JCDA
Journal of the Canadian Dental Association

Vol. 69, No. 11 December 2003


*Painting by Dr. B. Christine Collison*

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# Editorial

## LEADING FROM THE FRONT

*Dr. John P. O'Keefe*

With the approach of the holiday season and feelings of good cheer, we can reflect on how lucky we are as individuals. Dentists are blessed with a wonderful profession that offers many advantages others can only dream of.

According to the sociology literature, the hallmarks of a successful profession are legitimacy in the eyes of society, market power and organizational cohesion. On all 3 counts, Canadian dentistry scores highly. Ours is a respected profession with a scientific foundation. The return on investment for our professional education is arguably surpassed only in medicine. Despite some cracks at the seams, our professional organizations are the envy of the world.

As we reflect on our good fortune, our thoughts are surely drawn to those less fortunate than ourselves who have poor health, suffer from poverty or marginalization, and who are aged or alone. It should be of particular concern to us that these people tend to have the worst oral health.

Surveys consistently show that the burden of oral ill health is borne disproportionately by the most vulnerable groups in society. Paradoxically, those who most need our expertise have the least access to oral health care. When they do access our care, people in these groups often complain that their interaction with our profession is less than satisfactory.

In an article published in the December 2003 edition of *Social Science and Medicine*, a group of Quebec-based researchers noted that social assistance recipients often receive extractions rather than more conservative treatments. These individuals feel that they are talked down to in dental offices and may hold our profession in lower regard than we would like. Working with this group of patients myself, I feel they should have access to more comprehensive care than the emergency treatments that tend to be covered by public programs.

Surely, the issue of access to oral health care for the most vulnerable groups in society is one that requires true leadership on the part of the dental profession and, crucially, coalition-building with interested stakeholders. We cannot, and cannot be expected to, solve society's oral health problems on our own. But if we don't take a visible and vocal leadership role in advocating optimal oral health for all Canadians, others may attempt to fill the void.

We must not pat ourselves on the back that all is rosy in the Canadian dental garden. If the U.S. Surgeon General says there is a silent epidemic of oral disease in that country (and my clinical experience tells me that the same situation exists here), we must not ignore the challenge that this poses to our profession. So what do we do about it?

We need to raise the public profile of oral health and its importance to general health with decision-makers, media and the general public. While I have nothing against esthetic dentistry, agreeing that it can be health-enhancing, our profession shouldn't only focus on esthetics when speaking about oral health matters to the outside world. We must never forget to highlight the considerable pain and suffering experienced by a significant number of Canadians due to oral ill health. Surely, this is an unenviable state of affairs in a rich civilized country like ours.

Canada needs a National Oral Health Strategy that will focus on promoting oral health (especially among vulnerable groups), help us measure the burden and consequences of oral ill health, and propose ways to get much-needed oral health care to those who need it urgently.

The Federal, Provincial, and Territorial Dental Directors Working Group (www.fptdd.ca) has taken the initiative to generate such a strategy. The dental profession should put its shoulder to the wheel and work hard to achieve the same goals. Speaking of "dental directors," I believe we should also advocate firmly that each government in Canada must employ an oral health leader in an advisory capacity.

Given that there's still so much work before us, it's a wonder we have time for holidays. To meet the challenges ahead, let's recharge our batteries and have some fun. Peace, good health and happiness to you and yours!

*John O'Keefe*
*1-800-267-6354, ext. 2297*
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# President's Column

## JOIN CDA NOW... I DID!

*Dr. Louis Dubé*

CDA's membership recruitment campaign is now in full swing. Planning this campaign is a very interesting exercise. After drawing up our report for the preceding year, CDA's officers and members prepare a list of issues that will be of concern to the profession over the next few years. This process is very stringent, since all of CDA's activities are related to our mission.

CDA is dedicated to defending our profession and improving oral health. These 2 objectives go hand-in-glove. Quite simply, a higher degree of competence on the dentist's part is reflected in higher-quality treatment for patients.

Nevertheless, according to surveys and our consultations among dentists across the country, there are those who feel that CDA does not offer enough tangible benefits to its members, thereby inhibiting our efforts to recruit new members from Ontario and Quebec. Another reason often given for not joining CDA is the cost of membership dues. In our daily lives, we often spend hefty sums on consumer products that we really want, or think we really need, because we appreciate the inherent value of these products. Usually, if we assign a value to an object, its cost becomes far less important. On the other hand, if we do not see the overriding value of a product, the cost can become an excuse for not buying it. So my mission during my term as Association president is to demonstrate to you the immense value of being a member of CDA.

Our mission can be broken down into 4 key points. The first focuses on a steady improvement in the quality of oral health for all Canadians. CDA has developed a Public Education Program and raised its media profile substantially, emphasizing that the dentist is the primary provider of oral health care. Our Association is also helping dental faculties fulfill their role by offering administrative and even financial support. This key point also involves promoting the dentist-patient relationship. It is vital that we preserve the patient's right to choose a treatment plan suiting his or her needs, one that is not regulated by the interests of third-party payers.

The second key point is to maintain our status as a leader in oral health. By developing policies and guidelines, establishing work groups and organizing sessions on various issues, CDA enables provincial organizations to avoid duplicating efforts to solve problems, while also reducing their policy development-related expenditures. By maintaining discussions with professions allied to dentistry, CDA again ensures that the oral health of Canadians is among the best in the world. Of course, much work remains to be done, but we can accomplish a great deal if we work together to find a common solution. This process ensures that everyone emerges a winner — especially the patient.

The third key point, essential if we are to succeed in our mission, is that CDA must obtain the funds it needs to cover its budget. This year's priorities are based on recommendations made by member-associations and the concerns of individual members. The participation of these groups and individuals is crucial. The more members we represent, the more influence and credibility we have with our partners.

Lastly, faithful to its fourth key point, CDA does not limit itself to membership dues as its sole source of revenue. We recognize the need to lighten the load imposed by individual dues and are developing more sources of non-dues revenue. We are also developing products that will be very attractive — and indeed essential — to our members. CDAnet has been, and still is, the state-of the-art in electronic transmission of dental claims to insurers. ITRANS™ — a uniquely secure, Internet-based transaction and messaging service — promises to propel claim transmission into the 21st century. ITRANS™ is scheduled to be available in the first quarter of 2004.

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So you have 2 good reasons to join CDA: value *and* savings. When it comes to membership in CDA, you can count me in!

À la prochaine!

*Louis Dubé, DMD*
*president@cda-adc.ca*

# Letters

## Editor's Comment

The *Journal* welcomes letters from readers about topics that are relevant to the dental profession. The views expressed are those of the author and do not necessarily reflect the opinions or official policies of the Canadian Dental Association. Letters should ideally be no longer than 300 words. If what you want to say can't fit into 300 words, please consider writing a piece for our Debate section.

## October President's Column

Bravo on your *President's Column* in the October 2003 *JCDA*. I once had an accountant friend ask how much money I'd need to retire (we were in our early forties). I told him I'd never really thought about it. He said he'd need about 5 or 6 million dollars. I said, "…and you'd retire?" He said, "I wouldn't even go in Monday morning to pick up my stuff!" So I said, every morning when I wake up, part of me is a dentist, as you aptly said "it's what I am" and I wouldn't feel the same if I didn't wake up feeling that way. I think and hope most of us feel that way. It was nice to see it in print. On a side note, after 23 years of practice, I was surprised to read that less than 50% of Ontario dentists are members of CDA. I've always thought of this as a privilege, not as a choice or duty.

*Dr. Steven H. Brown*
*Toronto, Ontario*

Your *President's Column* in the October 2003 *JCDA* brought back many pleasant memories. I too gave some lectures and led discussions on practice management and dental group practice, back some 20–25 years ago. My involvement in dental politics led me to become president of the Ontario Dental Association (ODA) and to 5 years on the CDA Executive.

I idolized my dentist as an 8-year-old and lived through your caries experience. I wanted to be a dentist when I started high school. I very much enjoyed being a dentist for the last 49 years. My enthusiasm and love for dentistry has helped 17 of my patients and family choose a dental career.

I know what you mean when you talk about the joy of helping and treating the young ones, who spread the word that dentistry is not to be feared. One of my patients, who is presently a dentist in St. Catharines, used to fall asleep while I restored his teeth. No, I did not use a general anesthetic. Four of my former patients now practise dentistry in St. Catharines.

*Dr. Ivan Hrabowsky*
*St. Catharines, Ontario*

## Humanitarian Appeal

This letter is an appeal for assistance from the dental profession in Canada. My name is Lieutenant Colonel Martin Field; I am currently deployed with Task Force Kabul, Afghanistan, as the Canadian Contingent Dental Officer. Recently, I have had the opportunity to make 2 visits to a small rural village located in the mountains northwest of Kabul. In this village is a combined medical/dental clinic that serves a population of 300,000.

This is a region that has been heavily fought over; there is extensive damage and much poverty. Afghanistan has suffered through more than 30 years of constant warfare. Ordinary people have been brutalized by the fighting and continue to be victims of circumstances beyond their control. Dental care for the average citizen is almost impossible to access, and the care that is provided is necessarily limited to emergency extractions and basic operative dentistry. In this clinic, equipment is woefully inadequate and consumable supplies almost non-existent. Things are so bad that dental needles are reused and anesthetic cartridges refilled and reused.

*LCol Field expressed support to the dentist working in a medical/dental clinic located in a small rural village near Kabul, Afghanistan. War and poverty have profoundly impacted this clinic, which serves more than 300,000 people and operates in primitive conditions.*

The Canadian Forces are in Afghanistan to provide stability and humanitarian aid. An opportunity exists for the dental profession in Canada, in partnership with the Canadian Forces Dental Services, to do something that will make a significant difference in the lives of many people. The staff are good, caring people who know better and are embarrassed by their circumstances. They need our help. I propose to institute and coordinate a dental assistance effort for this clinic. This is a rare opportunity for us to do a lot of good for many people at little cost. Anything that can be provided will have an immediate, lasting and positive impact on the lives of these people.

My request is that you, members of our profession, donate select items of small equipment and (most importantly) consumable dental materials. Specific items have either been requested by the clinic or identified by myself. For more information, contact Maj Sylvie Lavoie at (613) 945-6713

or Maj Carolyn Boyd at (613) 945-6628.

*LCol M.A. Field*
*Operation ATHENA*
*Afghanistan*

## Water Conservation

I was prompted to write this letter after hearing a comment on CBC Radio the other day. The comment came from an elderly lady who said that she was reminded by her dentist to make sure she turned off her tap while brushing her teeth.

As a father of 7 children living in the country on Prince Edward Island, with a shallow well and an overworked septic system, I realized that this is the same message I have been preaching at home for years.

We all must realize that good clean water is our most precious resource. We are reading every day in the newspaper about problems with our drinking water. The cost of a litre of water and a litre of gasoline are almost equal at this point in time. I predict that there will be major wars fought over water in our lifetime.

We all tell our patients that they must not "Rush Their Brush." We recommend that 2 or 3 minutes are required to do a good job. These are great suggestions, but I think that as members of CDA, we should start a campaign to convey the message "Turn Off Your Taps While Brushing" to all our patients, every chance we get.

There are millions of gallons of precious water being wasted in this country every day by patients who leave taps running while they are standing there brushing their teeth.

We have had a lot of bad press over the years with regards to our push for fluoride in the drinking water and amalgam waste going down our drainpipes. I think we would be doing ourselves a great service by making this one small suggestion a part of our daily office routine.

*Dr. Paul J. McCarvill*
*Kensington, Prince Edward Island*

## Lavigne et al

In reference to *Understanding and Managing the Interaction between Sleep and Pain: An Update for the Dentist* by Dr. Gilles Lavigne and others (July/August 2003 *JCDA*), the U.S. Food and Drug Administration has taken to task the pharmaceutical firm for improper marketing of gabapentin (Neurontin). This drug was never approved for use in the management of severe or persistent pain.

*Dr. James R. Miller*
*St. John's, Newfoundland*

## DAT Online

Re *DAT Success Story* (November 2003 *JCDA*): The new Dental Aptitude Test (DAT) online registration form is outstanding. CDA's Web site is very informative, and it is refreshing to see that, along with many of the dental schools, your DAT site offers full electronic form submission capabilities. I was very impressed with the layout, navigation and functionality of the site, and found the process of being able to register online exceptionally useful and much more efficient than the previous mail-in form. It is reassuring to see, in real time, that my information was processed and recorded correctly. I especially enjoyed being able to view the "seat availability" in each test location.

*Crystal Janicki*
*Calgary, Alberta*

## Advertisers' Index

# News

## Celebrating a Century of Dentistry at McGill

On December 24, 1903, the Board of Governors of McGill University established a School of Dental Surgery, and the first 3 students were accepted in 1904. Thus, 2004 will mark 100 years of dentistry at McGill and the Faculty of Dentistry will celebrate throughout the year.

Many events are planned for this centennial: the faculty will invite graduates, students, staff and friends to participate and celebrate with them. Commemorative events include an Alumni reception on March 4 at Vancouver's Pan Pacific Hotel, during the 2004 Pacific Dental Conference. And a Centennial Gala Evening has been set for October 16 at Montreal's Sofitel Hotel, in conjunction with McGill Homecoming Weekend. The faculty will also sponsor a series of Continuing Education Courses throughout the year, including the Dr. Ernie Ambrose Lectureship Series (with Dr. Ambrose invited as a guest lecturer) scheduled in October during Homecoming Weekend.

The faculty will publish a special centennial edition of its newsletter in early spring. Feature articles will include historical references, anecdotes from graduates over the years, faculty highlights and future plans, and a schedule of major events.

The faculty hopes that everyone will take the opportunity to join in commemorating this milestone, said Dr. James Lund, dean of McGill University's faculty of dentistry.

For more information, contact Debbie Larocque, Faculty of Dentistry, McGill University; tel.: (514) 398-7203, ext. 4165; fax: (514) 398-8900; e-mail: debbie.larocque@mcgill.ca.

## COVER ARTIST

**Dr. B. Christine Collison** maintains a full-time dental practice in West Vancouver. She started drawing at the age of 8 and has incorporated art into all aspects of her life ever since. Her education includes Towson State University (BSc), Johns Hopkins University (MAS) and the University of Maryland where she received her dental degree in 1983.

A native of Baltimore, Dr. Collison emigrated to Canada in 1984. She joined the Federation of Canadian Artists in 1989 and then studied art in France, participated in numerous workshops, and exhibited in solo and group shows in various galleries on B.C.'s Lower Mainland.

"My work is heavily influenced by French Impressionism," Dr. Collison told *JCDA*. "The medium is predominantly watercolour, but more recently has included a mixed-media approach with watercolour, acrylics and gouache. *The Calla Lilies of St. Emilion* is the original title of this piece. It was an image I observed near the catacombs in the village of St. Emilion, of flowers growing wild on the side of the road. The focus is on the movement of light and the elements of design inherent in nature. I use a technique I call 'find a line, lose a line' to convey the natural flow of light, using both colour and line to create the subject and emphasize the opposing forces of light and dark. Flowers are a favourite subject, selected simply for their beauty and the sense of calm they afford us all."

## Canada Ranks 4th for Attendance at FDI 2003 Sydney

Figures indicate that Canada was the country with the fourth largest representation at the FDI 2003 Sydney World Dental Congress, held in late September: 223 Canadian delegates were in attendance. The top 3 countries in terms of number of delegates were host country Australia (4,755); Sweden (398); and the United States (305).

***At the helm of FDI*** *— Dr. Heung-Ryul Yoon of Korea is the FDI World Dental Federation's new president. He was formerly treasurer of FDI. Dr. Michèle Aerden, president of the Chambres Syndicales Dentaires in Brussels, Belgium, is the FDI's new president-elect. They stand against a backdrop of the world-famous Sydney Opera House during FDI's recent World Dental Congress.*

## ADI Convocation

The Annual Convocation of Fellows of the Canadian Section of the Academy of Dentistry International (ADI) was held in Jasper, Alberta, on May 23, during the joint convention of CDA and the Alberta Dental Association and College. Twenty-two Fellows, including one from the United States, were inducted.

A highlight of the evening was the presentation of an Honourary Fellowship to George Weber, executive director of CDA.

A new class of Fellows will be inducted in 2004, during the combined CDA/Association of Dental

Surgeons of British Columbia Pacific Dental Conference in Vancouver. The ADI ceremonies will be conducted on Saturday, March 6, starting at 5 p.m.

To view the complete list of 2003 inductees, go to *Related News* on CDA's Web site at www.cda-adc.ca, under *News and Events*.

## NIHB Audits

Health Canada has agreed to CDA's request to extend the December 2002 protocol arrangement for the Non-Insured Health Benefits (NIHB) program to December 31, 2004. This means that First Canadian Health will not be performing intrusive on-site audits in Saskatchewan, Manitoba, Ontario and Quebec; the Alberta Dental Association and College will perform joint on-site audits with First Canadian Health in those practices where the 2 organizations deem it appropriate; and First Canadian Health on-site audits will be performed in the rest of Canada.

The extension will give the CDA's NIHB Audit Working Group ample time to develop a proper evaluation process, and ensure that the protocol's 2 main objectives are met: Health Canada will maintain accountability for the expenditure of public funds, and the Dental Regulatory Authorities (DRAs) will protect the public interest through the regulation of dentistry according to the various provincial statutes.

On November 3, Health Canada presented the Working Group with a detailed explanation of the next-day claims verification process and arguments for the need for Dental Faxback Confirmation Form C. (See *NIHB Dental Faxback Confirmation Form C Is Unacceptable* on page 637 of the November 2003 *JCDA*.) CDA agreed to thoroughly review Health Canada's material and provide comments and suggestions in short order.

Health Canada is now implementing the protocol. First Canadian Health audits are moving forward for those provinces that selected Option C, and all other DRAs can expect to be contacted before January 1, 2004, as stipulated in the protocol.

## Lab Track Survey Draw Winner

CDA member Dr. Samantha Bohay of Mississauga, Ont., is the winner of the $500 cash prize for completing the *Lab Track Survey*, CDA's study of dentist satisfaction with dental laboratory services. Dr. Bohay is a former CDA student governor; she was a student member of the Association from 1996 to 2000, when she graduated from the University of Manitoba. Dr. Bohay has generously given the $500 to CDA and asked that this amount be applied to a student activity or event.

## Towards a National Oral Health Strategy

A symposium on *Access and Care: Towards a National Oral Health Strategy* will be held May 13–15, 2004, in Toronto. The symposium's objectives are to develop key recommendations for a national oral health policy, and to identify knowledge, service and funding gaps in oral health. The symposium is hosted by the University of Toronto faculty of dentistry, George Brown College Dental Hygiene Program and the Toronto Oral Health Coalition. Sponsors to date are the Canadian Dental Hygienists Association, Canadian Association of Public Health Dentistry, Ontario Association of Public Health Dentistry, and Health Canada. For more information, contact Continuing Education, Faculty of Dentistry, University of Toronto, 124 Edward Street, Suite 527, Toronto, ON M5G 1G6; tel.: (416) 979-4902, ext. 7.

## Health History Questionnaire in 21 Languages

The University of the Pacific School of Dentistry in San Francisco has posted a multi-language health history questionnaire to its Web site. To access the 67 questions, go to http://www.dental.uop.edu/; select *Dental Professionals*, *Translated Health History Forms* and then one of the 21 languages listed. The questionnaires are in pdf format and print easily on a single page.

## Recommended Reading

***Amalgam Separators: Update***

The special report on *Purchasing, installing and operating dental amalgam separators: Practical issues* which appeared in the August 2003 edition of *JADA* (*Journal of the American Dental Association*) can be accessed at http://www.ada.org/prof/resources/pubs/jada/reports/report_amalgam.pdf.

The authors review factors related to office infrastructure that dentists should consider when investing in an amalgam separator. The article also includes a cost-analysis worksheet and checklist that dentists who are thinking of purchasing a separator may find quite useful.

***New Reviews from the Cochrane Collaboration***

The Cochrane Collaboration has released 3 new reviews related to oral health:

- *Oral appliances for obstructive sleep apnea* (substantive amendment on January 23, 2001, but updated search as of July 2003)
- *Screening programs for the early detection and prevention of oral cancer* (substantive amendment made on August 26, 2003)
- *Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents* (substantive amendment made on August 20, 2003)

The Cochrane Collaboration is an international non-profit and independent organization, dedicated to making up-to-date, accurate information about the effects of health care readily available worldwide. The titles above can be

found in the alphabetical list of titles at http://www.cochrane.org/cochrane/revabstr/mainindex.htm.

*Insights into Early Dentistry*

A wealth of information showcasing the birth and evolution of the dental profession in the United States from 1859 to 1891 is now online. For more than 70 years, *Dental Cosmos* was considered *the* source of information for dental practitioners in the United States. It began as a publication designed to encourage dentists to use the products manufactured by the magazine's founder, the Samuel S. White Dental Manufacturing Company. In time, *Dental Cosmos* became the first enduring national journal for the American dental profession and one of the most significant in the early history of American dentistry. In 1936, the publication merged with the *Journal of the American Dental Association* (*JADA*).

The first 33 issues of *Dental Cosmos*, from the inaugural edition of August 1859 through to December 1891, are now accessible online at www.hti.umich.edu/d/dencos.

## Seniors' Health Web Site Launched

On October 23, the U.S. National Institutes of Health (NIH) launched NIHSeniorHealth.gov, a new talking Web site tailored to the needs of older people. The senior-friendly site uses techniques developed by the National Institute on Aging and the National Library of Medicine, designed to encourage older people to use the Internet as a resource for accessing the best information available on health and medical research.

The site focuses on health topics or specific diseases that are of particular interest to older people, including Alzheimer's disease, arthritis, balance problems, breast and prostate cancer, hearing loss, exercise for older adults and caregiving options.

# APPOINTMENTS

## New President of CAE

*Dr. Greg Burk*

**Dr. Greg Burk** of Halifax was elected president of the Canadian Academy of Endodontics at its September annual general meeting in Halifax.

After graduating from Dalhousie University's faculty of dentistry in 1981, Dr. Burk took postgraduate training in endodontics from Tufts University's School of Dental Medicine in Boston. He maintains a specialty practice and is an assistant professor of endodontics at Dalhousie.

## Pierre Fauchard Academy News

*Dr. Kevin Roach*

Dr. Kevin Roach of Pembroke, Ont., was recently installed as the international president of the Pierre Fauchard Academy (PFA). Dr. Roach is a past president of CDA and served as the Academy's international trustee for many years. He is only the second Canadian to attain this prestigious position.

# OBITUARIES

**Cantin, Dr. Rosaire:** A 1948 graduate of the University of Montreal, Dr. Cantin of Sainte-Foy, Quebec, passed away on October 31 at age 82.

**Evans, Dr. Glenn W.:** Dr. Evans of Stratford, Ont., was a 1965 graduate of the University of Toronto. He passed away on September 24.

**MacIntosh, Dr. Charles A.:** A 1945 graduate of Dalhousie University, Dr. MacIntosh of Liverpool, N.S., passed away on September 28. He was a life member of CDA.

**McMurray, Dr. Gordon L.:** Dr. McMurray of Qualicum Beach, B.C., was a 1950 graduate of the University of Alberta. He passed away on November 4 at age 86. A specialist in orofacial pain, Dr. McMurray was a life member of CDA.

**Stoneman, Dr. Douglas Wright:** Dr. Stoneman died suddenly on November 7 in his 82nd year. A 1945 graduate of the University of Toronto, Dr. Stoneman taught oral radiology full-time at his alma mater. He retired in 1987 as professor emeritus after a distinguished academic career, during which he authored or co-authored over 100 papers and book reviews. The full-length tribute to Dr. Stoneman by Dr. John McComb can be found on CDA's Web site at www.cda-adc.ca/jcda/vol-69/issue-11/index.html.

For direct access to the Web sites mentioned in the News section, go to the December *JCDA* bookmarks at http://www.cda-adc.ca/jcda/vol-69/issue-11/index.html.

# Post-Operative Nausea and Vomiting

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¥ In this study, 101 patients completed a survey in which they rank ordered possible postoperative clinical anesthesia outcomes. Vomiting was the least desirable outcome by both the ranking methodology and the relative value methodology (F-test <0.01). Ranking and relative value data were positively and significantly correlated ($r^2$=0.69, P<0.0001).

*2061 high risk patients (history of PONV or motion sickness) undergoing highly emetogenic procedures in 2 randomized, double-blind studies received either 4 mg ondansetron, 0.625 mg droperidol, 1.25 mg droperidol or placebo 20 minutes before induction. Patients were followed for a period of 24 hours. Ondansetron was more effective than placebo at reducing nausea and vomiting (p<0.05) and reduced mean-median total costs vs placebo (p=0.001). Patients receiving ondansetron were more satisfied than patients receiving placebo (p< 0.05).

** In a double-blind, randomized, placebo-controlled, multicentre study (n=1044) for the prevention of PONV in patients undergoing major gynecological surgery, ondansetron (4 mg IV), n=465, was superior in achieving complete control of emesis and nausea versus metoclopramide (10 mg IV), n=462 (44% and 37%, p=0.049, and 32% and 24%, p=0.009, respectively) over 24 hours.

††Two identical, randomized, double-blind, placebo-controlled studies enrolled 2,061 adult surgical outpatients at high risk of PONV to compare IV ondansetron 4 mg (n=515) with droperidol 0.625 mg (n=518) and droperidol 1.25 mg (n=510) for the prevention of PONV. In the 0 to 24 hour postoperative period, complete responses for ondansetron (53%) and droperidol 1.25 mg (56%) were superior to placebo (36%), p<0.05. Patient satisfaction scores for ondansetron were superior to placebo, p<0.05.

† Reductions in dosage are recommended in patients with moderate or severe hepatic dysfunction.

**Considerations re:**

# Prevention of Traumatic Oral/ Facial Injuries

Canadian Dental Association

Dentists should inquire as part of the history if the patient is involved in any activity, organized or informal, that might result in oral/facial injury and counsel them and/or their parents/guardians regarding available oral/facial protection.

Depending on the activity involved, an intra-oral appliance, face/head protection, or both may be necessary for safety.

The Canadian Dental Association advocates that any organized activity develop a safety protocol to minimize the risk of oral/facial injury and enforce its use. The Canadian Dental Association is pleased to act as a resource for groups wanting to develop such safety protocols.

*Approved by the CDA Board of Directors*
*November 2003*

**Considerations re:**

# Recall Frequency

Canadian Dental Association

In order to promote optimal health, barriers preventing access to oral care, including limits on care frequency, should be eliminated for all Canadians.

Continuing care frequencies (recall examinations) should be determined based on a risk assessment with respect to total oral health including but not limited to caries risk, periodontal health, cancer screening, growth and development, soft and hard tissue evaluation and medical status of the individual patient. A growing body of evidence is demonstrating relationships between oral health and general health.

Appropriate frequency of continuing care can only be determined by the dentist in partnership with the patient.

*Approved by the CDA Board of Directors*
*November 2003*

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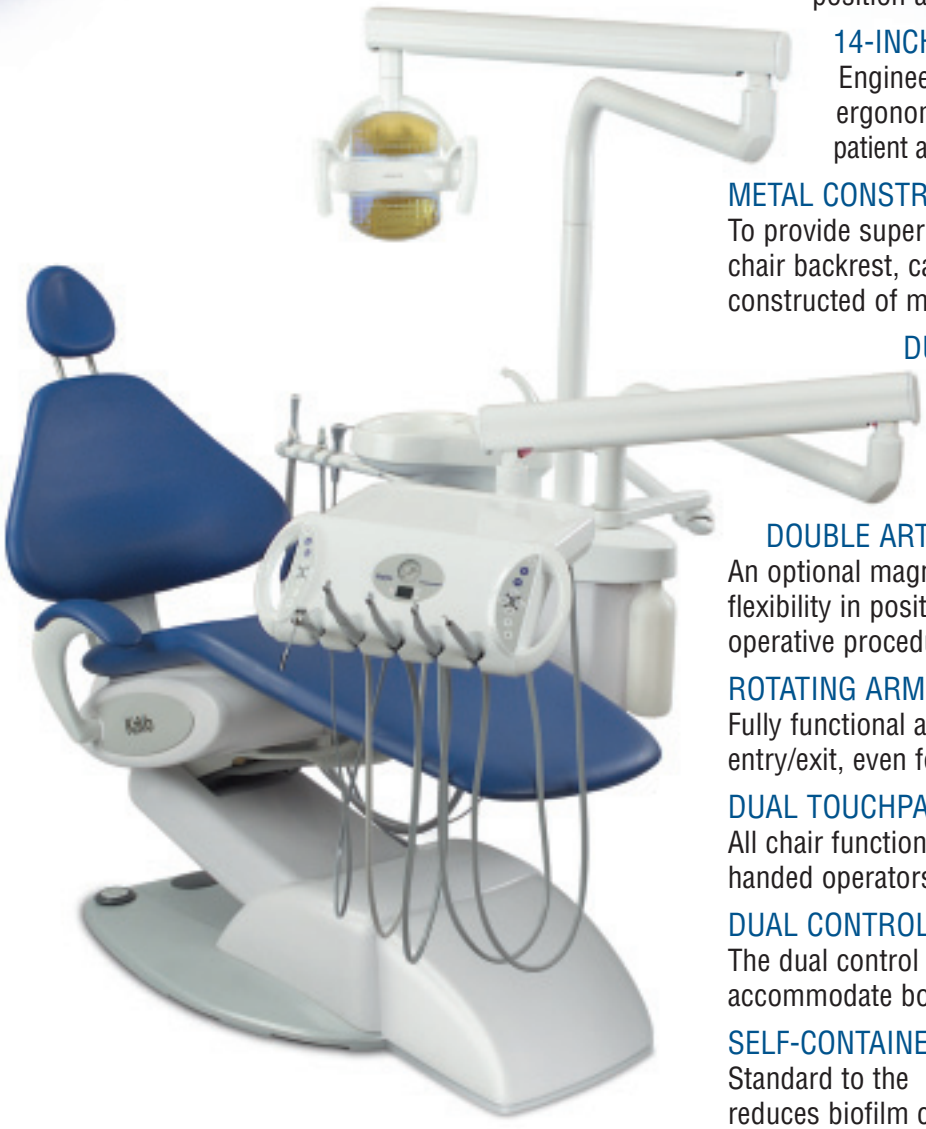

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# Statement by the fdi

## Global Goals for Oral Health

### Rationale

- The FDI and the WHO established the first Global Oral Health Goals jointly in 1981 to be achieved by the year 2000. A review of these goals, carried out just prior to the end of this period established that they had been useful and, for many populations, had been achieved or exceeded. Yet, for a significant proportion of the world's population they remained only a remote aspiration.
- An FDI Public Health Section Workshop in October 1999 in Mexico City examined the 1981 Global Goals. In parallel, WHO Headquarters and the WHO Regional Offices carried out evaluation of accomplishment of goals and initiated formulation of new goals for the year 2020.
- A Working Group was subsequently appointed including members of FDI, WHO and IADR being chosen from different regions of the world, and this group has prepared new goals for the year 2020. These were submitted for comment to National Dental Associations, WHO Collaborating Centres in Oral Health and other interested individuals and groups.

### Evidence

- Having reviewed the Global and Regional Goals set for the year 2000: the uses to which they had been put and the success in achieving them, it was determined that new goals should reflect the overall aspirations of the dental profession for global oral health and that their successful use was dependent upon the details of the targets set reflecting national or more local oral health priorities.
- Existing oral health goals from a number of countries and regions were reviewed to determine the most appropriate format for the new global goals. The format adopted allows both Global Goals and Objectives but encourages the local setting of national and local targets.

### Future Research

- There is a need for long-term follow-up on the use and utility of the new goals as well as recording the frequency of their successful attainment.

### Public Health Significance

- When planning and evaluating oral health programmes and services global, national and local goals can be invaluable in the shaping and enactment of health policies at all levels.
- If achieved they provide a measure of oral health improvement and of the value of the oral health profession.

### Global Oral Health Goals, Objectives and Targets for the Year 2020

### Goals

- To promote oral health and to minimise the impact of diseases of oral and craniofacial origin on general health and psychosocial development, giving emphasis to promoting oral health in populations with the greatest burden of such conditions and diseases;
- To minimise the impact of oral and craniofacial manifestations of general diseases on individuals and society, and to use these manifestations for early diagnosis, prevention and effective management of systemic diseases.

### Objectives

- To reduce mortality from oral and craniofacial diseases;
- To reduce morbidity from oral and craniofacial diseases and thereby increase the quality of life;
- To promote sustainable, priority-driven, policies and programmes in oral health systems that have been derived from systematic reviews of best practices (i.e. the policies are evidence-based);
- To develop accessible cost-effective oral health systems for the prevention and control of oral and craniofacial diseases using the common risk factor approach;
- To integrate oral health promotion and care with other sectors that influence health;
- To develop oral health programmes to improve general health;
- To strengthen systems and methods for oral health surveillance, both processes and outcomes;
- To promote social responsibility and ethical practices of care givers.
- To reduce disparities in oral health between different socio-economic groups within countries and inequalities in oral health across countries.

- To increase the number of health care providers who are trained in accurate epidemiological surveillance of oral diseases and disorders.

### Targets

The targets should be selected to match predetermined oral health priorities at a national or local level. Consideration should be given to the following areas when selecting targets, based on local priorities:

Pain, functional disorders, infectious diseases, oropharyngeal cancer, oral manifestations of HIV-infection, noma, trauma, cranio-facial anomalies, dental caries, developmental anomalies of teeth, periodontal diseases, oral mucosal diseases, salivary gland disorders, tooth loss, health care services, health care information systems.

**Main authors:** Prof Martin Hobdell (FDI), Prof Poul Erik Petersen (WHO) and Prof John Clarkson (IADR)
**Submitted by:** FDI Science Commission
**Reference:** FDI Science Commission Project 7-99: *Global Goals for Oral Health*

*Joint FDI - WHO - IADR Statement*
*General Assembly 2003*

# Statement by the fdi

## Basic Dental Training

The primary aim of dental education is to ensure that competent practitioners are capable of critical thinking and possess the skills for lifelong learning. The new graduate practitioner must be capable of carrying out independent dental practice without harm to patients using modern, appropriate, effective and currently accepted methods of treatment. Additionally, the new practitioner must be capable of implementing suitable preventive programmes for individuals and groups in the context of community orientated programmes. In order to achieve that aim, dental education must provide the student with a sound clinical training based on humanitarian, scientific, and evidence based learning principles.

The term clinical competence is applied to a combination of knowledge, skills and judgement which provide the practitioner with the competence to undertake a specific clinical task. The knowledge needed includes an appropriate understanding of molecular biological principles, as well as anatomical and physiological features and the pathogenesis of disease processes. It is not simply a technical ability or a prescribed amount of knowledge, it implies more than this. The acquisition of clinical competence may be achieved through a diversity of educational and training programmes. These may be assessed and examined in different ways throughout the world.

There is not a single curriculum appropriate to achieving basic clinical competence, therefore the Dental Practice Commission of the FDI has specifically avoided recommending detailed regulations. Apart from the required clinical competence, all subjects should form part of an overall educational philosophy in undergraduate dental education. It is essential that a comprehensive integrated curriculum is followed to avoid dominance of certain subjects over others, even though there may be variance in emphases from dental school to dental school or from country to country.

There is a wide variety of dental educational systems throughout the world. These systems are developed, governed, operated and applied differently but they should all result in the graduate being competent to perform nationally or internationally agreed basic clinical competence covering patient examination assessment and diagnosis, communication and patient education, ethics and jurisprudence, treatment, medical emergencies and practice management.

The national dental professional organisations should recommend that regulatory agencies comply with this description of basic dental training.

***This statement should be read in conjunction with the background paper***

**Main author:** Dr Claus Munck
**Submitted by:** FDI Dental Practice Commission

*FDI Statement*
*General Assembly 2003*

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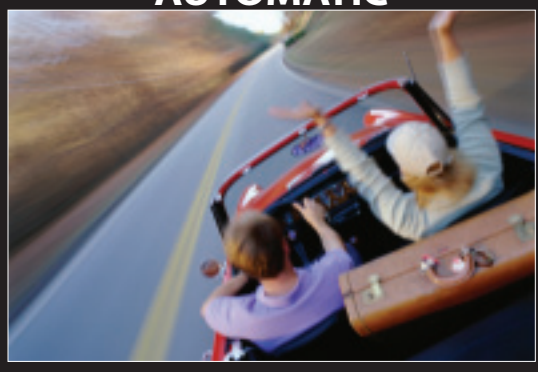

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**UNIVERSITY OF MANITOBA**
**ORTHODONTIC FACULTY POSITION**

Applications are invited for a full-time tenure-track appointment at the rank of Assistant Professor in the Department of Preventive Dental Science (Division of Orthodontics). The appointment will commence on April 1, 2004, or as soon thereafter as possible, subject to final budgetary approval. The appointee must have university-based specialty training in orthodontics (Certificate/Diploma/Masters or equivalent) which will enable them to register as an orthodontic specialist with the Manitoba Dental Association. Extra/intramural practice privilege is available two half days per week. Salary will be commensurate with qualifications and experience.

Responsibilities will include didactic, preclinical and clinical teaching in the undergraduate and graduate programs, involvement in research, administration, outreach and community service programs in orthodontics and supervision of research projects at the M.Sc. level.

The University of Manitoba encourages applications from qualified women and men, including members of visible minorities, Aboriginal peoples, and persons with disabilities. All qualified candidates are encouraged to apply; however Canadians and permanent residents will be given priority.

With a population of more than 650,000, Winnipeg is a major multicultural centre, including the Royal Winnipeg Ballet, the Winnipeg Symphony Orchestra, the Manitoba Opera Association, the Manitoba Theatre Centre, and also a variety of professional sports activities. Excellent private and public schools are available that teach in English and/or French. Professional baseball, basketball, and hockey teams have their homes in Winnipeg. Superb shopping opportunities are available and it has been said that Winnipeg has the most restaurants per capita of any city in North America. Nearby are some of the finest beaches in Canada along the shores of Lake Winnipeg and our provincial parks offer excellent outdoor recreational opportunities throughout the year. Winnipeg also boasts some of the most affordable housing in Canada and has an international airport within the city limits.

For more information, please contact: Dr. W.A. Wiltshire, Professor and Head of Orthodontics, e-mail WA_Wiltshire@umanitoba.ca, fax (204) 789-3913, phone (204) 789-3856.

Applicants should forward their curriculum vitae, statement of career goals and arrange for three letters of reference to be forwarded confidentially to:

Dr. W.A. Wiltshire, Professor and Head of Orthodontics, Faculty of Dentistry, University of Manitoba, D341-780 Bannatyne Ave., Winnipeg, MB CANADA R3E 0W2

Applications will be considered after February 1, 2004 and will continue until the position is filled. Please refer to Position #AFD 665. For more information visit our website (www.umanitoba.ca\dentistry).

Application materials, including letters of reference, will be handled in accordance with Manitoba's *Freedom of Information and Protection of Privacy Act.*

# Dentin Hypersensitivity
## Managing and Treating

Canadian Advisory Board on Dentin Hypersensitivity

**The high prevalence of dentin hypersensitivity, combined with continued underreporting and underdiagnosis, has intensified the need to focus on the management of this condition. Responding to that need, the Canadian Advisory Board on Dentin Hypersensitivity, a committee representing a broad range of dental care specialties, convened to determine best-practice recommendations.[1] Collectively, they evaluated the scientific evidence as well as condition-related knowledge gaps that were identified by an extensive national survey of 8,000 dental professionals (7% response rate). By contributing their own diverse expertise, the committee produced the first ever "Consensus-Based Recommendations for the Diagnosis and Management of Dentin Hypersensitivity," to provide direction to the dental care profession.**

*Barry Dolman, DMD*

*K. Tony S. Gill, DMD*

## Management begins with removal of predisposing factors

Evidence suggests erosion is the most significant factor in the loss of tooth enamel and a key predisposition for the development of dentin hypersensitivity. Dietary acids from foods and beverages, such as citrus fruits and juices, wines and carbonated drinks are recognized as risk factors for erosion, as they play a critical role in the "softening" of enamel. While normal enamel is resistant to various stresses, such as toothbrushing with or without toothpaste, "softened" enamel becomes increasingly susceptible to physical forces such as abrasion, attrition or even abfraction.

**The most convenient non-invasive and reversible treatment is one that can be initiated by patients at home.**

Regardless of the predisposing factors and forces implicated in each patient's dentin hypersensitivity, once diagnosed, management must begin with the removal of the factors that "soften" enamel. For many patients, changing dietary habits, oral hygiene or tooth grinding behaviour is difficult and presents a professional challenge when treating dentin hypersensitivity. While behaviour modification is critical to controlling exacerbation of the condition, the removal of risk factors alone may not be totally effective. Treating the pain may be the only recourse.

## First-line treatment should be non-invasive and reversible

Available first-line treatments for dentin hypersensitivity are generally designed to reduce fluid flow in dentin tubules or block the nerve response in the pulp. Most treatments interrupt neural activation and pain transmission with potassium nitrate or potassium chloride, but there are also a variety of physical and chemical agents that reduce fluid flow by occluding the tubules themselves. Strontium chloride is an example of such an occluding agent. While procedures like mucogingival surgery, pulpectomy or the use of resins present viable treatment options, they are invasive and irreversible, and should be reserved for severe cases. With comfort, convenience and cost in mind, non-invasive and reversible alternatives should be recommended first to any patient experiencing dentin hypersensitivity.

The most convenient non-invasive and reversible treatment is one that can be initiated by patients at home, as part of their existing oral hygiene routine. Experience demonstrates that desensitizing toothpaste provides improvement for a majority of cases. As a result, the Consensus Report recognizes desensitizing toothpaste as an efficacious, inexpensive and non-invasive first-line treatment for preventing the pain of dentin hypersensitivity. It also notes that ongoing use of desensitizing toothpaste need not sacrifice cavity prevention, whitening, or other benefits that many patients seek in their regular toothpastes. The Consensus Recommendations do emphasize, however, that for best results, desensitizing toothpaste should be used properly. Considering the natural outward flow of fluid from the pulp toward the outer surface of dentin,[2] it is important to ensure that the right amount of active ingredient is applied, and over time, accumulates to build a protective barrier. Twice-daily brushing maintains the barrier, and prevents pain from coming back. (There is no published evidence to support topical application or "dabbing.") Dental care professionals need to instruct the patient before initiating treatment. An ongoing regimen of regular, twice-daily brushing is the only clinically supported method of application.

## Follow-up helps achieve treatment success

Many patients use desensitizing toothpaste only when they feel tooth pain. Once the pain disappears, they return to their regular toothpaste until the next painful bout. If pain abates with treatment but recurs following treatment cessation, it may be an indication that the patient's condition requires ongoing attention. Patients need to be instructed about the need for long-term treatment in such cases. Unless properly educated about their condition and its treatment, they may think treatment has been unsuccessful in preventing pain and mistakenly stop it altogether.

The need to follow up with those diagnosed with dentin hypersensitivity cannot be overstated. Only diligent care including pain prevention combined with long-term management will successfully treat the ongoing discomfort and ultimately help sufferers stay pain-free.

**The Canadian Advisory Board on Dentin Hypersensitivity was supported by an unrestricted educational grant from GlaxoSmithKline Consumer Healthcare.**

1. Consensus-Based Recommendations for the Diagnosis and Management of Dentin Hypersensitivity. Canadian Advisory Board on Dentin Hypersensitivity. *J Can Dent Assoc* 2003;69(4):221-226.
2. Jain P, Vargas MA *et al.* Dentin desensitizing agents: SEM and X-ray microanalysis assessment. *Am J Dent* 1997;10:21-27.

# What Is the Critical pH and Why Does a Tooth Dissolve in Acid?

• **Colin Dawes,** BSc, BDS, PhD •

## Abstract

*This paper discusses the concept of critical pH for dissolution of enamel in oral fluids. The critical pH does not have a fixed value but rather is inversely proportional to the calcium and phosphate concentrations in the solution. The paper also discusses why teeth dissolve in acid, why remineralization of white-spot caries lesions is possible and why remineralization of teeth eroded by acid is not possible.*

***MeSH Key Words:*** *dental enamel solubility; hydrogen-ion concentration; tooth remineralization*

*© J Can Dent Assoc 2003; 69(11):722–4*
*This article has been peer reviewed.*

A recent article in this journal[1] referred frequently to the critical pH of dental enamel as 5.5, as though this were a fixed value, independent of the composition of the solution to which enamel is exposed. In fact, the critical pH varies over a wide range, its value depending on the concentrations of calcium and phosphate in the solution.

The critical pH is the pH at which a solution is just saturated with respect to a particular mineral, such as tooth enamel. If the pH of the solution is above the critical pH, then the solution is supersaturated with respect to the mineral, and more mineral will tend to precipitate out. Conversely, if the pH of the solution is less than the critical pH, the solution is unsaturated, and the mineral will tend to dissolve until the solution becomes saturated.

The concept of critical pH is applicable only to solutions that are in contact with a particular mineral, such as enamel. Saliva and plaque fluid, for instance, are normally supersaturated with respect to tooth enamel because the pH is higher than the critical pH, so our teeth do not dissolve in our saliva or under plaque. However, these fluids cannot be supersaturated with respect to individual ions, such as calcium or phosphate, as some authors state.[1]

Dental enamel is composed primarily of hydroxyapatite (HA), $Ca_{10}(PO_4)_6(OH)_2$, but it also contains several impurities such as carbonate and fluoride. Because the proportions of these impurities vary from person to person, and indeed from tooth to tooth, and because the impurities can influence enamel solubility, that solubility is not fixed and varies slightly from person to person. Nevertheless, the factors that influence the solubility of enamel's primary component, HA, also influence the solubility of enamel.

When HA is in contact with water, the following reaction occurs:

$$\begin{array}{rcl} \text{Precipitation} & \leftrightarrows & \text{Dissolution} \\ Ca_{10}(PO_4)_6(OH)_2 & \leftrightarrows & 10Ca^{2+} + 6PO_4^{3-} + 2OH^- \\ \text{Solid} & \leftrightarrows & \text{Solution} \end{array}$$

A small amount of HA dissolves, releasing calcium, phosphate and hydroxyl ions. This process continues until the water is saturated with respect to HA. At that point, the rate of the forward reaction (mineral dissolution) is equal to the rate of the backward reaction (mineral precipitation).

The solubility of a substance such as HA, which can split into separate ions, is characterized by its solubility product, or Ksp, the product of the concentrations (mol/L) of the component ions, raised to the appropriate power, in a saturated solution. Thus, for a solution saturated with respect to HA, the Ksp is $[Ca]^{10}[PO_4]^6[OH]^2$. Strictly speaking, the values within brackets represent the activities (effective concentrations) of the component ions rather than their actual concentrations. The activities are inversely proportional to the concentrations of other ions, such as sodium and potassium, that are present. Because HA is a highly insoluble mineral, and because the activities of the 3 component ions are expressed in the large units of moles per litre, the measured value of Ksp for HA is very small, on the order of $10^{-117}$. Although the Ksp is a constant, the

concentrations of each of the 3 component ions in a saturated solution can vary, provided that their product remains equal to the Ksp. Thus, in a more acidic solution, in which the hydroxyl concentration is reduced, the concentrations of the calcium or phosphate ions (or both) would have to increase if saturation were to be maintained.

For any given solution, such as saliva, plaque fluid, gastric juice or a soft drink, the ion product (Ip) is determined by means of a similar calculation, also based on the calcium, phosphate and hydroxyl concentrations. If Ip = Ksp, then the solution is just saturated with respect to HA. If Ip < Ksp, the solution is unsaturated, and if Ip > Ksp, the solution is supersaturated.

When a tooth is placed in distilled water of pH 7, a small amount will slowly dissolve (about 30 mg in 1 L of water).[2] The Ip for HA in distilled water is zero, because although the water contains hydroxyl ions, it contains no calcium or phosphate ions. Because Ip < Ksp, the water is unsaturated and the tooth will dissolve until Ip = Ksp. Likewise, a tooth will dissolve to some extent in any solution in which calcium and phosphate ions are not present, such as a sodium fluoride solution.

In contrast, saliva and plaque fluid do contain calcium, phosphate and hydroxyl ions, and most of the time Ip > Ksp for HA. Therefore, a tooth will dissolve in saliva or plaque fluid only if the pH is reduced to less than the critical pH. In people with low salivary concentrations of calcium and phosphate, the critical pH may be 6.5, whereas in those with high salivary calcium and phosphate concentrations, it may be 5.5.[3] The fluid phase of dental plaque contains much higher concentrations of calcium and phosphate than does saliva,[4] and its critical pH may be as low as 5.1.

Thus, the critical pH is not a constant, because the levels of calcium and phosphate in plaque fluid vary among individuals. The more calcium and phosphate that are present in a solution, the lower its critical pH.

## Why Does a Tooth Dissolve in Acid?

Although the solubility of some minerals, such as sodium chloride, is virtually independent of pH, the solubility of HA increases about 10-fold for each unit decrease in pH. At pH 7, the solubility of HA in water is about 30 mg/L, whereas at pH 4 it is about 30 g/L.[2]

There are 2 reasons for the increased solubility of enamel in acid. First, the hydrogen ions remove hydroxyl ions to form water, as follows: $H^+ + OH^- \leftrightarrows H_2O$. The product of $[H^+][OH^-]$ in water always equals $10^{-14}$ $(mol/L)^2$. Therefore, as the $[H^+]$ increases in an acid solution, the $[OH^-]$ must decrease in a reciprocal manner.

Second, the inorganic phosphate in any fluid such as saliva or plaque fluid is present in 4 different forms, namely $H_3PO_4$, $H_2PO_4^-$, $HPO_4^{2-}$ and $PO_4^{3-}$, and the proportions depend entirely on the pH. **Figure 1** illustrates how the

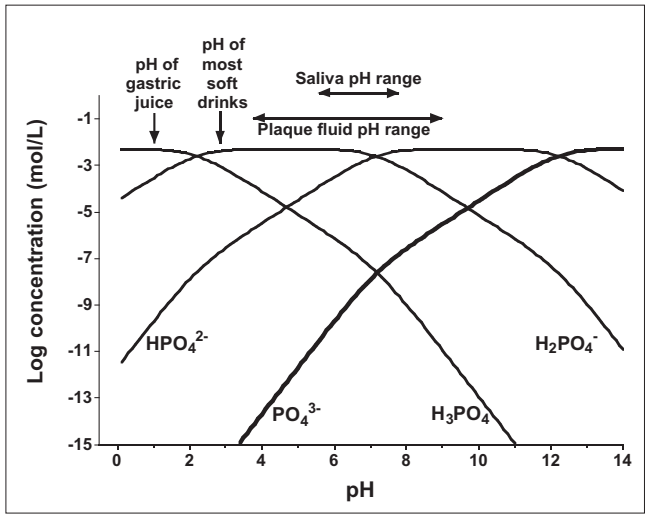


***Figure 1:*** *The effect of pH on the concentrations of the various inorganic phosphate species in saliva containing a total phosphate concentration of 5 × $10^{-3}$ mol/L. There is a marked fall in the concentration of $PO_4^{3-}$ (thick line) as the pH is reduced.*

proportions of the 4 phosphate species vary with pH when the total phosphate concentration is 5 × $10^{-3}$ mol/L, as is typical of saliva. The lower the pH, the lower the concentration of $PO_4^{3-}$, the only species that contributes to the Ip of HA.

Thus, as any solution is acidified, the calcium concentration is unaffected but the concentrations of both $OH^-$ and $PO_4^{3-}$ are reduced and so, therefore, is the Ip, often to a value less than the Ksp.

Clinically, there are 2 situations in which dentists place acid in contact with enamel and in which enamel dissolves. The first is the acid-etch technique, which usually employs 37% phosphoric acid. This solution contains no calcium and thus the Ip for HA is zero. Normally, though, the acid is applied for only about 10 s, so potential dissolution of the enamel is limited. The second situation is the use of acid fluorophosphate gels, which usually contain 0.1 mol/L phosphoric acid in addition to the sodium fluoride and which have a pH of 2.3. Again, these gels contain essentially no calcium and the Ip for HA is zero, which means that the tooth will begin to dissolve. Hence, to avoid excessive enamel loss, it is important not to exceed an exposure time of 4 min with these gels.

Patients, of course, may also introduce acid into their mouths, where it can cause erosion of enamel. The most devastating acid is gastric juice,[1] which contains hydrochloric acid and low concentrations of calcium and phosphate and which has a pH of about 1 (**Fig. 1**). Other sources of acid include fruit juices and soft drinks, which have great potential to cause erosion because many of them have a pH of less than 3 (**Fig. 1**).

Patients with severe xerostomia usually require daily exposure to fluoride rinses or gels to reduce the risk of caries to which they are susceptible. To avoid excessive enamel

decalcification in such patients, a neutral sodium fluoride gel or rinse rather than an acidulated fluorophosphate gel should be employed. The fluoride reacts with enamel to form fluorapatite which, being less soluble than hydroxyapatite, has the effect of reducing the critical pH.

## Can Decalcified Enamel Be Remineralized?

In a white-spot caries lesion, the decalcification has occurred below the surface, and the lesion is covered by a virtually intact surface zone of enamel with a thickness of about 0.03 mm. There is very good clinical evidence that such lesions can be remineralized if the surface remains intact, provided they are kept free of plaque, salivary flow is adequate or is regularly stimulated by use of sugar-free gum, and topical fluoride treatments are given.[5] Such remineralization can take place only because saliva and plaque fluid are normally supersaturated with respect to tooth mineral, particularly when salivary flow is stimulated,[6] and because the subsurface lesion provides a suitable matrix for crystal growth after calcium and phosphate ions have passed through the pellicle and surface enamel.

In contrast, enamel that has suffered surface erosion by acid cannot be recalcified,[5] because there is no suitable matrix for crystal growth. An enamel surface eroded by acid becomes covered by an acquired enamel pellicle of salivary and bacterial proteins as soon as it contacts the saliva, and this pellicle inhibits mineral deposition. If saliva contacts enamel after acid etching, the pellicle that forms also reduces the strength of bonding to composite resin. In addition, the presence of the enamel pellicle prevents the teeth from enlarging continuously, even though they are bathed in saliva supersaturated with tooth mineral. Thus, contrary to some views,[1] enamel erosion is irreversible, which is why it is so important for dentists to check for its occurrence and thus allow patients to take appropriate measures to reduce further exposure of their teeth to acid.

## Conclusions

In summary, the critical pH below which enamel dissolves is not constant but rather is inversely proportional to the concentrations of calcium and phosphate in the saliva and plaque fluid. Teeth with early subsurface caries lesions can be remineralized, but teeth that have suffered acid erosion cannot. ◆

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# Have Dentin Adhesives Become Too Hydrophilic?

• **Franklin R. Tay,** BDSc (Hons), FADM, PhD •
• **David H. Pashley,** DDS, FADM, PhD •

## Abstract

*This review discusses current trends in the development of dentin adhesives and the possibility that some classes of currently available adhesives are too hydrophilic. Manufacturers have reformulated dentin adhesives to make them more compatible for bonding to intrinsically moist, acid-etched dentin by adding 2-hydroxyethyl methacrylate and other hydrophilic resin monomers. These 3-step adhesives work well but are more time consuming to use and more sensitive to technique than the newer, simplified adhesives. When primers are mixed with adhesives in 2-step single-bottle adhesives and self-etching primers, the adhesives are more permeable to water and hence absorb more water over time than previous generations of adhesives. The most recent single-step self-etching adhesives are even more hydrophilic and hence more permeable to water derived from the underlying bonded dentin. This permeability can lead to a wide variety of seemingly unrelated problems, including incompatibility of chemically or dual-cured composites with simplified adhesives and expedited degradation of resin–dentin bonds.*

***MeSH Key Words:*** *dental bonding; dentin-bonding agents/chemistry; permeability*

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*This article has been peer reviewed.*

Early generations of dentin adhesives were relatively hydrophobic, and dry dental substrates were required for bonding. The adhesives were placed on smear layers but could not penetrate through them. The resulting bond strengths were very low. When manufacturers reformulated the adhesives by adding 2-hydroxyethyl methacrylate (HEMA), the adhesives were able to wet the dentin and could tolerate more moisture. This moisture tolerance became very important with the introduction of the "total-etch concept" (simultaneous etching of enamel and dentin).[1] With the advent of contemporary self-etching adhesives, greater concentrations of acidic (ionic) resin monomers were incorporated into the adhesives to enable them to etch through the smear layer and demineralize the underlying intact dentin.[2–4] Although the incorporation of hydrophilic and acidic resin monomers has substantially improved the initial bonding of contemporary total-etch and self-etching adhesives to intrinsically wet dental substrates, few manufacturers have recognized the potential problems associated with these increasingly hydrophilic adhesives. These potential problems may be realized as manufacturers endeavour to simplify adhesives in response to clinicians' demand for adhesives with speedier application and greater user-friendliness. In this paper, some of these issues will be discussed, along with the current trend of simplifying dentin bonding in both the total-etch and self-etching techniques.

## Technique Sensitivity Associated with Total-Etch Adhesives

When the total-etch technique was first introduced, the dentin adhesives available at the time required that the dentin surface be dried after acid-etching. It is now known that air-drying of acid-etched dentin causes collapse of the collagen fibril matrix and interferes with resin infiltration.[5] Thus, the strength of resin–dentin bonds was only half that of resin–enamel bonds. The discovery that water or water–HEMA primers could double the strength of resin–dentin bonds led Kanca to introduce the "wet bonding" technique.[6] However, this new technique raised questions about "how wet is wet dentin,"[7,8] which have never been completely resolved. The optimal amount of surface

wetness necessary for wet bonding varies among marketed total-etch adhesive systems, which are acetone-based, ethanol-based or water-based.[9,10] Also, it is impossible to simultaneously achieve uniform wetness on the axial, pulpal and gingival walls because of differences in hydraulic conductance between superficial and deep dentin[11–13] and the presence of caries-affected or sclerotic dentin in which the dentinal tubules are partially or completely obliterated by whitlockite crystals.[14–16] Thus, it is not uncommon to have over-wet regions and over-dry surfaces in the same preparation, which causes non-uniform resin bonding.

Total-etch adhesives are more sensitive to technique because optimal hybridization and sealing of dentinal tubules with the wet bonding technique may differ with each bonding system.[17] Although most bonded restorations are retained because there is sufficient well-bonded surface area, a common clinical manifestation of inconsistent bonding within a restoration is the patient's complaint of postoperative sensitivity.[18–20] If it is necessary to choose between over-drying or over-wetting of total-etched deep dentin, the former is to be preferred, as vital deep dentin is intrinsically wet after removal of the smear layer (**Fig. 1**).[21] Because the volatile adhesive solvent evaporates quickly, the continuous transudation of dentinal fluid through open dentinal tubules before polymerization of the adhesive may result in the entrapment of water-filled blisters along the adhesive interface (**Fig. 2**).[22] As the patient masticates, these blisters may create a pumping effect that causes rapid movement of fluid through the tubules, which in turn may trigger the A-delta nerve fibres in the pulpal–dentin complex.[23,24]

Postoperative sensitivity may be reduced by 1 of 4 methods. The first of these is the use of HEMA-containing aqueous dentin desensitizers, since HEMA is miscible with water and may form a soft hydrogel after polymerization.[25] However, when HEMA-containing primers are used as desensitizers without adhesives, they do not polymerize. Their desensitizing action may be the result of precipitation of plasma proteins within dentinal fluid.[26] The second method involves the use of a resin-modified glass-ionomer cement as a dentin replacement in the sandwich technique.[27] A new technique, the use of oxalate desensitizers after acid-etching of dentin,[28] prevents calcium oxalate crystals, which would reduce bond strength, from forming on the surface. Instead, the oxalate crystals are formed only within the tubules below the surface (**Fig. 3**). Finally, self-etching adhesives that do not remove the smear plugs may be used, thus reducing hydraulic conductance through the dentinal tubules.[29–31]

## Technique Sensitivity Associated with Self-etching Adhesives

Another approach to decreasing the technique-sensitivity of wet bonding is to return to dry bonding to smear layers, but using much more acidic monomers dissolved in water–HEMA primers. The materials used with this method are known as self-etching primer adhesives. These water-containing adhesives are acidic enough to etch and prime through thick smear layers and into the underlying intact dentin.[32] Those with a pH between 1.9 and 2.4 incorporate the smear layer into the hybrid layer if the primers are not agitated during etching.[33] If the primers are agitated, the smear layer can be dissolved and dispersed into the hybrid layer and the overlying adhesive (**Fig. 4**).[34] All self-etching primers are covered with a more hydrophobic adhesive that seals off the underlying hydrated dentin. Therefore, all self-etching primers involve 2-step adhesive systems.[35]

Although all self-etching adhesives bond reasonably well to ground enamel, there is a general consensus that the milder versions of these adhesives do not etch well on unground, aprismatic enamel (**Fig. 5**), where there is no resin tag formation and little subsurface demineralization for micromechanical retention.[36–38] At a clinical level this may result in staining of the enamel margins, which is occasionally reported.[39] Thus, the creation of bevelled cavosurface margins is helpful for improving the bonding of mild self-etching adhesives to restorations with margins placed in enamel, because this process removes the aprismatic enamel that is resistant to acid-etching.

To make self-etching primer systems even simpler, manufacturers have recently introduced single-step self-etching adhesives, which etch, prime and bond tooth surfaces simultaneously. Some of these all-in-one adhesives have been made more acidic and more hydrophilic than the 2-step self-etching primers.[2,35] One disadvantage of hydrophilic resin systems is that they attract water.[40] It is difficult to evaporate water from these all-in-one adhesives, and, even if evaporation is successful, water will rapidly diffuse back from the bonded dentin into the adhesive resin. This water sorption plasticizes polymers and lowers their mechanical properties.[41] Although hydrophobic dimethacrylates are added to all-in-one adhesives to produce stronger cross-linked polymer networks, the hydrophilic monomers tend to cluster together before polymerization to create hydrophilic domains[42,43] and microscopic water-filled channels called "water trees."[44,45] These water trees permit movement of water from the underlying dentin, through the hybrid and adhesive layers to the adhesive–composite interfaces.[46]

## Incompatibility of Simplified Adhesives with Chemically Cured Composites

It is well known that chemically cured composites that use tertiary amine as a component of the catalyst do not bond well with adhesives containing acidic resin monomers. This is because the acidic monomers in the adhesives deactivate the more basic amines that are used as catalysts for the

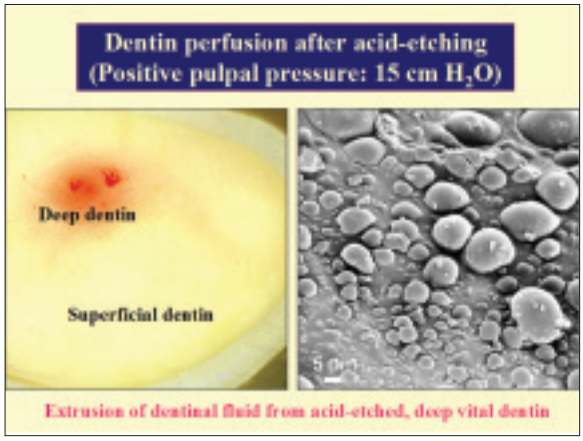


***Figure 1:*** *Scanning electron micrograph of a replica of vital acid-etched dentin shows transudation of dentinal fluid to the surface. Adapted from Itthagarun and Tay.*[21]

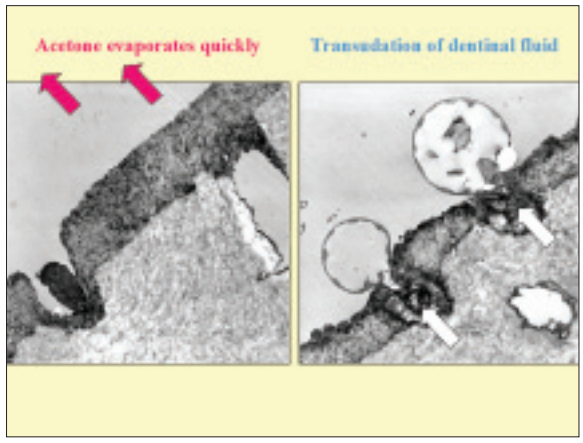


***Figure 2:*** *Dentinal fluid trapped by water-immiscible resins forms water blisters along the resin–dentin interface. Adapted from Pashley and others.*[22]

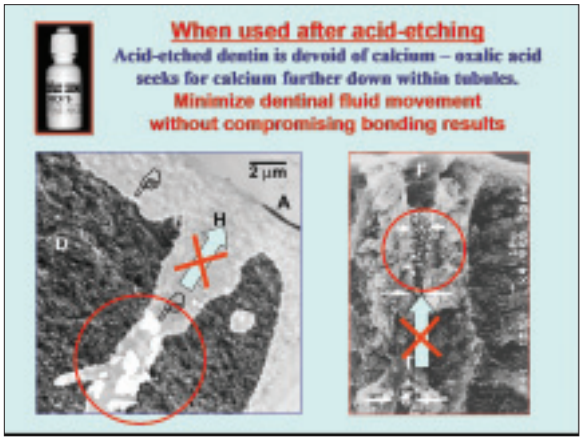


***Figure 3:*** *Scanning and transmission electron micrographs show the result of application of a potassium oxalate desensitizing solution to acid-etched dentin. Calcium oxalate crystals have formed deep inside the dentinal tubules, reducing dentin permeability. Adapted from Pashley and others.*[28]

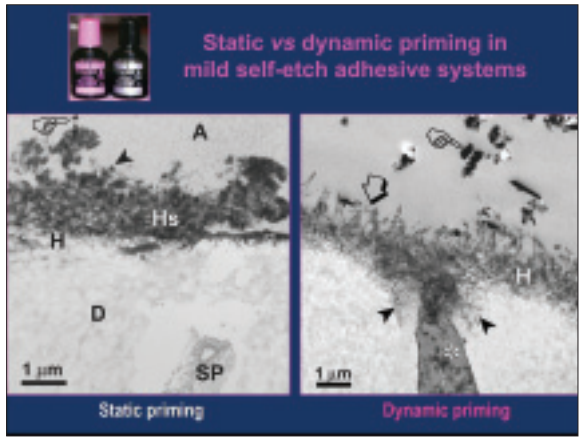


***Figure 4:*** *Transmission electron micrographs show the effect of static and dynamic priming when a mild self-etching adhesive was applied to dentin with thick smear layers. With static priming, a thick hybridized smear layer (Hs) was present, and the underlying hybrid layer (H) was minimal. With dynamic priming, the smear layer was completely dispersed, and a 1-mm thick hybrid layer (H) was created in the intact dentin.*

autopolymerization of the composites.[47,48] Clinically, this may result in the debonding of core buildups with self- or dual-cured composites during impression-taking.[49–53] However, this adverse chemical interaction is only partially responsible for the incompatibility between simplified adhesives and chemically cured composites. The other factor responsible for compromising the bonding of chemically cured composites to light-cured adhesives is the recent observation that single-step adhesives behave as permeable membranes after polymerization.[54,55] This apparent incompatibility relates to the fact that both single-bottle total-etch adhesives and single-step self-etching adhesives are used without an additional bonding resin layer.[46,56] In these adhesives, the oxygen-inhibited layer contains acidic monomers that come into direct contact with the chemically cured composite, where they can titrate the basic amine accelerators and inactivate them[57] and also osmotically attract water from the underlying dentin.[58]

The first problem, that of acid–base incompatibility, was reported in 1986[47] but has been largely rectified for many single-bottle adhesives by the introduction of dual-cured versions, which include an additional bottle of chemical co-initiator containing sodium benzene sulphinate.[47,48,58] However, the second problem, that of increased adhesive permeability, has been recognized only recently and occurs only when dentin is used as the bonding substrate. As illustrated with OptiBond Solo Plus (Kerr Corp., Orange, Calif.; **Fig. 6**), the use of a chemical co-initiator improves the tensile bond strength with self- or dual-cured composites to only a certain extent.[56] This problem does not occur when acidic adhesives containing ternary catalytic systems are

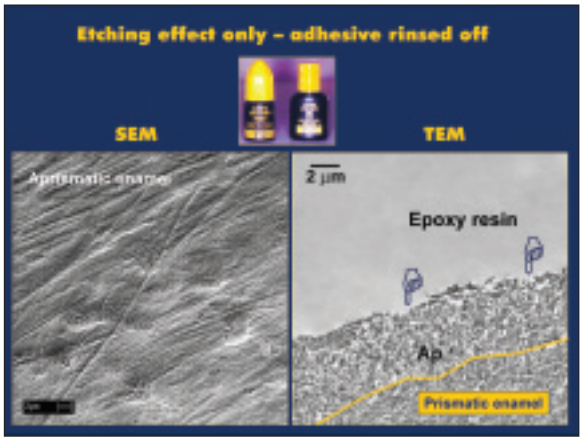


***Figure 5:*** *Scanning and transmission electron micrographs show the effect of a mild self-etching adhesive on uncut, intact enamel. The self-etching primer was rinsed off to demonstrate the etching effect. Adapted from Pashley and Tay.*[36]

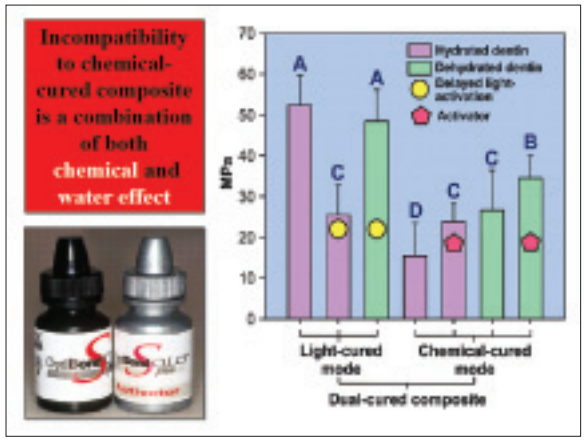


***Figure 6:*** *The incompatibility of single-bottle adhesives with chemically cured composites results from a combination of both chemical (i.e., adverse acid–base reaction) and water (i.e., increase in adhesive permeability) effects; these effects lead to low bond strengths for adhesives containing a dual-cure activator on hydrated dentin. Adapted from Tay and others.*[55]

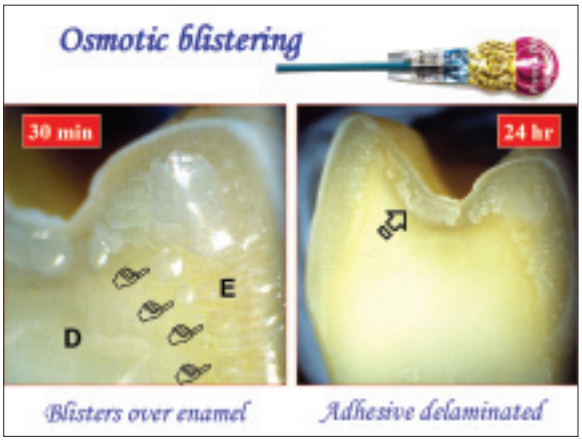


***Figure 7:*** *Demonstration of osmotic blistering when single-step self-etching adhesive was applied to cut enamel and immersed in water. The osmotic blisters, which formed after 10 to 30 minutes, eventually burst, resulting in delamination of the adhesive layer. This delamination does not occur if the adhesives are covered with a more hydrophobic resin layer.*

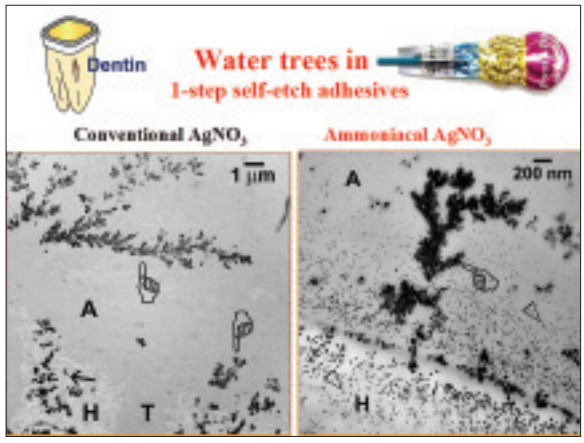


***Figure 8:*** *Water trees (also called water channels) are apparent in transmission electron micrographs of the adhesive layers of some single-step self-etching adhesives after polymerization. These water channels were identified when bonded specimens were immersed in silver nitrate. Adapted from Tay and others.*[43]

coupled to enamel or processed composites, as these bonding substrates are much less permeable than dentin.[59]

## In Vitro Evidence of Adhesive Permeability

To understand just how hydrophilic the simplified adhesives are, any clinician can perform the following experiment. Create a flat tooth surface containing both enamel and dentin. Apply one of the all-in-one adhesives. After curing the adhesive, remove the sticky oxygen-inhibition layer with a moist cotton ball, and immerse the bonded tooth in water. On retrieval after 10 minutes, water blisters will be apparent on the bonded enamel (**Fig.** 7). These blisters are formed by a process commonly known in the resin-coating industry as "osmotic blistering."[60,61] Dissolved calcium and phosphorus ions are probably present within the acidic adhesive as a result of etching of the highly mineralized enamel. These ions osmotically attract water, which diffuses in from the outside through the hydrophilic adhesive layer to create the water blisters. The existence of water-filled channels (water trees) within these adhesives,[60,61] rendering the adhesives permeable, has recently been demonstrated. These water trees were readily observed after the resin–dentin interfaces were immersed in either conventional or ammoniacal silver nitrate (**Fig. 8**). Chemically cured composites polymerize more slowly than light-cured composites, allowing sufficient time for water to diffuse from hydrated dentin across the all-in-one adhesive to form water blisters along the adhesive–composite

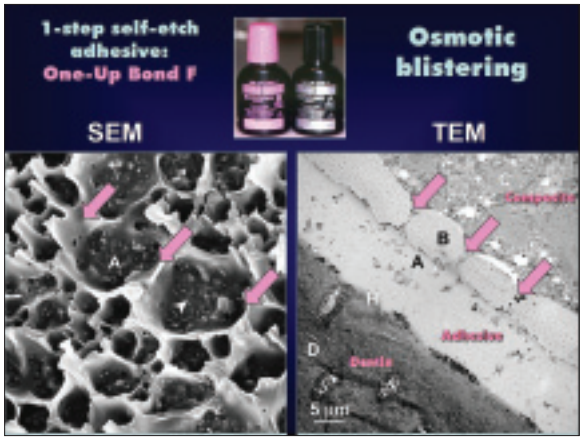


***Figure 9:*** *Scanning and transmission electron micrographs of water blisters that formed along the self-cured composite interface with single-step adhesives; these blisters resulted in very weak bonds and premature failure of the adhesive. Adapted from Tay and others.*[54]

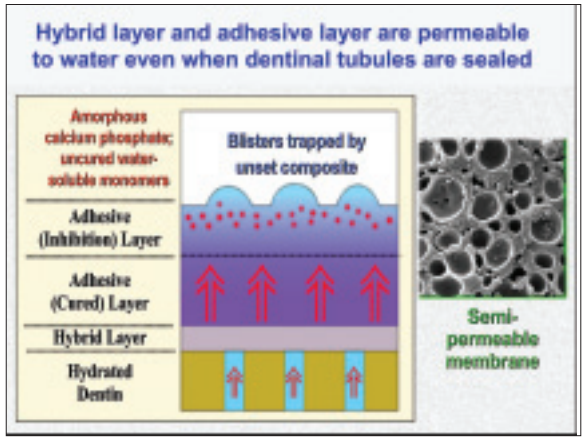


***Figure 10:*** *The proposed mechanism of osmotic blistering in dentin adhesives, with the osmotic gradient derived from the oxygen-inhibited layers of adhesives containing a high concentration of ionic monomers and dissolved minerals. Water droplets are trapped by the hydrophobic composite, resulting in a honeycomb appearance when the composite is subsequently polymerized.*

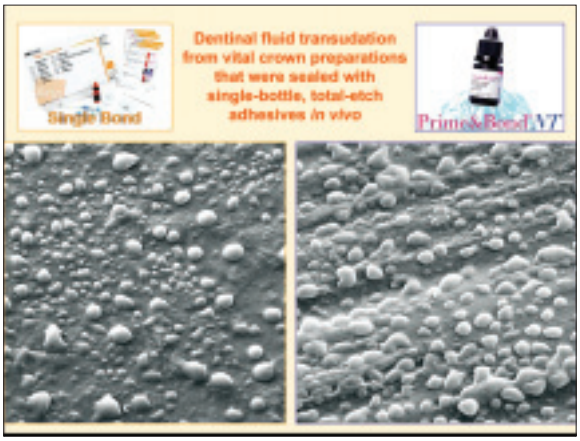


***Figure 11:*** *Scanning electron micrographs of epoxy resin replicas of vital crown preparations that were sealed in vivo with single-bottle total-etch adhesives before the impression was taken, as a means of reducing dentin sensitivity. Transudation of dentinal fluid occurred through the polymerized adhesive layers.*

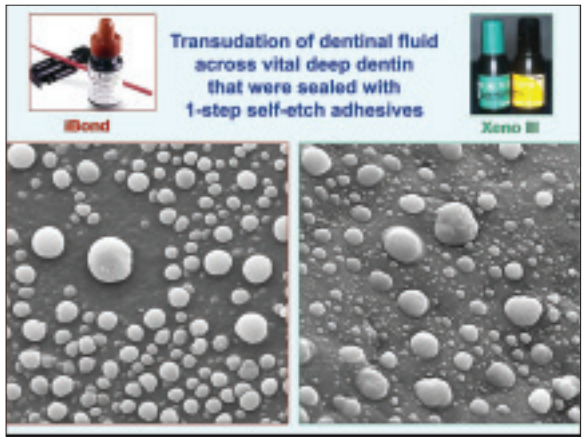


***Figure 12:*** *Scanning electron micrographs of similar dentinal fluid transudation along the surfaces of vital crown preparations that were sealed in vivo with single-step, self-etching adhesives. The simplified adhesives did not provide a hermetic seal for vital deep dentin.*

interface. This phenomenon, demonstrated with an all-in-one adhesive (One-Up Bond F, Tokuyama Corp., Tokyo, Japan) (**Fig. 9**), has been observed with all of the single-step self-etching adhesives. It has also been suggested that the osmotic gradient responsible for the induction of this type of water transport is derived from the dissolved ions within the oxygen inhibition layer of these polymerized adhesives (**Fig. 10**).[58]

## In Vivo Evidence of Adhesive Permeability

The increase in the permeability of contemporary simplified adhesives (both the single-bottle total-etch adhesives and the single-step self-etching adhesives) to water is readily apparent when they are used for sealing crown preparations of vital deep dentin in vivo before impressions are taken for indirect restorations. In investigations performed by the authors, these adhesives were applied to vital crown preparations, the oxygen-inhibited layer was removed, and impressions of these "sealed" crown preparations were obtained with a low-viscosity polyvinyl siloxane impression material. The impressions were poured up in epoxy resins to produce replicas of the crown preparations for examination with scanning electron microscopy. The results obtained with some of the single-bottle adhesives are shown in **Fig. 11**, and those obtained with single-step self-etching adhesives are shown in **Fig. 12**. The simplified adhesives did not provide a hermetic seal for vital deep dentin (unless they were immediately covered with light-cured resin composites), as evidenced by transudation of dentinal fluid across the polymerized adhesives to form

fluid droplets along the surface of the adhesive (**Figs.11** and **12**). From a clinical perspective, the diffusion of dentinal fluid across the adhesive occurs relatively slowly, so it is unlikely to result in severe postoperative sensitivity. Although water and small ions such as fluoride can certainly move across adhesive-sealed dentin, one wonders if large molecules, such as glucose, bacterial products or hydrolytic enzymes, can permeate from the outside, through the adhesive and dentin, into the pulp. Moreover, the collection of water droplets on the surface of a polymerized adhesive can result in a mode of polymerization of the resin composites that is referred to in polymer chemistry as emulsion polymerization. In such situations, the hydrophobic composite forms an emulsion in the presence of water (i.e., an oil-in-water type emulsion), which results in the appearance of numerous resin beads along the interface instead of a continuous film of polymerized composite. Because resin cements have lower viscosities than resin composites, they are also prone to form resin beads when applied to vital dentin bonded with single-step self-etching adhesives (e.g., ED Primer in Panavia F, Kuraray Medical Inc., Tokyo, Japan).[62] This may cause partial decoupling of bonded indirect restorations and lead to low bond strengths.[63]

## Conclusions

The authors of a recent review[64] suggested that technological progress in adhesion between polymeric restorative materials and dentin has been optimized to the point that further major improvements should not be anticipated within the next decade. However, the authors of the current review do not concur with this assessment. The simplification of bonding steps has not improved the quality or the durability of resin–dentin bonds. Although the increased permeability of acidic adhesives to water is probably responsible for their improved fluoride release, water sorption by hydrophilic and ionic resin monomers within both the hybrid layer and the adhesive layer may contribute to the degradation of resin–dentin bond strength over time.[65–69] This phenomenon is aggravated by an increased concentration of hydrophilic resin components in contemporary self-etching adhesives, as the hydrophilicity and hydrolytic stability of resin monomers are generally antagonistic.[70] One solution to this problem is to cover these hydrophilic adhesives with a hydrophobic adhesive (e.g., Scotchbond Multi-Purpose adhesive, 3M-ESPE, St. Paul, Minn.) or a thin layer of flowable composite.[63] Most all-in-one adhesives are simple, easy-to-use self-etching primers that must be covered with a hydrophobic adhesive or composite. This allows the convenience of dry bonding, simplified packaging and simplified bonding procedures without sacrificing bond strength or quality. Admittedly, there have been great advances in knowledge about bonding to dentin during the past decade. More effort should be devoted over the next decade to improving the quality of bonds so as to increase their longevity. ➧

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# Endodontic Treatment of Bilaterally Occurring 4-rooted Maxillary Second Molars: Case Report

• **Adil H. Alani,** BDS, HDD, PhD •

## Abstract

*The presence of 4-rooted maxillary second molars has been described in only a limited number of case reports. Studies of anatomical features have demonstrated substantial variation in the number of roots and root canals in different teeth. The maxillary second molar usually has 1, 2, or 3 roots and generally 3 or 4 root canals. This case describes the presence of 4 roots occurring bilaterally in maxillary second molars in one patient.*

***MeSH Key Words:*** *case report; molar/abnormalities; tooth root/abnormalities*

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*This article has been peer reviewed.*

The principal objective of root canal treatment is to relieve pain, eliminate bacteria from the root canal and prevent reinfection. A clear understanding of root morphology and canal anatomy is an essential prerequisite to achieving clean, disinfected and 3-dimensionally obturated root canal systems. Undetected extra roots or root canals are a major reason for failure of root canal treatment.[1]

Many of the challenges faced during root canal treatment may be directly attributed to an inadequate understanding of the canal morphology of teeth. Human molars show considerable anatomic variation and abnormalities with respect to number of roots and root canals. Unusual canal anatomy associated with the maxillary molars has been investigated in several studies.[2,3] Most reports have focused on the morphology of the mesiobuccal root and particularly on its mesiopalatal canal.[4,5] However, Christie and others[6] have reported a variation in the number of roots and an unusual morphology of root canal systems in maxillary molars.

Radiographs are an important and necessary aid in root canal treatment, and accurate radiographic techniques and proper interpretation are essential for sound diagnosis and treatment. The use of preoperative radiographs is the best way to detect and evaluate root canal morphology and anatomy. Further radiographs should be taken at different angles to confirm any variation in anatomical features.[7]

The purpose of this clinical report is to describe the unusual anatomy of bilaterally occurring, 4-rooted maxillary second molars detected during routine root canal treatment.

## Case Report

A 35-year-old woman was referred for root canal treatment of the right maxillary second molar. Two general dental practitioners had started root canal treatment. The tooth was asymptomatic and free from any clinical signs. A diagnostic radiograph revealed radiolucencies in the periapical area. The diagnosis of asymptomatic chronic apical periodontitis was made. Careful examination of the radiographs revealed the possibility of more than 1 palatal root (**Fig. 1**). The medical history was noncontributory.

Clinical examination revealed that both right and left maxillary first molars had been extracted and that mesial migration of the maxillary second molars had occurred. The tooth was anesthetized and isolated with a rubber dam, and access to the pulp chamber was achieved using a round diamond bur (ISO 801001016, Komet, Lemgo, Switzerland). Clinical evaluation of the internal anatomy confirmed the presence of 4 root canal orifices, 2 located buccally and 2 palatally (**Fig. 2**). The working lengths of each canal were estimated by means of an electronic apex locator (Root ZX, Morita, Tokyo, Japan), then confirmed by a radiograph. The canals were initially instrumented with #15 nickel titanium files (Dentsply Maillefer, Ballaigues, Switzerland) under irrigation with 5% sodium hypochlorite (NaOCl), then dried with sterile paper points.

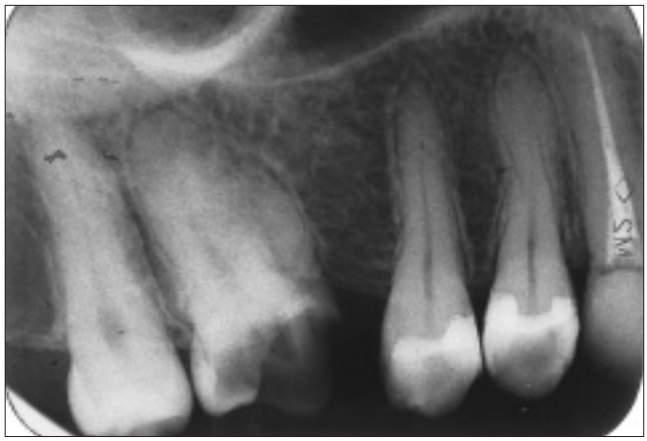

***Figure 1:*** *Preoperative radiograph of maxillary right second molar.*

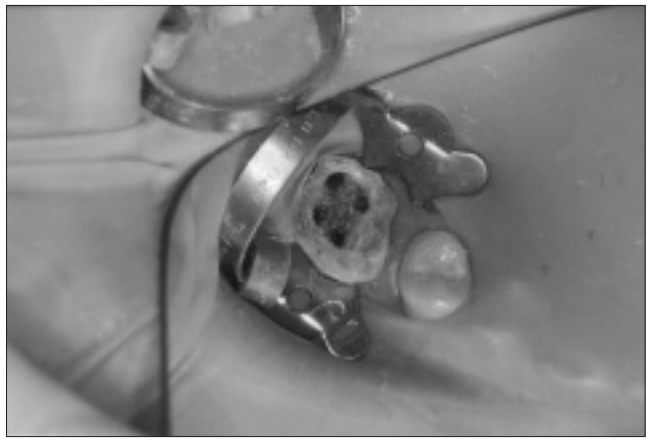

***Figure 2:*** *Clinical examination showing 4 root canal orifices: 2 located buccally and 2 palatally.*

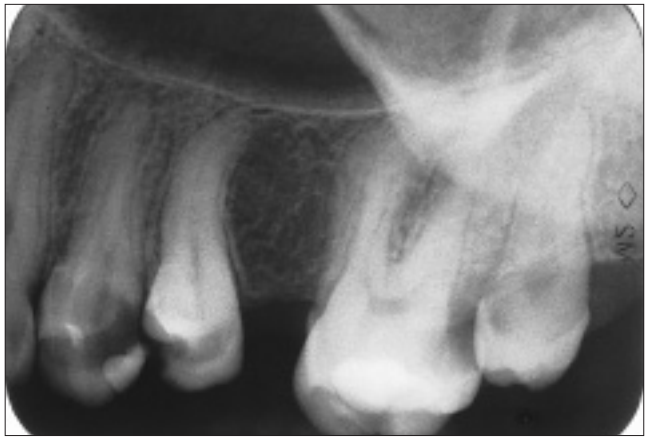

***Figure 3:*** *Preoperative radiograph of maxillary left second molar.*

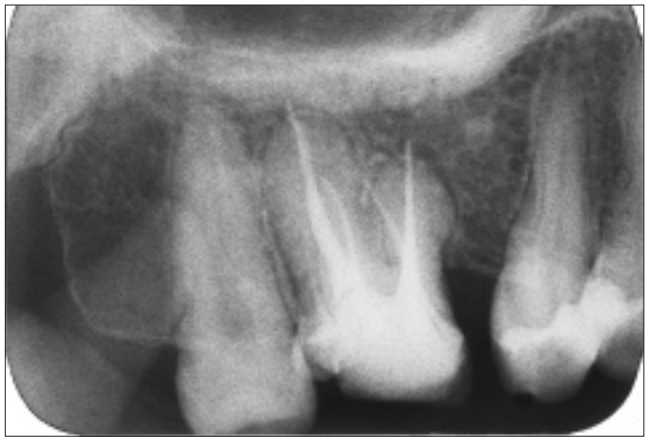

***Figure 4a:*** *Postoperative radiograph showing obturation of bilateral 4-rooted maxillary second molar.*

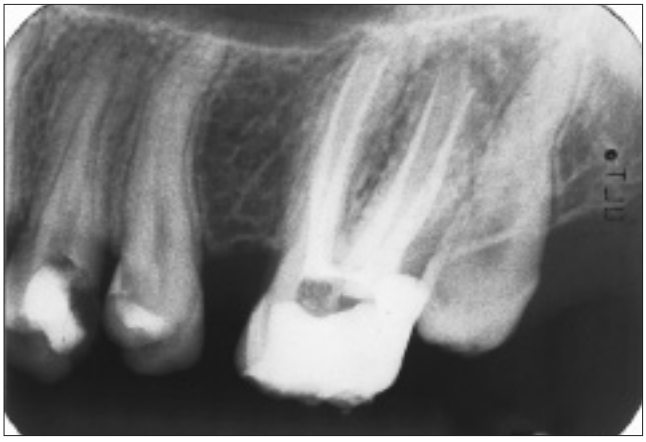

***Figure 4b:*** *Postoperative radiograph showing the separation and divergence of the 4-rooted maxillary second molar.*

Calcium hydroxide paste (Produits Dentaires S.A., Vevey, Switzerland) was used as an intracanal medicament. A sterile cotton pellet was placed in the pulp chamber, and IRM cement (Dentsply De Trey GmbH, Konstanz, Germany) was used to seal the access cavity after each appointment as a temporary filling to prevent coronal leakage.

After 3 days, the patient presented with severe pain in the left maxilla. Clinical examination revealed that the maxillary second molar had deep cervical caries. Thermal testing with ethyl chloride produced severe, long-lasting pain. There was no evidence of periapical radiolucency, but an interproximal carious lesion (distally) was confirmed. A diagnosis of irreversible pulpitis was established. Careful examination of the radiograph disclosed the presence of 4 roots (**Fig. 3**). The tooth was anesthetized and isolated with a rubber dam; access was gained using a round diamond bur. Caries was simultaneously removed. Pulp extirpation was carried out to relieve initial symptoms. Four root canal orifices were clearly identified, similar to those observed in the right maxillary second molar: 2 buccal and 2 palatal. The distance between the orifices of the 2 palatal roots was approximately 5 mm. Loupe magnification (×3.5) was used to clearly identify the number of canal orifices.

Root canal treatment was scheduled over 2 visits for each tooth because of the complexity of the root canal systems. By the second appointment, all symptoms had disappeared. Coronal flaring was carried out using Gates Glidden burs (numbers 3 and 2; Dentsply Maillefer). All canals were

cleaned and prepared by hand with nickel titanium files using a crown-down technique similar to that described by Saunders and Saunders.[8] One week later, all canals were obturated with Tubli-seal (Kerr UK, Peterborough, U.K.) and laterally condensed gutta-percha points. Final radiographs were taken to establish the quality of the obturation (**Figs. 4a** and **4b**). After completion of root canal treatment, the right maxillary second molar was fitted with a post and core with a porcelain-fused-to-metal crown; the left maxillary second molar was restored with a posterior composite filling (Z250, 3M Dental Products, St. Paul, Minn.).

## Discussion

This report highlights the unusual anatomy of the maxillary second molar occurring bilaterally in the same patient. Most endodontic and dental anatomy textbooks describe the maxillary second molar as having 3 roots with 3 or 4 root canals.[9–11] The reported percentage of 2-rooted maxillary molars ranges from 0–12%[5,9] to 15%.[12] The prevalence of maxillary second molars with 4 roots (2 buccal and 2 palatal) is rare; a review and radiographic survey[13] of 1,200 teeth found only 0.4% exhibiting this condition, which is rarer still in maxillary first molars. The possibility of maxillary second molars with 1 root and 1 root canal has been described in only a few textbooks.[14] Studies[15] have reported 0.6% of maxillary second molars with 1 root canal and, recently, Peikoff and others[16] demonstrated that 3.1% of endodontically treated maxillary second molars had 1 root and 1 canal.

In certain circumstances, root canals may be left untreated during endodontic therapy if the practitioner is unable to detect their presence.[17] The presence of extra roots is readily determined using routine radiography, as was demonstrated in the current case. However, teeth with extra canals and a normal number of roots present a greater challenge in terms of diagnosis and treatment. Extra root canals may be difficult to identify because of their superposition over other root canals or, sometimes, their relatively small size. Careful examination of the preoperative radiograph will aid in the detection of extra canals. Knowledge of anatomic aberrations, such as root position, root shape and relative root outline will also help decrease the failure rate of root canal therapy.

The current case demonstrated bilateral abnormality in maxillary second molars. Yew and Chan[18] reported bilateral symmetry in 67% of cases of 3-rooted mandibular first molars, whereas Tamse and Kaffe[19] found bilateral symmetry in 89.65% of cases of single conically rooted mandibular second molars. The findings of Peikoff and others[16] were consistent with these studies; however, in many cases of contralateral pairs, where endodontic treatment was performed, although the dental anatomy was similar, the bilateral symmetry was not always perfect.

Christie and others[6] have proposed a classification system describing 3 types (I–III) of 4-rooted maxillary second molar abnormalities, based on root separation level and their divergences. Under this system, the maxillary left second molar (**Fig. 3**) presented here could be considered a type II molar (well-separated roots). The maxillary right second molar (**Fig. 1**) could fall into a new type IV category,[20] representing that of conjoined buccal and palatal root trunks. Deveaux[21] presented a similar case in which endodontic treatment was performed on a maxillary second molar exhibiting 2 palatal roots classified as type II under this system.

Access to the root canal is the initial step in canal preparation. Properly designed and prepared access cavities will eliminate many potential problems during canal preparation and obturation. In the case reported here, a large access was required to locate the 2 palatal roots. Although the size of the mesiolingual cusp is larger in first maxillary molars than in second maxillary molars, teeth with 2 palatal roots often have a wider mesiodistal dimension of the palatal cusps.[6] The access cavity on maxillary molars exhibiting 2 palatal roots should be wider than usual on the palatal aspect. The access outline will be square rather than triangular (**Fig. 2**). In the current case, the 2 palatal orifices were also found to be well developed and large.

Treatment prognosis for molars with 4 canals and 2 palatal roots should be considered to be the same as that for any maxillary molar. Failure to treat a missed canal is an obvious reason for root canal treatment failure.[3] Therefore, all practitioners must make every effort to locate and treat all existing canals during root canal treatment.

## Conclusions

Anatomic variation in the number of roots and root canals can occur in any tooth. Examination of clear radiographs taken from different angles and careful evaluation of the internal anatomy of teeth is essential. Root canal treatment is likely to fail if extra roots or root canals are not detected. The similarity in dental anatomy might occur in any bilateral teeth. As a result, the clinician should be aware that variations in tooth morphology may well occur bilaterally. ◆

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# An Index for the Measurement of Normal Maximum Mouth Opening

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• **Silvia Lobo Lobo,** DDS, MS •
• **Marcello Melis,** DDS, RPharm •
• **Noshir R. Mehta,** DMD, MDS, MS •

## Abstract

***Purpose:*** *The aim of this study was to evaluate the relationship between the width of 3 or 4 fingers of one hand and maximum mouth opening (MMO) in healthy subjects.*

***Methods:*** *One hundred and forty dental students (age 21 to 42 years, mean 27.4 years) participated in the study. The ability of each subject to position 3 or 4 fingers, vertically aligned, between the upper and lower central incisors up to the first distal interphalangeal folds, was documented. Measurements of MMO and the width of 3 fingers (index, middle and ring fingers) and 4 fingers (index, middle, ring and little fingers) were recorded.*

***Results:*** *All subjects were able to position 3 fingers (of both the right and left hands) between the upper and lower central incisors. Only 12 subjects were able to position 4 fingers (both right and left) in this way. There were no significant differences among the measurements of MMO (mean 48.8 mm), 3 fingers of the right hand (mean 47.3 mm) and 3 fingers of the left hand (mean 47.0 mm) ($p > 0.05$). However, MMO was significantly different from the width of 4 fingers of the right hand (mean 58.1 mm) and 4 fingers of the left hand (mean 57.5 mm) ($p < 0.001$). Moreover, there was a strong positive correlation between MMO and the 3-finger measurements ($p < 0.0001$).*

***Conclusions:*** *These findings strongly suggest that the ability to position 3 fingers in the mouth during dental examination is a convenient index for assessing normal MMO.*

***MeSH Key Words:*** *range of motion, articular; reference values; temporomandibular joint dysfunction syndrome/diagnosis*

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*This article has been peer reviewed.*

Assessment of mandibular function is performed by means of several diagnostic tests including muscle and joint palpation, occlusal evaluation and radiographic examination. One of the elementary tests to evaluate temporomandibular joint function is measurement of the range of motion of the joints during maximum mouth opening (MMO) and lateral and protrusive movements; limitation of these movements is considered a sign of dysfunction.[1–4]

MMO can be expressed either as interincisal distance or as corrected interincisal distance, which is determined by adding the amount of vertical overlap between the upper and lower incisors to the incisal distance.[5] **Table 1**, a summary of previously reported mouth opening measurements, shows that the sensitivity of this method as a means of evaluating temporomandibular joint function is low, because there is enormous variability between the sexes, among people of different ages and among individual subjects. Previously reported mean MMO has ranged from 43.3 mm (reported by Posselt[6]) to 59.0 mm (for men only, as reported by Travell[10]). In individual studies, the reported range has been as wide as 32–62 mm[7] (for subjects of both sexes) and 39–75 mm[5] (for women only). Differences have also been observed between men and women.[5,9,10,16,18]

***Table 1*** **Summary of previously reported values for mouth opening measurements**

| Reference | Year | Mouth opening measurement, mean or range (mm) |
|---|---|---|
| Posselt[6] | 1952 | 43.3 |
| Braus[7] | 1954 | 32–62 |
| Shore[8] | 1959 | 33–45 |
| Nevakari[9] | 1960 | Men 57.5; Women 54.0 |
| Travell[10] | 1960 | Men 59.0; Women 53.0 |
| Posselt[11] | 1962 | 50–60 |
| Sheppard and Sheppard[12] | 1965 | 46.9 |
| Posselt[13] | 1968 | 43.4 |
| Ingervall[14] | 1970 | 51.3 |
| Ingervall[15] | 1971 | 52 |
| Bosman[16] | 1974 | Men 54.4; Women 53.6 |
| Agerberg[5] | 1974 | Men 42–77(mean = 58.6); Women 39–75 (mean 53.3) |
| Rosenbaum[17] | 1975 | 44.9 |
| Rieder[18] | 1978 | Men 40–60; Women 35–55 |
| Szentpetery[19] | 1993 | 51.7 |

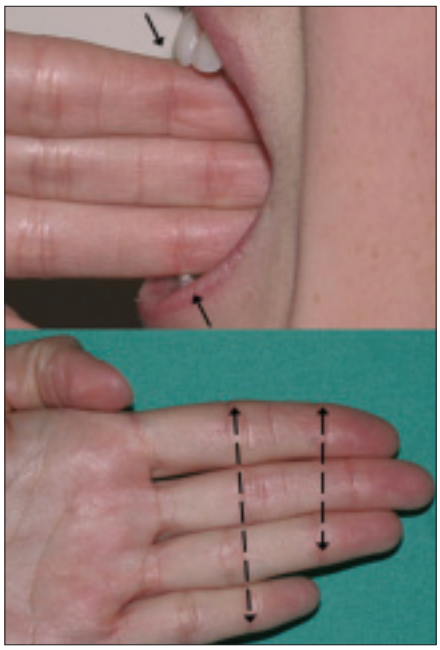

***Figure 1:*** *To assess the ability of each subject to position 3 or 4 fingers (right and left) vertically aligned, the distal interphalangeal folds (arrows) were used as an anatomical landmark.*

For example, Rieder[18] reported that men generally have a wider mouth opening than women: in that study, 83% of men had a mouth opening of 40–60 mm, whereas 87% of women had a mouth opening of 35–55 mm. Other authors have also reported differences between men and women (**Table 1**).

Because the variability in the range of mouth opening is so large, clinicians do not usually have a baseline measurement for a particular individual to determine if there is any limitation in mouth opening. This wide variability may be related to a variety of factors, such as generalized joint hypomobility or hypermobility and differences in body size among subjects. To correct for the latter factor, it would be more appropriate to use a measuring method that is directly proportional to the subject's body size.[20]

To make up for the lack of exact reference values for every patient, Hochstedler and others[21] suggested using the ratio of maximum opening to lateral movement, instead of the simple MMO measurement, to evaluate temporomandibular joint function. This ratio was 4.4:1 in normal subjects.[21] However, in patients with intracapsular and extracapsular disorders, both components of the ratio may be affected similarly, with the risk that limitations in all movements may yield a "normal" ratio, even though dysfunction is present.

This study had 2 objectives: first, to assess the ability of each subject to vertically position 3 fingers or 4 fingers between the upper and lower incisors during MMO, and second, to study the relationship between MMO and the width of 3 and 4 fingers.

## Materials and Methods

One hundred and forty students from Tufts University School of Dental Medicine, 60 men and 80 women between the ages of 21 and 42 years (mean 27.4 years, median 27 years) participated in this study. All subjects provided informed consent for participation. Clinical examination was performed at the Craniofacial Pain Center for subjects meeting the following inclusion criteria: no history of jaw, head or face trauma; not more than 1 mm of attrition on the incisal edges; no history of signs or symptoms of jaw or face pain, either at rest or during function; no history of bruxism; no history of temporomandibular joint sounds; no more than 2 absent teeth (excluding wisdom teeth); no facial or dental developmental abnormalities; no dental prosthesis on the anterior teeth; and occlusion in Class I relationship.

The following sites were palpated for signs of temporomandibular disorders and myofacial pain: temporomandibular joint and the masseter, temporalis, and medial and lateral pterygoid muscles bilaterally. The presence of joint sounds on motion was also evaluated.

The ability to position the fingers, vertically aligned, between the upper and lower central incisors up to the first distal interphalangeal folds was documented. For the 3-finger assessment, the index, middle and ring fingers were used. For the 4-finger assessment, the little finger was added (**Fig. 1**).

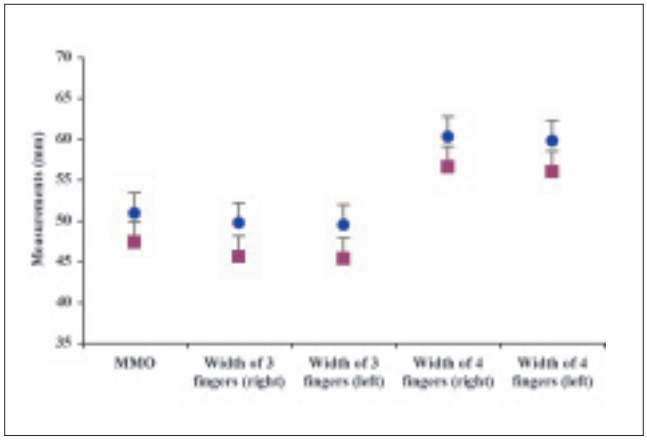


***Figure 2:*** *Mean measurements (and standard error of the mean) of maximum mouth opening (MMO) and the width of 3 and 4 fingers (for right and left hands). Circles = men (*n *= 60), squares = women (*n *= 80).*

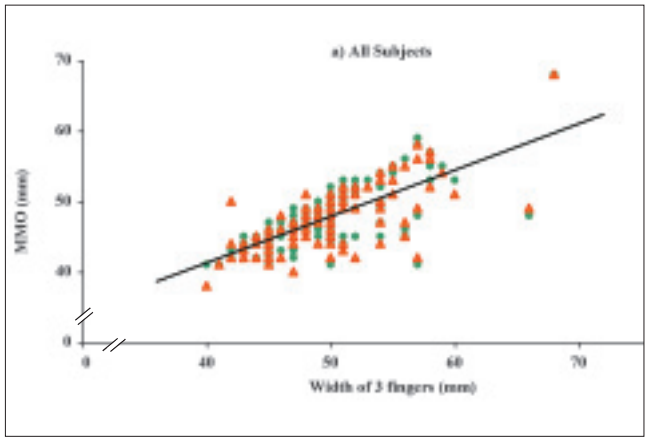


***Figure 3a:*** *Correlation between maximum mouth opening (MMO) and width of 3 fingers for right hand (circles) and left hand (triangles), for all 140 subjects, both men and women. Pearson's correlation coefficient* r *= 0.75 for right hand and* r *= 0.76 for left hand (*p *< 0.001).*

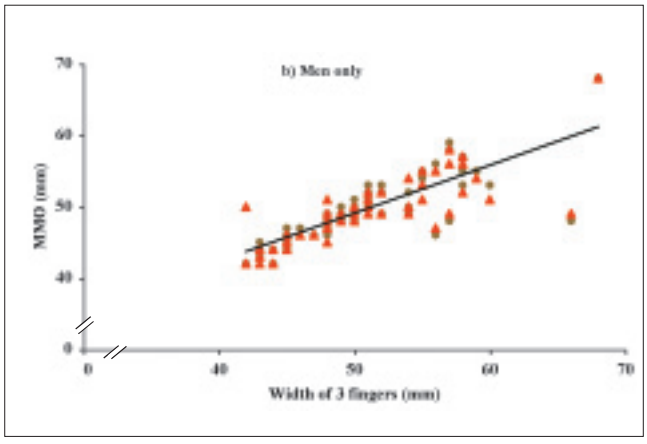


***Figure 3b:*** *Correlation between maximum mouth opening (MMO) and width of 3 fingers for right hand (circles) and left hand (triangles) for men only (Pearson's correlation coefficient* r *= 0.81 for both right and left hands).*

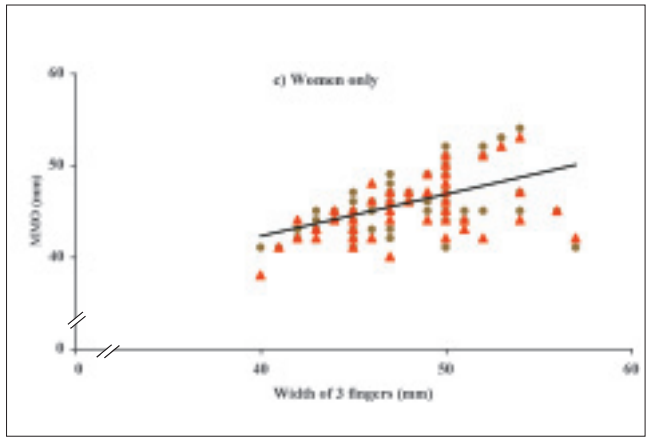


***Figure 3c:*** *Correlation between maximum mouth opening (MMO) and width of 3 fingers for right hand (circles) and left hand (triangles) for women only (Pearson's correlation coefficient* r *= 0.54 for the right hand and* r *= 0.55 for the left hand).*

To measure MMO, each subject was asked to open his or her mouth as wide as possible, and the examiner measured the maximum distance from the incisal edge of the maxillary central incisors to the incisal edge of the mandibular central incisors at the midline. A disposable scale was used to obtain this measurement (Therabite range of motion scale, Therabite Corp., West Chester, Penn.). The width of 3 fingers and of 4 fingers was measured with a Boley gauge (Pearson Dental Suppliers Co., Sylmar, Calif.).

The examination and measurements were performed while the subjects were seated comfortably in the dental chair in an upright position. The time of evaluation was kept consistent (between 9 am and noon). To control for inter-examiner and intra-examiner reliability, each step was performed by a single examiner.

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Ill.). Analysis of variance (ANOVA) was used to assess differences between recorded measurements. Scheffé's multiple-comparison method was used to assess significant differences between the 5 recorded measurements (MMO; width of 3 fingers, right and left; width of 4 fingers, right and left). The Pearson correlation test was used when appropriate. A stringent level of statistical significance was chosen ($p < 0.01$) for all tests. The results are expressed as mean ± standard error of mean.

## Results

All subjects were able to position 3 fingers, vertically aligned, between the upper and lower central incisors up to the first distal interphalangeal folds, but only 12 subjects (8 women and 4 men) were able to position 4 fingers in this way.

***Table 2*** **Summary of measurements of maximum mouth opening (MMO) and width of 3 and 4 fingers on right and left hands (all measurements in millimetres)**

| | | 3 fingers | | 4 fingers | |
|---|---|---|---|---|---|
| **Subject group** | **MMO** | **Right** | **Left** | **Right** | **Left** |
| **Women** | | | | | |
| Mean ± SEM | 47.4 ± 0.4 | 45.6 ± 0.3 | 45.4 ± 0.3 | 56.6 ± 0.5 | 56.0 ± 0.5 |
| Minimum | 40.0 | 41.0 | 38.0 | 46.0 | 47.0 |
| Maximum | 57.0 | 54.0 | 53.0 | 71.0 | 70.0 |
| **Men** | | | | | |
| Mean ± SEM | 50.7 ± 0.7 | 49.6 ± 0.6 | 49.3 ± 0.6 | 60.1 ± 0.8 | 59.6 ± 0.8 |
| Minimum | 42.0 | 42.0 | 42.0 | 50.0 | 50.0 |
| Maximum | 68.0 | 68.0 | 68.0 | 75.0 | 76.0 |
| **All subjects** | | | | | |
| Mean ± SEM | 48.8 ± 0.4 | 47.3 ± 0.4 | 47.0 ± 0.4 | 58.1 ± 0.5 | 57.5 ± 0.5 |
| Minimum | 40.0 | 41.0 | 38.0 | 46.0 | 47.0 |
| Maximum | 68.0 | 68.0 | 68.0 | 75.0 | 76.0 |

*SEM = standard error of the mean.*

**Table 2** summarizes the measurements of MMO and the widths of 3 and 4 fingers (right and left hands).

There was a significant difference among the 5 recorded measurements (ANOVA, $p < 0.0001$). Post hoc multiple comparisons indicated that the 3-finger measurements (47.3 ± 0.4 for the right hand, 47.0 ± 0.4 for the left hand) were not significantly different from MMO (48.8 ±0.4) ($p > 0.05$), whereas the 4-finger measurements were significantly different from MMO (58.1 ± 0.5 for the right hand, 57.5 ± 0.5 for the left hand) ($p < 0.001$) (**Table 2**, **Fig. 2**).

There was a strong positive correlation between MMO and the width of 3 fingers (Pearson's correlation coefficient $r = 0.75$ for the right hand and $r = 0.76$ for the left hand; $p < 0.0001$) (**Fig. 3a**). This correlation was even stronger when the data for the 12 subjects who were able to position 4 fingers in this way were omitted ($r = 0.90$ for the right hand and $r = 0.88$ for the left hand; $p < 0.00001$).

The correlation between MMO and the width of 3 fingers (for both right and left hands) was also significant when data for women and men were analyzed independently ($p < 0.001$). However, this correlation was stronger for men (**Fig. 3b**; $r = 0.81$ for both right and left hands) than for women (**Fig. 3c**; $r = 0.54$ for the right hand and $r = 0.55$ for the left hand).

## Discussion

MMO varies greatly from one subject to another and hence measurement of MMO on its own could be misleading, making it difficult to set criteria for impairment of mandibular movement. In general, the cutoff values for restricted opening are less than 40 mm for muscular disorders and less than 35 mm for joint-related disorders.[2,22] It has previously been reported that measurements of anatomic landmarks correlate with MMO. For example, Landtwing[20] found that body height was strongly correlated with MMO, and this correlation has also been demonstrated by Vanderas[23] and Agerberg.[24] The relationship between mandibular movements and facial morphology was analyzed by Ingervall,[15] who found that mouth opening was correlated with measurements of the cranial base and the mandible. Unfortunately, these measurement methods are rarely used in daily practice and are not considered in the diagnosis of temporomandibular disorders.

In the present study, the ability to place 3 or 4 fingers between the central incisors was investigated; only 8.6% of the subjects (8 women and 4 men) were able to position 4 fingers during MMO, whereas all subjects could position 3 fingers in this way. The correlation between the width of 3 fingers and MMO was significantly greater among men than among women. This finding may be related to women's smaller stature.[20]

This index is proposed as a way to predict normal MMO with reasonable accuracy ($r = 0.75$ for the right hand and $r = 0.76$ for the left hand).

One limitation of this study is that asymptomatic subjects with limitations in mouth opening might have been included in the study sample, which would bias the results to some extent. Moreover, the inclusion criteria did not encompass any specific radiographic or magnetic resonance imaging evaluation of the temporomandibular joint. However, the absence of any history of signs or symptoms of jaw or face pain and the lack of history of temporomandibular joint sounds should have minimized the number of subjects with undetected limitation of mouth opening.

Other limitations related to the interpretation of the data are due to the possibility of disproportionate body size, such that the sample might have included subjects with small MMO and large fingers or large MMO and small

fingers, even in the absence of any abnormality or limitation; if so, the suggested method of assessing normal MMO might yield incorrect results.

## Conclusions

A simple, quick method of assessing and recording normal mandibular motion during mouth opening has been presented. The findings of this study strongly suggest that the ability to position 3 fingers in the mouth during dental examination is a convenient and reliable index for assessing normal MMO. Using this method clinicians may be able to more accurately distinguish "normal" from "restricted" mouth opening. However, it must be remembered that this is only one variable, and all aspects of possible dysfunction should be assessed comprehensively before a definitive diagnosis is made. In future investigations, body weight should be recorded and subjects should be classified by racial background and age. In addition, a larger sample size from a multicentre setting should be used, and results should be compared between normal subjects and those with temporomandibular disorders. ◆

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## CDA'S DEFINITION OF ORAL HEALTH

Oral health is a state of the oral and related tissues and structures that contributes positively to physical, mental and social well-being and the enjoyment of life's possibilities, by allowing the individual to speak, eat and socialize unhindered by pain, discomfort or embarrassment.

*Approved by Resolution 2001.02*
*Canadian Dental Association Board of Governors*
*March 2001*

# Clinical Abstracts

*The Clinical Abstracts section of* JCDA *features abstracts and summaries from peer-reviewed dental publications. It attempts to make readers aware of recent literature that may be of interest to oral health care workers. It is not intended to provide a systematic review of the topic. This month's selection provides an update on recent research in prosthodontics. The articles were chosen by Dr. Asbjørn Jokstad, a professor at the Institute of Clinical Dentistry, faculty of dentistry, University of Oslo. A commentary is provided that puts these articles into context for readers.*

## *Commentary*

### Modern Prosthodontics Research: Focus on Treatment Outcomes

Asbjørn Jokstad, DDS, PhD

Imagine that you have an old aunt living in a part of the country you left years ago. As kin you're her favourite dentist and dearly trusted advisor. One evening you receive a distressed call from her. She's been told by her dentist that her last remaining teeth have to go. Many of her friends have warned her of the problems associated with dentures, and she is terrified at the thought of having to adapt to wearing them. She is not alone; many elderly Canadians share her feelings.[1]

Her dentist has suggested placing some dental implants, but he has warned that this will be expensive. Her pension does not allow for any superfluous excesses. Do you believe this would be the best treatment for her? After all, she could switch to a diet that requires less chewing. And what about her slight osteoporosis and her coming of age — wouldn't these health concerns negate the treatment? You promise to find the answers to all of your aunt's questions and begin a search of the latest available research.

You're in luck. The prosthodontic scientific literature has matured from a focus on descriptions of materials and how best to manufacture custom-made prostheses to treatment outcomes for patients fitted with alternative devices.[2] The literature still contains descriptions of techniques and best use of new biomaterials, but today there is more interest in what patients (and operators) can actually expect from different prosthetic solutions, in recognition of the fact that patients need this information to decide what treatment option is best for them.[3] A major reason for this new focus is the paradigm shift that occurred as a result of research into dental implants initiated some 25 years ago. A group of investigators at the University of Toronto, led by Dr. George Zarb, was among the first to evaluate systematically the benefits and risks of implant-based prosthodontics,[4] contributing tremendously to today's understanding of the possibilities and limitations of this treatment mode. Other research groups in Canada have followed their lead (a fact that reflects the current high standard of clinical research being carried out in Canadian dental schools), and there is now a wealth of up-to-date research on how modern prosthodontic treatment can enhance quality of life, diet, nutrition, and perhaps even general health.

So what can you tell your aunt about her condition? You can start by pointing out that implant-based overdentures are considered the best and most appropriate treatment for replacing teeth in the lower jaw,[5] and that age[6] and osteoporosis[7] are not contra-indications to implant surgery. You can also point out that poor chewing ability is associated with an unhealthy nutrition (see abstract 1) and a negative psychosocial impact (abstract 2). Reassure her that elderly patients in Canada prefer implant-based prostheses to conventional dentures (abstract 3) and that this solution can have a positive impact on their diet (abstract 4) and quality of life (abstract 5). Moreover, there is evidence that an overdenture on 2 implants will be less costly in the long run than a fixed bridge on multiple implants (abstract 6), and that an overdenture will still provide acceptable chewing effectiveness and comfort. And finally, promise her you'll visit soon. ◆

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## 1 Are denture wearers at nutritional risk?

Nowjack-Raymer RE, Sheiham A. Association of edentulism and diet and nutrition in US adults. *J Dent Res* 2003; 82(2):123–6.

### Background

There have been few studies of the relationship between dental status and diet and nutrition, despite reports of chewing problems by edentulous persons. This study assessed whether the intake of nutritious food, dietary fiber and levels of biochemical analytes differed between adults who were edentulous and wore complete dentures and those who had all their natural teeth.

### Methods

Data came from a nationally representative sample of individuals 25 years of age and older who participated in the Third National Health and Nutrition Examination Survey (NHANES III). Variables measured were intake per month of carrots and tossed salads, intake of dietary fiber, and serum levels of beta carotene, folate and vitamin C. Comparisons were made between those who wore dentures and the fully dentate, after adjusting for potential social and behavioural factors.

### Results

Adjusted mean numbers of intake of carrots and tossed salads were, respectively, 2.1 and 1.5 times lower for denture-wearers than for the fully dentate ($p < 0.0001$), and dietary fiber intake was 1.2 times lower ($p < 0.05$). Denture-wearers also had lower serum levels ($p < 0.05$) of beta carotene (9.8 microg/dL), folate (4.7 ng/dL) and vitamin C (0.87 mg/dL).

### Clinical Significance

Evidence from this study suggests that denture-wearers may be at a nutritional disadvantage compared to the fully dentate because they consume less nutrient-rich foods. Health professionals must be aware of the potential diet-related problems denture-wearers may face.

## 2 Are edentulous older adults more susceptible to changes in chewing ability?

Locker D. Changes in chewing ability with ageing: a 7-year study of older adults. *J Oral Rehabil* 2002; 29(11):1021–9.

### Background

Oral diseases and disorders cause chewing problems that can become more prevalent over time as older adults experience a decline in oral functioning. This article reports the results of a study of the chewing capacity of older adults using measures of functional limitation, psychosocial impact and satisfaction in relation to age and dental status.

### Methods

The cohort study of community-dwelling older adults aged 50 years and older consisted of a baseline phase and follow-ups at 3 and 7 years. Chewing capacity was measured using an index of 6 indicator foods, the psychosocial impact of chewing dysfunction was measured using 4 questions, and satisfaction with chewing ability was measured using a single question.

### Results

The proportion of subjects reporting a chewing problem increased from 24.0% at baseline to 25.2% at 3 years and 33.8% at 7 years. The increase in prevalence over 7 years was 26.1% in older edentulous subjects (> 65 years) compared with 5.3% in younger dentate subjects (< 64 years). Overall, increases were also observed in the proportion of subjects reporting some psychosocial impact related to chewing problems and dissatisfaction with their capacity to chew. Patterns of change varied according to age and dental status. Change scores calculated after 7 years indicated that some individuals improved while others deteriorated.

### Clinical Significance

Oral functioning declined in both the dentate and the edentulous subjects, but was most marked in older edentulous subjects. The author suggests that the measures used in this study may be helpful in clinically assessing patient needs and outcomes of therapies designed to enhance functioning and well-being.

## 3 Can implant overdentures improve the nutritional state of edentulous people?

Morais JA, Heydecke G, Pawliuk J, Lund JP, Feine JS. The effects of mandibular two-implant overdentures on nutrition in elderly edentulous individuals. *J Dent Res* 2003; 82(1):53–8.

### Background

Edentulism can have a negative impact on diet. Dental therapies to treat edentulism are designed to maintain oral health-related quality of life, including nutritional status. This study tested whether mandibular 2-implant retained overdentures improved the nutritional state of edentulous patients better than conventional complete dentures.

### Methods

Sixty edentulous subjects (ages 65 to 75 years) were enrolled in this randomized clinical trial; 30 received 2-implant mandibular overdentures (IOD) and 30 received conventional dentures (CD). Nutritional state was measured before treatment and 6 months after treatment.

### Results

Anthropometric data revealed significant improvements in the IOD but not in the CD group, for percent body fat ($p = 0.011$) and skin-fold thickness at the biceps, subscapularis, and abdomen ($p < 0.05$), and significant decreases in waist circumference ($p < 0.0001$) and waist–hip ratio ($p = 0.001$). Concentrations of serum albumin ($p = 0.015$), hemoglobin ($p = 0.01$), and B12 ($p = 0.01$) also increased significantly in the IOD group. There were no significant between-group differences.

### Clinical Significance

Subjects who received IOD were better able to modify their diet and increase their food choice. The results of this study suggest that low-cost IOD treatment improves the dietary intake and nutritional status of edentulous people.

## 4 What is the impact of oral disorders on overall quality of life of the elderly?

Locker D, Matear D, Stephens M, Jokovic A. Oral health-related quality of life of a population of medically compromised elderly people. *Community Dent Health* 2002; 19(2):90–7.

### Background

Oral disorders may have functional and psychosocial impacts, which, in turn, may compromise overall quality of life. This study assessed the oral health-related quality of life of a medically compromised population of older adults.

### Methods

A cross-sectional survey of 225 medically compromised subjects (mean age: 83 years), most of whom lived in a long-term care setting. Data was collected by means of a personal interview and a review of dental charts. Four oral health indicators (functional limitation, pain and discomfort, psychological impacts, and behavioural impacts) were measured using the Geriatric Oral Health Assessment Index (GOHAI) and the 14-item Oral Health Impact Profile (OHIP-14). The questionnaire also included quality of life indicators (morale, perceived life stress and life satisfaction).

### Results

Missing teeth, dry mouth and limitations in chewing ability were the main oral problems reported. One-third of subjects rated their oral health as fair or poor and 20% were dissatisfied with their oral health. Using the GOHAI, 53% reported one or more functional or psychosocial problems "very often" or "all the time." The corresponding percentage for the OHIP-14, which addresses more severe outcomes, was 17%. There was a significant association between the 4 oral health indicators and the quality of life measures; subjects with poor self-perceived oral health had lower morale, more life stress and were less satisfied with their lives. These associations remained after controlling for other determinants.

### Clinical Significance

Oral disorders have a significant impact on the well-being and life satisfaction of elderly individuals. Access to appropriate oral health care would likely result in improved overall quality of life.

## 5 Do implant overdentures provide better oral health-related quality of life than conventional dentures?

Awad MA, Lund JP, Shapiro SH, Locker D, Klemetti E, Chehade A, Savard A, Feine JS. Oral health status and treatment satisfaction with mandibular implant overdentures and conventional dentures: a randomized clinical trial in a senior population. *Int J Prosthodont* 2003; 16(4):390–6.

### Background

Failure to adapt to conventional dentures can result in oral health-related quality of life problems. This is especially true of the elderly, who are the most vulnerable to malnutrition. This study compared satisfaction and oral health-related quality of life of elderly patients with mandibular 2-implant overdentures and conventional dentures.

### Methods

Sixty edentulous subjects (ages 65 to 75 years) were enrolled in a randomized clinical trial. All participants received maxillary conventional dentures, with half receiving a mandibular conventional denture and the other half an overdenture supported by 2 implants with ball retainers. Subjects rated their general satisfaction with treatment, as well as comfort, stability, ability to chew, speech, esthetics and cleaning ability. Outcomes were measured before treatment and 2 months after treatment. Oral health-related quality of life was assessed using the Oral Health Impact Profile (OHIP) and its short form (OHIP-EDENT).

### Results

General satisfaction 2 months posttreatment was significantly higher in the group treated with mandibular 2-implant overdentures ($p$ = 0.001). Comfort, stability and ability to chew were also rated higher in this group. Using the OHIP-EDENT, subjects who received mandibular 2-implant overdentures reported significantly fewer oral health-related quality of life problems than the conventional group.

### Clinical Significance

Results of this study suggest that elderly patients who receive mandibular 2-implant overdentures combined with maxillary conventional dentures have significantly better oral function and oral health-quality of life than patients who receive mandibular and maxillary conventional dentures. ➧

## 6 Is overdenture therapy more cost-effective than fixed prosthodontic treatment?

Attard N, Wei X, Laporte A, Zarb GA, Ungar WJ. A cost minimization analysis of implant treatment in mandibular edentulous patients. *Int J Prosthodont* 2003;16(3):271–6.

Although there is considerable evidence endorsing the functional benefits of implant treatment, there is less information pertaining to its cost-effectiveness. This study aimed to determine if implant-supported overdentures are more cost-effective for edentulous patients than fixed osseointegrated prostheses.

### Methods

Twenty-five participants from 2 long-term studies (fixed prostheses and overdentures) were included in this study. The analysis of total costs, clinical and time costs was conducted from the patient's perspective over a 9-year follow-up period. All cost figures were deflated using the 1995 Consumer Price Index; patients' time was valued using national salary rates.

### Results

Significantly higher mean total, clinical and time costs were reported for the fixed restoration group (Can$10,748, $10,094 and $654, respectively) compared to the overdenture group ($3,665, $3,343 and $322, respectively). Higher costs were also reported in terms of initial, maintenance and clinical visit costs for the fixed restoration group ($7,567, $2,527 and $542, respectively) compared to the overdenture group ($2,505, $830 and $292, respectively). Time cost for the fixed prosthodontic group was still significantly higher ($488 vs. $322), even after an equal mean salary rate was assumed.

### Clinical Significance

Long-term costs associated with overdenture therapy for edentulous patients are lower than costs associated with fixed prosthodontic treatment. Overdenture therapy should be recommended for patients with limited physical and economic resources. ➧

# Clinical Showcase

*Clinical Showcase is a series of pictorial essays that focus on the technical art of clinical dentistry. This new section features step-by-step case demonstrations of clinical problems encountered in dental practice. This month's article is by Dr. Louis Malcmacher, one of the featured speakers at the 2004 Pacific Dental Conference, presented in partnership with the Canadian Dental Association. The conference will take place in Vancouver, B.C., from March 4 to 6. If you would like to propose a case or recommend a clinician who could contribute to Clinical Showcase, contact editor-in-chief Dr. John O'Keefe at jokeefe@cda-adc.ca.*

## A New Twist to One-Hour Tooth-Whitening

Dr. Louis Malcmacher, DDS, FAGD

Tooth whitening has undergone significant developments in the past few years with the advent of systems that can whiten teeth in one hour. Dentists have been very successful in this area of cosmetic dentistry, as they become familiar with proper technique and case selection. However, tooth whitening remains a challenging and sometimes frustrating procedure.

This article presents a new twist to the traditional one-hour whitening technique that has helped overcome some of the initial challenges inherent in the procedure. Improvements to the one-hour process include etching the teeth before the application of the peroxide gels, wrapping the teeth to keep the oxygen released by the peroxide close to the enamel, and sealing the whitened teeth with an unfilled resin. Patients report greater satisfaction with this one-hour whitening process, as well as continued whitening for a few days afterwards.

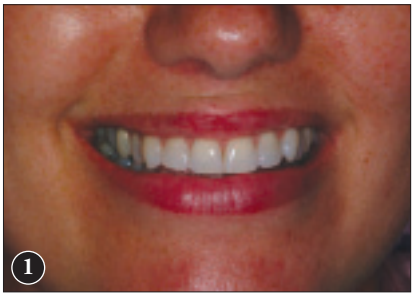


***Figure 1:*** *This woman was not happy with the yellow colour of the cervical areas of the teeth. She tried wearing tooth-whitening trays but found that her teeth became very sensitive. She wanted to try one-hour whitening.*

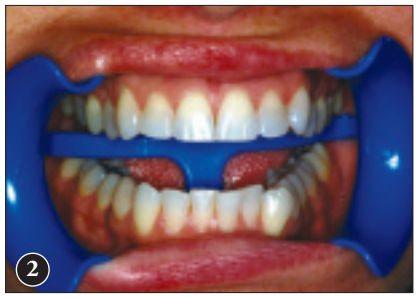


***Figure 2:*** *Good retraction is crucial because the powerful peroxide materials can harm soft tissues.*

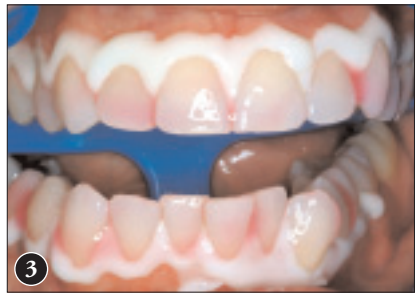


***Figure 3:*** *Protecting the soft tissues is key to eliminating sensitivity. A dental dam resin is applied to the dry gingival tissues and cured into place. Most of the sensitivity comes from the peroxide formulations attacking exposed dentin in the cervical regions of the teeth. Great care must therefore be taken to completely cover these areas as well.*

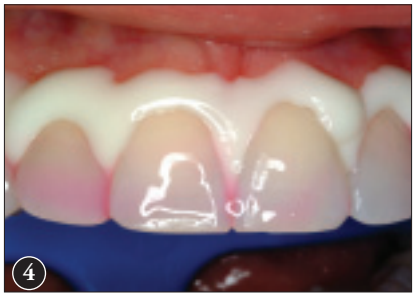


***Figure 4:*** *A 37% phosphoric acid gel etchant is applied to the teeth for 5 seconds.*

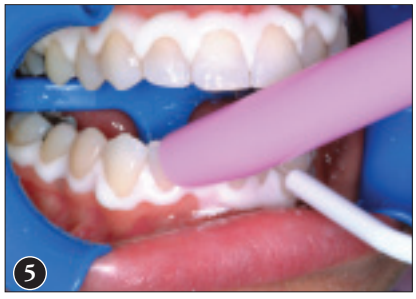


***Figure 5:*** *The etchant is thoroughly washed off the teeth.*

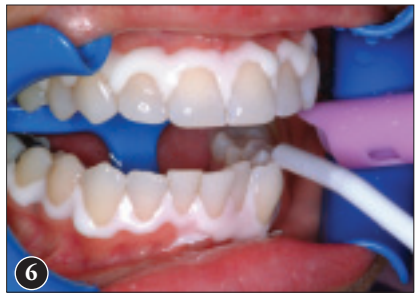


***Figure 6:*** *The teeth are lightly dried.*

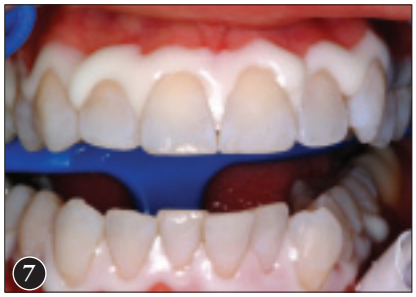

***Figure 7:*** *The dried teeth will have a frosted appearance.*

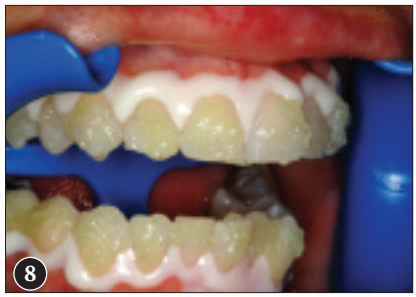

***Figure 8:*** *A 35% hydrogen peroxide teeth whitening gel (Rembrandt Lightning Plus, Denmat Corporation, Santa Maria, Calif.) is applied to the freshly etched teeth in 1-mm-thick increments. This gel has a potassium nitrate desensitizer to help eliminate sensitivity.*

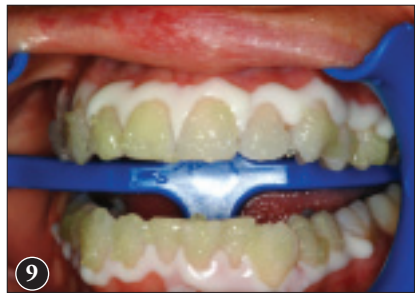

***Figure 9:*** *Front view of the whitening gel applied to the teeth.*

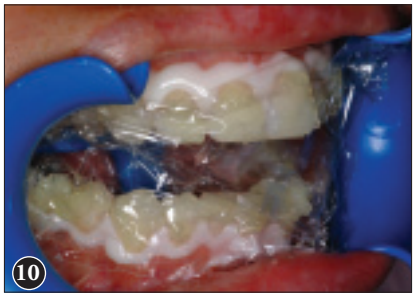

***Figure 10:*** *A cellophane wrap is placed gently on the gel. Care should be taken not to push the gel onto the soft tissues.*

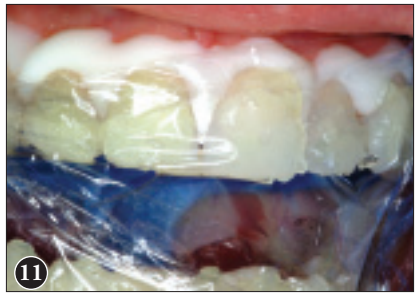

***Figure 11:*** *The wrap keeps any oxygen release directed towards the enamel instead of dissipating into the air. More oxygen is thus available to whiten the teeth.*

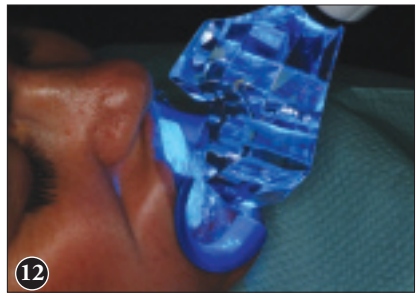

***Figure 12:*** *A plasma arc light (Rembrandt Sapphire Light, Denmat Corporation) with a light-diffusing device (Rembrandt Crystal, Denmat Corporation) is placed close to the teeth.*

***Figure 13:*** *The plasma arc light is left for approximately 40 minutes.*

***Figure 14:*** *Oxygen release associated with the 35% peroxide formula is significant. The captured oxygen is directed towards the teeth, thanks to the cellophane wrap.*

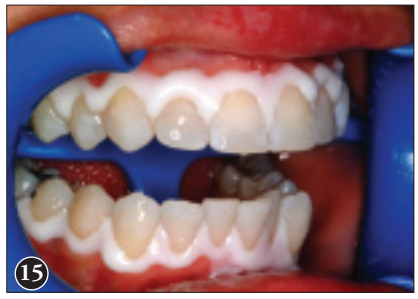

***Figure 15:*** *The teeth are milky white after the cellophane wrap and the whitening gel are removed.*

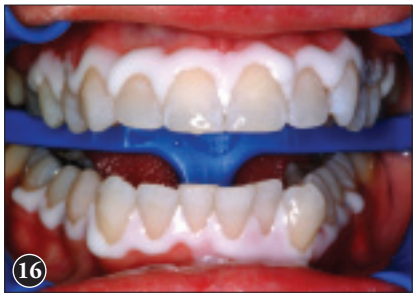

***Figure 16:*** *Clear unfilled resin sealant has been painted on the teeth and light-cured to seal the enamel pores that were opened with the etchant. Failure to seal the teeth after the procedure would result in immediate colour absorption once the patient imbibes any kind of chromogenic liquid.*

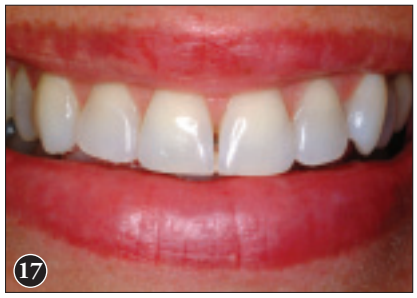

***Figure 17:*** *Postwhitening smile with the yellow cervical stains removed.*

Improvements to the one-hour tooth-whitening process include use of a cellophane wrap, as well as an etchant and a clear sealant, to deepen the whitening effect of the peroxide gel. Care must be taken to always protect the soft tissues from the strong whitening gels.

This case also illustrates how, when done properly, one-hour tooth whitening can be used in place of tray whitening if there are problems with tooth sensitivity, which can also be minimized by waiting at least one week after the patient has had a prophylaxis and by making sure all cervical lesions and areas are well covered, either with a restorative material or a dental dam. ◆

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*The author has no declared financial interests in any company manufacturing the types of products mentioned in this article.*

*Dr. Malcmacher's seminar "Advanced Esthetic Dentistry and Practice Management for Every Dental Practice" will be presented on Thursday, March 4. For more information on the joint PDC/CDA conference, visit www.pacificdentalonline.com.*

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# Point of Care

*The Point of Care section of* JCDA *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. This month's responses were provided by speakers at the 2004 Pacific Dental Conference, presented in partnership with the Canadian Dental Association. The conference will take place in Vancouver, B.C., from March 4 to 6. If you would like to submit or answer a question, contact editor-in-chief Dr. John O'Keefe at jokeefe@cda-adc.ca.*

## *Question 1* How can I foster realistic patient expectations regarding complete dentures and minimize dissatisfaction at the delivery appointment?

### Background to the Issue

Many general dentists today express reluctance to provide complete denture services.[1] This reluctance may be due to:

- the increasing complexity of cases, which frequently involve frail, elderly patients
- limited denture experience in dental school and a feeling that mastery is not attainable with general dental skill sets
- fear that patients will not be satisfied.

Most dentures placed today are replacement dentures, which raises additional concerns about patients resisting change and not wanting to give up that which is familiar to them. The denture technique described below addresses the issues of tissue restoration and vertical dimension, while encouraging dentist–patient communication *before* prosthetic treatment begins.

### Managing Soft-Tissue Injuries

Persistent tissue irritation can prompt patients to seek replacement dentures; however, chronic denture injuries often go unnoticed until a dentist points them out. Pointing out such injuries is important because it highlights the benefits of treatment, while serving as a baseline against which change can be referenced. It is important for patients to understand that discomfort and injury don't necessarily go hand-in-hand and that chronic injury compromises future prosthetic treatment. Placement of a tissue conditioner, without making any other change to the denture base, is a reversible intervention that restores tissue health and buys time to consider treatment options.

### Managing Patient Expectations: Appearance and Function

Occlusal vertical dimension (OVD) of dentures is lost gradually and patients are often unaware of associated changes in facial form and occlusion (**Fig. 1**). Incremental layering of tissue conditioner can re-establish posterior occlusion and increase OVD, while allowing restored facial form to be previewed. Placing incremental layers of tissue conditioner offsets flange overextensions and often eliminates the need for border adjustments. After 2 or 3 tissue conditioning appointments, dentists can weigh patient expectations against possible outcomes and begin prosthetic treatment. This time can be used to plan occlusion and tooth position.

### Predicting Success and Beginning Treatment

Tissue conditioners are functional impression materials, flowing to shape and defining coverage. It is important to evaluate OVD and freeway space as well as occlusal plane orientation with each placement of tissue conditioner. The occlusal plane should be verified using the interpupillary line and Camper's plane after placement of each layer of tissue conditioner (**Fig. 2**). Closest speaking space is used to confirm preservation of adequate freeway space. A low-viscosity, nonaqueous elastomeric impression wash placed on top of the tissue conditioner is then used to capture soft tissue detail and to record maxillo-mandibular relations when impressions are taken. An open-mouth impressioning technique is used to capture mandibular tissues (**Figs. 3** and **4**) as the patient's tongue and facial muscles are activated.

Border molding is accomplished automatically in both arches as the tissue conditioner functionally defines flange extension and width. Maxillary denture impression and bite registration are simultaneously completed using a closed-mouth technique. Tissue compression/distortion is always a concern during denture impressioning. With this technique, the tissue conditioner has already dynamically captured soft-tissue form and a very thin layer of low-viscosity polyvinylsiloxane will refine the surface detail of the conditioner. A few brushstrokes of tray adhesive are used to secure the impression to the tissue conditioner.

***Figure 1:*** *Profile of patient with lost occlusal vertical dimension.*

***Figure 2:*** *Evaluation of occlusal plane using the Occlusal Plane Analyzer (Dentsply Trubyte).*

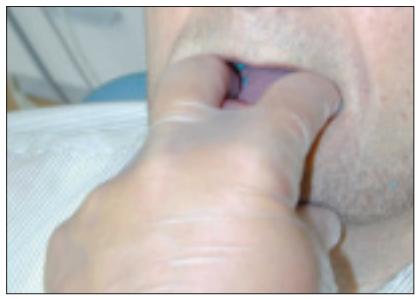

***Figure 3:*** *Mandibular impressioning, open-mouth technique.*

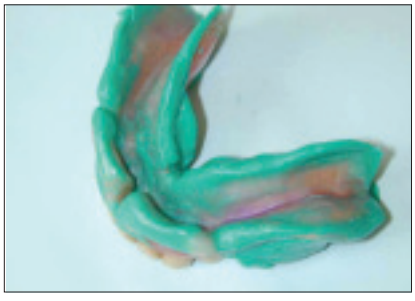

***Figure 4:*** *Completed mandibular impression.*

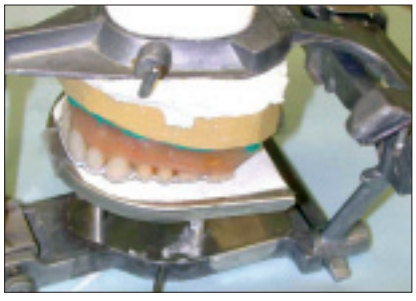

***Figure 5:*** *Maxillary tooth position indexed to occlusal mounting table after closed-mouth maxillary impressioning technique.*

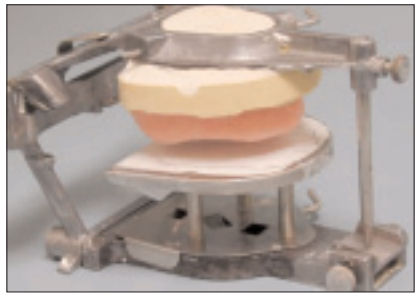

***Figure 6:*** *Tooth position relationship to processed baseplate.*

***Figure 7:*** *Final denture bases made of Eclipse Prosthetic Resin System (Dentsply Trubyte).*

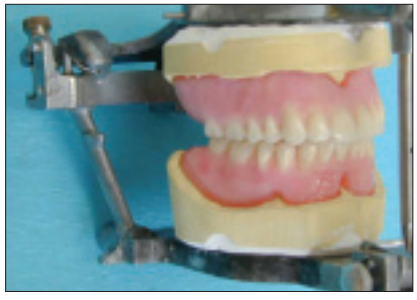

***Figure 8:*** *Replacement dentures ready for trial insertion.*

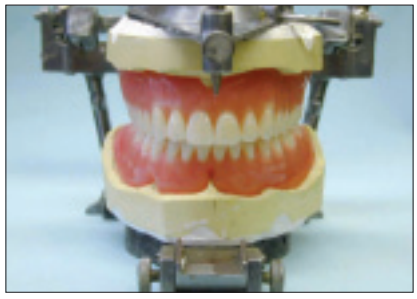

***Figure 9:*** *Finished complete dentures.*

***Figure 10:*** *Satisfied patient with replacement dentures.*

### Model Articulation and Tooth Positioning

A mounting plate replaces the facebow and allows casts to be mounted with existing tooth positions referenced to the maxillary model. Tracing of existing tooth position (**Fig. 5**) facilitates tooth arrangement and allays patient fears regarding unwanted changes in appearance.

### Trial Insertion Using Final Denture Bases

The trial denture should be inserted on finished denture bases (**Figs. 6** to **8**) to allow problems with fit to be identified *before* final processing and improve occlusal record accuracy.[2] New denture resin technology allows simple construction of dimensionally stable final bases. The trial denture is ready for insertion at the second appointment in the denture construction sequence. Delivery of the finished prosthesis is completed at the third appointment (**Figs. 9** and **10**).

### No Surprises

The steps described above are familiar to most dentists and are independent of material selection. It is the sequencing of these steps that offers communication opportunities and insight. Use of tissue conditioners to restore OVD and define coverage supports an impression technique that simultaneously captures soft tissue detail and jaw relations, saving chair time and allowing existing tooth positions to be referenced to the articulated models. Use of final denture bases at the try-in appointment ensures the same fit at delivery. My experience suggests the above clinical sequence will reduce postinsertion adjustments (19 patients treated for 27 complete denture arches with fewer than 25% requiring postinsertion adjustments to the denture base), will virtually eliminate remakes and improve patient satisfaction. This treatment sequence offers clinicians an opportunity to gracefully dismiss patients with unrealistic expectations and to help other patients understand when an implant-supported prosthesis should be considered. ◆

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*Dr. Ewoldsen's seminar "From Functional Impressions to Finished Dentures: Three Appointments — Zero Surprises" will be presented on Thursday, March 4.*

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## *Question 2*

I understand current research shows that dental decay is an infectious disease. What should I do differently now to treat my patients?

### Background to the Issue

The newest research (some of which is more than 15 years old) strongly supports the theory that dental decay is an infection caused by *Streptococcus mutans*. Children usually acquire the infection from their mother, but they can sometimes acquire it from their father or, more infrequently, from other children at a daycare centre.[1] The higher the maternal *S. mutans* levels in saliva, the greater the risk of transmission. Acquisition of the infection occurs around 1 to 2 years of age. It can be acquired in the predentate period, but the organisms prefer hard surfaces for persistent colonization, and so are more commonly found when teeth are in the mouth.

The modern management of caries continues to be elimination of decay, restoration of affected teeth, and hardening of teeth with fluoride, thereby making them less susceptible to dissolution at any given acid pH. The newest development in topical fluoride is fluoride varnish.[2] Now dentists must go one step further to eliminate *S. mutans* organisms, either by killing them with a disinfectant such as chlorhexidine or iodine, or by altering the oral environment, such that it is not conducive to the growth of the cariogenic bacteria. This is done by introducing xylitol into the oral environment. Xylitol is a natural sugar that does not promote decay and that facilitates the evolution of noncariogenic organisms.[3,4]

Essentially, to incorporate the most recent findings into dental practice, the dentist and patient have to do a little bit more than in the past to cure dental decay and to ensure that it is not passed on to children.[5,6] This is the new concept implied by the terms "managing dental decay as an infectious disease" and "medical management of caries."

### Medical Management of Caries

The basics of caries management still apply to all patients:

**Reduce/eliminate snacking**

- Remind the patient not to constantly sip or eat fermentable carbohydrates like coffee with sugar, raisins and pretzels. All carbohydrates are food for decay-

causing bacteria. The stickier the snack (candy, raisins, dried apricots) and the more frequently it is ingested, the likelier there will be decay.

**Use of toothbrush, floss and mouthrinse**

- Advise the patient to floss and to brush with an over-the-counter fluoride toothpaste and to rinse daily with an over-the-counter nonalcohol mouthrinse containing 0.05% NaF.

Dentists treating high-risk patients should be aware of the newest protocols for caries management:

**Fluoride treatments**

- Prescribe a 5,000 parts per million fluoride toothpaste (e.g., Prevident 5000 Plus, ControlRx).

  Rx Prevident
  Disp 4.2 oz (1 tube)
  Sig Use to brush teeth 2 times per day, especially before going to sleep at night

- In the dental office, apply fluoride varnish (e.g., Cavity Shield, Duraflor) to the teeth twice a year.

**Antimicrobial products**

- Have the patient rinse and brush his or her teeth with iodine for 1 minute once every 2 months (ensure the patient has no allergies to iodine or shellfish).

  Rx Betadine Solution
  Disp 8 oz bottle
  Sig Once every 2 months, rinse and brush with 1 teaspoon of Betadine Solution in mouth and around teeth, then spit out.

or

- Have the patient rinse and brush his or her teeth with chlorhexidine once a day for 2 weeks every 3 months.

  Rx Chlorhexidine 0.12%
  Disp 16 oz.
  Sig Every 3 months, rinse and brush with 1 tablespoon of the chlorhexidine solution in mouth for 1 minute once a day for 2 weeks.

**Xylitol**

- Advise the patient to chew 2 pieces of xylitol gum for 5 minutes 3 to 5 times a day (if the patient chews gum and has no temporomandibular joint problems) or to suck on xylitol candy 3 to 5 times a day. Xylitol must be the first ingredient in the gum or candy to ensure a high enough concentration to be effective.

Selected xylitol sources:

www.epicdental.com, 1-866 920-4200
www.xylitolworks.com, 1-800 601-0688
www.omniipharma.com, 1-800 445-3386
www.xylitolnow.com, 1-619 445-2689
www.bioscienceproducts.com, 1-800 595-1089 ◆

***Dr. Peter L. Jacobsen*** *is a professor in the department of pathology and medicine, University of the Pacific, School of Dentistry, San Francisco, California. E-mail: pjacobse@pacific.edu. He has no declared financial interest in the companies manufacturing the types of products mentioned in this response.*

*Dr. Jacobsen will be presenting 2 seminars at the joint PDC/CDA convention on Friday, March 5, "Modern Dental Pharmacology" and "Over-the-Counter Dental Products."*

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## Question 3

What can be done for dental health care professionals who develop symptoms or reactions that may be due to latex hypersensitivity?

This question is being asked more frequently as people become increasingly concerned about dermatitis problems and issues surrounding latex allergies. The first step is to ascertain whether the problem represents a true hypersensitive reaction to latex. It is important to understand that the most common form of hand dermatitis is actually a nonspecific irritation and not an immunologic response. While routine handwashing is a fundamental application of good aseptic technique, frequent washing of hands by health professionals can lead to dermatitis or other exudative lesions, which may manifest as dry, chapped or abraded epithelium. Incomplete drying of hands before donning gloves or rinsing hands in hot water are the most common causes of irritation dermatitis (**Fig. 1**).

Diagnosis of true immunologic reactions either to components of natural rubber latex (type I, immediate) or to chemicals used in the manufacture of latex products (type IV, delayed) continues to be a serious challenge for health care workers and their patients. In addition to latex gloves used in the health care environment, a number of other devices can contain latex, including blood pressure cuffs, dental dams, elastic bands on masks, adhesive bandages, nitrous oxide nose cones and prophylaxis cups.

Type I hypersensitivity typically develops within minutes after a sensitized person comes into direct contact with allergens or is exposed via aerosolization. Natural rubber latex proteins adhering to glove powder can remain suspended in the air for prolonged periods after gloves are donned or new boxes of gloves are opened. Wheal and flare reactions (i.e., urticaria, hives) may develop along with pruritis and localized edema (**Fig. 2**). Coughing, wheezing, shortness of breath and respiratory distress may occur and can be life-threatening. In contrast, type IV or delayed hypersensitivity reactions typically occur as contact dermatitis. Onset of symptoms may be delayed for several hours, with a 24- to 48-hour interval before the allergic reaction peaks (**Fig. 3**). Healing can take 4 days, with scabbing and sloughing of affected epithelial tissues.

Many of these reactions look alike in the early stages of development. Definitive diagnosis must be made by a qualified physician using specific clinical and laboratory tests, such as the in vitro radioallergosorbent (RAST) test or the in vivo skin-prick test. Should the condition be caused by a type I or type IV hypersensitivity, specific latex avoidance precautions must be followed by the health care worker. These include the use of latex-free products and possible accommodations in the work environment. ◆

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*Dr. Molinari's seminar "Emerging Disease and Challenging Issues in Infection Control" will be presented on Thursday, March 4.*

## Further Reading

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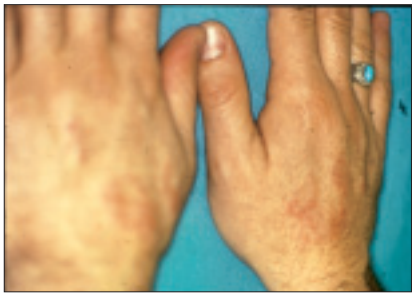

***Figure 1:*** *Cutaneous type I reaction to natural rubber latex in latex examination gloves.*

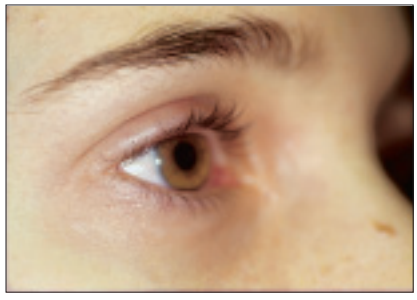

***Figure 2:*** *Anaphylactic conjunctivitis from aerosolized latex protein allergens.*

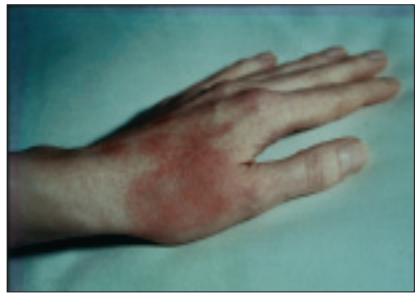

***Figure 3:*** *Contact dermatitis (type IV hypersensitivity) on hand of dental hygienist after challenge with chemical accelerators used in latex glove manufacturing process.*

## Question 4 What are the technical advantages and disadvantages of adopting digital radiography in my office?

Digital radiography is already seen as the up-and-coming technology that will replace film-based imaging technology.

What is the difference between film-based imaging and sensor-based imaging? The answer is a simple one. The x-ray film is being replaced by an electronic sensor based on 1 of 2 main technologies: the CCD (charged coupled device) or the CMOS (complimentary metal oxide semiconductor device). To date, only one company uses the latter (Shick Systems). Image acquisition is identical, with results so similar that it is difficult to distinguish one system from the other. The difference between different companies' systems is their software programming. A third type of system is the wireless storage phosphor system (SP).

At the University of the Pacific all available digital systems were tried, and they all had advantages and disadvantages. The dental school selected a CCD system. The decision was based on cost as well as the proximity of the company servicing the system. The students use only digital imaging for endodontic procedures and for 50% of full-mouth radiographs (7 to 8 sets).

### Advantages of Digital Radiography

The most important advantage is a reduction in the amount of radiation given to patients. Digital radiography requires one-third of the radiation needed with ultra-speed film. The reduction is smaller, however, when comparison is made with high-speed films like Insight F speed film.

A digital sensor (**Fig. 1**) placed with its holding device in the oral cavity allows the practitioner to view the area imaged in a fraction of a minute. If the sensor has been incorrectly placed, a slight position change will allow immediate correction of the image location or quality, saving considerable time in the case of endodontic and surgical procedures.

Film contrast and sharpness cannot be modified, while an image obtained by digital technology can be adjusted for contrast, positive/negative image and colourization, all features that enhance diagnostic abilities.

There is no longer a requirement to purchase and store film-processing chemicals, and maintenance costs for film-processing equipment are eliminated.

The display of digital images on a computer monitor in the operatory makes for a powerful patient education tool.

### Disadvantages of Digital Radiography

The size (especially the thickness) of the sensor is still greater than the size of x-ray film. As a result, the sensor is more rigid than conventional film. Obtaining images of child patients may therefore be difficult, although the SP systems seem to override this problem. With the SP system, the sensor is like a celluloid film which, after exposure, needs to be scanned into the computer. This increases image acquisition time considerably. The average time needed is 2 minutes; other sensors allow instant imaging.

There may be some difficulty with positioning of the sensor, initially at least. Some dentists find that retakes are needed more often than with film.

The sensors are reusable, but cannot be sterilized. Care must therefore be taken to use proper barriers to prevent cross-infection. ◆

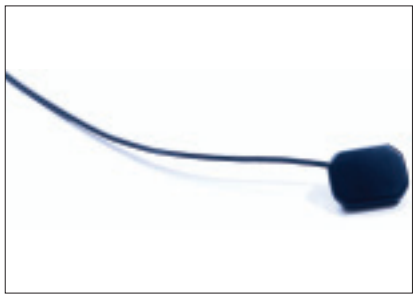

***Figure 1:*** *The sensor for the Dexis digital radiography system measures 1.5 inches × 1.14 inches × 0.3 inches.*

***Dr. Thomas Schiff*** *is professor and chair of the maxillofacial radiology department of the University of the Pacific, School of Dentistry, San Francisco, California. E-mail: TSCHIFF@Pacific.edu. He has no declared financial interest in the companies manufacturing the types of products mentioned in this response.*

*Dr. Schiff's seminar "All You Ever Wanted to Know about Radiography but Were Afraid To Ask!" will be presented on Thursday, March 4.*

### Further Reading

Miles DA. The deal on digital: the status of radiographic imaging. *Compend Contin Educ Dent* 2001; 22(12):1057–62.

Parks ET, Williamson GF. Digital radiography: an overview. *J Contemp Dent Pract* 2002; 3(4):23–39.

Van der Stelt PF. Principles of digital imaging. *Dent Clin North Am* 2000; 44(2):237–48. (This edition of Dental Clinics of North America, titled "Applications of Digital Imaging Modalities for Dentistry," is available to CDA members from the Resource Centre.)

*For more information on the joint PDC/CDA conference, visit www.pacificdentalonline.com.*

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**CDA Fund Performance (for period ending October 31, 2003)**

| | MER | 1 year | 3 years | 5 years | 10 years |
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| **CDA CANADIAN GROWTH FUNDS** | | | | | |
| Aggressive Equity fund (Altamira) | up to 1.00% | 43.9% | 8.4% | 12.0% | n/a |
| Common Stock fund (Altamira) | up to 0.99% | 18.3% | -7.4% | 6.5% | 5.4% |
| Canadian Equity fund (Trimark)†[1] | up to 1.65% | 17.6% | 2.8% | 7.7% | 8.1% |
| Special Equity fund (KBSH)†[2] | up to 1.45% | 28.3% | -17.6% | 7.7% | 13.6% |
| TSX Composite Index fund (BGI) | up to 0.67% | 26.2% | -6.0% | 5.6% | 7.5% |
| **CDA INTERNATIONAL GROWTH FUNDS** | | | | | |
| Emerging Markets fund (KBSH) | up to 1.45% | 39.3% | 2.3% | 11.0% | n/a |
| European fund (KBSH) | up to 1.45% | -4.3% | -21.6% | -6.0% | n/a |
| International Equity fund (KBSH) | up to 1.45% | 7.1% | 18.5% | -1.0% | n/a |
| Pacific Basin fund (KBSH) | up to 1.45% | 13.0% | -25.4% | -2.8% | n/a |
| US Equity fund (KBSH)†[3] | up to 1.20% | -2.7% | -17.8% | 0.5% | 9.4% |
| Global fund (Trimark)†[4] | up to 1.65% | 5.9% | 3.2% | 8.6% | 11.0% |
| Global Stock fund (Templeton)†[5] | up to 1.77% | 7.5% | -6.7% | -0.7% | n/a |
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| Balanced fund (KBSH) | up to 1.00% | 8.6% | -4.5% | 4.4% | 6.6% |
| Balanced Value fund (McLean Budden)†[7] | up to 0.95% | 9.4% | 2.7% | 6.2% | 8.1% |

**CDA 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. The annual MERs (Management Expense Ratios) depend on the value of the assets in the given funds. MERs shown are maximum.**

† *Returns shown are those for the following funds in which CDA funds invest: [1]Trimark Canadian Fund, [2]KBSH Special Equity Fund, [3]KBSH US Equity Fund, [4]Trimark Fund, [5]Templeton Global Stock Trust Fund, [6]McLean Budden Fixed Income Fund, [7]McLean Budden Balanced Value Fund.*

†† *Returns shown are the total returns for the index tracked by this fund.*

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# CDSPI Reports

## WHY GROUP PLANS MATTER

*By Dr. T. C. Larder*

You may have noticed that insurance for your car or home is costlier and/or harder to obtain recently. You're not alone. Some professional organizations and large businesses are encountering similar difficulties at insurance renewal time because insurers are not writing new policies or limiting the types of risks they'll cover on existing policies.

Investment market underperformance, the effects of the September 11 attacks and large claim payouts have combined to create an environment where insurance companies and reinsurers have decided they don't have sufficient equity to sustain current business at past premium levels, much less underwrite new business. Consequently, those "lucky" enough to still have coverage are paying higher premiums — drastically higher in many cases.

In spite of this difficult environment, during its own group insurance renewal discussions, the Canadian Dentists' Insurance Program managed to achieve several significant coverage improvements for its dental participants (effective January 1, 2004) — largely because of the positioning that the Insurance Program has with its insurance providers. Quite simply, there's strength in numbers. Having a group of dentist participants numbered in the ten thousands bolsters the Program's negotiating position when renewal time rolls around.

Improvements for 2004 include greater protection under the Program's Accidental Death and Dismemberment (AD&D) Insurance plan for accidental injuries involving dentists' index fingers and thumbs — which are arguably dentists' most valuable "tools" — and a higher coverage limit, which will double to $1 million. (In contrast, many AD&D plans in the market only cover major limbs.) The Program also managed to preserve the earthquake protection in the TripleGuard™ Insurance plan. While the deductible for earthquake claims is higher than the deductible for other types of claims filed under the TripleGuard™ Insurance plan, the earthquake coverage is still a very attractive feature because it's not available through most other office insurance plans.

*If there is a way for you to save money, we will show you how. Not many other companies can say that and mean it.*

Your group plans provide other valuable advantages that you won't find with private for-profit insurance plans. If claims experience for the life or disability plans is favourable, plan participants benefit through stable or reduced premiums. For example, effective January 2004, Office Overhead Expense Insurance plan participants will receive a 10% reduction in premiums due to favourable claims experience.

When the group plans are sufficiently profitable, the Program distributes the surplus to individual participants or uses it to reduce or stabilize premiums. Either way, it's money in your pocket, rather than in an insurance company's. Since 1993, participants in the Basic Life, Long Term Disability and Office Overhead Expense Insurance plans have all received at least one surplus distribution — including a distribution in 2002. That year, about 6,600 individuals who participated in the Basic Life Insurance plan in 2001 received cheques from the Canadian Dental Association, representing their share of a $4-million surplus distribution. You *won't* see private for-profit insurance plans making these types of distributions.

For your investing needs, there are also significant advantages to choosing group plans, such as the Canadian Dentists' Investment Program's CDA RSP, CDA RIF, CDA RESP and CDA Investment Account. You and your family gain exclusive access to brand name funds (including funds from Trimark, Altamira, Franklin Templeton and McLean Budden) at a lower cost than is available to the average investor who is not a group plan member. Choosing the Program's investment plans allows you to keep more of your investment returns since you don't pay loads or commissions, and fund management fees are extremely low.

Whether it's for insurance or investing, having advisors you trust is important. CDSPI (administrator of the Insurance and Investment Programs) and Professional Guide Line Inc. (CDSPI's wholly owned licensed insurance advisory affiliate) employ a team of insurance and investment professionals dedicated to serving the needs of Canadian dentists. The licensed advisors at Professional Guide Line have years of experience working with dental professionals, so you can be confident that you'll always receive expert advice appropriate for your specific situation. These advisors don't work on commission and they never try to sell you products you don't need. In fact, if

there is a way for you to save money, they'll show you how. Not many other companies can say that and mean it.

From products tailored specifically for your personal or professional needs to the convenience of accessing them all in one place and not being pressured into unwanted sales, your group plans have much to offer. Your continued participation in the dental profession's group plans will make our bargaining position even stronger, as we endeavour to source products and services providing tremendous value for you.

*Dr. T. C. Larder is chair of CDSPI's Board of Directors. To learn more about the Canadian Dentists' Insurance and Investment Programs, contact CDSPI at 1-800-561-9401 or (416) 296-9401, extension 5000 (insurance) or extension 5020 (investment).*

CDSPI *Information provided by Canadian Dental Service Plans Inc.*

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## THERAPEUTIC CLASSIFICATION

**Antiemetic**
**(5-$HT_3$ receptor antagonist)**

## INDICATIONS AND CLINICAL USE:

ZOFRAN® (ondansetron hydrochloride; and ondansetron) is indicated for the prevention of nausea and vomiting associated with emetogenic chemotherapy, including high dose cisplatin, and radiotherapy.
ZOFRAN® is also indicated for the prevention and treatment of post-operative nausea and vomiting.

## CONTRAINDICATIONS:

ZOFRAN® (ondansetron hydrochloride; and ondansetron) is contraindicated in patients with a history of hypersensitivity to the drug or any components of its formulations

## WARNINGS:

Cross-reactive hypersensitivity has been reported between different 5-$HT_3$ antagonists. Patients who have experienced hypersensitivity reactions to one 5-$HT_3$ antagonist have experienced more severe reactions upon being challenged with another drug of the same class. The use of a different 5-$HT_3$ receptor antagonist is not recommended as a replacement in cases in which a patient has experienced even a mild hypersensitivity type reaction to another 5-$HT_3$ antagonist. ZOFRAN® ODT (ondansetron) contains aspartame and therefore should be taken with caution in patients with phenylketonuria.

## PRECAUTIONS:

ZOFRAN® (ondansetron hydrochloride; and ondansetron) is not effective in preventing motion-induced nausea and vomiting. There is no experience in patients who are clinically jaundiced. The clearance of an 8 mg intravenous dose of ZOFRAN® was significantly reduced and the serum half-life significantly prolonged in subjects with severe impairment of hepatic function. In patients with moderate to severe hepatic function, reductions in dosage are therefore recommended and a total daily dose of 8 mg should not be exceeded. This may be given as a single intravenous or oral dose.
As ondansetron is known to increase large bowel transit time, patients with signs of subacute intestinal obstruction should be monitored following administration.

Ondansetron does not itself appear to induce or inhibit the cytochrome P450 drug-metabolizing enzyme system of the liver. Because ondansetron is metabolized by hepatic cytochrome P450 drug metabolizing enzymes, inducers or inhibitors of these enzymes may change the clearance and, hence, the half-life of ondansetron. on the basis of available data, no dosage adjustment is recommended for patients on these drugs.

**Use in Pregnancy:**

The safety of ondansetron for use in human pregnancy has not been established. Ondansetron is not teratogenic in animals. However, as animal studies are not always predictive of human response, the use of ondansetron in pregnancy is not recommended.

**Nursing Mothers:**

Ondansetron is excreted in the milk of lactating rats. It is not known if it is excreted in human milk, however, nursing is not recommended during treatment with ondansetron.

**Use in Paediatrics:**

Insufficient information is available to provide dosage recommendations for children 3 years of age or younger.

**Interactions**

Specific studies have shown that there are no pharmacokinetic interactions when ondansetron is administered with alcohol, temazepam, frusemide, tramadol or propofol.

Ondansetron is metabolised by multiple hepatic cytochrome P-450 enzymes: CYP3A4, CYP2D6 and CYP1A2. Due to the multiplicity of metabolic enzymes capable of metabolising ondansetron, enzyme inhibition or reduced activity of one enzyme (e.g. CYP2D6 genetic deficiency) is normally compensated by other enzymes and should result in little or no significant change in overall ondansetron clearance or dose requirement. In patients treated with potent inducers of CYP3A4 (i.e. phenytoin, carbamazepine, and rifampicin), the oral clearance of ondansetron was increased and ondansetron blood concentrations were decreased.

Data from small studies indicate that ondansetron may reduce the analgesic effect of tramadol.

## ADVERSE REACTIONS:

ZOFRAN® has been administered to over 2500 patients worldwide in controlled clinical trials and has been well tolerated. The most frequent adverse events reported in controlled clinical trials were headache (11%) and constipation (4%). Other adverse events include sensations of flushing or warmth (<1%).

**Metabolic:**

There were transient increases of SGOT and SGPT of over twice the upper limit of normal in approximately 5% of patients. These increases did not appear to be related to dose or duration of therapy. There have been reports of liver failure and death in patients with cancer receiving concurrentmedications including potentially hepatotoxic cytotoxic chemotherapy and antibiotics. The etiology of the liver failure is unclear. There have been rare reports of hypokalemia.

**Central Nervous System:**

There have been rare reports of seizures.

**Hypersensitivity:**

Rare cases of immediate hypersensitivity reactions sometimes severe, including anaphylaxis, bronchospasm, urticaria and angioedema have been reported.

**Cardiovascular:**

There have been rare reports of tachycardia, angina (chest pain), bradycardia, hypotension, syncope and electrocardiographic alterations.

**Dermatological:**

Rash has occurred in approximately 1% of patients receiving ondansetron.

**Special Senses:**

Rare cases of transient visual disturbances (e.g. blurred vision) have been reported during or shortly after intravenous administration of ondansetron, particularly at rates equal to or greater than 30 mg in 15 minutes.

**Local Reactions:**

Pain, redness and burning at the site of injection have been reported.

**Other:**

There have been reports of abdominal pain, weakness and xerostomia.

**Post-Market Experience:**

Over 128 million patient treatment days of ZOFRAN® have been supplied since the launch of the product worldwide. The following events have been spontaneously reported during post-approval use of ZOFRAN®, although the link to ondansetron cannot always be clearly established.

Transient episodes of dizziness (<0.01%) have been reported during or upon completion of iv infusion of ondansetron. Rare reports (<0.01%) suggestive of extrapyramidal reactions such as oculogyric crisis/dystonic reactions (e.g. orofacial dyskinesia, opisthotonos, tremor, etc.) have been reported without definitive evidence of persistent clinical sequelae.

There have been rare reports (<0.01%) of myocardial infarction, myocardial ischemia, angina, chest pain with or without ST segment depression, arrythmias (including ventricular, supraventricular tachycardia, premature ventricular contractions, and atrial fibrillation), electrocardiographicalterations (including second degree heart block), palpitations and syncope. There have also been rare reports of hiccups.

Occasional asymptomatic increases in liver function tests have been reported.

Rare cases of hypersensitivity reactions, such as, laryngeal edema, stridor, laryngospasm and cardiopulmonary arrest have also been reported.

## SYMPTOMS AND TREATMENT OF OVERDOSAGE:

At present there is little information concerning overdosage with ondansetron. Individual doses of 84 mg and 145 mg and total daily doses as large as 252 mg have been administered with only mild side effects. There is no specific antidote for ondansetron, therefore, in cases of suspected overdosage, symptomatic and supportive therapy should be given as appropriate.
The use of Ipecac to treat overdosage with ondansetron is not recommended as patients are unlikely to respond due to the antiemetic action of ondansetron itself.
"Sudden blindness" (amaurosis) of 2 to 3 minutes duration plus severe constipation occurred in one patient who was administered 72 mg of ondansetron intravenously as a single dose. Hypotension (and faintness) occurred in another patient who took 48 mg of oral ondansetron. Following infusion of 32 mg over only a 4-minute period, a vasovagal episode with transient second degree heart block was observed. In all instances, the events resolved completely.

## DOSAGE AND ADMINISTRATION
## CHEMOTHERAPY INDUCED NAUSEA AND VOMITING:

ZOFRAN® (ondansetron hydrochloride; and ondansetron) should be given as an initial dose prior to chemotherapy, followed by a dosage regimen tailored to the anticipated severity of emetic response caused by different cancer treatments. The route of administration and dose of ZOFRAN® should be flexible in the range of 8-32 mg a day. The selection of dose regimen should be determined by the severity of the emetogenic challenge as shown below.

**Use in Adults:**

***HIGHLY EMETOGENIC CHEMOTHERAPY* (e.g. regimens containing cisplatin):**

ZOFRAN® has been shown to be effective in the following dose schedules for the prevention of emesis during the first 24 hours following chemotherapy:

**Initial Dose:** ZOFRAN® 8 mg infused intravenously over 15 minutes given 30 minutes prior to chemotherapy. OR ZOFRAN® 8 mg infused intravenously over 15 minutes, given 30 minutes prior to chemotherapy, followed by 1 mg/h by continuous infusion for up to 24 hours. OR ZOFRAN® 32 mg diluted in 50-100 mL of saline or other compatible infusion fluid and infused over not less than 15 minutes[i], given 30 minutes prior to chemotherapy.

**Post-chemotherapy:** After the first 24 hours, ZOFRAN® 8 mg orally every 8 hours[ii] for up to 5 days. No significant differences in terms of emesis control or grade of nausea have been demonstrated between the 32 mg single dose, the 8 mg single dose, or the 8 mg dose followed by the 24 hour 1 mg/h continuous infusion. However, in some studies conducted in patients receiving medium or high doses of cisplatin chemotherapy, the 32 mg single dose has demonstrated a statistically significant superiority over the 8 mg single dose with regard to control of emesis.
The efficacy of ZOFRAN® in highly emetogenic chemotherapy may be enhanced by the addition of a single intravenous dose of dexamethasone sodium phosphate, 20 mg administered prior to chemotherapy.

***LESS EMETOGENIC CHEMOTHERAPY* (e.g. regimens containing cyclophosphamide, doxorubicin, epirubicin, fluorouracil and carboplatin)**

**Initial Dose:**

ZOFRAN® 8 mg infused intravenously over 15 minutes, given 30 minutes prior to chemotherapy; or ZOFRAN® 8 mg orally 1 to 2 hours prior to chemotherapy.

**Post-chemotherapy:**

ZOFRAN® 8 mg orally twice daily for up to 5 days.

**Use in Children:**
Clinical experience of ZOFRAN® in children is currently limited; however, ZOFRAN® was effective and well tolerated when given to children 4-12 years of age. ZOFRAN® injection should be given intravenously at a dose of 3-5 mg/m$^2$ over 15 minutes immediately before chemotherapy. After therapy, ZOFRAN® 4 mg should be given orally every 8 hours[ii] for up to 5 days.

**Use in Elderly:**
Efficacy and tolerance in patients aged over 65 years were similar to that seen in younger adults indicating no need to alter dosage schedules in this population.

## RADIOTHERAPY INDUCED NAUSEA AND VOMITING:

**Use in Adults:**

**Initial Dose:**
ZOFRAN® 8 mg orally 1 to 2 hours before radiotherapy.

**Post-radiotherapy:**
ZOFRAN® 8 mg orally every 8 hours[ii] for up to 5 days after a course of treatment.

**Use in Children:**
There is no experience in clinical studies in this population.

**Use in Elderly:**
Efficacy and tolerance in patients aged over 65 years were similar to that seen in younger adultsindicating no need to alter dosage schedules in this population.

## POST-OPERATIVE NAUSEA AND VOMITING:

**Use in Adults:**
For prevention of post-operative nausea and vomiting ZOFRAN® may be administered as a single dose of 16 mg given orally one hour prior to anaesthesia. Alternatively, a single dose of 4 mg may be given by slow intravenous injection at induction of anaesthesia. For the treatment of established post-operative nausea and vomiting, a single dose of 4 mg given by slow intravenous injection is recommended.

**Use in Children:**
There is no experience in the use of ZOFRAN® in the prevention and treatment of post-operative nausea and vomiting in children.

**Use in Elderly:**
There is limited experience in the use of ZOFRAN® in the prevention and treatment of post-operative nausea and vomiting in the elderly.

## PATIENTS WITH RENAL/HEPATIC IMPAIRMENT:

**Use in Patients with Impaired Renal Function:**
No alteration of daily dosage, frequency of dosing, or route of administration is required.

**Use in Patients with Impaired Hepatic Function:**
The clearance of an 8 mg intravenous dose of ZOFRAN® was significantly reduced and the serum half-life significantly prolonged in subjects with severe impairment of hepatic function. In patients withmoderate to severe hepatic function, reductions in dosage are therefore recommended and a total daily dose of 8 mg should not be exceeded. This may be given as a single intravenous or oral dose. No studies have been conducted to date in patients with jaundice.

## PATIENTS WITH POOR SPARTEINE/DEBRISOQUINE METABOLISM:

The elimination half-life and plasma levels of a single 8 mg intravenous dose of ondansetron did not differ between subjects classified as poor and extensive metabolisers of sparteine and debrisoquine. No alteration of daily dosage or frequency of dosing is recommended for patients known to be poor metabolisers of sparteine and debrisoquine.

## ADMINISTRATION OF INTRAVENOUS INFUSION SOLUTIONS:

***Compatibility with Intravenous Solutions:*** ZOFRAN® Injection is compatible with the following solutions:

For Ampoules
0.9% w/v Sodium Chloride Injection;
5% w/v Dextrose Injection;
10% w/v Mannitol Injection;
Ringers Injection;
0.3% w/v Potassium Chloride and 0.9% w/v Sodium Chloride Injection;
0.3% w/v Potassium Chloride and 5% w/v Dextrose Injection.

For Vials
5% w/v Dextrose Injection;
0.9% w/v Sodium Chloride Injection;
5% w/v Dextrose and 0.9% w/v Sodium Chloride Injection;
5% w/v Dextrose and 0.45% w/v Sodium Chloride Injection;
3% w/v Sodium Chloride Injection.

***Compatibility with Other Drugs:***
ZOFRAN® Injection should not be administered in the same syringe or infusion with any other medication with the exception of dexamethasone (see below). ZOFRAN® may be administered by intravenous infusion at 1 mg/hour, e.g. from an infusion bag or syringe pump.
The following drugs may be administered via the Y-site of the administration set, for ondansetron concentrations of 16 to 160 µg/mL. If the concentrations of cytotoxic drugs required are higher than indicated below, they should be administered through a separate intravenous line.

For Ampoules and Vials:

**Cisplatin** — concentrations up to 0.48 mg/mL administered over 1 to 8 hours.

**Dexamethasone** — admixtures containing 8 mg of ondansetron and 20 mg of dexamethasone phosphate, in 50 mL of 5% dextrose infusion fluid stored in 50 mL polyvinyl chloride infusion bags, have been shown to be physically and chemically stable for up to two days at room temperature or up to seven days at 2° C–8° C. In addition, these same admixtures have demonstrated compatibility with Continu-Flo® administration sets.
In a clinical study (Cunningham *et al*, 1989) ondansetron (standard dosing regimen) was given to patients receiving cisplatin or non-cisplatin chemotherapy. Eight patients who continued to experience nausea and vomiting were given dexamethasone in addition to ondansetron. In every case there was an improvement in the control of emesis and all patients preferred the combination of ondansetron and dexamethasone.

For Ampoules:

**5-Fluorouracil** — concentrations up to 0.8 mg/mL, administered at rates of at least 20 mL/hour. Higher concentrations of 5-fluorouracil may cause precipitation of ondansetron. The 5-fluorouracil infusion may contain up to 0.045% w/v magnesium chloride.

**Carboplatin** — concentrations of 0.18 mg/mL–9.9 mg/mL, administered over 10–60 minutes.

**Ceftazidime** — bolus i.v. doses, over approximately 5 minutes, of 250–2000 mg reconstituted with Water for Injections BP.

**Cyclophosphamide** — bolus i.v. doses over approximately 5 minutes, of 100–1000 mg, reconstituted with Water for Injections BP 5 mL per 100 mg cyclophosphamide.

**Doxorubicin and Epirubicin** — bolus i.v. doses, over approximately 5 minutes, of 10–100 mg as a 2 mg/mL solution. Lyophilized powder presentations can be reconstituted with 0.9% Sodium Chloride Injection USP.

**Etoposide** — concentrations of 0.144 mg/mL–0.25 mg/mL, administered over 30–60 minutes.

## STABILITY AND STORAGE RECOMMENDATIONS:

ZOFRAN® Tablets, Oral Solution, Injection and ODT orally disintegrating tablets should be stored below 30°C.
ZOFRAN® Oral Solution should be stored upright and should not be refrigerated.
ZOFRAN® Injection should not be frozen and should be protected from light.
ZOFRAN® Injection must not be autoclaved.

**Stability and Storage of Diluted Solutions:**
Compatibility studies have been undertaken in polyvinyl chloride infusion bags, polyvinyl chloride administration sets and polypropylene syringes. Dilutions of ondansetron in sodium chloride 0.9% w/v or in glucose 5% w/v have been demonstrated to be stable in polypropylene syringes. It is considered that ondansetron injection diluted with other compatible infusion fluids would be stable in polypropylene syringes.
Intravenous solutions should be prepared at the time of infusion. ZOFRAN® Injection, in ampoules and vials, when diluted with the recommended intravenous solutions, should be used within 24 hours if stored at room temperature or used within 72 hours if stored in a refrigerator, due to possible microbial contamination during preparation.
Hospitals and institutions that have recognized admixture programs and use validated aseptic techniques for preparation of intravenous solutions, may extend the storage time for ZOFRAN® Injection in admixture with 5% Dextrose Injection and dexamethasone phosphate Injection (concentration of 0.34 mg/mL) in Viaflex bags, at a concentration of 0.14 mg/mL, to 7 days when stored under refrigeration at 2° to 8°C.[iii]

## DOSAGE FORMS:

**AVAILABILITY**

ZOFRAN® Tablets 8 mg:
Oval shaped, yellow, film-coated tablets, engraved '8' on one face and 'GLAXO' on the other. Each tablet contains 8 mg ondansetron (as hydrochloride dihydrate). Available in a tamper-evident polypropylene container of 100 tablets and a unit dosed blister pack of 10 tablets.

ZOFRAN® Tablets 4 mg:
Oval shaped, yellow, film-coated tablets, engraved '4' on one face and 'GLAXO' on the other. Each tablet contains 4 mg ondansetron (as hydrochloride dihydrate). Available in a tamper-evident polypropylene container of 100 tablets and a unit dosed blister pack of 10 tablets.

ZOFRAN® Oral Solution:
Ondansetron 4 mg/5 mL (as hydrochloride dihydrate) is supplied in 50 mL bottles.

ZOFRAN® ODT 4 mg and 8 mg orally disintegrating tablets:
White, round, plano-convex orally disintegrating tablets with no markings on either side, packaged in double-foil blister packs with a peelable, aluminum foil laminate lidding, in paperboard carton with 2 x 5 orally disintegrating tablets per blister. Each 4 mg tablet contains 4 mg ondansetron (base) and each 8 mg tablet contains 8 mg ondansetron (base).

ZOFRAN® Injection:
Ondansetron 2 mg/mL (as hydrochloride dihydrate) for intravenous use is supplied in 2 mL (4 mg) and 4 mL (8 mg) ampoules, in boxes of 5 ampoules and 20 mL (40 mg) vials, packed in individual cartons.
Ondansetron hydrochloride is a SCHEDULE "F" drug.

Full prescribing information available to healthcare professionals upon request.

Revised September 16, 2003.

i Infusion of 32 mg ZOFRAN® for injection should take place over a period of not less than 15 minutes, because of increased risk of blurred vision.

ii The efficacy of twice daily dosage regimens for the treatment of post-chemotherapy emesis has been established only in adult patients receiving less emetogenic chemotherapy. The appropriateness of twice versus three times daily dosage regimens for other patient groups should be based on an assessment of the needs and responsiveness of the individual patient.

iii As with all parenteral drug products, intravenous admixtures should be inspected visually for clarity, particulate matter, precipitate, discoloration and leakage prior to administration, whenever solution and container permit. Solutions showing haziness, particulate matter, precipitate, or discoloration or leakage should not be used.

## REFERENCES:

1. Marcario A, Weinger W et al. Which Clinical Anesthesia Outcomes Are Important to Avoid? The Perspective of Patients. Anesth Analg. 1999;89:652-658. 2. Hill RP, Lubarsky DA et al. Cost-effectiveness of Prophylactic Antiemetic therapy with Ondansetron, Droperidol, or Placebo. Anesthesiology 2000; 92:958-67. 3. Morris RW, Aune H, Feiss P et al. International, multicentre, placebo-controlled study to evaluate the effectiveness of ondansetron vs. metoclopramide in the prevention of post-operative nausea and vomiting. Eur J Anaes 1998;15:69-79. 4. Fortney JT, Gan TJ, Graczyk S et al. A comparison of the efficacy, safety, and patient satisfaction of ondansetron versus droperidol as antiemetics for elective outpatient surgical procedures. Anesth Analg 1998;86:731-8 5. Zofran® Product monograph GlaxoSmithKline Inc., September 16, 2003. 6. Kovac AL, Prevention and treatment of postoperative nausea and vomiting. Drugs 2000; 59(2):213-243.

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PAAB
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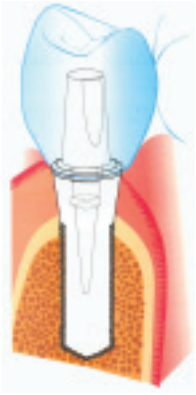
# New Products

*JCDA's New Products section provides readers with brief descriptions of recent innovations in dentistry. Publication of this information does not imply endorsement by* JCDA *or the Canadian Dental Association. If you would like material to appear in* JCDA*'s New Products listing, send all news releases and photographs to Rachel Galipeau, coordinator, publications, at rgalipeau@cda-adc.ca. English- and French-language material will be given priority.*



Tenax Implant Inc. introduces a **wide diameter implant** in 7 mm, 9 mm, 12 mm and 15 mm intraosseous lengths. The WD intraosseous diameter is 4.75 mm and the platform is 5.75 mm. Like its standard diameter implant, the WD implant can be restored without using any prosthetic components by treating the implant like a tooth to be restored with a post and core. The WD internal geometry remains the same, allowing the use of existing abutments, transfer copings and burnout patterns for clinicians who prefer to use these components. The addition of a wide diameter implant body increases the system's versatility.

• **Tenax Implant Inc., 888-265-1010, www.tenaximplant.com** •


**Gloves In A Bottle** is a lotion that bonds with the outer layer of skin to turn it into what works like an invisible pair of gloves to keep the moisture-robbing irritants out while retaining the skin's own natural moisture. It also helps protect against reactions to latex, latex powders and other irritating substances found in disposable gloves. Frequent washings with hot water and antibacterial soap, then putting on disposable gloves can leave the hands irritated and dry. Gloves In A Bottle is virtually undetectable once dry, lasts four hours or more, and comes off naturally with exfoliated skin cells.

• **Gloves In A Bottle, 800-600-1881, www.glovesinabottle.com** •

Crosstex International has introduced the **Isofluid Plus**, a lightweight, durable, highly breathable mask. This latest addition to the Isofluid line features a white cellulose inner layer whose natural fibres are extra soft and especially good for sensitive skin. This material is extremely strong and will not lint, tear or shred. It also provides excellent wet strength, while the highly breathable nature of the material makes this an exceptionally comfortable mask to wear, particularly during long procedures. The Isofluid Plus mask has a PFE of 99% at 1.0 microns. Isofluid Plus masks are latex-free.

• **Crosstex, 888-Crosstex, www.crosstex.com** •

Pulpdent introduces **Embrace WetBond Seal-n-Shine**, a moist-bonding resin specifically designed for sealing, finishing and polishing composite restorations. Formulated with advanced, hydrophilic resin acid-integrating network, it bonds chemically and mechanically to teeth and composites, providing strong bonds. Seal-n-Shine is a clear resin that penetrates and seals porosities and cracks within composites and seals margins. It provides a smooth, durable finish that eliminates the need for final finishing and polishing. Seal-n-Shine can be cured using any curing light.

• **Pulpdent, 800-343-4342, www.pulpdent.com** •

# Classified Ads

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## Offices & Practices

**ALBERTA - Edmonton:** "Retiring fangsnatcher" selling a very successful general practice in downtown Edmonton. Five operatories, 1,800 active patients. Bright open plan with a view of the city skyline. Dentist willing to mentor as an associate. Please contact: Dr. Jim Demas, tel. (780) 425-9847 (days) or (780) 435-8320 (evgs. or weekends). D1436

**ALBERTA - Southeastern:** Busy, modern 5-operatory practice for sale. Recently renovated, new equipment. Only practice in town of 1,100 with drawing area of 4,000. Grossing $400,000 based on 3-day work week with 1,200 active charts. Opportunity to invest in real estate. Owner will assist in transition. $325,000. For details, call Vicki, (403) 664-0134. D1419

**ALBERTA - Edmonton:** For sale: fully fixtured orthodontic clinic that has been recently renovated. This superb facility can be obtained complete with all equipment, fixtures, computers, etc., as desired. Full digital integration, Sirona Orthophos 3, state-of-the-art computer system, new compressor, suction unit, etc. This facility has 6 treatment chairs, 1 examination room, 1 records room. Situated on the 15th floor, great panoramic views. Building also has 3 oral surgeons, 1 periodontist and 2 pediatric dentists who all have busy practices. Present owner is relocating. Available April 2004. Call Terry Carlyle at (780) 435-3641 or e-mail us at braces@str8teeth.com or visit our Web site www.str8teeth.com. We will be glad to e-mail photos of the facility to you. D1426

**ALBERTA - Edmonton:** Practice for sale. Owner retiring. Centre of city on Light Rail Train (LRT) stop. Three operatories, newer equipment (Adec and Den-Tal-Ez), Pan, 962 sq. ft. Educated patients. Tel. (780) 422-1731 (days), (780) 482-2869 (evgs.), fax (780) 426-2910, e-mail dwlloyd@shaw.ca D1427

**ALBERTA - Rural:** West-Central solo practice for sale. Progressive clinic features newer equipment, computerized operatories, intraoral cameras, etc. Busy, family patient base in an area that services industry and recreation. Owner willing to assist with transition. Please leave message at (780) 405-7032. D1430

**ALBERTA - Calgary:** Exceptional dental practice for sale. Primarily non-assignment. Producing $940,000 with low overhead on 178 days a year. Located in Northwest Calgary in newly renovated shopping area. Outstanding team in place. Please leave message for Michelle, tel. (403) 270-2684. D1377

**BRITISH COLUMBIA - Burnaby/ Vancouver area:** Partnership opportunity in a 5-operatory office with new equipment and set-up. Practice is established and still expanding rapidly. $350,000 for 1/3 partnership. Guaranteed income potential. Interested parties please call Christine at (604) 562-3888 or e-mail jadohan@hotmail.com D1446

**BRITISH COLUMBIA - Burnaby:** $90,000. Four operatories fully set up and ready to go. No patients. Office is newly upgraded. Lots of potential. A real bargain. Strategic location to attract clients from office buildings, residents and students in the area. For more information e-mail jadohan@hotmail.com D1447

**BRITISH COLUMBIA - Kitimat:** Well-established general practice for sale. Hygienist-supported recall and perio program, in a great town with a solid long-term industrial base. All kinds of outdoor and indoor recreation available minutes from your doorstep. No traffic jams and good income on 4-day week. Owner relocating for family reasons. Tel. (604) 576-1176 for more information. D1423

**BRITISH COLUMBIA - Vancouver:** Successful, modern storefront practice for sale on desirable West Broadway. Lots of new patient flow. $550,000 gross in 160 days worked last year. Optional cost-sharing arrangement with second dentist available; contributed additional $48,000 last year. Unique opportunity. Seller motivated due to back problems. Andrew, tel. (604) 244-9885 or e-mail andypa@istar.ca D1424

**BRITISH COLUMBIA - Courtenay (Vancouver Island):** Practice for sale. I want to transition out completely or partially - someone to carry on what I've built up - wonderful patients and wonderful staff. Building and equipment 10 years old, 6 operatories, 2,200 sq. ft., 1,600 active charts, mid $500,000 on 185 days, 6 hours/day. Area has all forms of recreation available - a great place to live! One-quarter ownership in 9,000 sq. ft. building also available. I am flexible. Tel. (250) 338-6080 (private line). D1330

**BRITISH COLUMBIA - Kelowna:** Busy high-grossing practice looking for new partner. Well-established staff, systems and patients. Current partner going back to graduate school. Associate/partner transition available. For more information e-mail kelownadentist @shaw.ca D1390

**BRITISH COLUMBIA - Vancouver Island:** Successful practice for sale, beautiful Vancouver Island. Gross $700,000 working 3 days/week, 3 months holiday. 3,000 charts. High proportion of patients insured. Booked 2 months in advance. Lots of potential to work more days and make more money. Owner going to graduate school. E-mail islanddental@shaw.ca D1355

**MANITOBA - Winnipeg:** Established general practice for sale. Professionally appraised. Cost-sharing set-up in mall location with great exposure, parking and new patient flow; 4-day work week with above-average billings. Owner returning to academics/graduate studies. Interested parties e-mail drewbrueckner@shaw.ca or leave message at (204) 477-4753. D1425

**ONTARIO - Ottawa East:** Space available for general dentist or specialist. Approximately 1,200 sq. ft. including four operatories ready to receive equipment. Occupied by dentist for over 30 years. Building features elevator, handicap access, has easy access by car or bus and provides parking spaces for patients and tenants. For more information contact: Val-Roca Management, tel. (613) 744-1199. D1438

**ONTARIO - Toronto:** Office space. Rosedale Medical Centre (Bloor St. at Sherbourne subway). Suitable for general or specialist practice. Ensuite washroom including shower. Two underground parking spaces included. Call (416) 221-3308. D1431

**ONTARIO - Ottawa South:** Well-established, 4-operatory general practice set in ideally located house. Suitable for 1-2 dentists. Owner will stay for transition. Above-average gross. Excellent growth potential. If interested please call (613) 859-1876. D1313

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# GENERAL DENTIST

**Grenfell Regional Health Services**
**St. Anthony, Newfoundland**

Grenfell Regional Health Services invites applications for the position of permanent General Dentist on a full-time basis to provide services from a base location at the Labrador South Health Centre in Forteau, Labrador. As one third of the dentist's clinical time will be spent at other community clinics on the south-east Labrador coast, a commitment to providing traveling dental services at remote, but road-accessible communities is a defined requirement of this position.

Salary for this position is on an 11 point Government scale of $75,433 - $94,916 from January 1, 2004. Initial placement on this scale will be dependent on years of experience. An isolation bonus payment ranging from $5,000 - $10,000 will be payable upon the completion of 1 full year of service. Currently, a retention incentive of $10,000 annually, payable bi-weekly, is also in effect.

Fringe benefits include 6 weeks paid leave in a 12-month term. Assistance with relocation and continuing education costs are available. Accommodations are available at a reasonable rate.

Applicants must be eligible for registration with the Newfoundland Dental Board. Preference will be given to applicants who are agreeable to working for a minimum 24-month term. Experience in oral surgery is desirable. Experience in general dentistry is essential. A valid driving licence is obligatory.

Interested individuals are requested to submit resumes, along with names and addresses of referees, stating competition number, 03.84, to:

**Selma Strangemore**
**Human Resource Specialist**
**Grenfell Regional Health Services**
**St. Anthony, NL, Canada A0K 4S0**
**Tel. (709) 454-0347 • Fax (709) 454-3301**
**E-mail humanresources@grhs.nf.ca**

D1434

# PROSTHODONTICS

**McGill University**

The Faculty of Dentistry, McGill University, invites applications for a position in Prosthodontics at the level of Assistant or Associate Professor. Candidates must have completed an undergraduate degree in dentistry and a M.Sc., Ph.D. or equivalent degrees. A working knowledge of French would be advantageous. Responsibilities will include undergraduate and graduate teaching and administration. The successful candidate will be expected to obtain funding and to carry out research in a relevant field. Rank and salary will be commensurate with education and experience. Intramural private practice facilities are available.

Applications, including a curriculum vitae, a statement of research and teaching interests, and the names, postal and e-mail addresses of three referees, should be sent to the following address by December 20, 2003.

**Dr. Marie Dagenais**
**Chair, Search Committee**
**Faculty of Dentistry, McGill University**
**1650 Cedar Avenue, Room B3.112.12**
**Montreal, QC H3G 1A4**
**E-mail marie.dagenais@muhc.mcgill.ca**
**Fax (514) 934-8352**

*McGill University is committed to equity in employment*
*All qualified candidates are encouraged to apply;*
*however, Canadians and permanent residents will be given priority.*

D1442

# ORTHODONTICS

## Faculty of Dentistry
## University of Toronto

The Faculty of Dentistry, University of Toronto, invites applicants for a full-time tenure-stream position in Orthodontics within the multidisciplinary Department of Clinical Sciences. The primary responsibilities of the person selected will be to develop an independent and innovative research program and to engage in undergraduate and graduate teaching programs of the Faculty. Applicants must comply with the following requirements: (i) have an advanced research degree, preferably a Ph.D. (or equivalent), and evidence of high-quality research accomplishments as a principal investigator in an area related to Orthodontics; (ii) have teaching experience and clinical expertise in Orthodontics; and (iii) have graduated from an official graduate program in Orthodontics, preferably CDA or ADA accredited. Eligibility for Fellowship in Orthodontics in the Royal College of Dentists of Canada is preferred.

Rank, tenure status, and salary would be commensurate with the candidate's qualifications and academic accomplishments. Extramural private practice privileges are permitted 1 day per week.

Applicants should arrange for three reference letters, as well as a detailed curriculum vitae, to be received by **March 31, 2004** at the following address:

**Professor Daniel Haas, Associate Dean**
**Department of Clinical Sciences**
**Faculty of Dentistry**
**University of Toronto**
**124 Edward Street, Toronto, Ontario M5G 1G6.**

For additional information regarding the position please contact **Dr. D. Haas, tel. (416) 979-4922, ext. 4577, e-mail daniel.haas@utoronto.ca**

The University of Toronto is strongly committed to diversity within its community. We especially welcome applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to further diversification of ideas. All candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

D1441

**NEW HAMPSHIRE, US - Grafton County:** Practice for sale. $1 million gross, mercury-free practice near Dartmouth college. Established 1966, new office (6 years old). Six operatories, 2,200 sq. ft., state-of-the-art equipment, including Cerec CAD/CAM unit. Open 30 hours, 4 days, no evenings or weekends. Owner willing to stay through transition period. Call The Snyder Group, (800) 988-5674 or respond through our Web site www.snydergroup.net D1376

**MAINE, US:** Western Maine mountains. Successful, solo dentist practice for sale. Low-volume, fee-for-service, restorative focus. Beautiful new facility - real estate opportunity. Ski, golf, fish in a small college town. Maine is looking for Canadian DDS; receptive to your relocation. Practice for US$215,000. Tel. (207) 778-0653. D1439

**EXOTIC OFFSHORE:** Exceptional, absolutely beautiful office, island paradise, wonderful staff, any U.S./Canadian licence, price $751,000, low tax rate, $464,000 net. E-mail laura@milliondollardentalpractices.com, #osmp2021. D1437

## Positions Available

**ALBERTA - Calgary (Southeast):** Dentist required 30-35 hours/week at busy family dental office. Excellent new patient flow. No evenings. Pleasant office environment. Long-term staff. Please fax resume to (403) 246-4143. D1413

**ALBERTA - Edmonton:** Practice opportunity. Associate position available in our expanding practice located in Edmonton, Alberta. The newly renovated/enlarged office is currently under constuction with expected completion fall 2003. Excellent growth potential as we are located in a major mall located in an agressively developing residential area of the city. Please fax CV in confidence to (780) 472-9835 or e-mail to drdch@compuserve.com D1409

**ALBERTA - Rural:** Associate required. Established family practice. Young, energetic staff. Relaxed atmosphere. Ideal for the caring, patient-oriented dentist. New graduate welcome. Great family town with a myriad of outdoor recreation opportunities. Quick 2 hours from Edmonton. Tel. Neil, (780) 484-5868 (evgs.). D1014

### ASSOCIATE
**Calgary, Alberta**

Oral and maxillofacial surgery practice requires a full-time associate to assist in well-established busy practice. Must be eligible for a licence to practise in Alberta. Excellent opportunity with great earning potential.

Please reply to: CDA Classified Box 2813. D991

**ATLANTIC CANADA:** Oral maxillofacial surgeon and orthodontist. Opportunities available for associateships leading to partnerships in busy oral surgery and orthodontic practices in the "jewell" of Atlantic Canada. If interested please reply to: CDA Classified Box # 2840. D1433

**BRITISH COLUMBIA - Victoria:** Associate opportunity. Busy, progressive family practice requires a motivated, enthusiastic dentist to take over existing patients and work with 2 other dentists in providing total patient care. Newly renovated, well-equipped, 5-operatory office located in Victoria Eaton Centre. Optional future buy-in potential. For further information please contact: Dr. Don Bays, tel. (250) 381-6433 (bus.), (250) 595-8050 (res.), fax (250) 381-6421, e-mail nbays@shaw.ca D1417

**BRITISH COLUMBIA - Grand Forks:** Locum required Feb. 2, 2004, to July 15, 2004, 4 days per week. Accommodation provided. Busy family practice with emphasis on bonded restorative dentistry and fixed/removable prosthodontics. Please call (250) 442-2731 or fax (250) 442-0092. D1406

**BRITISH COLUMBIA - South Central:** Busy, full-service dental practice located in south central British Columbia requires experienced dentist. Associateship leading to equity participation for the right applicant. Present dentist wishes to reduce current workload. Preventive philosophy with excellent hygiene department. Hospital (general anesthetics) surgery and pediatric restorative dentistry available within the practice. Mid-sized city with excellent referral hospital, world-class skiing, golf courses, fishing and mountaineering among the benefits of our location. Reply to: CDA Classified Box # 2838 or e-mail docjr@kamloops.net D1386

**BRITISH COLUMBIA - Kamloops:** Associate required with opportunity to buy into busy, progressive, fun practice.

### DOWNTOWN TORONTO

**Prestigious building.**

On the Subway. Close to most amenities. This 2-unit building is ideal for medical and related professionals. Currently used as a medical clinic on the main floor and residence upstairs. Fully renovated with luxurious features. Parking for 4 cars.

To view or for more information contact:

**ANIL SHARMA**
**Sales Representative**
**Tel. (905) 456-1000, ext. 3440**
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D1445

### GENERAL PRACTICE
**Central Alberta**

Solo rural general practice for sale. One hour to Edmonton, 45 minutes to Red Deer. Grossing $550,000 plus/year on 4 days/week.

Opportunity for expansion. Good leaseholds. Great long-term staff, including hygienist. Low overhead. Owner relocating to British Columbia.

Call Anne at **403 843-2173.**

D1449

Contact: Dr. D. Barry Dextraze, 21 - 750 Fortune Dr., Kamloops, BC V2B 2L2; tel. (250) 376-5354, fax (250) 376-5367. D693

**MANITOBA - Brandon:** Full-time associate required immediately in a multi-dentist, multi-hygienist general practice. Brandon is a growing university city and hospital privileges (general anesthetics) are available through our practice. Associateship can lead to an equity position in the near future. Fax resume to (204) 728-9108. D1440

**MANITOBA - Winnipeg:** Associate/option to purchase. Dentist relocating, currently providing care in 1 of our 3 locations. We will consider associate position or sale of fully equipped practice with 3 operatories. This is an established, high-quality dental practice located in a neighbourhood with rapid growth. Excellent leasehold improvements and modern equipment provide a beautiful environment for both staff and patients. Experienced, friendly support staff with an emphasis on providing exceptional patient care. Position available December 2003. For more information please contact: Dr. Brian Friesen, tel. (204) 694-2042 (bus.), (204) 475-8483 (res.) or e-mail docsholiday@shaw.ca D1443

**NEWFOUNDLAND - St. John's:** Associate dentist. Excellent full-time associate opportunity available immediately in a well-established yet rapidly expanding family practice of 20 years. Our fully computerized office currently has 7 dentists/6 hygienists/10 operatories with a large and dedicated recall base. Come experience this fast-growing scenic "City of the Arts" with lots of fresh air, outdoor activities and no traffic jams. New graduates welcome. Please contact: Dr. Stuart Macdonald, tel. (709) 726-1662 or e-mail srmgmp@roadrunner.nf.net D1420

**NORTHWEST TERRITORIES - Hay River:** Full-time dental associate and/or locum positions available for busy, progressive, northern practice. Please contact Lesli, tel. (867) 874-6663 or one of our awesome associates at the same number. Learn about the town and office by checking us out on the Web www.hayriverdentalclinic.com. Fax (867) 874-3233. D1444

College of Dental Surgeons of British Columbia

**College of Dental Surgeons of British Columbia**

# DEPUTY REGISTRAR

The College of Dental Surgeons of British Columbia is responsible for registering, licensing and regulating all dentists and certified dental assistants in British Columbia. The College serves the public, dentists and certified dental assistants as a supportive and accountable resource for standards of conduct and practice in British Columbia.

As a senior member of the College management team, you will be one of two deputy registrars, dentists involved in administering the College complaints process and providing dental and administrative support to various College committees. You have extensive experience as a general dentist practitioner, and you have experience with committees and boards in developing governance policy. You have a sincere interest in, and value, self-regulation. You are an innovative problem solver. You are a self-starter and a team builder. You are objective, flexible and organized. Your experience in investigation, report writing and alternative dispute resolution will be an asset.

Salary and benefits are negotiable within a compensation range established by the College of Dental Surgeons of British Columbia.

Interested dentists should forward a detailed resume, including a cover letter stating the reason for their application and the attributes they would bring to the position. All applications should be identified as "Deputy Registrar Position" and forwarded in confidence to:

**Mrs. Betty Larsen, Manager of Operations**
**College of Dental Surgeons of British Columbia**
**500 - 1765 West 8th Avenue**
**Vancouver, BC V6J 5C6**
**Tel. (604) 736-3621 • Fax (604) 734-9448**

Deadline for application is January 15, 2004.

D1435

**NORTHWEST TERRITORIES - Yellowknife:** Extremely busy Yellowknife dental practice needs a highly motivated associate dentist. The right person will be quality orientated, and can expect to be busy from day one. A high income is assured, as is an enviable lifestyle. For further information, please telephone Dr. Roger Armstrong at (867) 766-2060, and fax resumes to (867) 873-5032. D1410

**NORTHWEST TERRITORIES - Yellowknife:** Associate needed to join an established, very busy, modern dental clinic (6 dentists) in a thriving community - the diamond capital of North America. The clinic offers all modern equipment including intraoral cameras, abrasion units, etc., with an excellent and friendly support staff, providing very high-quality dentistry, with the emphasis on quality rather than quantity. This is an excellent opportunity for anyone wishing to enjoy a wonderful lifestyle whilst practising dentistry at its best. Please send resume to: Administration, PO Box 1118, Yellowknife, NT X1A 2N8; tel. (867) 873-6940, fax (867) 873-6941. D1159

**NORTHWEST TERRITORIES - Fort Smith:** Associate dentist for Fort Smith Dental Clinic. Utilize the full range of your skills working in our modern, well-equipped clinic with skilled and experienced staff. The centre for Wood Buffalo National Park and located beside world-class whitewater of the Slave River rapids, Fort Smith is an ideal location if you love the outdoors. This is a full-time position offering an established patient base and an excellent compensation package. Opportunity for future partnership and/or succession. Tel. (867) 872-2044, fax (867) 872-5813, e-mail whill@auroranet.nt.ca or send resume to: Dr. Hill, Fort Smith Dental Clinic, PO Box 1047, Fort Smith, NT X0E 0P0. D1191

**NORTHWEST TERRITORIES - Yellowknife:** Seeking experienced orthodontic lab technician to live and work in the city of Yellowknife, Northwest Territories. Attractive salary and compensation package. Please send application including CV and salary expectations, to: CDA Classified Box # 2828. D1216

**NUNAVUT - Iqaluit:** Generous package available to associate dentist on joining busy, modern, 2-dentist practice in Canada's newest capital city. Accommodation available. Please call administration, (867) 873-6940. D1416

**NUNAVUT - Iqaluit:** Dentists wanted! Busy Nunavut dental clinic requires full-time associate in Iqaluit. Community of 7,000 +, only serviced by one other clinic. Part-time locum positions also available in other communities. Excellent remuneration. All travel and accommodations paid for. Fax CV to (867) 979-6744 or e-mail coreygrossman @yahoo.ca D1373

**ONTARIO - Morrisburg:** Located near the scenic St. Lawrence River in eastern Ontario. We are seeking a part- to full-time associate to join our busy general practice. Present associate is moving out of the area. Please fax resume or letter of interest to (613) 543-3444. D1421

**ONTARIO - Barrie:** Full-time associate position available for growing, well-established, progressive group practice with state-of-the-art equipped operatories. We are seeking a dentist with at least 2 years private practice experience, caring, dynamic, with excellent clinical and verbal skills and who is interested in a potential future partnership. We have a strong hygiene program with competent qualified staff who are friendly and knowledgeable. Please fax your resume to (705) 721-9940 or contact Dr. Michael Dove, tel. (705) 721-1143. D1414

**ONTARIO - Windsor:** Oral and maxillofacial surgery. Full-scope, professionally satisfying, private practice opportunity. Associateship position leading to partnership. Please reply in confidence to: Dr. Joe Multari, tel. (519) 252-0985, fax (519) 734-8853, e-mail multari @mnsi.net D1391

**ONTARIO - Brockville:** Experienced associate required for 1 of 2 well-established, busy practices. Enjoy a small-town atmosphere and the scenic beauty of the 1000 Islands region with easy access to large city centres. Only 30 minutes to Kingston and 60 minutes to Ottawa. For more information contact: Dr. George Christodoulou, Altima Dental Canada, tel. (416) 785-1828, ext. 201, e-mail drgeorge@altima.ca D1269

**ONTARIO - Sault Ste. Marie:** Associate required immediately for a very busy established practice of 20 years. Excellent patient volume. Fully computerized practice and modern equipment. Four dentists/5 hygienists. Seeking a caring and dynamic individual with excellent clinical and verbal skills. Emphasis on quality dentistry. A perfect opportunity for partnership for the right individual. Please fax resume to (705) 945-5149. D1387

**QUEBEC - Sherbrooke:** Full- or part-time dentist required. Charming city located 1 hour from Montreal and less than 1 hour from Vermont. Great work environment. New graduates welcome. Please contact Maureen, tel. (819) 563-6141 or e-mail carinne.lavalliere @sympatico.ca D1401

**QUEBEC - Eastern Townships:** We are giving an associate the opportunity to become part of a mature and fully competent team. Pleasant and motivating work atmosphere. Please fax resume to (819) 845-7854. Dr. Jacques Vaillancourt, Windsor, near Sherbrooke. Tel. (819) 845-9014. D1371

**YUKON TERRITORY - Whitehorse:** Come for the beauty - mountains, lakes and rivers. Or come for the opportunity to practise dentistry where you are appreciated and well compensated. Have a look at our Web site www.klondike-dental .com. Tel. (867) 668-4618, fax (867) 667-4944. D1422

## Equipment Sales & Service

**DENTAL EQUIPMENT FOR SALE:** We are relocating and have the following items available for sale: 3 Cox units with attached lab; 1 MCC cabinet, white, rear delivery; 1 MVS twin suction dental EZ; 1 AT 2000 developer with daylight loader; 1 dental technicians lab station - grey; Adec chair mount unit with PC light and whale tail chair; assorted doctor and assistant chairs and mobile carts; dual signature dental cart - dental EZ; P&C sink unit in barn door laminate and corion; Ohmeda dual head compressor. For more information please contact: Dr. Brian Friesen, tel. (204) 694-2042, (204) 475-8483, or e-mail docsholiday@shaw.ca. Will ship, no reasonable offers will be refused. D144

# For When You Need a Helping Hand

When life's obstacles seem insurmountable, reach for help. Call the Members' Assistance Program, an Affinity Service of CDSPI. It's a confidential no-cost, short-term counseling, consulting and referral service, providing help on issues ranging from parenting to substance abuse. Dentists, dental office staff, dental students and their families can call 24 hours a day, seven days a week.*

**Call MAP at: 1-800-268-5211**

MAP website: **www.fgiworldmembers.com**
Username: cdspmap Password: cdsp101

Canadian Dental Service Plans Inc.
1-800-561-9401 or (416) 296-9401, ext. 5032
E-mail: cdspi@cdspi.com
Website: www.cdspi.com.

**MAP is meant to complement similar services that may be provided by your provincial association. Check with your association for details.*

CDSPI Affinity SERVICES

03-101 10/03

ACCIDENTAL DEATH AND DISMEMBERMENT (AD&D) INSURANCE FROM THE CANADIAN DENTISTS' INSURANCE PROGRAM


If a dental tool is lost, you can always replace it.

But your hands are another thing entirely. If you were to lose the use of your hands or eyes, or be otherwise seriously injured, what would you do? Your disability insurance could replace some of your income. But you'll need Accidental Death and Dismemberment (AD&D) Insurance from the Canadian Dentists' Insurance Program to help you deal with the steep additional expenses associated with an injury.

To protect the assets that are the *most* important to you, for less than forty cents a month per $10,000 coverage, call Professional Guide Line Inc.* to obtain an AD&D application today or visit **www.cdspi.com**.

**1-877-293-9455, extension 5002**

**Restrictions may apply to advisory services in certain jurisdictions. PEI and Quebec residents, call CDSPI at 1-800-561-9401, extension 5000.*

Canadian Dental Association / L'Association dentaire canadienne

CDSPI

Professional Guide Line
A CDSPI Affiliate

03-72 10/03

# New Fluoride LISTERINE*

Antiseptic Mouthwash

## All the proven benefits of Listerine, which helps

- *Prevent & reduce gingivitis*
- *Reduce plaque*
- *Fight malodor*

## NOW with the added benefits of Fluoride, which helps

- *Prevent caries*
- *Reverse early tooth decay*
- *Remineralize tooth enamel*

## *Helps improve the health of gingival tissues and strengthen teeth.*


Fluoride Listerine helps reduce and prevent the progression of gingivitis and prevents tooth decay when used in a properly applied program of oral hygiene and dental care.
CANADIAN DENTAL ASSOCIATION

**Indications:** *Fluoride Listerine Antiseptic-Antiplaque-Antigingivitis-Anticaries oral rinse* kills the germs that cause gingivitis, plaque and bad breath.

**Cautions:** Keep out of reach of children. In case of accidental ingestion contact a Poison Control Centre or doctor immediately.

**Dosage:** Adults and children 12 years and older: Rinse full strength with 20 mL for 30 seconds twice a day. Do not swallow. Do not eat or drink for 30 minutes after use. **Medicinal Ingredients:** Eucalyptol 0.091% w/v, Thymol 0.063% w/v, Menthol 0.042% w/v, Sodium Fluoride 0.022% w/v. **Non-Medicinal Ingredients:** alcohol, benzoic acid, D&C Yellow No. 10, FD&C Green No. 3, flavour, methyl salicylate, poloxamer, propanol, saccharin sodium, sodium benzoate, sorbitol, water. **Note:** Cold temperatures may cloud this product; its efficacy will not be affected. **Supplied:** Bottles of 250, 1000 and 1500 mL.

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PAAB