0.1%    | 4.0%    | 5.0%     |
| CDA Balanced Portfolio (CI)†                   | 1.65%| -7.9%  | -1.2%   | 4.1%    | 4.7%     |
| CDA Conservative Growth Portfolio (CI)†        | 1.65%| -9.5%  | -2.0%   | n/a     | n/a      |
| CDA Moderate Growth Portfolio (CI)†            | 1.65%| -12.2% | -3.0%   | 2.4%    | n/a      |
| CDA Aggressive Growth Portfolio (CI)†          | 1.65%| -15.7% | -4.3%   | n/a     | n/a      |

Figures indicate annual compound rate of return. All fees have been deducted. As a result, performance results may differ from those published by the fund managers. CDA figures are historical rates based on past performance and are not necessarily indicative of future performance.

† Returns shown are the underlying funds in which CDA funds invest.

†† Returns shown are the total returns for the indices tracked by these funds.

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