



JCDA

Journal of the Canadian Dental Association

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Photograph by Dr. Steven M. Baylin

Special Pediatric Dentistry Issue

in conjunction with the Canadian Academy of Pediatric Dentistry

Microbiology of Early Childhood Caries

Update on Fluorides and Fluorosis

Dental Trauma: Avulsions and Intrusions

Intravenous Procedural Sedation

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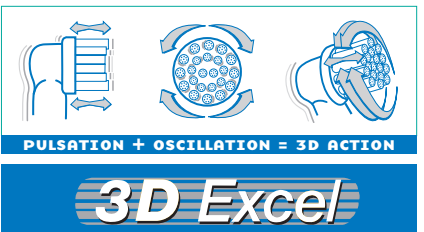
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Editorial

SARS, WAR AND DENTISTRY



Dr. John P. O'Keefe

Despite all our modern sophistication, it is ironic that as of this writing, the 2 main headline grabbers are problems dating back to ancient times, namely war and infectious disease. By the time you read this, both the conflict in Iraq and the Severe Acute Respiratory Syndrome (SARS) outbreak will likely be fading from our television screens, newspapers and collective memories.

Yet the fact remains that the problems of war and infection will never go away. Their combined threat in the form of biological warfare has forced its way into the popular consciousness. Our colleagues at the American Dental Association (ADA) are taking this menace quite seriously, and we must never forget that deadly pathogens cross borders very easily.

A keynote speaker at the 2003 congress of CDA and the Alberta

Dental Association & College will deal with dentistry's role in the event of a bioterrorism attack. Dr. Al Guay, the ADA's chief policy advisor, has given considerable thought to biological weapons and how dentists can put their medical skills to good use in the event of an attack. The importance of this issue was impressed upon ADA during the anthrax scare in fall 2001.

What that scare demonstrated was that the public (and the profession) knew little about anthrax. As a result, the U.S. population was whipped into a frenzy of anxiety about contracting the condition. The episode also showed that public health services were ill-prepared to deal with biological weapons attacks.

These elements sound familiar to us today as we witness the panic and fear surrounding the appearance of the SARS disease in Canada that thankfully appears to have been successfully contained to the Toronto area. Of course, as SARS looks to be coming under control, there is a tendency to downplay the incident and shrug our shoulders, telling ourselves: "That issue was all hyped up."

At the height of the outbreak, I asked an eminent Canadian public health physician if he thought SARS represented a long-term threat to public health. While he felt it was too early to tell, he observed that "when a rich man gets a pain in his finger, the whole town knows about it; when a poor man dies, nobody hears of it." As he said that, I immediately thought of the 2 million deaths per annum caused by tuberculosis around the globe. Perspective is everything!

That being said, those caught in the eye of the storm don't have the luxury of sitting down to watch The Weather Channel. Dentists and patients were anxiously calling CDA, the Ontario Dental Association and the Royal College of Dental Surgeons

of Ontario, asking how to deal with the potential for SARS transmission in the dental office. All 3 organizations scrambled to collate information, especially Health Canada reports, and present this in a manner that is useful and pertinent to the needs of dentists. CDA's strategy was to direct members, mainly via *CDAlert* e-mail bulletins and updates on our Web site (www.cda-adc.ca), to information from public health authorities.

A lesson I take from this episode and the recent Dental Association of Canada affair is that it is very important for CDA to identify an emerging national issue as early as possible, gather pertinent information on that issue and disseminate it rapidly to members. The ability to update the information quickly and economically is vital.

As the SARS episode shows, the Internet is the superior communications tool to execute the gathering and dissemination of crucial information. Our estimation is that over 80% of Canadian dentists use the Internet, yet CDA has e-mail addresses for only 40% of our members.

If you give us your e-mail address, we can send you timely alerts on matters that are vital to your practice and profession. Our commitment to you is that we will not abuse the confidence you show in us. Perhaps the time has also come for CDA to set up a national e-mail discussion group where members can exchange important professionally related information. Such a forum could serve as a community builder and help CDA to have an even better feel for the pulse of the profession.

John O'Keefe
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President's Column

NEW GOVERNANCE MODEL GOOD FOR ALL



Dr. Tom Breneman

March 28 and 29, 2003, were historic dates in CDA's ongoing evolution. When Board of Governors chair Dr. Nick Mancini accepted a motion for adjournment, it meant that this was the Board's final meeting, following the formal approval of a revised governance framework for the Association.

What does this mean for dentistry in general and CDA in particular? For several years, we have sought more input and discussion on current and emerging topics of interest to dentistry. The changes to our governance framework will allow CDA to be even better informed and more responsive to its members.

How will the new system work? On September 5–6, 2003, CDA will hold its first meetings under the newly approved framework. The General Assembly format will include voting representatives from provincial dental associations, dental students, the Canadian Forces Dental Services, national dental specialty organizations

and academic dentistry, as well as non-voting members and observers. This group is tasked with big-picture, directional policy issues, approving bylaws and changes in dues, selecting auditors and electing the Board's chair, vice-president and members.

On the second day, the Strategic Forum will include all participants of the General Assembly and invited oral health care and dentistry-related representatives, allowing for very broad-based input. Attendees are encouraged to discuss emerging issues that will impact on the oral health of Canadians.

The Board of Directors is elected by the General Assembly. The duties of Board members include identifying and managing strategic issues, approving general policy, recommending strategic direction and preparing agendas for the General Assembly, acting as CDA's official spokespersons, developing and maintaining an accountability system, and overseeing the Association's finances.

The Board of Directors will be responsible to the General Assembly for activities it undertakes in achieving CDA's Strategic Plan. As such, the Board will need to reexamine the current committee structure and the way we accomplish our tasks. The goal will be to have a system of standing committees and task forces to achieve results in as efficient, timely and effective manner as possible. This process of examination, dialogue, planning and implementation will take several months to complete.

The presidents of the provincial dental associations held a breakfast meeting before the recent Board meeting to discuss their major concerns. At the top of their list of worries is the shortage of dental hygienists and the inability to meet current demand for their services. This was such an overriding issue that it was subsequently

discussed at an in-camera session of the Board of Governors. CDA has already been involved with this issue in a number of ways. We recently had the pleasure of co-hosting with the Association of Dental Surgeons of British Columbia a forum on the oral hygiene shortage, which resulted in some initial investigation of the problem. Key messages were developed as well. CDA is now involved in Human Resources Development Canada's oral health sector study, which will add some solid data to the realities we find in practice, as we attempt to add staff in our offices. This study will allow us to predict the numbers of trained individuals required in the years ahead, including dentists, dental hygienists, dental assistants, denturists and lab technicians; it will also allow our universities and colleges to plan and ensure adequate trained professionals to meet the oral health needs of Canadians.

Just before the final Board of Governors meeting, we participated in an interactive session, which will help set the stage for the examination of different practice models. We are currently trained in and comfortable with one very successful private practice model of delivering dental care that has evolved over many years. This team approach is cost-effective and efficient, serving our patients very well. But there are segments of our population who are unable to access oral health care, for both physical and financial reasons. We need to be aware of alternate models for delivery of care to allow for appropriate treatment in a manner complementary to our current models.

These kind of proactive discussions of issues will be enhanced by CDA's new governance model.

*Tom Breneman, 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.

Preferred Treatment for Pulp Exposure of a Vital Primary Molar

In the March 2003 *JCDA*, the *Point of Care* section asks the question: "What is the preferred treatment for pulp exposure of a vital primary molar?"

Dr. Michael Casas alludes to a "standard of care" by using the word "preferred" in the question. *JCDA* even has a disclaimer stating: "The responses do not purport to set forth standards of care or clinical practice guidelines." Is there not a lack of consistency here?

The guidelines of the American Academy of Pediatric Dentistry (endorsed by the Canadian Academy of Pediatric Dentistry) do not delineate chemicals or procedures for pulp treatment. In a recent Cochrane Review¹ of pulp treatment for extensive decay in primary teeth, 82 studies were identified that were randomized or quasi-randomized controlled trials (RCTs), comparing different pulp treatment techniques (with each other, with extraction or with no treatment) for extensive decay in primary molar teeth.

Only 3 of the 82 were suitable for inclusion. "Nine of the studies meeting the inclusion criteria, but with inappropriate study design or analysis, are also described. Included trials investigated formocresol pulpotomy,

ferric sulphate pulpotomy, electrosurgical pulpotomy or zinc oxide eugenol pulpectomy in symptom-free, cariously exposed teeth. Data were unavailable on long-term effects. Data on extraction following pulp treatment were available in all 3 studies; in 2 studies, there was no statistically significant difference between treatments. The difference seen in the other study, where more teeth treated by ferric sulphate pulpotomy were extracted, compared to zinc oxide eugenol pulpectomy, must be viewed with caution.

"Based on the available RCTs, there is no reliable evidence supporting the superiority of one type of treatment for pulpally involved primary molars. No conclusion can be made to the optimum treatment or techniques for pulpally involved primary molar teeth, due to the scarcity of reliable scientific research. High-quality RCTs, with appropriate unit of randomization and analysis, are needed."

Dr. Casas also cites papers that are not included in any reference section attached to the article (references 1 and 2). I have no idea how he can conclude that the (ferric sulphate) "procedure can be completed in less time than either the full-strength or one-fifth dilution formocresol technique."

*Dr. Robert Barsky
Calgary, Alberta*

Reference

1. Nadin G, Goel BR, Yeung CA, Glenn AM. Pulp treatment for extensive decay in primary teeth (Cochrane Review). In: The Cochrane Library, Issue 1, 2003, Oxford: Update Software.

Editor's Note: Here are the missing references that were inadvertently left out of Dr. Casas' article.

1. Casas MJ, Layug MA, Kenny DJ, Johnston DH, Judd PL. Two-year outcomes of primary molar ferric sulfate pulpotomy and root canal therapy. *Pediatr Dent* 2003; 25:97-102.

2. Fuks AB, Holan G, Davis JM, Eidelman E. Ferric sulfate versus dilute formocresol in pulpotomized primary molars: long-term follow-up. *Pediatr Dent* 1997; 19(5):327-30.

Response from Dr. Casas

Preference for any clinical procedure should be based on the best available evidence for safety and efficacy. The Cochrane Review assessed, in depth, 2 studies of ferric sulphate (FS) pulpotomy that met its criteria for acceptable scientific methodology.¹ One investigation reported equivalent outcomes for FS and formocresol (FC) pulpotomy.² The other reported equivalent survival for FS pulpotomy and vital primary root canal therapy (RCT) but better radiographic outcomes for RCT than FS pulpotomy.³ Based on this evidence, FS pulpotomy produced equivalent outcomes to FC, while RCT produced better outcomes than FS pulpotomy. Three additional publications have concluded that FS and FC pulpotomy produce equivalent outcomes in direct comparisons.^{4,5,6} Therefore, based on equivalency, FS pulpotomy provides an evidence-based alternative for dentists and patients concerned about the formaldehyde component of FC.

All components of the FS and FC pulpotomy are identical, other than application of the medicament to the pulp tissue. Full-strength FC technique requires a 1-minute application of FC, while one-fifth dilution requires 5 minutes. Ferric sulphate is applied to the pulp for only 10-15 seconds.^{3,4} FS technique can be completed in less time than FC technique.

Ferric sulphate pulpotomy is the preferred treatment for vital molar pulp therapy at the Hospital for Sick Children (HSC) and is performed by University of Toronto graduate students in pediatric dentistry when they attend HSC for their clinical and didactic education.

Dentistry is a science-based profession and should move to new therapies as these are supported by sound evidence. Hopefully, other dentists will choose pulp procedures that reduce exposure of children to aldehydes, while offering equivalent or better outcomes.

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1. Nadin G, Goel BR, Yeung CA, Glenny AM. Pulp treatment for extensive decay in primary teeth (Cochrane Review) In: The Cochrane Library. Issue 1, 2003. Oxford: Update Software 2003.
2. Ibricevic H, al-Jame Q. Ferric sulfate as pulpotomy agent in primary teeth: twenty month clinical follow-up. *J Clin Pediatr Dent* 2000; 24(4):269-72.
3. Casas MJ, Layug MA, Kenny DJ, Johnston DH, Judd PL: Two-year outcomes of primary molar ferric sulfate pulpotomy and root canal therapy. *Pediatr Dent* 2003; 25:97-102.
4. Fuks AB, Holan G, Davis JM, Eidelman E. Ferric sulfate versus dilute formocresol in pulpotomized primary molars: long-term follow-up. *Pediatr Dent* 1997; 19(5):327-30.
5. Smith NL, Seale NS, Nunn ME. Ferric sulfate pulpotomy in primary molars: a retrospective study. *Pediatr Dent* 2000; 22(3):192-9.
6. Fei AL, Udin RD, Johnson R. A clinical study of ferric sulfate as a pulpotomy agent in primary teeth. *Pediatr Dent* 1991; 13(6):327-32.

Hospital Discharge Is Bad for Dentistry

I share your concern about the closure of the dental department at the Toronto General Hospital (TGH) (Editorial, February 2003). I have been on staff at Lakeshore General Hospital since it opened in 1974. Quebec's overseeing legislation requires that general hospitals have a dental department, but most of them do not, primarily because dentists in the community have not insisted that the law be respected.

I agree that CDA should strike a hospital dentistry committee. I would also suggest that this committee should have a good proportion of general dentists on it. General practitioners have kept our service alive. We take the calls at the ER on a 24/7 basis. We do in-hospital consultations the same day they are requested, and

frankly, most consultations don't require invasive surgery. We have a program for the treatment of the mentally handicapped and medically compromised. We participate in staff activities. On 3 occasions, I have served on the executive of the Council of Physicians, Dentists and Pharmacists that represents the staff. I have even been the spokesperson for the staff in a major confrontation we had with the administration.

We must make an effort to ensure that dental services remain an essential part of hospital health services. If TGH succeeds in closing its dental department, it puts all hospital dental services at risk.

*Dr. William F. Shaw
Senior Attending Dental Surgeon
Lakeshore General Hospital
Pointe-Claire, Quebec*

We read with interest your recent editorial. I'd like to present the point of view of 2 oral and maxillofacial surgeons currently practising in Canada's health care system.

Regardless of what the lobbyists, journalists, pundits and politicians say, the Canadian health care system is in acute crisis. Regional health authorities, hospitals, extended care facilities and frontline providers are all underfunded. All resources, including human resources, are being "rationalized." Every service provision is an *expenditure* and the only way to curb expenditures is to limit service provision. The health care administration and providers are requested to provide more with less every day. They are expected to improve service quality and access, with no expectation of additional human, physical or financial resources. To complicate the problem, the users of the system (patients) expect the highest level of excellence in access, diagnostic investigations and service provision.

Yet patients want it all for free. No one wants to write a big enough cheque. The result has been an ongoing cannibalization of health care

programs and marginalization of providers. The administration targets general and specialty programs for resource savings. Recruitment of new providers is obstructed and the introduction of new technologies is put in abeyance. These decisions have nothing to do with the need for improved levels of patient care, outcome measures, quality assurance, changing and aging population demographics or the actual need for care. They have everything to do with available resources (money, taxes, transfer payments), public sentiment and political misinformation.

Unfortunately, the voice of frontline providers (including those providing "dental services") has been viewed as one of a conflict of interest and hence has not been loud or united enough to fight these battles for our patients. As you put it, "we have been off the radar." In truth, for some providers and patients, the hospital is now "restricted airspace." The best way to reduce the need for resources is to restrict access. These circumstances are likely the driving forces behind the unfortunate situation at the Toronto General Hospital.

Our advocacy bodies have all tried, but they seem to have lacked the collective focus to effectively meet this challenge. This is because hospital dentistry is not on the radar screen for the average dentist or patient. Now, with actions such as the threatened closure of our hospital-based training programs, even our educational underpinnings are being eroded. Those on the frontline are fatigued from their ongoing care provision responsibilities and repetitive patient, program and resource advocacy efforts. This burnout factor leaves us devoid of inspiration or enthusiasm necessary to offer creative solutions.

What is worse still is that the system of health care delivery in Canada, with its multiple tiers, affords the individual no choices of care provision outside the system. Imagine

this state of affairs in a supposedly democratic and free country! This is an amazing counterpoint to how the Canadian dental profession has, over the last 50 years, established value, choice, excellence and access in the provision of oral health care.

We agree with your comments that a united voice must make itself heard. Unfortunately, sufficient resources and human initiative do not appear to exist at present for the battle to be won. Obviously, it would be helpful if all dentists became directly involved by voicing their views to government bodies at all levels. Being realistic, however, perhaps the whole system needs to implode before it can rise phoenix-like from the ashes.

*Dr. Kevin Lung
Chair, CDA Subcommittee on Hospital-Based Dentistry
Edmonton, Alberta*

*Dr. Christopher Robinson
Chair, CDA Committee on Specialist Affairs
Edmonton, Alberta*

We would like to commend you on your February editorial. I serve as head of the hospital-based dentistry/oral and maxillofacial surgery service in the Saskatoon Health Region. We are the sole dental service for the 3 major hospitals in Saskatoon and provide the only 24-hour emergency service in the city. Additionally, we are the only facility in Saskatoon and surrounding area that provides comprehensive dental care for the pediatric, medically compromised and adult special needs population.

It is a constant battle to maintain funding for the department and for the general practice residency we administrate. Forever falling between the cracks of the College of Dentistry and hospital administration, we struggle with staffing and capital equipment issues, as well as physical plant problems. All departments within the hospital must be vigilant when it comes to their financial fitness. This

was very evident at the Ottawa Hospital, when its dental clinic had to secure its future through outside funding. This is a reality our department faces daily and we have begun to adopt the same approach.

Questions are often raised about the utility of the service and whether dentistry really needs to be in the hospital. Our clinic is regularly eyed by other departments intent on occupying our space. We commend you on the urgent tone of your letter. It is to be hoped that your challenges will be met and dentistry will continue to be represented in hospitals across the country.

In light of the population demographics in Canada, the question for governments should not be whether they can afford to fund hospital-based dental programs, but if they can afford not to.

*Dr. Frank I. Hohn
Head, Department of Dentistry/Oral and Maxillofacial Surgery
Saskatoon Regional Health Authority*

*Dr. Mohan A. Teekasingh
Assistant director, General Practice Residency
Royal University Hospital
Saskatoon, Saskatchewan*

Your recent editorial and an unrelated response to a letter by Dr. Peter Cooney (*The Role of Clinical Guidelines in Controlling Expenditures for Dental Care*, JFDA February 2003) prompt me to respond.

The editorial presupposes (incorrectly in my view) that the dental profession supports the inclusion of dental care systems within a semi-socialized framework (hospitals). Dr. Cooney's letter appears to be a polemic/apologia for the "bulked-up bureaucracies" the free western world is trying to reduce. The wistful nostalgia of government employees and a longing for the paradigms of the "golden years" of bloated bureaucracies are no longer appropriate.

I believe we, as a profession, are perfectly capable of dealing with areas of social responsibility largely from within our profession and without significant "assistance" from government. Indeed, the time has come for a formal pro-bono service commitment by all dentists (practising and non-practising). However, my provincial dental association has twice rejected this suggestion. Although we hold up our much-vaunted social safety nets for iconic display to our friends south of the border, I would suggest that we could adopt American and European concepts of charitable foundations as a replacement or adjunct to fulfill areas of social and dental need and avoid intrinsic government waste and inefficiency.

I see no need (as you suggested) that we ally ourselves with the medical profession. We have little to learn from our medical confreres in terms of service delivery and aspirations towards clinical excellence.

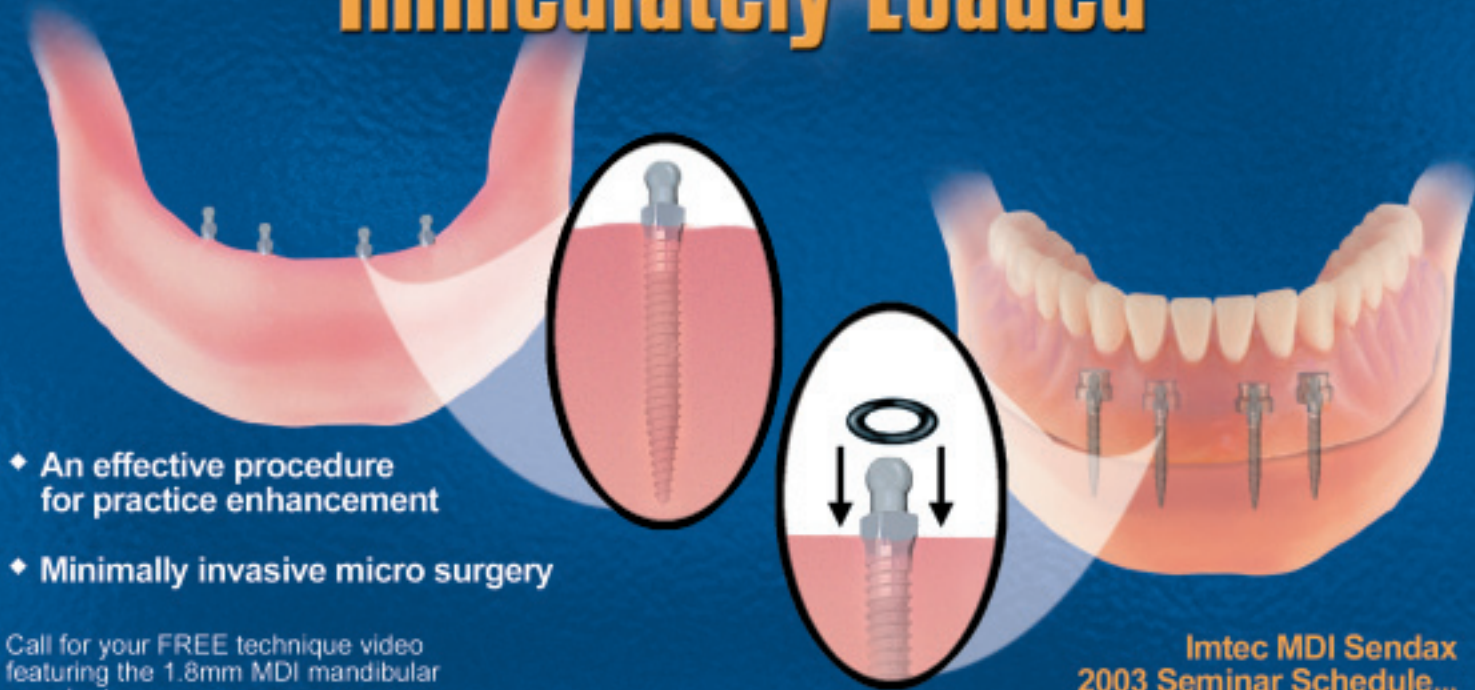
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*Dr. Andrew F. Thompson
Halifax, Nova Scotia*

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News

Considerations re: Use of Fluorides in Dentistry Approved

CDA's Board of Governors approved Considerations re: Use of Fluorides in Dentistry during its meetings held in Ottawa March 28–29. The new statement — posted online at *eJCDA* (<http://www.cda-adc.ca/jcda/vol-69/issue-5/fluorides.html>) — takes into account the fact that dentists will spend more time assessing the risk of fluoride supplements before prescribing them.

“The challenge is to be able to provide the appropriate balance and guidance,” said Dr. Robert Hallett, chair of CDA's Committee on Community and Institutional Dentistry. “It is also crucial to know how much fluoride patients are getting. The message to dentists is that all resources available should be used when determining risk.” ♦

Two Dentists Elected to Quebec National Assembly

The Liberal sweep in the April 14 Quebec elections included 2 dentists: Dr. Diane Legault of Montreal (formerly executive director of the Order of Dentists of Quebec) was elected Liberal Member of the National Assembly for Chambly and Dr. Pierre Corbeil of Val-d'Or is now Liberal MNA for Abitibi-Est. ♦

Aspirin May Lessen Risk of Throat Cancer

Taking low-dose aspirin regularly may cut the risk of developing cancers of the mouth, throat and esophagus, claim researchers at the Institute of Pharmacological Research in Milan.

According to Dr. Christina Bosetti, an epidemiologist at the institute, the research team has shown that aspirin can slash the risk of mouth cancer by two-thirds, protecting the upper aerodigestive

tract against cancer. The research, which is reported in the *British Journal of Cancer*, revealed fewer mouth and throat cancers in subjects who had been taking aspirin for 5 years or longer. The Italian researchers believe that aspirin may play a role in cutting cancer risk because of its impact on an enzyme called cyclooxygenase-2, which is involved in inflammation and is thought to be linked to the development of cancer. ♦

New Research on Cleft Palate

Folate-rich Diet May Cut Cleft Palate Risk

Women who have certain variations in a folate-processing gene are at greater risk of having a child with a cleft lip or palate, according to a new study by the University Medical Centre Nijmegen in the Netherlands.

Getting enough folate in the diet and taking a folic acid supplement may significantly reduce the risk that

women will give birth to a child with a cleft lip or palate, says study author Dr. Regine P.M. Steegers-Theunissen.

The findings are reported in the *American Journal of Epidemiology* (2003; 157(7):583–91; <http://aje.oupjournals.org/cgi/content/full/157/7/583>). ♦

Extreme Nausea in Pregnancy May Cut Oral Cleft Risk

Pregnant women who develop a condition marked by extremely severe vomiting may be less likely to have a baby with a cleft lip or palate than those who do not develop the condition, according to a new study by the Foundation for the Community Control of Hereditary Diseases in Budapest.

If the findings are confirmed by more studies, researchers may be able to discover a factor that reduces the risk of the birth defects by studying women with the condition, known as hyperemesis gravidarum. The study is

COVER ARTIST

Dr. Steve Baylin has been in private practice in Calgary since 1978. Originally from Montreal, he graduated from McGill University's faculty of dentistry in 1976, moving to Boston where he acquired his postgraduate Diploma in Pediatric Dentistry. In 1978, Dr. Baylin earned a MScD from Boston University's School of Graduate Dentistry.

Dr. Baylin is currently the editor of the Canadian Academy of Pediatric Dentistry's national newsletter and designer/administrator for that organization's Web site, to be launched in July. He is a guest lecturer in pediatric dentistry for the Dental Assisting Program at the Southern Alberta Institute of Technology (SAIT) in Calgary. Dr. Baylin is also the pediatric dental representative on the Canadian Downs Syndrome Society Professional Resource Council.

Landscape photography has always been a passion for Dr. Baylin. This issue's cover illustration shows a young girl gazing toward the commanding mountain peaks, expressing a sense of wonderment and appreciation for the natural beauty and splendour of the landscape. Dr. Baylin snapped the picture at Elbow Lake in Alberta's Kananaskis Country in summer 2001. ♦



published in the April edition of the *Journal of Obstetrics and Gynecology* (2003; 101(4):737–44). ♦

Study Links Alcohol Abuse with Poor Oral Health

Alcohol abusers show a higher incidence of periodontal disease, tooth decay and potentially precancerous oral lesions, according to a study by the State University of New York at Buffalo School of Dental Medicine.

As part of the study, 24 men and 10 women at a local alcohol abuse rehabilitation centre provided information on their dental hygiene habits and lifestyle behaviours and received a dental exam.

The study found that 82% of these alcoholics had moderate to severe gum inflammation, and more than 66% showed heavy accumulation of dental plaque. Fifteen per cent of the subjects had missing teeth, with 41% of the remaining teeth showing signs of enamel erosion. In addition, 79% of those studied had at least one decayed tooth, with an average of 3.2 decayed teeth per subject, while more than one-third had potentially precancerous oral lesions.

Based on these findings, researchers are planning to conduct a larger study of oral health among alcoholics to develop rational measures for preventing oral disease in this population. ♦

Risk of Heart Failure Reduced for Obstructive Sleep Apnea Patients

Continuous positive airway pressure (CPAP) lessens the likelihood of heart failure in patients with coexistent obstructive sleep apnea, according to the results of a small, randomized trial published in *The New England Journal of Medicine* (2003; 348(13):1233–41).

“Obstructive sleep apnea subjects the failing heart to adverse hemodynamic and adrenergic loads and may thereby contribute to the progression of heart failure,” writes Dr. Yasuyuki Kaneko of the University of Toronto.

“In medically treated patients with heart failure, treatment of coexisting obstructive sleep apnea by CPAP reduces systolic blood pressure and improves left ventricular systolic function.” ♦

DPD Survey Draw Winner

Dr. Gérald Q. Le of Montreal has won the \$500 prize for participating in the Dental Product Distribution study.

CDA recently conducted a survey of dentists’ satisfaction with products and services offered by dental distributors. More than 1,100 responses to the questionnaire were obtained. (The highlights of the survey will appear in an upcoming edition of *JCDA*.)

Dr. Le has generously offered to donate the money to a dental student-related activity. A 1982 graduate of the University of Montreal, Dr. Le now practises in Montreal. He has been a member of CDA since 1983. ♦

RCDC Convocation



Drs. Evelyn McNee and David Kennedy

During the recent convocation and annual dinner of the Royal College of Dentists of Canada (RCDC), Dr. David Kennedy of Vancouver was elected president, while Dr. Elie Wolfson of Willowdale, Ontario, became vice-president. An honorary fellowship went to Commission on Dental Accreditation of Canada chair Dr. Evelyn McNee of Vancouver. A Distinguished Service Award was given to CDA life member Dr. John Speck of Richmond Hill, Ontario.

The next RCDC Convocation and Annual Dinner will be held on September 6 at the Westin Nova Scotian Hotel in Halifax. This year, Dr. Ray Wenn, registrar of the Prince Edward Island Dental Council, will be inducted as an honorary fellow of RCDC. ♦

CAP’s New Web Site

The Canadian Academy of Periodontology has launched a new Web site at www.cap-acp.ca. It features a wealth of information on fighting gum disease, highlights advances in cosmetic dentistry and helps visitors locate periodontists in their area. ♦

Two Honourees at Pierre Fauchard Academy Breakfast

Dr. Perry Trester of Vancouver and Dr. George Peacock of Saskatoon will be honoured at the Pierre Fauchard Installation and Awards Breakfast scheduled for May 24 (7 a.m. to 9 a.m.) at the Fairmont Jasper Park Lodge. ♦

For direct access to the Web sites mentioned in the News section, go to the May *JCDA* bookmarks at <http://www.cda-adc.ca/jcda/vol-69/issue-5/index.html>.

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CAPD News

The Canadian Academy of Pediatric Dentistry

President's Message



Dr. Paul MacDonald

The Canadian Academy of Pediatric Dentistry (CAPD) was pleased to be invited to participate in this issue of *JCDA* devoted to children's dentistry. As president, I strive to represent a specialty group that numbers less than 200 members dispersed across a rather large country. I'm proud to see our pediatric dentists contribute to children's oral health on multiple levels, including in private practice, public health clinics, and university and hospital-based facilities. Formerly known as pedodontists, we hope that our dental colleagues can now not only spell our specialty name more easily, but also continue to appreciate the benefit of learning and working with our specialty to improve dental care for children.

Pediatric dentistry is an age-defined specialty that provides both primary and comprehensive preventive and therapeutic oral care for infants and children through adolescence. This patient group includes many with special health care needs. Indeed, we are often called on to continue providing care for young handicapped adults. Most specialties focus on a particular area of dental expertise. Pediatric dentists acquire a broad base of dental knowledge and skills, which they adapt to the special needs of their patients. Canadian

pediatric dentists are versed in such disciplines as behaviour management, care of medically and developmentally compromised children, orofacial growth and development, caries prevention, sedation dentistry and hospital dentistry. It is not uncommon for pediatric dentists to use all these skills on a daily basis.

Pediatric dentists in Canada can receive training through one of 2 Canadian programs or through many American hospitals and university-based institutions. CAPD worked closely with the Royal College of Dentists of Canada to help set the fellowship examination, which is the current standard for specialty certification. Our members serve on numerous committees of provincial associations, CDA, the American Academy of Pediatric Dentists, and international associations concerned with dentistry for handicapped children.

Our vision is the achievement of optimal health for all children. Early childhood caries remains a significant problem, as evidenced by the high numbers of children being treated in hospital for rampant caries. Improved oral health in children means simply improved general health. CAPD is dedicated to the goal of improving and maintaining the oral health of infants, children, adolescents and persons with special health care needs. Access to treatment time in hospital operating rooms and appropriate funding of children's dental programs remain a priority. CAPD has tried to build strong partnerships with CDA, the Canadian Pediatric Society and the American Academy of Pediatric Dentists, in an effort to enhance dental care for children. CAPD advocates that infants should be assessed by oral health care providers within 6 months of the eruption of the first tooth or by one year of age.

Our specialty group has set communication as a goal for 2003, and an important first step toward achieving that goal will be taken when we launch our new Web site in July. We invite you to visit our site this summer and also to contact any of our members to discuss any aspect of children's dental care.

Dr. Paul MacDonald



Message from the Editorial Consultant



Dr. Alan Milnes

It is indeed a pleasure to have been asked to serve as the guest scientific editor for this special issue on pediatric dentistry. This landmark issue marks the first time that CAPD has participated in the development of a theme issue of *JCDA*. The idea for an issue devoted to pediatric dentistry arose in conjunction with the October 2001 meeting of CAPD in Vancouver, British Columbia. The theme adopted for this meeting was early childhood caries. Although dentists have been inundated with information suggesting that caries is on the decline, tooth decay affecting preschool children continues to be a significant problem in many communities throughout Canada. In fact, in some jurisdictions there is now good evidence to show

that tooth decay in young children is on the increase.

Three keynote speakers were invited to present on different aspects of early childhood caries. Dr. Stephen Levy's up-to-date review of the use of fluoride in children and the presence of fluoride in the food chain is particularly useful at this time. Many parents are now requesting that their children not receive fluoride for fear they will develop fluorosis. While this is a legitimate concern, it is important that dentists recognize the children who are at high risk for decay and who would benefit from enhanced fluoride exposure. Furthermore, it is important that dentists use the most appropriate form of fluoride in the most appropriate fashion when treating children who are at moderate to high risk for early childhood caries.

It has long been known that dental caries occurs as a result of activity by indigenous bacteria in the oral cavity. Too often, however, dentists have adopted a surgical model for the correction of dental disease and ignored its bacteriologic basis. The paper by Dr. Berkowitz provides up-to-the-minute information on the infectious nature of dental caries, in particular early childhood caries, and highlights several novel approaches for controlling oral microbial populations with antibacterial substances.

Those who work in community dentistry in public health have finally recognized the ravages of dental disease in preschool children, something pediatric and family dentists who treat these children have known for far too long. Community interventions by nondental personnel aimed to convey preventive information and to assess risk for early childhood caries have been the thrust of a research program developed by Dr. Rosamund Harrison at the University of British Columbia. Collectively, these 3 papers provide new ideas for managing a particularly

virulent form of tooth decay that can have lifelong effects.

Two other papers appear in this issue. The first paper, which was also presented at the CAPD meeting, discusses intravenous sedation. Traditionally, dentists have treated children affected with early childhood caries under general anesthesia in hospital-based settings. Intravenous sedation is an alternative method for managing the behaviour of preschool children who require treatment for early childhood caries. While it is recognized that this modality of sedation is beyond the realm of general dentistry, it is presented as an alternative that could become more common should postgraduate programs in pediatric dentistry choose to offer such training. This is especially important in light of increasingly difficult access to general anesthesia services across Canada. The second paper, from the Dental Trauma Research Unit of The Hospital for Sick Children, reviews treatment guidelines for the perplexing and controversial issue of tooth avulsions and intrusions.

We were fortunate to have been able to secure presentations for the CAPD meeting from Drs. Harrison, Berkowitz and Levy, all leaders in their respective fields. We sincerely hope that all the articles selected for publication in this issue will be of interest to all those who provide dental care for children in Canada.

Finally, I must pay tribute to Dr. John O'Keefe, editor of *JCDA*. It has been a great pleasure to work with someone who is entirely dedicated to ensuring that the dentists of Canada have practical and up-to-date information available to assist them in the daily practice of dentistry. His vision and forward thinking have resulted in a significant transformation of this journal.

Dr. Alan Milnes

Pediatric Dentistry and the Royal College of Dentists of Canada



Dr. David B. Kennedy

The attainment of fellowship in the Royal College of Dentists of Canada (RCDC) serves a dual function for pediatric dentists. First, the National Dental Specialty Examination (NDSE), run by RCDC, has served as part of the specialty licensing process for all provinces in Canada since 2001. Second, fellowship in RCDC is a useful qualification to possess for obtaining hospital privileges, and many pediatric dentists work in hospitals. A one-step examination was adopted in 1997, which allowed pediatric dentists to obtain fellowship immediately upon graduation, as do their medical confreres. This movement to a one-step fellowship followed a similar route taken by oral and maxillofacial surgeons in the mid-1990s and by other hospital-based specialty groups, such as oral pathologists and oral radiologists.

When the dental regulatory authorities sought to establish a national dental specialty exam, CAPD supported RCDC as the examining body of choice, because of its proven track record in providing quality exams. The pediatric dentistry exam has evolved from a blueprint that identifies topics to be covered, weighted by importance. A reading list is provided to guide candidates in their preparation for the exam, divided into 2 parts: a 3-hour objective structured clinical exam (OSCE), consisting of questions

generated by photographic images of clinical or radiographic situations; and a 2.5-hour case simulation exercise, involving a variety of pediatric dental case histories presented in a multiple-choice format. Many CAPD members have participated in the development of the exam and continue to maintain its quality. These individuals donate many hours of their time and are to be thanked for their efforts: Drs. Bill Croft, Nanaimo, British Columbia (former chief examiner), Sam Cheung, Coquitlam, B.C., Felicity Hardwick, Nanaimo, Alan Milnes, Kelowna, B.C. (chief examiner), Robert Barsky, Calgary, Alberta, Christine Corbeil, Montreal, Quebec, David Richardson, Hunter River, Prince Edward Island, Heather Dymont, Halifax, Nova Scotia, Lorne Koroluk and Rocio Quinonez, Chapel Hill, North Carolina, and Keith Morley, Barry, Ontario (former chief examiner).

Pediatric dentists in good standing who have been in practice for at least 3 years can take the interim examination (OSCE and case simulation exercise) to obtain fellowship. This window of opportunity ends at the fall exam session in 2004. Interested parties should telephone RCDC at (416) 512-6571 or visit the College's Web site at www.rcdc.ca.

RCDC has enjoyed a mutually beneficial relationship with CAPD, presenting reports at its annual meetings and including information in communications vehicles sent to its members. As a result, pediatric dentistry boasts a high percentage of members who have successfully completed the NDSE and obtained fellowship in RCDC.

Dr. David B. Kennedy
President
Royal College of Dentists of Canada



CAPD Statement on the Training and Practice of Pediatric Dentistry

Definition

As defined by CDA, the Commission on Dental Accreditation of Canada, the Canadian Academy of Pediatric Dentistry and the Royal College of Dentists of Canada, pediatric dentistry is that branch and specialty of dentistry concerned with providing primary and comprehensive preventive and therapeutic oral health diagnosis, care and consultative expertise for infants and children through adolescence, including those of all ages with special care needs.

Education and Training

As with all areas of dentistry, pediatric dentistry has undergone a remarkable number of changes over the last 20 years. The development of new restorative materials, the increasing demand for treatment under sedation, issues of informed consent and age of consent to treatment, and the need for presenting evidence-based rationales for treatment decisions have had a significant impact on education and training. Pediatric dentists, like their counterparts in general practice, are expected to be skilled in all areas of dentistry. They are also expected to possess the special skills necessary to provide comprehensive oral health care for children and adolescents, as well as medically, physically or emotionally compromised individuals.

The specialty program curriculum for pediatric dentistry must ensure that residents receive comprehensive training in all of the above areas. This training involves the management and treatment of healthy children in a dental faculty clinic and the treatment of medically compromised and disabled individuals in a hospital setting, with particular attention paid to interactions with physicians, surgeons and other health care providers from related disciplines. Training is given in pharmacologic

and nonpharmacologic behaviour management techniques, preventive practices (including prenatal and postnatal counselling), and diagnosis and management of abnormalities in the developing occlusion. The curriculum also includes training in the surgical management of the hard and soft tissues and traumatic dental injuries. Residents are also expected to gain teaching experience in the undergraduate DDS/DMD program and to participate in outreach programs.

A substantial part of a pediatric dental specialty program takes place in a hospital setting, where residents are trained to physically evaluate patients, recognize oral diseases, provide dental services to patients under general anesthesia, and assist in managing anesthetic emergencies. At the University of Toronto, residents rotate between the departments of anesthesia, cardiology, hematology and plastic surgery.

At present there are 2 specialty programs in pediatric dentistry in Canada. The University of Toronto's 3-year program leads to an MSc degree. Three places are available in each year of the program. The residents train at the Hospital for Sick Children, Mount Sinai Hospital, Bloorview MacMillan Centre and the City of Toronto dental clinic on Victoria Street. In their final year the students give seminars and teach in the undergraduate preclinical laboratories and treatment clinics. Outreach experience is obtained in the first 2 years of the program and involves 2 rotations of 2 weeks at the Weeneebayko General Hospital in Moose Factory, Ontario. To successfully complete the MSc degree, each student must undertake a research project and defend a thesis.

The other program, given at the University of Montreal, is also a 3-year program that leads to an MSc degree. Two places are available in each year of the program. The residents train at the Sainte-Justine Hospital and the Mother-Child University Medical

Centre. They are also able to observe pediatric dentists in their private clinics. The residents rotate between the departments of anesthesia, cardiology, hemato-oncology, dermatology, pediatrics, general surgery, gastroenterology, immunology, nephrology, and the emergency room. In their second and third year, they teach in the undergraduate clinic.

The pediatric specialty programs of the Universities of Toronto and Montreal are both accredited by the Commission on Dental Accreditation of Canada.

*Dr. Keith Titley
Professor, Faculty of Dentistry
University of Toronto*



Pediatric Hospital Dentistry

Hospital dentistry has existed at The Hospital for Sick Children (HSC) since the turn of the nine-

teenth century, when it was realized that good dental health is essential if young children are to overcome various medical problems.

The department of dentistry at HSC has grown over the years and currently treats almost 20,000 patients a year, all of whom are either medically compromised or very young and afflicted with severe dental caries. About 15% of the patients are treated under general anesthesia. The department includes dental specialists in pediatric dentistry, orthodontics, oral and maxillofacial surgery, endodontics and periodontics.

HSC is affiliated with the University of Toronto's faculty of dentistry, and the academic linkages have promoted research and education at the graduate level. The pediatric dentistry program is the only English-speaking program in Canada. Graduate students treat patients with the most complex and rare of medical problems, cleft lip and

palate, craniofacial anomalies and traumatic injuries. This exposure provides them with sufficient experience to feel comfortable and competent treating pediatric dental patients with complex needs.

The need for pediatric dentists and residents with hospital experience is great in this country. Some provinces have so few hospital-trained dentists that the ratio of patients to dentist is staggering. There is a need for a second graduate training facility outside of Ontario to train more pediatric dentists than Toronto currently trains. The University of Manitoba is in the process of developing such a training facility.

*Dr. Doug Johnston
Dentist-in-chief, The Hospital for Sick Children
Director, Dental Services and Cleft Lip and Palate/Craniofacial Dental Program, Bloorview MacMillan Children's Centre
Associate professor, University of Toronto*

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An Update on Fluorides and Fluorosis

• Steven M. Levy, DDS, MPH •

A b s t r a c t

Decisions concerning use of fluoride in its many forms for caries prevention are more complicated now than in the past because of the need to balance these benefits with the risks of dental fluorosis. This article reviews pertinent literature concerning dental fluorosis (definition, appearance, prevalence), pre- and post-eruptive use of fluoride, esthetic perceptions of dental fluorosis, fluoride levels of beverages and foods, the Iowa Fluoride Study, and the U.S. Centers for Disease Control and Prevention's "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States." Water fluoridation and use of fluoride dentifrice are the most efficient and cost-effective ways to prevent dental caries; other modalities should be targeted toward high-risk individuals.

MeSH Key Words: dental caries/prevention & control; fluorides/administration & dosage; fluorosis, dental/epidemiology

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This article has been peer reviewed.

Fluoride is still the best defence against dental caries, and fluoridation of water was recently named by the U.S. Centers for Disease Control and Prevention (CDC) as 1 of the 10 most important public health measures of the 20th century.¹ In the United States, fluoridation is probably taken for granted, because about 60% of the population is exposed to fluoridated water. However, the percentage is much lower in Canada and varies substantially across provinces. Furthermore, continuing controversies about fluoridation will probably prevent substantial expansion of such water treatment.

The history of fluoridation is a classic story of how public health should work. On the basis of the observation of a probable link between natural fluoride levels in water and caries, there was a period of controlled experimentation, followed by the broader implementation of community water fluoridation programs. Water fluoridation remains the most equitable and efficient means of delivering fluoride to the population.²

Dental Fluorosis

With the substantial decline in prevalence and severity of dental caries among U.S. and Canadian children and young adults, there has been an increase in the prevalence of fluorosis.^{3,4} The level of fluoride intake between the ages of about 15 and 30 months is believed to be most critical for the development of fluorosis of the most esthetically important teeth, the maxillary central incisors, but intake at

younger and older ages could also be of concern.^{5,6} The main documented risk factors for fluorosis (in no particular order) are fluoride in water, infant formula reconstituted with fluoridated water, supplements and dentifrice.⁷⁻¹⁰

Fluorosis varies in appearance from white striations to stained pitting of enamel. Fluorosis of the primary teeth occurs less often and is milder than that of the permanent teeth. Because much of the development of primary teeth occurs prenatally, fluorosis is seen primarily in the gingival third of the second primary molars.¹¹ Fluorosis in this location is also a strong predictor of the subsequent appearance of fluorosis in the early eruption permanent dentition (if high fluoride intake continues to about age 3).¹²

In a sectioned tooth, mild fluorosis has the appearance of a white spot lesion because of subsurface porosity.¹³ With more severe forms of fluorosis, caries risk increases because of pitting and loss of the outer enamel. While some contend that it is difficult to attribute particular patterns of opacities to fluorosis, the classic appearance is characterized by banding that follows the developmental lines of the enamel and by substantial symmetry on homologous teeth.

Mild fluorosis is often not discernible. Somewhat paternalistically, the profession of dentistry decided that mild fluorosis was an acceptable tradeoff for a substantial reduction in caries. However, with esthetics becoming more important than ever, decisions concerning this tradeoff could warrant reconsideration.

Pre- and Post-eruptive Fluoride

Fluoride is delivered topically by means of rinses, dentifrice and water. The primary means of ingestion are water and other beverages and foods, as well as dentifrice. A new emphasis describes fluoride exposures as being either “pre-eruptive” or “post-eruptive,” mainly because most modalities deliver fluoride both topically and systemically (even with topical application, some fluoride is ingested, whether intentionally or not). Post-eruptive fluoride acts mainly by reducing demineralization and enhancing remineralization.

By the age of 1 year, the crowns of the first permanent molars are largely formed and those of the permanent incisors are well on their way to formation. Ingestion of fluoride before 3 to 4 years of age is critical to the possibility of fluorosis in the early erupting permanent dentition, including the maxillary incisors. Thus, the damage is very often done before young patients have their first dental visit.

Current thinking focuses more on risk assessment and individualization of fluoride therapies. It is important not to think that “more fluoride is better.”¹⁴ In the 1940s, before any fluoride products were developed, there was a reduction of 50% to 60% in caries in areas with fluoridated water relative to those without fluoridation, and fluorosis tended to appear only where water fluoride levels substantially exceeded 1 ppm. Now, with more varied and more widely available sources of fluoride, the benefit curve is flatter and the fluorosis curve is steeper.¹⁵

Total fluoride intake is the true risk factor for fluorosis; however, this is very difficult to quantify.¹⁶ Fluorosis increased from the 1940s to 1980s and 1990s in both fluoridated and nonfluoridated communities. However, because various studies have used different indices of fluorosis, precise comparisons are difficult.

It is important to report the prevalence of fluorosis according to the different categories that are detected in studies and probably to make a distinction between questionable, mild and definitive forms. There is little evidence that the severity of fluorosis has been increasing in recent years.

Esthetic Perceptions of Dental Fluorosis

There is some evidence that members of the public can be aware of even mild changes due to fluorosis and may display a preference for “normal” over mildly fluorotic teeth.¹⁷ Until the 1990s there was very little knowledge about the public’s esthetic perceptions about fluorosis, and the dental profession probably thought these perceptions were not very important.

Riordan¹⁸ found that dentists were more perceptive of slight changes from normal appearance, probably because they are more aware of what a “normal” tooth looks like.

Clark and others^{19,20} found few differences among the perceptions of parents, children and dental professionals at low Tooth Surface Index of Fluorosis (TSIF) scores. Lalumandier and Rozier²¹ found that, of subjects with TSIF scores of 0 (no fluorosis), 74% were somewhat or very satisfied with the colour of their teeth, whereas 26% were somewhat or very dissatisfied. Among those with a TSIF of 1 (very mild fluorosis), 11% more (total of 37%) were dissatisfied with tooth colour, and among those with a TSIF of 2 (mild fluorosis), 50% were dissatisfied.

Our studies of esthetic perceptions of dental fluorosis^{17,22–24} found that members of the public had strong preferences about variations from normal tooth appearance. For example, all respondents had a preference for teeth with normal colour over teeth with mild fluorosis, whereas about two-thirds preferred the appearance of an open bite to that of moderate fluorosis. Entering dental students may be similar to lay individuals in their perceptions.²² Interestingly, the same group of dental students assessed before entering first year and again late in their fourth year were more tolerant of many presentations of dental fluorosis, isolated opacity, and diastema after several years of dental training.²⁴ This change in perceptions could be because exposure to a wide variety of oral conditions during dental training leads to less concern about conditions that are not progressive disease conditions.

Fluoride Intake

The optimal level of fluoride intake is not known with certainty. A level of 0.05–0.07 mg/kg is often thought of as “optimal”²⁵; however, lower levels of intake have been associated with fluorosis. The optimal level is virtually impossible to calculate because of variations in fluoride levels in all sorts of foods and beverages. It cannot be assumed that because a person resides in a community with nonfluoridated water, he or she is receiving low levels of fluoride.²⁶ People can get fluoride from water at locations other than home (e.g., child care setting, school, work) or from drinking substantial amounts of soft drinks or juices, which often have fluoride levels close to the optimal range for drinking water. Conversely, just because a food manufacturing plant is situated in an area with fluoridated water does not mean that all of its products contain fluoride, as the plant could have an alternative water source.

In the United States, sources of bottled water must generally be tested for fluoride content only once per year. Most bottled waters contain less than 0.3 ppm; however, some contain close to or more than 1 ppm.^{1,26,27} Some home water filtration systems (distillation and reverse osmosis) take the fluoride out of water, but the carbon/charcoal systems do not.^{26,27}

Breast milk and cow’s milk are very low in fluoride; however, in the 1970s some infant formulas were found to have high fluoride content.²⁶ U.S. manufacturers voluntarily

Table 1 Fluoride levels of bottled waters,²⁷ infant formulas,²⁷ infant foods,³⁹ juices³⁷ and soft drinks³⁸

Source	No.	Fluoride level (ppm)		
		Range	Mean (and SD)	Median
Bottled water	78	0.02–1.36	0.18 (0.35)	0.06
Infant formulas				
Ready-to-feed	16	0.04–0.55	0.17 (0.15)	0.16
Liquid concentrate ^a	14	0.04–0.19	0.12 (0.08)	0.10
Powder concentrate ^a	17	0.05–0.28	0.14 (0.11)	0.09
Ready-to-eat infant foods	206	0.01–8.38	0.35 (0.83)	0.12
Infant dry cereals^a	32	0.05–0.52	0.22 (0.13)	0.15
Juices	532	0.02–2.80	0.56 (0.52)	0.65
White grape (as ingredient)	19	0.15–2.80	1.33 (0.51)	1.40
Other grape (as ingredient)	66	0.05–2.45	1.00 (0.65)	0.66
Other	447	0.02–2.64	0.57 (0.50)	0.32
Soft drinks	332	0.02–1.28	0.72 (0.34)	0.79

SD = standard deviation.

^aReconstituted with distilled water.

and dramatically reduced levels of fluoride in formula by the 1980s, and lower concentrations were documented in the 1990s.²⁷ No recent studies have been done in Canada. In the United States, levels are higher when powdered concentrate is reconstituted with fluoridated water. Also, soy-based formulas are consistently higher in fluoride content than milk-based products. Other foods that have high fluoride content are teas, dry infant cereals, dried chicken, fish and seafood products.

Fluoride mouth rinses are generally contraindicated for young children, because preschool children cannot rinse and spit properly. There is little risk of fluorosis from ingesting fluoride through professionally applied gels, especially when adequate suction is used. Use of fluoride varnish or foam reduces ingestion further. However self-applied gels, used on a daily basis, could present a considerable risk for overingestion.²⁶

There continues to be controversy concerning the use of dietary fluoride supplements, and now they are not generally recommended. In the United States, national data from the mid- to late 1980s showed that about 15% of children less than 2 years of age, 16% of those 2–4 years of age and 8% of those 5 to 17 years of age took dietary supplements, and more than 50% of children took fluoride supplements at some time.²⁸ Many dentists and physicians who prescribe supplements do not adequately test the child's water supplies for fluoride content, which substantially increases some patients' risk of overingestion.^{29,30} Also, if the child lives in a home with low fluoride levels in the water, but drinks fluoridated water in the child care setting or at school, then fluoride supplement doses should be reduced accordingly. An additional paradox is that high-risk children are least likely to comply with a fluoride supple-

ment regimen³¹ although they would have the greatest potential to benefit.

Over 90% of dentifrices contain fluoride, usually at a concentration of 1,000 ppm. U.S. national data from the late 1980s showed that use increased from about 32% of children younger than age 2 to 91% among 4-year-olds. Studies of families with generally higher socio-economic status found that approximately 85% of children were using fluoride dentifrice by 24 months of age.^{32,33} While low-fluoride toothpastes (e.g., 500 ppm) are available for children in a number of countries, they are not available in North America. Furthermore, they are unlikely to become available here, as the manufacturers would have to conduct expensive new clinical trials to gain regulatory clearance from the U.S. Food and Drug Administration, and these products would probably show reduced effectiveness in reducing caries at the lower concentrations.³⁴

The Iowa Fluoride Study

Because it is so difficult to determine the relative importance of the various sources of fluoride exposures and intake, a study was begun in Iowa in 1992 with the goal of assessing longitudinal patterns of fluoride intake and dental fluorosis and caries. This prospective cohort study enrolled about 1,400 mothers with newborns from 8 Iowa hospitals from 1992 to 1995, and about 750 of these women are still participating. In general, the mothers are well educated, and there is an even split between male and female children.^{11,16,31–33,35} An expansion of the study is assessing the children's bone development.³⁶ Concurrently, the levels of fluoride in a large number of beverages and infant foods have been assayed, which has resulted in a number of interesting observations, including those outlined below.

Table 2 Distributions of estimated daily fluoride intake from water, supplements, dentifrice and combined by age (mg) (adapted from Levy and others¹⁶)

Source of fluoride, by child's age (months)	No. of children	Fluoride intake (mg)			Fluoride intake (mg), by percentile					
		Mean	SD	Minimum	10th	25th	50th	75th	90th	Maximum
Dentifrice										
3	1,202	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	777	0.038	0.136	0.000	0.000	0.000	0.000	0.010	0.109	1.750
24	627	0.257	0.312	0.000	0.000	0.041	0.125	0.375	0.656	1.750
36	523	0.278	0.292	0.000	0.018	0.063	0.188	0.438	0.750	1.688
Supplements										
3	1,193	0.018	0.060	0.000	0.000	0.000	0.000	0.000	0.042	0.833
12	794	0.015	0.054	0.000	0.000	0.000	0.000	0.000	0.013	0.500
24	646	0.008	0.052	0.000	0.000	0.000	0.000	0.000	0.000	1.000
36	536	0.013	0.079	0.000	0.000	0.000	0.000	0.000	0.000	1.000
Water										
3	1,178	0.429	0.525	0.000	0.000	0.000	0.264	0.740	1.065	6.656
12	779	0.307	0.372	0.000	0.019	0.065	0.207	0.434	0.740	5.989
24	630	0.289	0.264	0.000	0.035	0.102	0.222	0.394	0.594	2.109
36	532	0.341	0.299	0.000	0.047	0.127	0.266	0.461	0.712	1.724
Combined										
3	1,169	0.448	0.520	0.000	0.000	0.033	0.304	0.746	1.065	6.656
12	755	0.360	0.396	0.000	0.033	0.107	0.259	0.503	0.790	5.989
24	603	0.547	0.414	0.004	0.139	0.264	0.441	0.722	1.132	2.880
36	506	0.634	0.425	0.009	0.195	0.327	0.539	0.826	1.163	2.976

Soy-based formula tends to have a higher fluoride content than milk-based formula, because soy proteins bind some of the fluoride.²⁷ If children are getting fluoride from a lot of other sources, it might be better if they were given milk-based formula, if possible. Fluoridated water added to powdered concentrate could result in ingestion of high levels of fluoride if infants are ingesting many ounces of reconstituted formula per day. Among the bottled waters tested, 83% contained less than 0.3 ppm; however, 10% contained more than 0.7 ppm.²⁷ Thus, it cannot be assumed that, just because a child is consuming bottled water, the fluoride intake is low. Another finding is that the manufacturers of particular beverages change the water sources used for reconstitution over time, which could lead to variations in fluoride levels. However manufacturers are not required to document fluoride levels, so there is no way to know.

Many types of juices and juice drinks were tested,³⁷ and, consistent with other research, the grape juices (especially white grape juices) contained the highest fluoride levels. Overall, about 42% of the tested juices and juice drinks had fluoride levels greater than 0.6 ppm. It is especially difficult to determine the level of fluoride in soft drinks because the manufacturers operate so many bottling plants. Samples of Coca-Cola tested ranged from less than 0.1 ppm to greater than 1 ppm of fluoride.³⁸ The water used in the bottling operation is the key factor, not the flavour, caffeine status or format (diet vs. regular) of the beverage. Overall,

about 77% of soft drinks had fluoride levels greater than 0.60 ppm.

Among solid foods, fruits consistently had low fluoride levels, meats had slightly higher levels, and chicken products for infants had the highest levels.³⁹ The manner in which the chicken is mechanically deboned allows fluoride-rich bone particles to be incorporated into the food. Chicken products for infants have about 20 times the level of fluoride of fruit products for infants. Just 2 ounces (about 60 g) per day of the chicken food provides about 0.5 mg fluoride, about the maximum that an infant should be receiving from all sources.

Table 1 summarizes the Iowa Fluoride Study's findings concerning fluoride levels of beverages and infant foods.^{27,37-39}

Children should be supervised carefully when using fluoride dentifrice because they tend to swallow a lot of dentifrice.³⁴ Parental supervision should occur both during placement of dentifrice on the brush and during brushing. In a study of preschoolers, the amount swallowed was most frequently 55% to 79% of the amount of dentifrice used, but ranged as high as 90%.³³ As a general rule, children use more dentifrice when not supervised. This author recommends that children spit out the dentifrice, but not rinse, so that fluoride will continue to bathe the teeth for a period after brushing.

Use of dentifrices that have been flavoured for children (e.g., bubble gum or fruit flavour) increases children's

Table 3 Summary of recommendations for using fluoride to prevent and control dental caries in the United States (adapted from CDC¹)

Public health and clinical practice

1. Continue and extend fluoridation of community drinking water.
2. Counsel parents and caregivers regarding use of fluoride toothpaste by young children, especially those < 2 years of age.
3. Target mouth-rinsing to persons at high risk.
4. Judiciously prescribe fluoride supplements.
5. Apply high-concentration fluoride products to persons at high risk for dental caries.

Self-care

1. Know the fluoride concentration in the primary source of drinking water.
2. Use small amounts of fluoride frequently.
3. Supervise use of fluoride toothpaste among children < 6 years of age.
4. Consider additional measures for persons at high risk for dental caries.
5. Use an alternative source of water for children ≤ 8 years of age whose primary drinking water contains > 2 ppm fluoride.

Consumer product industries and health agencies

1. Specify the fluoride concentration of bottled water on the bottle label.
2. Promote use of small amounts of fluoride toothpaste by children < 6 years of age.
3. Develop a low-fluoride toothpaste for children < 6 years of age.
4. Collaborate to educate health care professionals and the public.

Further research

1. Continue metabolic studies of fluoride.
2. Identify biomarkers of fluoride.
3. Re-evaluate the method of determining the optimal fluoride concentration of community drinking water.
4. Evaluate the effect of fluoride mouth rinse, fluoride supplements and other modes of delivering fluoride on dental caries.
5. Study the current cost-effectiveness of fluoride modalities.
6. Conduct descriptive and analytical epidemiologic studies.
7. Identify effective strategies to promote adoption of recommendations for using fluoride.

acceptance of fluoride dentifrice, enhancing caries prevention. However, children's flavours have been associated with use of larger quantities of dentifrice.^{40,41} A small, pea-sized amount of dentifrice is recommended; however, this expression has different meanings, which has led to recommendations that dentifrice be applied across rather than lengthwise along the brush bristles.

To estimate the amount of fluoride ingested from various sources, parents of children in the Iowa Fluoride Study were asked to complete questionnaires about water sources, use of fluoride supplements and dentifrice, and intake of beverages and selected foods.¹⁶ It was found that 25% of the children were ingesting an estimated 0.8 mg of fluoride daily, and 10% were ingesting more than

1 mg daily. On a per-kilogram basis, 25% of the children were getting more than double the recommended 0.05 to 0.07 mg/kg. Intake of fluoride also varies considerably over the first couple of years of life. Table 2 details the distribution of combined fluoride intake from water, supplements and dentifrice at 3, 12, 24 and 36 months of age.¹⁶

Approximately 12% of children in the Iowa Fluoride Study had mild fluorosis of the primary teeth, mostly on the cervical third of the second molars.¹¹

Conclusions

These findings underlie the need to prescribe fluoride on the basis of sound information about the patient. The recent "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States" from the CDC¹ are helpful. Table 3 summarizes the CDC recommendations.

Water and toothpaste are the mainstays of fluoride delivery for all. Other modalities should be considered only if the child is at high risk for caries. Care should be exercised in prescribing other modalities of fluoride delivery before age 6, and especially before age 3, because of the risk of dental fluorosis.

High-risk groups include children of low socioeconomic status, those whose parents have low levels of education, those who do not regularly attend for dental care and those without dental insurance. High-risk children are those with active caries; those whose siblings have high levels of caries; those with high levels of *Streptococcus mutans*, cognitive or physical challenges to oral hygiene, or low salivary flow or buffering capacity; and especially those consuming a cariogenic diet and receiving inadequate exposure to fluoride.

The most important messages about fluoride recommendations are that making them is more difficult than it used to be and that "more fluoride is not necessarily better." ♦

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Oral Health Promotion for High-Risk Children: Case Studies from British Columbia

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A b s t r a c t

Socio-economics, family stress and parenting style each plays an important role in the development of early childhood caries as dietary and microbiological factors. Therefore, to be successful, oral health promotion initiatives should be designed and implemented with due consideration of issues such as collaboration with community partners, the role of dental health in overall child health and the involvement of the community in program planning. This article briefly describes 3 programs that have been undertaken in British Columbia either as public health initiatives or as demonstration research projects to improve oral health in young children from diverse communities with a high prevalence of early childhood caries.

MeSH Key Words: health education/dental; health promotion/methods; social environment

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The prevention of early childhood caries (ECC) in children at high risk for this disease continues to challenge all who are interested in bettering children's health. While serious disturbances in the balance between bacteria, substrate and host are the factors traditionally considered to result in ECC, family, economic and social conditions also have a substantial impact on the development of the disease.¹ Income level and socio-economic status are probably the major determinants of which children will suffer from ECC.² The relationship of these social and environmental factors suggests that an approach emphasizing health promotion, rather than disease prevention at the individual level, is the model likely to have the greatest positive effect on children's oral health. Oral health promotion is a planned approach to build healthy public policies, create supportive environments, strengthen community action, develop personal skills or reorient health services in the pursuit of oral health goals.^{3,4} Not only will approaches that include at least some of these principles of health promotion have a positive impact on the child's health, but they will also positively affect the family and the community.

This paper describes some issues of importance when adopting a health promotion approach for a condition such as ECC and outlines examples of some current programs in British Columbia.

Considerations for Oral Health Promotion Initiatives

Because of the significance of socio-economic status, family stress and access to care in the development of ECC, it is important that oral health promotion initiatives include some of the following considerations.

Collaboration with Community Partners

The prevalence of ECC will not be diminished by the efforts of private dental offices working independently; instead, there must be collaboration among private practitioners, public health officials and anyone else who interacts with young children. As a positive example to the community, dental offices should offer any family, no matter how young their children, a "dental home" where preventive counselling and early management of disease is available.⁵ Other health care and child care workers are unlikely to accept their role in preventing ECC in extremely young children if the dental profession fails to adopt this approach. In addition, because community dental health staff throughout the country are reorienting their role to focus on families with infants and toddlers,⁶ practising dentists should make themselves aware of, and offer support to, these public health initiatives.

Dental Health and Overall Child Health

The evidence that supports the links among dental health, overall child health and quality of life^{7,8} provides a unique incentive to encourage collaboration with other health care workers, such as community health nurses and physicians, so as to increase their awareness of these links and their role in improving children's dental health. Reorienting existing services to encompass oral health concerns is a key aspect of oral health promotion.

Community-based Approach

Because of their particular cultural background, economic situation or remote location, individual communities may present unique challenges and opportunities for health promotion. Without a consultative process that involves the communities and listens to the voices of their residents, oral health programs and preventive interventions are unlikely to be successful.^{9,10}

Early Adoption of Positive Habits

New parents are keen to adopt practices that will encourage their child to grow and develop in a healthy manner. Health promotion interventions occurring *before* negative habits have developed may have a reasonable chance of success. Thus, introducing dental health messages and counselling at or about the time that primary teeth are erupting should be the ideal time to promote adoption of healthy habits and parenting skills. Dental health messages should continue to be part of well-child care throughout infancy and toddler stages. For high-risk children, preventive counselling beginning at the age of 3 years is too little, too late.

Counselling Approach

Families are unlikely to adopt positive behaviours or change existing poor behaviours when an authoritarian, advice-giving approach is used.¹¹ A counselling style that embraces empathy and reflective listening and that considers the stage of behavioural change of the client has more likelihood of success.¹²

Realistic Indicators of Success

Before implementing a health promotion intervention, realistic outcome measures and indicators of success must be established. Changing the "25% of children who have 80% of the cavities"¹³ to a more favourable statistic is a long-term proposition. For example, rather than aiming to decrease by 50% the prevalence of ECC among all preschool children in a given community, it may be more realistic to work on delaying the onset and severity of the caries process so that fewer children require hospitalization for dental disease at 2 years of age and more children can instead be treated in the dental operatory when they are older.

Experiences in Dental Health Promotion in British Columbia

In British Columbia, dental screenings by calibrated, certified dental assistants working in public health have demonstrated that about 11% of kindergarten-aged children have evidence of "nursing bottle tooth decay," defined as decay on at least 2 primary incisors.⁶ Given this troublesome finding, that 1 in 10 children entering kindergarten has significant dental disease, a variety of programs have been introduced throughout the province, both in public health and in externally funded demonstration research projects, to explore initiatives that might improve the oral health of young children who are at risk for ECC.

Identification of High-Risk Children by Community Dental Health Staff

Community dental staff from the province's health authorities have initiated a variety of programs to identify children at risk for ECC.⁶ A simple 7-point questionnaire is now used to identify "risky" behaviours in children attending for 12-month vaccinations at health unit offices. On the basis of responses to these questionnaires, dental staff then contact parents and offer counselling on how to reduce the risk. In 2001, about three-quarters of the 20 health regions around the province used these risk-assessment questionnaires at a total of 90 sites. The responses revealed that about one-fifth of toddlers were from families where the risk was determined to be high.⁶

The success of these risk-assessment programs depend on the cooperation and assistance of other health unit staff, such as health unit aides, public health nurses, clerical staff and volunteers. British Columbia is a large and diverse province in a variety of ways; there is even variation throughout the province in terms of where parents attend for infant vaccinations. For example, public health nurses provide 70% of the vaccinations in the Capital Health Region around Victoria; families can thus complete the questionnaire at child health clinics. However, in North Delta, a suburban community outside of Vancouver, 80% of infants attend physicians' offices for vaccinations; here, questionnaires are administered by telephone.

For many regions, data from outcomes assessment are not yet available, but some information has been gathered in the Capital Health Region. Families who were contacted after completing the questionnaire were compared with families for whom no follow-up was performed, and contact with dental staff appeared to have a positive impact on changing "dentally unhealthy" behaviours. Parents were in general more likely to begin brushing their child's teeth with a fluoridated toothpaste than they were to change the child's feeding habits.⁶ This finding is supported by the results of similar projects in other countries.¹⁴

Throughout the province, dental staff have introduced other ECC-related projects that reflect British Columbia's cultural and socio-economic diversity. The following are a few examples of the variety of programs that are underway:

- A poster and brochure designed specifically for physician's offices were developed in the Fraser South Health Region, which includes North Delta, where 80% of families see their family physician for vaccinations. Input from focus groups informed the design and size of the poster, which has been translated into Punjabi to attract the attention of the large number of South Asian families in the region. The materials have also been distributed to every community pharmacy in the province.
- Focus groups with parents of young children in the Simon Fraser Health Region explored where and when parents would benefit most from information about ECC and identified barriers to "dentally healthy" behaviours.
- The North Interior Health Region began a fluoride varnish program for high-risk preschool children. Fluoride varnish programs for preschool children are now underway throughout northern British Columbia.

Demonstration Research Projects in Oral Health Promotion

Any community-based research project must involve a strong collaboration between the community and the researchers. The aim of the project should address issues that are relevant to the community, and, ideally, the community should be involved at all stages of the project. While these goals are laudable, community participation does not always take the form that the researchers initially imagined.¹⁵ The following are brief descriptions of 2 community-based oral health promotion programs that have been undertaken in culturally diverse B.C. communities with a high prevalence of ECC.

Child Oral Health Promotion in a Northern First Nations Community

The overall purpose of this demonstration project, funded by a Special Research Demonstration Project Grant from the B.C. Health Research Foundation and conducted in a single B.C. First Nations community, was to develop a community-based, culturally sensitive health promotion program that would diminish the use of feeding and comforting practices that contribute to ECC.¹⁶ Anecdotal reports from community members indicate that bottles were not traditionally used in First Nations communities for pacifying fussy infants. In the participating community, willow cradles served this purpose. However, in recent times, the tradition of making cradles has been all but lost. The information-gathering phase demonstrated a prevalence of nursing caries in preschool children of 59%, and a mean decayed, extracted or filled teeth, or deft (and standard

deviation) of 7.0 (4.9). The activities of the project, planned and supervised by a committee of mothers from the community and health workers, emphasized traditional child-rearing practices, such as the use of willow cradles. The project supported the fabrication of cradles by community elders, and the completed cradles were then loaned to parents. In addition, pamphlets and posters with a local First Nations theme were developed, and the community health nurse provided individual counselling for mothers of infants and toddlers. The results showed improvements over baseline and were also better than those obtained in a neighbouring community, although the differences were not statistically significant. When project funding ended, more children were reported to be off the bottle by the age of 2 years and fewer slept with a bottle. The mean decayed, extracted or filled surfaces (defs) of children 18–38 months of age had decreased, and a general awareness of the program within the community was reported. Although the results of the project are not compelling as far as their statistical significance, the re-adoption of a traditional child-rearing practice, coupled with a modest improvement in dental health and an increase in community awareness of the problem of ECC, is a positive step in the spirit of community capacity-building and health promotion.¹⁶

Child Oral Health Promotion by a Lay Health Worker in an Urban Vietnamese Community

The objective of this project was to design, implement and evaluate an oral health promotion program for Vietnamese preschool children in Vancouver's inner city.¹⁷ The project comprised 4 general phases: gathering information and then planning, implementing and evaluating the project. The first phase of the project demonstrated extensive tooth decay in young children, bottle use (during the day and during sleep-time) long past the recommended weaning age and a belief by many parents that the primary teeth were not important.¹⁷ In addition to the high prevalence of dental caries among inner-city Vietnamese preschool children, another incentive to develop this program specifically for Vietnamese families was the support of a Vietnamese-speaking public health nurse who had recently established a twice-monthly Vietnamese child health clinic. Greatly respected by Vietnamese families, this nurse was a strategic community partner in emphasizing to families the link between dental health and overall child health. The project planning committee, which included Vietnamese community workers, developed a program that featured one-on-one counselling by a Vietnamese lay health counsellor, supported by community-wide activities¹⁸ (Table 1). The lay health counsellor, who had no previous dental training or background, provided in-person counselling to mothers with telephone follow-up a week later that coincided with scheduled infant vaccination visits to the Vietnamese child health clinic. Mothers were able to

Table 1 Counselling schedule at Vietnamese child health clinics in Vancouver

Age of child (months)	Messages	Gift to parent
2	Importance of baby teeth Use of soother for comforting	Soother
4	Teething Tooth cleaning	Pamphlets in Vietnamese language
6	Tooth cleaning Avoiding use of bottle in bed	Infant toothbrush
12	Baby bottle tooth decay Switching from bottle to cup	Training cup
18	Review all topics	Infant toothbrush

provide input to the project as a whole and to the content and method of delivery of the dental messages during their visits to the clinic and during follow-up telephone conversations. Frequently, mothers dropped in to consult with the community dental health worker about dental questions pertaining to their children. At all of the 4 follow-up assessment clinics held since this continuing project began more than 7 years ago, mothers who had had more than one counselling visit reported significantly less use of daytime and sleep-time bottles for their children, and these children demonstrated significantly lower prevalence of caries compared with similar-aged children at baseline. One-on-one counselling and regular follow-up provided by a lay person of similar background and culture to program participants shows promise as an effective way to facilitate adoption of healthy behaviours and to improve the oral health of children. In recent years, this program has been extended to the inner-city Chinese community of Vancouver in response to requests from community health staff. This project was initially supported by the B.C. Health Research Fund and more recently has received continuous funding from the Sharon Martin Community Health Trust Fund.

Conclusions

While the 3 initiatives described here have obvious differences, they share many similarities in approach and philosophy. Collaboration with existing public health programs such as well-baby clinics and involving other providers such as physicians and pharmacists are common threads. Encouraging community input through mothers' committees or focus groups occurred before the introduction of all of these programs. Some of the programs were designed or adapted to address the cultural differences of families of interest, for example, by reaching out to family doctors in North Delta where Punjabi-speaking families attend for vaccinations and by developing a cradle loan program for First Nations family seeking more traditional ways to comfort a fussy infant. Beginning interventions in infancy was an essential aspect of all of the projects. The importance of targeting children at high risk rather than

developing a generic program for all is a value shared by the community public health initiatives and the demonstration projects. Scrupulous outcomes assessment continues to be a challenge, and the value of all these projects will be enhanced by more rigorous evaluation. ♦

This paper is based on a presentation given at the October 2001 CAPD annual meeting.

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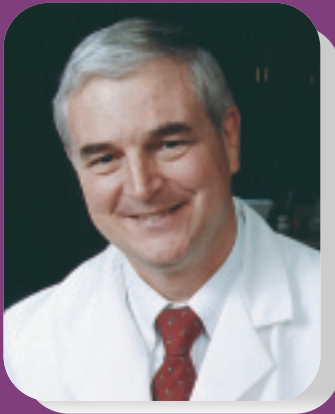
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Intravenous Procedural Sedation: An Alternative to General Anesthesia in the Treatment of Early Childhood Caries

• Alan R. Milnes, DDS, Dip Paed, PhD, FRCD(C) •

A b s t r a c t

Providing comprehensive dental treatment for preschool children with early childhood caries (ECC) is probably the greatest challenge facing most dentists; many elect to hospitalize a child with ECC and provide treatment under general anesthesia. However, as waiting lists for hospital admission are long, ECC continues to progress and can cause pain or acute infection. Hospital treatment also results in substantial costs beyond those for dental treatment. This paper describes a cost-effective intravenous sedation program being used in a pediatric dental practice in Kelowna, British Columbia. The program offers an alternative to general anesthesia that allows qualified dentists to provide comprehensive dental treatment to children with ECC safely and efficiently in the private practice setting.

MeSH Key Words: anesthesia, dental/methods; anesthetics, intravenous; dental care for children/methods

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Although the prevalence of dental caries has declined among the population as a whole, early childhood caries (ECC) is recognized as a significant public health problem among preschool children,^{1,2} especially children from certain ethnic groups³ and those living in poverty.⁴ While various preventive strategies have been developed and tested in selected populations with varying degrees of success,⁵ comprehensive treatment is still required for a large number of children with ECC. Arguably, a child with ECC presents the greatest challenge most dentists will face.

Historically, dentists treating uncooperative children with extensive dental disease, including ECC, have relied on a variety of patient management strategies, including behavioural, nonpharmacologic techniques,^{6,7} different combinations of oral sedatives, nitrous oxide–oxygen sedation, and general anesthesia (GA),⁸ to deliver quality treatment safely and compassionately. These procedures have enjoyed varying degrees of success in eliminating uncooperative behaviours, with oral sedation (OS) and nitrous oxide–oxygen being the least successful and most unpredictable,⁸ especially in young children, and GA being the most successful. Many young children lack the emotional and social maturity to allow treatment to

proceed when behavioural, nonpharmacologic management techniques alone are used.

GA is the most common modality for managing uncooperative children with ECC. However, as waiting lists at Canadian hospitals continue to increase, in the opinion of many, to unworkable lengths, children with ECC experience a progression of their condition to the point where many develop pain and acute infection before the scheduled treatment date. Studies have shown^{9,10} that ECC can have a profoundly negative impact on the quality of life and general growth and development of affected children. Increasing waiting times for dental surgery will only exacerbate these problems. Although private surgical facilities offer a partial solution, many families do not have the financial resources to choose this option and many communities cannot support these facilities. The costs of providing GA in a hospital or private facility range between \$600 and \$1,500 for anesthesia and facility services alone.¹¹

Pediatric dentistry has been slow to embrace patient management strategies employed in pediatric medicine, such as intravenous procedural sedation (IVPS), when invasive and potentially painful dental procedures must be performed on uncooperative children. The costs of providing IVPS are substantially less than those associated



Figure 1: Sedated child with an intravenous line placed in the dorsum of the right hand. The child has been placed into a protective stabilization device. Note that his head has not yet been properly positioned. Monitoring equipment in the background consists of a pulse oximeter/NIBP/EKG monitor, capnograph and defibrillator. These monitors are placed on a crash cart that contains essential emergency drugs and supplies.



Figure 2: The child's head is now properly positioned. A Vac Pac (Olympic Medical, Port Angeles, Wash.) is used to stabilize the head in a sniffing position during sedation. The pretracheal stethoscope monitors respirations intraoperatively.

with GA. Moreover, since the practitioner controls patient scheduling for in-office IVPS, children usually receive treatment faster and at greater convenience to parents. IVPS is a powerful and predictable method for sedating children,¹² and because the agents used in IVPS are titratable (unlike those used for OS), the procedure has a wider margin of safety. Furthermore, unlike some of the popular agents used in OS (e.g., chloral hydrate and antihistamines), the primary agents used in IVPS regimens — benzodiazepines and opioids — are readily reversible should a complication arise or if an undesirable depth of sedation is reached. It is important to recognize, however, that practitioners who wish to use IVPS must obtain advanced training.

This paper compares the use of IVPS and GA to treat uncooperative children with ECC in a private practice setting in Kelowna, British Columbia.

The Kelowna Experience

Kelowna is located in the Okanagan Valley and has a population of 95,000. As the largest city outside of the Lower Mainland, it has become a tertiary medical centre for the Southern Interior of British Columbia. Because the author's practice is the only pediatric dental practice between Calgary and the Lower Mainland of British Columbia, Kelowna has become a tertiary care centre for children requiring specialist pediatric dental services. Children are referred from a large geographic area encompassing both the Interior and Northern Health Authorities, 2 of the 6 administrative units that administer health care in British Columbia. Many families must travel long distances to access care in Kelowna. Hence, an important goal is to complete all necessary treatment in one appointment.

Children must be seen initially for a consultation, at which time a diagnosis is made, a treatment plan developed

and various treatment options presented to the parents. A decision is also made, on the basis of the child's medical history, present state of health and treatment requirements, whether treatment can proceed with local anesthesia and nonpharmacologic techniques, IVPS or GA. Only children who are healthy (ASA 1) or have a well-controlled and minor medical condition (ASA 2) are eligible for treatment in the office under IVPS. The sedation protocol, including drugs and dosages, has been previously described (Figs. 1 and 2).¹² Children with more severe medical conditions who require extensive dental treatment and exhibit high anxiety or uncooperative behaviour are treated under GA after an anesthesia consult.

IVPS is generally restricted to children 30 months of age and older. For procedures such as extracting several painful teeth, IVPS can be safely administered to children under 30 months of age because the appointment length is very short and drug dosages needed to induce cooperation under sedation are small. The decision to limit IVPS to children 30 months of age or older in this author's practice is arbitrary and largely based on our training and experience in providing comprehensive restorative treatment to children with ECC. The treatment required, its urgency, the speed with which the treatment can be accomplished, airway evaluation, and a child's behaviour and social competence as determined during the consultation appointment are several important factors that need to be considered when deciding whether to offer treatment under IVPS or GA. The author's experience in using IVPS to provide comprehensive restorative care to children under 30 months of age is limited. However, in the few cases completed to date, drug dosages required to secure cooperation in this age group were often higher than those needed for older children. Increasing drug



Figure 3: The author and a certified dental assistant treat a 5-year-old boy under IV sedation. Note the patient's head position and protective stabilization to prevent random movement.



Figure 5: Appropriate staffing is essential when moderate levels of sedation are used. One registered nurse draws midazolam from a multidose vial for administration as a preoperative oral sedative, while the other registered nurse monitors the patient and administers medication at the author's direction.

dosages may lead to deep sedation. This is a scenario practitioners must try to avoid when sedating a child in this age group, as the risk of respiratory complications increases significantly when sedation deepens.

In the last five years, 1,832 children with ECC have received treatment under IVPS in the author's private practice (Figs. 3 to 5). The mean age of the children was 35 months. The mean treatment time was 65 minutes, with a range of 30 to 115 minutes. Comprehensive dental treatment, including extracoronal and intracoronal restorations, pulp therapy and removal of unrestorable or



Figure 4: Appropriate monitoring is essential when sedating a child. This monitor measures heart rate, SpO₂, diastolic and systolic blood pressure, respiratory rate and temperature, and provides a lead II electrocardiogram tracing.

abscessed teeth, was accomplished in one appointment. The mean IVPS fee was \$140, with a range of \$80 to \$236. The mean cost to the author for providing IVPS was \$62, with a range of \$32 to \$104. This amount included the wages for one registered nurse who was responsible for assessing the patient before treatment, administering a preoperative sedative, monitoring the patient during and after treatment and recording vital signs, discharging the patient to a responsible parent and reviewing discharge instructions with the parent.

During the same time period, 432 children with ECC were treated in hospital under GA. The mean age of the subjects was 32 months, with most children between the ages of 19 and 28 months. Several parents of older children requested treatment under GA, which increased the mean age of the children treated. The mean treatment time was 60 minutes, with a range of 30 to 110 minutes. The mean total cost for treatment under GA was \$1,105. The mean cost per patient for hospital-related services was \$775. The mean anesthetist's fee was \$360, which in some cases included the cost of a preoperative history and physical by the anesthetist. Hospital-related costs included the salaries of registered nurses working in the day surgery unit, the operating room, post-anesthesia recovery area and the pediatric ward, the salaries of clerical staff responsible for booking and admitting patients, and costs for OR and anesthesia supplies and equipment, as well as OR maintenance after each case.

None of the children suffered adverse events intraoperatively with either IVPS or GA. During IVPS, a significant proportion of the children cried at some juncture in the treatment, in particular when a rubber dam was placed, local anesthesia was administered and, oddly, when teeth with newly placed proximal restorations were flossed. Parents should be warned beforehand that the child may cry during treatment when IVPS is used. These disruptions had

no effect on treatment but served as important indicators of child comfort and depth of sedation. Both groups of children cried or struggled at the conclusion of treatment when monitors were removed and they were being transported to the recovery area. Eight per cent of children treated with IVPS experienced postoperative nausea or vomiting, compared to 7% of children treated under GA. None of the children treated with GA or IVPS required hospital visits after discharge since there were no postoperative complications.

Discussion

This article has shown that IVPS can be a suitable alternative to GA for some children with ECC. Not all children with advanced dental disease, however, are suitable for IVPS. The very young (less than 30 months of age), children with respiratory, cardiac or metabolic conditions for which IVPS may increase the risk of complications, or children with extensive treatment requirements that may result in a lengthy sedation appointment are better managed under GA. Practitioners must be adequately trained and educated to use IVPS and must follow provincial sedation guidelines. For these reasons, the author does not recommend the use of IVPS by family dentists to treat children with ECC. This technique should be restricted to specialists with advanced training in pediatric anesthesia and sedation.

Incorporating IVPS into pediatric dental treatment has many advantages. Because treatment under IV sedation does not require a hospital visit, it may be less traumatic for both the child and the parents. Costs to provide treatment under GA, although not borne directly by the parents, are much higher than the costs of providing the same treatment under IVPS. With IVPS it is possible to reverse sedation rapidly if complications ensue during treatment. There is low morbidity and mortality associated with IVPS¹³ when it is administered by qualified personnel who adhere to recognized sedation standards.

OS is widely used in pediatric dental practices to manage uncooperative children. However, the failure rate of OS is approximately 40%, primarily because the absorption of sedative agents is unpredictable.⁸ Most OS regimens do not have sufficiently long durations of action to allow completion of treatment in one appointment. Sometimes 2 or 3 appointments are necessary to complete treatment for ECC under OS. This increases the costs to parents and causes greater inconvenience to the family, especially if travel and time away from work are considered. Nonetheless, it is likely that OS will continue to occupy an important place in the behaviour management armamentarium of pediatric dentists. This paper argues that, given the high failure rates and the need for multiple appointments with OS, IVPS should assume a larger place in managing the behaviour of uncooperative children in pediatric dental offices. IVPS is more predictable than OS

and has a higher success rate because medications can be titrated as needed during treatment. It can also be argued that IVPS is safer than OS if benzodiazepines and opioids are used, as there are reversal agents for each of these drug classes. The effects of some commonly used medications for OS (e.g., chloral hydrate, antihistamines and hydroxyzine) cannot be reversed, which is a significant disadvantage over IVPS.

Continuing education on IVPS is available in the United States under the auspices of the American Dental Society of Anesthesia. The curriculum is standardized, modular in design and competency-based. Successful candidates must be licensed and certified in advanced life support, must complete each module and demonstrate competency in a defined number of IVPS cases, which they administer under instructor supervision.

As with any treatment procedure, there are disadvantages associated with IVPS. Significant training is required before a practitioner can master the technique; currently no undergraduate program or graduate program in pediatric dentistry in North America offers this training. Appropriate patient selection and preoperative patient assessment is critical. Providing this treatment in the practice requires that the dentist purchase essential monitoring and emergency equipment. Staff with appropriate training must be employed when IVPS is used. Most provinces require that a qualified person, such as a registered nurse, be present in the treatment room whose sole purpose is to monitor the patient during and after treatment and to record vital signs at specific intervals. The operator must not also act as the sedationist during IVPS. Office design should take into account an IVPS program. A dedicated recovery room may be required, although a vacant dental operatory has all the attributes necessary. Hallways and doorways may need to be slightly wider than usual to accommodate wheelchairs or, in rare circumstances, stretcher beds. As most provincial building codes require that dental offices be fully accessible to those with disabilities who may use assistive devices, this latter issue is less of a consideration.

Conclusions

Equipment and training to provide GA is far more expensive than what is required for IVPS. The costs of providing GA in Canada are covered by the public health care system if the procedure is undertaken in a hospital or an accredited private facility; ultimately, the taxpayers are the ones who must bear those costs. The costs for IVPS are usually paid either by a private dental insurance plan or by the parents. The dental condition of a child who must wait many months for treatment under GA will likely deteriorate, and the progression of decay may also result in higher treatment costs. What cannot be quantified so easily is the pain and suffering a child may endure while waiting many months for admission to a facility that provides GA.

In comparison, pain and suffering can be eliminated much more quickly in a private practice setting, where a pediatric dental team qualified to perform IVPS can more easily schedule necessary treatment.

This article has described the use of IVPS to manage young children who required dental treatment for ECC. The experience in Kelowna has shown that IVPS can be both a successful and a cheaper alternative to GA for the treatment of children with ECC. The article has also discussed important limitations and considerations in the use of IVPS for the treatment of children with ECC. ♦

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Causes, Treatment and Prevention of Early Childhood Caries: A Microbiologic Perspective

• Robert J. Berkowitz, DDS •

A b s t r a c t

Early childhood caries (ECC) is a virulent form of dental caries that can destroy the primary dentition of toddlers and preschool children. It occurs worldwide, afflicting predominantly disadvantaged children. High-risk North American populations include Hispanic and Native American children, as well as children enrolled in Head Start, a federally funded program for preschool children living in poverty. The prevalence of ECC among these children ranges from 11% to 72%. ECC is an infectious disease, and Streptococcus mutans is the most likely causative agent; diet also plays a critical role in the acquisition and clinical expression of this infection. Early acquisition of S. mutans is a key event in the natural history of the disease. Acquisition may occur via vertical or horizontal transmission. Primary oral colonization by S. mutans coupled with caries-promoting feeding behaviours results in accumulation of these organisms to levels exceeding 30% of the total cultivable plaque flora which in turn leads to rapid demineralization of tooth structure. Treatment of ECC is costly because the cooperative capacity of babies and preschool children usually necessitates the use of general anesthesia. Treatment usually consists of restoration or surgical removal of carious teeth along with recommendations regarding feeding habits. However, this approach has resulted in unacceptable clinical outcomes, and relapse rates of approximately 40% have been reported within the first year after dental surgery. Primary prevention of ECC has largely been restricted to counselling parents about caries-promoting feeding behaviours. This approach has also had minimal success. Newer strategies addressing the infectious component through use of topical antimicrobial therapy appear promising.

MeSH Key Words: child, preschool; dental caries/microbiology; streptococcal infections/epidemiology

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Early childhood caries (ECC) is a particularly virulent form of dental caries that is characterized by an overwhelming infectious challenge and is associated with unusual dietary practices. ECC initially presents with smooth-surface carious lesions affecting the primary maxillary incisors (PMIs). As the disease progresses, decay appears on the occlusal surfaces of the primary maxillary first molars, with subsequent spread to other primary teeth, resulting in the eventual destruction of the primary dentition.

ECC is a public health problem that continues to affect babies and preschool children worldwide. A comprehensive review of the epidemiology of ECC showed that its prevalence varies from population to population; however, disadvantaged children, regardless of race, ethnicity or culture, are most vulnerable.¹ High-risk North American populations include many different groups. Almost 30% of 125 Mexican-American children (8–47 months of age) living in the Yakima Valley (Washington State) were

reported to have ECC.² Serwint and others³ reported that 20% of 110 Mexican-American children (18–36 months of age) who were patients of a hospital-based pediatric practice in Los Angeles had ECC. Results from epidemiology studies show that Native American children are at high risk for ECC. The prevalence of ECC among Navajo ($n = 1,463$) and Cherokee ($n = 144$) children enrolled in Head Start, a federally funded program for preschool children living in poverty, was 72% and 55% respectively.⁴ Similar observations were reported by Kelly and Bruerd,⁵ who observed a high prevalence of ECC among 515 American Indian (41.8%) and Alaskan Native (66.8%) children enrolled in Head Start programs in Oklahoma and Alaska respectively. Albert and others⁶ found that the prevalence of ECC in a population of 260 preschool Inuit children was 65%. Non-Native American children enrolled in Head Start programs also display high levels of ECC. In an examination of 1,230 children (3–5 years of age) in 37 Head Start

programs in Arkansas, Louisiana, New Mexico, Oklahoma and Texas, the prevalence of ECC was 18.5% for 3-year-olds, 22.4% for 4-year-olds and 27.9% for 5-year-olds.⁷ The prevalence of ECC in Head Start programs in 2 Ohio communities (total of 200 children 3.5–5 years of age)⁸ and St. Thomas, U.S. Virgin Islands (375 children 3–5 years of age)⁹ was 11% and 12% respectively. Overall, then, the prevalence of ECC for these high-risk North American populations ranged from 11% to 72%.

Because ECC is an infectious disease, this paper reviews current information regarding the causes, treatment and prevention of ECC from a microbiologic perspective.

Causes

Microbiological Risk Factors

Microbial Characteristics of ECC: Bacteriologic studies^{10–12} have demonstrated that in children with ECC, *Streptococcus mutans* regularly exceeded 30% of the cultivable plaque flora. This dense level of dental infection was associated with carious lesions, white spot lesions and sound tooth surfaces near the lesions. Conversely, *S. mutans* typically constitutes less than 0.1% of the plaque flora in children with negligible to no caries activity.¹³ These observations, together with other published results,^{14–16} clearly illustrate the concept that ECC is an infectious disease and that *S. mutans* is the most likely infectious agent; clearly diet also plays a critical role in the clinical expression of this infection.

Early Acquisition of S. mutans: The mouth of a normal predentate infant contains only mucosal surfaces exposed to salivary fluid flow. *S. mutans* could persist in such an environment by forming adherent colonies on mucosal surfaces or by living free in the saliva and duplicating at a rate exceeding the washout rate of salivary flow. Because the oral flora averages only 2 to 4 divisions per day¹⁷ and swallowing occurs every few minutes, it is reasonable to assume that bacteria cannot maintain themselves in saliva by proliferation, but instead must become attached to an oral surface. Previous studies (reviewed by Gibbons and Van Houte¹⁸) demonstrated that *S. mutans* has a feeble capacity to become attached to epithelial surfaces. Therefore, it seemed unlikely that these organisms could colonize the mouth of a normal infant before the eruption of teeth. Earlier clinical studies^{19–24} reported that *S. mutans* could not be detected in the mouths of normal predentate infants; instead, the organisms were found only after the insertion of acrylic cleft palate obturators or eruption of primary teeth. Accordingly, the concept that *S. mutans* required a nonshedding oral surface for persistent oral colo-

nization became a basic tenet of oral microbial ecology. However, more recent clinical studies^{25–27} have demonstrated that *S. mutans* can colonize the mouths of predentate infants; the furrows of the tongue appear to be an important ecological niche. Tanner and others,²⁸ using DNA probe technology, reported that *S. mutans* was present in 55% of plaque samples and 70% of tongue scraping samples of 57 children 6–18 months of age living in Saipan, Commonwealth of the Northern Mariana Islands, western Pacific. These recent studies on acquisition of *S. mutans* raise doubt that a nonshedding oral surface is required for colonization.

Early Acquisition of S. mutans and Dental Caries: Early colonization by *S. mutans* is a major risk factor for ECC as well as future dental caries. Alaluusua and Renkonen²⁹ performed longitudinal assessment for *S. mutans* colonization and dental caries in children 2–4 years of age; children who harboured *S. mutans* in their plaque at the age of 2 had the most caries activity by the age of 4. The mean DMFS score in these children was 10.6, whereas in children in whom colonization occurred later, the mean DMFS score was 3.4 at age 4 ($p < 0.005$). Similar observations were made by Kohler and others,³⁰ who reported that 89% of children with *S. mutans* colonization by 2 years of age had carious lesions by 4 years of age and a mean DMFS score at that time of 5.0; in contrast, only 25% of children

Early colonization by Streptococcus mutans is a major risk factor for ECC and future dental caries.

not infected with *S. mutans* before 2 years of age had experienced dental caries by 4 years of age, and they had a mean DMFS score of 0.3. In another longitudinal evaluation, Gindejford and others³¹ evaluated 786 children at 1 year of age for caries risk factors (*S. mutans* infection, exposure to fluoride, dietary habits, oral hygiene) and re-examined them at 3.5 years of age for the presence of dental caries. The presence of *S. mutans* at 1 year of age was the most effective predictor of caries at 3.5 years of age. These observations, together with other published results,^{32,33} illustrate that early infection with *S. mutans* is a significant risk factor for future development of dental caries.

Transmission of S. mutans: The major reservoir from which infants acquire *S. mutans* is their mothers. The evidence for this concept comes from several clinical studies in which *S. mutans* strains isolated from mothers and their babies exhibited similar or identical bacteriocin profiles^{34–36} and identical plasmid or chromosomal DNA patterns.^{37–41} Successful colonization of infants by maternally transmitted *S. mutans* cells may be related to several factors, including magnitude of the inoculum,⁴² frequency of small-dose inoculations¹³ and minimum infective dose.⁴³ Berkowitz and others⁴² reported that the

frequency of infant infection was approximately 9 times greater when maternal salivary levels of the organism exceeded 10^5 colony-forming units (CFU)/mL than when maternal salivary reservoirs were less than or equal to 10^3 CFU/mL (58% vs. 6%). Suppression of maternal reservoirs of *S. mutans* prevented or delayed infant infection,⁴⁴ and only 3 (11%) of 28 babies whose mothers underwent suppression of the *S. mutans* reservoir (by dental treatment and topical antimicrobial therapy) were infected by 23 months of age; in contrast, 17 (45%) of 38 babies in the control group (whose mothers did not undergo *S. mutans* suppression) were infected. In both groups the percentage of infected babies increased with age; nevertheless, at 4 years of age fewer babies in the test group were infected.

Two recent reports indicate that vertical transmission is not the only vector by which *S. mutans* is perpetuated in human populations. Mattos-Graner and others⁴⁵ isolated *S. mutans* from groups of nursery school children (12–30 months of age) and genotyped the isolates with primed polymerase chain reaction and restriction fragment-length polymorphism analysis. They reported that many children had identical genotypes of *S. mutans*, which indicated that horizontal transmission may be another vector for acquisition of these organisms. In addition, van Loveren and others,⁴⁶ using bacteriocin typing, demonstrated that when a child acquires *S. mutans* after the age of 5 years, there may be similarity in *S. mutans* strains in mother, father and child, which indicates that horizontal transmission can also occur among family members. These findings are of importance given the socio-economic changes in Western culture over the past 2 decades (for example, the use of daycare facilities for babies and preschool children when both parents are employed).

Dietary Risk Factors

Although ECC is an infectious disease, the role of diet in acquisition of the infection⁴⁷ and development of the disease⁴⁸ is critical. Children with ECC have frequent and prolonged consumption of sugars from liquids.^{2,49–52} Caries-promoting sugars such as sucrose, glucose and fructose, contained in fruit juices and many infant formula preparations,^{53–55} are readily metabolized by *S. mutans* and lactobacilli to organic acids that demineralize enamel and dentin. The use of nursing bottles and “sippy cups” enhances the frequency of exposure. This type of feeding behaviour during sleep intensifies the risk of caries, as oral clearance and salivary flow rate are decreased during sleep. In addition, caries-promoting feeding behaviours result in an increase in the magnitude of dental reservoirs of *S. mutans*.⁴⁸

Clinical Significance

The preceding narrative strongly suggests that the first event in the natural history of the infectious disease ECC is primary infection by *S. mutans*. The second event is accumulation of *S. mutans* to pathogenic levels, secondary to frequent and prolonged dietary exposure to caries-promoting sugars. The third event is rapid demineralization of enamel, which results in cavitation of tooth structure.

Treatment

The current standard of care for treatment of ECC usually necessitates general anesthesia, with all of its potential complications, because the level of cooperative behaviour of babies and preschool children is less than ideal. In a 1993 study, Milnes and others⁵⁶ found that the costs associated with the treatment of ECC for a Canadian aboriginal population (for travel, lodging, medical care and facilities, and general anesthesia) were a significant drain on government resources. A 1994 report indicated that the cost of treating a child with ECC exceeded US\$2,000.⁵⁷ More recent data have shown that costs have escalated. For example, the average cost for facilities and general anesthesia, excluding dental services, at Strong Memorial Hospital, University of Rochester Medical Center, is US\$3,500. Thus, this disease places a huge burden on third-party payers (insurance companies and government medical welfare agencies), as well as on parents least likely to be able to afford it.

Treatment of ECC is usually restricted to surgical removal or restoration of carious teeth coupled with recommendations regarding feeding habits. Restorative dentistry has little to no long-term impact on oral *S. mutans* populations⁵⁸ and, as discussed below in the Prevention section, recommendations regarding feeding behaviours have had minimal impact. Not surprisingly, the clinical outcomes for treatment of ECC are poor. Sheehy and others,⁵⁹ using a telephone survey, found that 23% of children treated for ECC under general anesthesia required restorations or extractions after the initial dental surgery. In another study,⁶⁰ 52% of the cohort treated under general anesthesia presented with new smooth-surface enamel lesions within 4–6 months after dental surgery. Eidelman and others,⁶¹ using a retrospective chart review, reported that 57% of the study cohort who had been treated under general anesthesia required treatment for new carious lesions within 6–24 months after the initial dental surgery. In another retrospective study⁶² of 42 children with ECC treated under general anesthesia at the Franciscan Children’s Hospital and Rehabilitation Center in Boston, 45% had experienced relapse by the end of 12 months after dental surgery. Given the morbidity and cost associated with treatment of relapse (e.g., general anesthesia, sedation, physical restraint), the current standard of care for ECC, involving

treatment under general anesthesia, results in unacceptable clinical outcomes. New treatment strategies (e.g., chemotherapeutic, behavioural) must be developed to address the causative factors associated with relapse if improvements in clinical outcomes are to be realized.

Prevention

Prevention of cariogenic feeding behaviours is one approach to preventing ECC. Regrettably, educating parents about this risk factor has had minimal success. Johnsen⁶³ reported that 78% of parents of children with ECC had attempted to substitute water for a cariogenic liquid (e.g., apple juice, formula) in the bedtime nursing bottle; this observation strongly suggests that these parents were aware of the feeding practices associated with ECC. In a survey of parents of 169 Inuit children with ECC, 54% of the parents knew that naptime and bedtime bottle feedings may be associated with ECC.⁶ Likewise, 25 of 38 Mexican-American parents whose children had ECC were aware of the feeding behaviours associated with ECC.² However, given the high prevalence of ECC in certain groups, it appears that information and knowledge do not always translate into appropriate parenting practices. Thus, the parents of children with ECC are frequently aware of the dietary practices associated with the development of the disease, but they may not implement changes in feeding behaviours.

A promising approach toward primary prevention of ECC is to develop strategies that target the infectious component of this disease, for example by preventing or delaying primary acquisition of *S. mutans* at an early age through suppression of maternal reservoirs of the organism.⁴⁴

Another approach is to prevent *S. mutans* from accumulating to pathologic levels through topical application of antimicrobial agents. This approach was recently applied in a group of Puerto Rican babies at high risk for ECC.⁶⁴ The study population consisted of 83 subjects who were 12 to

19 months of age at the time of their entry into the study. Inclusion criteria for the study included unremarkable medical history, presence of 4 PMIs with no visible defects, caries-free status (accordingly to clinical criteria), use of a nursing bottle containing a cariogenic substance at naptime or bedtime, and 2 consecutive *S. mutans*-positive cultures from pooled PMI plaque. The subjects were randomly assigned to 2 groups. In the experimental group ($n = 39$), a 10% povidone-iodine solution was applied to the dentition bimonthly for 1 year; in the control group ($n = 44$) a placebo solution was applied in the same manner. Treatment failure was defined as the appearance of one or more white spot lesions on any of the PMIs during the study period. Using the Kaplan-Meier procedure, the authors estimated that $91\% \pm 5\%$ of experimental subjects and $54\% \pm 9\%$ of control subjects experienced 12 months of disease-free survival (log-rank test, 2-sided $p = 0.001$). Therefore, bimonthly topical application of a 10% povidone-iodine solution to the dentition of babies at high risk for ECC increased disease-free survival. It is important to determine, through larger and more in-depth clinical trials, if this effect remains after the antimicrobial agent is withdrawn before introducing 10% povidone-iodine therapy into clinical practice as a primary prevention modality for ECC. ♦

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Avulsions and Intrusions: The Controversial Displacement Injuries

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A b s t r a c t

Avulsions and intrusions are the most complicated and controversial displacement injuries of permanent teeth. Clinical guidelines published by authorities such as the American Association of Endodontists, the Royal College of Surgeons of England and the International Association of Dental Traumatology are inconsistent. While a certain amount of inconsistency might be expected, some of these guidelines recommend treatments that are experimental or have not incorporated research information from the past 5 years, and in one case the guidelines incorrectly describe the nature of Hank's balanced salt solution. Recent laboratory studies support previous clinical outcome studies in emphasizing that only for teeth replanted within 5 minutes of avulsion is there a chance of regeneration of the periodontal ligament and normal function. Teeth replanted beyond 5 minutes will take another path, that of repair followed by root resorption, ankylosis and eventual extraction. Dentists should explain these outcomes at the time of the replantation decision. Severe intrusions also have predictable outcomes. Teeth intruded beyond 6 mm cannot regenerate a functional periodontal ligament and so are prone to root resorption and eventual extraction as well. In this situation the decision is one of immediate extraction or repositioning, with the understanding that it is inevitable that the tooth will eventually be extracted. Authoritative clinical guidelines available on the Internet provide the clinician with useful outlines for treatment. However, individual inconsistencies stimulate academic controversies and, in some cases, clinical misdirection.

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Avulsions and severe intrusions are associated with poor post-treatment outcomes. Management of both avulsions and intrusions is controversial: avulsions present the dilemma of whether or not to replant, whereas intrusions have the widest choice of treatment options. Every trauma intervention should be guided by application of the best scientific evidence integrated with the clinician's expertise and the values and expectations of patients and their parents. Yet dentists may be "rusty" in both clinical techniques and application of research-based information, primarily because of the rarity of such events. Clinical guidelines should incorporate the best research evidence and techniques, as well as the means to explore the expectations of patients and their parents. This review of recent research and the changing management of avulsions and intrusions identifies the controversies and clarifies clinical options.

Avulsions

Guidelines

Guidelines for replantation have been published by a number of organizations such as the American Association of Endodontists (AAE),¹ the Royal College of Surgeons of England (RCSE)² and the International Association of Dental Traumatology (IADT).³ Although there are similarities among them, it is obvious that personal opinion, anecdotal information and caprice are woven into these documents.⁴ For example, the guidelines for the management of avulsions have not addressed outcomes, the "drive for normalcy" that produces requests for replantation of teeth for which the prognosis is hopeless, the orthodontic implications of replantation into mouths with associated malocclusions and, finally, the direct and indirect costs of the replantation decision.¹⁻³ The guidelines just described

are “trailing edge” documents that at best provide consensus interpretation of research evidence published more than 5 years ago. Nevertheless, such guidelines may reduce the number of inappropriate or cavalier treatments of trauma.⁵ The advent of computer-assisted training packages provides yet another means of disseminating consensus-based treatment methods.⁶ The AAE,¹ RCSE² and IADT³ guidelines are also available online.

Extra-alveolar Time

Despite evidence that immediate replantation (i.e., within 5 minutes) is required for regeneration of the periodontal ligament (PDL) and its return to normal function,⁷ more than three-quarters of school teachers, coaches and caregivers would be reluctant to replant teeth if the circumstance arose.^{8,9} The reasons for this reluctance reportedly included inadequate training, reluctance to induce pain or fear in the child, personal fear of bloodborne infection, fear of replacing the tooth incorrectly and fear of possible legal consequences.⁹ Recently, attention has focused on the fact that the avulsed tooth (which is essentially a free graft) is often exposed to air or held in tissue or cloth (dry storage) while first aid caregivers search for milk. Laboratory studies have supported earlier clinical studies demonstrating that after dry storage for more than 15 minutes, precursor cells on the root-side PDL are unable to reproduce and differentiate into fibroblasts. Several authors have shown that with 30 minutes of dry storage, virtually all root-side PDL cells have died.^{10–14}

Why is it, then, that teeth replanted many hours after avulsion remain in the mouth, often “look good” and are functional? In these cases of delayed replantation, healing occurs by repair rather than by regeneration. Root-side PDL cells that are immediately stored in appropriate media can retain their vitality for extended periods, but become disabled. They lose their ability to become fibroblasts and to perform the normal functions of PDL cells. Consequently, healing is by repair and little or no PDL is regenerated. In addition, PDL cells on the alveolar side are affected by damage associated with physical tearing of the ligament and loss of the tooth, so they too have limited ability to contribute to the regeneration of new PDL.

Storage Media and Root Treatments

For the past decade, laboratory studies of PDL cell vitality have focused on a search for the Holy Grail of storage media, often without consideration of issues of practicality or the blood, tears and confusion that take place when a person is injured by a fall, collision or other misadventure. If the tooth is transferred to a liquid medium such as the patient’s own saliva, milk or saline within the first 15 minutes, some of the cells in the PDL and cementum will survive and may play a role in regeneration. Inevitably, however, storage in a liquid medium before

replantation results in ankylosis, root resorption and eventual extraction.¹⁵ The patient’s own saliva, which is always available, is preferable to desiccation and can be an effective storage medium for up to 30 minutes.¹¹ If the tooth is transferred to a liquid medium beyond 15 minutes of desiccation, the surviving cells will be increasingly limited in both number and function.¹³ Cool milk will maintain the ability of PDL precursor cells to reproduce for almost twice as long as milk that is allowed to warm to room temperature.¹¹ Clearly, milk packed in ice should be considered the primary extended-time storage medium for avulsed teeth intended for delayed replantation, and ice is almost always available where cold milk is found. Guidelines for the choice of storage media and prereplantation “treatment” of avulsed teeth suggest exotic solutions and treatments for which there is limited scientific evidence. Few dental practices stock saline, still fewer have Hank’s balanced salt solution, and virtually none have ViaSpan (DuPont Pharmaceuticals Co., Wilmington, Del.), a tissue culture medium.

For teeth that have undergone an extended extra-alveolar period, most guidelines advocate prereplantation “treatment” of the root surface with fluoride.^{1–3} This recommendation is based on a limited number of animal studies and a single case report and is directed toward increasing the resistance of the root to replacement resorption through the formation of fluorapatite on the root surface.^{16–18} This treatment has never been tested in a human outcome study, and its clinical utility remains unknown, yet it appears in all 3 guidelines.^{1–3} Another treatment that is still advocated on the home page of the AAE Web site¹ and subsequently disproved involved placing teeth with prolonged extra-alveolar time in Hank’s balanced salt solution, a balanced isotonic salt solution, before replantation, with the intent of reconstituting depleted cellular metabolites.¹⁹ Subsequent *in vitro* experiments have proven (not surprisingly) that root-side cells that are already dead cannot be resurrected by rehydrating them in media such as Hank’s balanced salt solution.²⁰ Some reputable animal studies (in dogs and monkeys) have supported the use of topical doxycycline “treatment” of teeth before replantation.^{21,22} However, topical application is mentioned in one set of guidelines² and systemic treatment in another.³ Furthermore, there are no human outcome studies to support the recommendation of doxycycline treatment for trauma. These treatments, which are only marginally supported by scientific research, are controversial and needlessly complicate clinical management.

Root Resorption

Obtaining a precise and accurate post-trauma, prereplantation history is paramount, as postreplantation outcomes are directly related to extra-alveolar time.^{7,14} Careful history-taking may reveal, for example, that a tooth

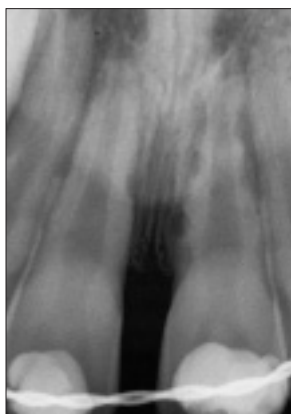


Figure 1: Two replanted central incisors affected by inflammatory root resorption. The process, characterized by bowl-shaped radiolucent areas, is initiated by infected dental pulp.



Figure 2: Infraocclusion of tooth 21 following replantation more than 3 hours after the initial trauma. Infraocclusion occurs when replacement root resorption (ankylosis) affects the teeth of young people with incomplete skeletal growth. Fusion between the teeth and the alveolus prevents the affected teeth from drifting with growth of the maxilla and thus distorts gingival architecture.



Figure 3: Radiograph of a central incisor affected by replacement root resorption. In the absence of infection, the process is progressive and results in eventual loss of the tooth.

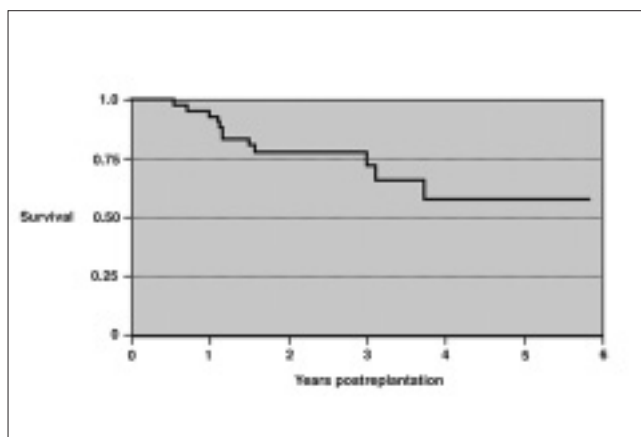


Figure 4: Survival rates after replantation. If a patient presents with an avulsed permanent incisor that has been stored dry for 60 minutes, the 5-year survival for the tooth is estimated at 0.56. This means that if the replanted tooth is retained for 5 years, there is a probability of 0.56 that the tooth will be retained beyond that point. It does not mean that there is a 56% chance the tooth will be retained for 5 years.²⁹

that has arrived in milk was desiccated in a paper napkin for 15 minutes while someone went for the milk. The clinician should strive for a replanted tooth that is free of infection by early removal of the necrotic pulp and timely completion of endodontic treatment. Elimination of infection and prevention of pulp necrosis represent the best means of preventing inflammatory root resorption (Fig. 1). Replacement resorption and ankylosis may be considered acceptable outcomes, as replanted teeth can survive for a number of years. If, in addition, the patient has achieved physical maturity, infraocclusion and gingival irregularity due to surrounding alveolar growth (Fig. 2) will be minimal. Almost all replanted teeth exhibit replacement resorption and ankylosis, as immediate replantation is achieved only rarely.

Replacement resorption leads to fusion of the tooth root with the adjacent alveolar bone (Fig. 3). In older children and adults this process produces bony replacement of root cementum and dentin, followed by loss of the crown either spontaneously or by surgical intervention. In children who have not achieved skeletal maturity, replacement resorption leads to progressive infraocclusion during the adolescent growth spurt. Adolescents and parents often do not want to have these incisor(s) extracted, yet the alveolar and gingival architecture becomes increasingly distorted with growth. Thus, the decision to replant a permanent tooth initiates a number of sequelae, including some that affect socio-economic aspects of family life.^{23,24}

Evidence that regeneration of a normal PDL is not expected beyond 5 minutes of extra-alveolar dry storage has produced a paradigm shift in understanding the outcomes of replantation. Avulsed teeth fall into 1 of 2 categories: less than 5 minutes of extra-alveolar dry storage, where the likelihood of regeneration of a functional PDL is maximized,^{7,25} and beyond 5 minutes of dry storage, where healing is by repair and tooth loss is inevitable (although survival may be prolonged if the patient is a young adult).²⁵

Tooth Survival

A previous study²⁶ produced survival curves illustrating tooth survival after replantation in a population of adolescents (Fig. 4). Use of this information in conjunction with a thorough discussion of the financial, temporal and emotional costs of replantation will help clinicians, parents and patients arrive at a rational treatment plan.

Bioactive Substances

Investigators are now working with an enamel matrix derivative, Emdogain (Biora AB, Malmo, Sweden), designed



Figure 5a: Clinical appearance after severe (> 6 mm) intrusion of tooth 22 in a 12-year-old girl. The tooth was surgically repositioned and splinted, and endodontic treatment was completed at the time of initial presentation.

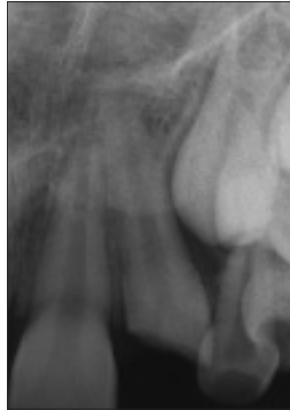


Figure 5b: Radiographic appearance after severe intrusion of tooth 22 in the same patient.



Figure 6a: Clinical appearance of tooth 21 intruded 4 mm at the time of initial presentation. A tooth with this much intrusion will not predictably reposition without traction.



Figure 6b: Radiographic appearance of intruded tooth 21 in the same patient, also at the time of initial presentation.



Figure 6c: The appliance employed for active repositioning of intruded tooth 21 in the same patient. Treatment was initiated at the time of initial presentation, and repositioning was accomplished over a period of 6 weeks. Restoration of the crown fracture was completed 7 days after the initiation of treatment.



Figure 6d: Final radiographic appearance of the tooth after 6 weeks of treatment.

that a differentiation factor such as Emdogain could promote migration, proliferation and differentiation of PDL fibroblasts³⁰ within the adjacent alveolus to repopulate the PDL.³¹

There are no published outcome data for Emdogain in the acute management of avulsed teeth. Nevertheless, this material is mentioned in the IADT guidelines³ as a treatment for replantation. Although the performance of Emdogain on replanted permanent incisors is as yet unknown, the use of such bioactive substances marks the beginning of the use of pharmacotherapeutics in dental trauma management.

Intrusions

Guidelines

Clinicians have noted discrepancies in the recommendations of Andreasen and Andreasen,³² the RCSE,² and Andreasen and others.³³ Even the terminology used to describe the treatment of intrusions and subsequent outcomes lacks precision and consistency. The term *spontaneous eruption* gives a falsely optimistic impression, as tooth movement after injury is both unpredictable and pathological rather than developmental, as it would be in normal eruption. Another imprecise term is *orthodontic repositioning*. The traction forces used to move intruded incisors exceed those of conventional orthodontic treatment, and severely intruded teeth do not have a functional PDL, a prerequisite for orthodontic movement (Figs. 5a, 5b). These terms imply that an intruded tooth will return to its original location with time or that it can be moved there by the same mechanics and with the same predictability as conventional orthodontic treatment, neither of which is necessarily true. Current management strategies include surgical reduction (immediate repositioning), repositioning with traction (active repositioning) and waiting for the tooth to return to its preinjury position (passive repositioning).

Amount of Intrusion as Most Critical Factor

Along with avulsions, intrusions are the other most complicated and controversial luxation injuries. A severe intrusion produces catastrophic injury to the alveolar bone, shears and destroys PDL cells and the ligament itself, and crushes the apical vascular system. Previously it was thought that the stage of root development was the determining factor for the outcome of intruded teeth.³²

Now it appears that the amount of intrusion is the critical determinant of pulp and tooth survival. Some studies have shown that intrusions of up to 3 mm have an excellent prognosis, whereas the prognosis of incisors with severe (> 6 mm)

to facilitate PDL regeneration and thus inhibit replacement resorption. One group is involved in a prospective outcome case series,²⁷ while others have undertaken animal studies²⁸ and described unconventional applications.²⁹ It is speculated

Table 1 Treatment options for intrusions by amount of intrusion

Amount of intrusion (mm) ^a	Treatment options
Mild < 3	Passive repositioning (observation)
Moderate 3–6	Passive repositioning (observation) Active repositioning (immediate traction)
Severe > 6	Extraction Immediate repositioning (surgical reduction) Extraction, immediate root canal treatment, removal of periodontal ligament, replantation

^aCategories of the Royal College of Surgeons of England.

intrusion is hopeless because of inflammatory root resorption and pulp necrosis.^{34,35}

Although the categories for severity of intrusion used by the RCSE are arbitrary, they approximate the results of a number of studies and provide a framework for outcome prediction (Table 1). Incisors intruded less than 3 mm (RCSE category 1) are best left to reposition themselves (passive repositioning) and have very good prospects for survival, although obturation of the pulp canal and early pulp necrosis are common outcomes.^{32,34} Incisors intruded between 3 and 6 mm (RCSE category 2) (Figs. 6a, 6b) are unpredictable and can be complicated by crown fractures and pulp necrosis, which lead to inflammatory resorption. Clinicians who use active repositioning or wait for passive repositioning of teeth intruded between 3 and 6 mm must ensure that they can obtain endodontic access within 1–2 weeks to remove the dental pulp and prevent the development of inflammatory root resorption, an unnecessary complication. If active repositioning is chosen, early application of forces is required. Orthodontic brackets or simple composite anchors to a stainless steel wire splint will provide a traction point for active repositioning of the tooth (Figs. 6c, 6d). Incisors intruded beyond 6 mm (RCSE category 3) are firmly held by compressed bone and do not respond predictably to active repositioning. Attempts to actively reposition these intrusions can delay the removal of necrotic pulp, which could lead to inflammatory resorption. Teeth with intrusion beyond 6 mm can be extracted or immediately repositioned, followed by root canal treatment. For severe intrusions, there is no chance of PDL regeneration, as the tooth has essentially been extracted (i.e., there is no PDL) and is held in compressed bone. This presents another option: extraction, removal of the damaged PDL, immediate extraoral root canal treatment and replantation. The outcome here is predictable: ankylosis accompanied by replacement root resorption and eventual loss of the tooth, the same result as would be obtained for an avulsed tooth treated the same way. Although there have been no outcome studies of intruded teeth treated in

this manner, the situation is analogous to replantation of avulsed teeth.³⁶

Treatment Equivalence

Presently no one treatment method has been demonstrated as superior to the others, and the incidence of pulp necrosis with all methods ranges between 45% and 96%.^{34,35} However, if active repositioning is chosen, it should begin immediately. The patient and the parents must understand the requirement for compliance with additional appointments and must also accept that success cannot be assured.

Knowledge Base

The mechanism of passive repositioning of intruded teeth is unknown. However, it has been established that appropriate, timely removal of a necrotic pulp followed by conventional root canal treatment will prevent inflammatory root resorption, whereas failure to remove a necrotic pulp stimulates inflammatory root resorption.

The mechanism of PDL regeneration after replantation is not well understood. Teeth replanted after 5 minutes of desiccation will ultimately have to be extracted. The resultant partially or completely resorbed roots will probably be associated with abnormal bone and produce an atypical implant site. Finally, the effects of avulsion and intrusion injuries and the resulting clinical decisions will be a burden on these patients for the rest of their lives.

Prevention

Although the evidence supports the importance of immediate replantation, first aid caregivers are often shy or frightened about replacing a tooth in an upset child. Dentists may be present at some organized sports events, where such injuries often occur, but the steps taken by lay caregivers will determine survival for the majority of avulsed teeth. Dental assistants and hygienists should have the confidence to replant teeth immediately at the scene of an accident, and coaches should be trained and empowered to do the same, through direct education or technique posters.

Parents perceive a shared responsibility with coaches to ensure compliance with mouthguard use.³⁷ One study showed that 40% of dentists favoured stock or “boil and bite” mouthguards, even though they are inferior.³⁸ Investigators are attempting to identify important parameters for protection by standardizing testing (impact) devices and tooth-jaw models. Regardless of the method of testing, laboratory-produced mouthguards of similar thickness provide better cushioning and dissipation of forces than user-fitted “boil and bite” mouthguards, yet even laboratory-produced mouthguards show considerable variation.³⁹

Immediate replantation can affect the survival of an avulsed tooth, and properly fitted mouthguards reduce the severity of dental injury. Dentists can educate and empower

all members of their team to provide first aid care for avulsions and to be vigilant for opportunities to encourage the use of custom mouthguards. ♦

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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 behaviour management techniques used in pediatric dentistry. The articles were chosen by Dr. Alan R. Milnes, a pediatric dentist from Kelowna, British Columbia, and editorial consultant to JCDA from the Canadian Academy of Pediatric Dentistry. A commentary is provided that puts these articles into context for readers.

Commentary

Striving for Successful Behaviour Management in Pediatric Dentistry

Alan R. Milnes, DDS, Dip Paed, PhD, FRCD(C)

Without successful communication, it is impossible for the dental team to build trust in anxious or potentially uncooperative children. Dental team members engage children using a dynamic process of dialogue, facial expression and voice tone to allay fear and anxiety and to teach appropriate coping mechanisms. Their goal is to help children be cooperative, relaxed and self-confident in the dental setting. Integration of each behaviour management technique into an overall management strategy is necessary for successful treatment. Most importantly, behaviour management strategies must be individualized for each child.

Dentistry has made great strides in increasing the comfort associated with dental treatment. However, many still view dental visits as threatening, especially preschool and young school-age children. There is no child-adult interaction that requires both the degree of pliant behaviour and the length of time over which compliance must be demonstrated than what is needed for the dental interaction.

Recent surveys of the changing use of restraint techniques (see abstract 1) and sedative agents (abstract 2) by pediatric dentists have indicated that practitioners are increasingly turning away from communication-based behaviour management techniques to pharmacologic methods for managing difficult behaviours. Why is this?

For one thing, parental acceptance of commonly used behaviour management techniques has declined recently as parents increasingly view professionals and these techniques with suspicion and mistrust. Changes in parenting styles have far-reaching consequences that extend even to the dental setting (abstract 3).

Behavioural researchers are studying child temperament to try to explain fear in the dental environment and to suggest appropriate methods for managing children of different temperaments. The old adage that uncooperative children are all the same — that is, they all behave badly — is no longer valid. Children with behaviour management problems in the dental setting form a heterogeneous group with different fear, temperament and behaviour problems (abstract 4). Presumably, each subgroup could benefit from different behaviour management regimens. Research has also shown that a child's temperament may predispose him or her to early childhood caries (abstract 5), as a child's temperament may influence parental behaviour in ways that increase the child's risk for dental disease.

If parents are reluctant to allow pediatric dentists to use traditional behaviour management techniques and are themselves ineffective in managing their child's behaviour, one would think that a logical solution would be to use medication to secure sufficient cooperation to ensure safe treatment. Use of sedation and general anesthesia in pediatric dentistry has increased in the past decades; however, these modalities are not without risk (abstract 6). It is extremely important that dentists who use sedation in outpatient settings adhere closely to provincial or national sedation guidelines.

Self-assessment of one's proficiency in managing the behaviour of anxious or uncooperative children should help to determine if there is a need to refer the child to a pediatric specialist. ♦

1 What is the current utilization and perception of restraint techniques in pediatric dental education?

Acs G, Hersch G, Testen RD, Ng MW. A 20-year perspective on the changing use of hand over mouth (HOM) and restraint in postdoctoral pediatric dental education. *Pediatr Dent* 2001; 23(4):301–6.

Background

Hand-over-mouth (HOM), hand-over-mouth with airway restraint (HOMAR) and other restraint techniques have traditionally been taught in pediatric dental programs. Surveys in 1979 and 1989 indicated that the techniques are still used, in spite of expressed uncertainty regarding the psychological sequelae of these techniques. This study compared responses regarding the use of HOM and restraint in pediatric educational programs to results obtained in previous surveys.

Methods

A survey assessing the use and teaching of restraint techniques was sent to directors of pediatric dentistry programs. The survey was identical to those used in 1979 and 1989. Responses from the 3 surveys were compared to determine changing patterns of response for programs or directors regarding use of HOM and other restraint techniques.

Results

The response rate was 87%. The number of programs using the HOM technique decreased significantly in the

last 10 years ($p < 0.0001$). Half of the individual directors who reported using HOM in 1989 discontinued its use ($p < 0.03$). Users were significantly more likely to describe the technique consistent with the guidelines of the American Academy of Pediatric Dentistry than were non-users ($p < 0.0001$). Although there was a significant decrease of certainty that use of HOM was free of psychological sequelae between the initial 2 surveys, the continuing decreasing trend between 1989 and 1999 was not significant. There was a significant reduction in the overall use of HOMAR since 1979 ($p < 0.001$).

Clinical Significance

The shift away from HOM reflects continuing uncertainty regarding the psychological sequelae of this technique. The authors suggest that the drop of programs teaching HOM may reflect evolving societal standards and changing use of behaviour management techniques in practice. Communicating with the child before using HOM may cause less psychological sequelae. ♦

2 Has the use of sedation in pediatric dentistry changed in recent years?

Haupt M. Project USAP 2000 — Use of sedative agents by pediatric dentists: a 15-year follow-up survey. *Pediatr Dent* 2002; 24(4):289–94.

Background

Many factors, including the needs of the patient, affect use of sedative drugs. This study surveyed members of the American Academy of Pediatric Dentistry (AAPD) on their use of sedative agents; the study followed similar surveys conducted in 1985, 1991 and 1995.

Methods

In the fall of 2000, a questionnaire on use of sedation was sent to all 3,315 active members of the AAPD. There were 1,778 respondents. The survey included questions about frequency of sedation use, types of drugs used and reasons for change in the use of sedation during the past 5 years. Survey findings were compared with those of the 3 previous surveys.

Results

Fourty-seven per cent of practitioners reported that 10% or less of patients were sedated with nitrous oxide alone (a slight decrease compared with the previous 3 surveys). As for other types of sedative agents, 82% of prac-

tioners used little, if any, sedation for 10% or less of patients (another slight decrease). A total of 1,224 practitioners used drugs other than nitrous oxide. There was a significant increase in the number of patients sedated with nitrous oxide in a 3-month period (77,112 sedations in 2000 vs. 33,683 in 1985); however, 80% of these sedations were administered by a smaller number of practitioners (478) who are heavier users of sedation (once or more every day). There was also an increase in the number of older patients (age 6 and above) being sedated.

Clinical Significance

There has been an overall increase in the use of sedation by pediatric dentists over the last 15 years. However, this increase is due to a heavier use of sedation by a small percentage of respondents. The authors believe the data reflect a lack of consensus about use of sedation and suggest that educators and practitioners develop a consensus regarding nonpharmacologic and pharmacologic behaviour management techniques. ♦

3 How have changing parenting styles affected the practice of pediatric dentistry?

Casamassimo PS, Wilson S, Gross L. Effects of changing U.S. parenting styles on dental practice: perceptions of diplomates of the American Board of Pediatric Dentistry. *Pediatr Dent* 2002; 24(1):18–22.

Background

There is a lack of data supporting the contention that parenting changes have affected child behaviour, and consequently, pediatric dental practice. This study surveyed board-certified pediatric dentists on their opinions about whether U.S. parenting styles have changed and what effect this has had on the practise of pediatric dentistry.

Methods

In the summer of 2002, a questionnaire was sent to all 1,129 members of the American Board of Pediatric Dentistry College of Diplomates.

Results

Out of 1,129 questionnaires, 577 (51%) were returned. The questionnaires were equally distributed across Academy districts; 90% of respondents were married and the male:female ratio was 4:1. Most respondents indicated

that parenting styles had changed since they began practising (88% responding “absolutely” or “probably”), with older practitioners more likely to indicate a change. Most respondents (92%) described these parenting changes as “probably bad” or “bad,” and 85% indicated these changes resulted in patient behaviour that was “somewhat worse” or “much worse.” Respondents reported using less assertive behaviour management techniques as a result of these changes.

Clinical Significance

Diplomates report that changes in parenting styles have had a negative impact on patient behaviour and has caused them to modify their behaviour management techniques. The authors believe the shift to less assertive behaviour management could have significant implications for clinical practice and the pediatric dental education system, as training programs and guidelines may need to be modified to reflect these changes. ♦

4 Does a child’s temperament and personality contribute to the development of behaviour management problems in pediatric dentistry?

Arnrup K, Broberg AG, Berggren U, Bodin L. Lack of cooperation in pediatric dentistry — the role of child personality characteristics. *Pediatr Dent* 2002; 24(2):119–28.

Background

Children may be uncooperative when attending for dental treatment for a number of reasons, including dental anxiety, temperament and behavioural problems. Level of verbal intelligence, defined as the ability to understand instructions and communicate feelings, can also be a factor. This study investigated these 4 variables in a group of child dental patients exhibiting behaviour management problems (BMP) and attempted to define distinct subgroups with different profiles of these variables.

Methods

Two groups of children were selected for analysis, a study group consisting of 86 children (36 children 4 to 7 years of age; 50 children 8 to 12 years) with BMP and a reference group of 117 regular children (8 to 12 years of age). All the parents answered a questionnaire dealing with aspects of dental care, fears, temperament and general behaviour. The children from the study group did a vocabulary test, as a measure of verbal intelligence. Analysis was

conducted using a variable-based and a person-based approach.

Results

The study group scored higher for dental fear and for negative emotionality, impulsivity, and internalizing and externalizing behaviour problems. Cluster analysis revealed 4 subgroups with different fear, temperament and behaviour problems. Behaviour problems were associated with family risk factors (socio-economic factors and cohabitation status).

Clinical Significance

Pediatric dental patients with BMP constitute a heterogeneous group with different fear and personality subgroups. The authors suggest that different treatment techniques adapted to the subgroups might benefit these children. They also suggest that a further investigation of the causes of BMP, with particular emphasis on temperamental, behavioural and intelligence factors, might help prevent its development. ♦

5 Are strong-tempered children at higher risk for early childhood caries?

Quinonez R, Santos RG, Wilson S, Cross H. The relationship between child temperament and early childhood caries. *Pediatr Dent* 2001; 23(1):5–10.

Background

A child's behavioural style may be a risk factor for early childhood caries (ECC). Strong-tempered children are more difficult to care for; parents may attempt to soothe their offspring with a bottle or by manipulating the contents in the bottle, thereby setting the stage for ECC. This study examined the potential association between the "strong-tempered" profile and parental feeding practices and ECC levels.

Methods

In this observational-correlational study, 58 healthy children, ranging in age from 18 to 70 months (mean age = 43 months, SD^a = 17), were clinically evaluated for ECC levels. The children's parents were then interviewed by a second evaluator blinded to the ECC status, to collect data on demographic variables, feeding practices and child temperament. The EAS Temperament Survey for Children was used to measure 4 temperament factors: emotionality, activity, sociability and shyness.

Results

Results of multiple regression analyses revealed that none of the 4 temperament factors were significant predictors for duration of feeding practices (i.e., length of breast-feeding or bottle-feeding time in months). However, the combined association of greater duration of feeding habit and shyness was a moderate predictor of all 3 ECC outcome measures: presence or absence of caries, number of carious teeth and number of carious surfaces. In addition, the combination of Native status with duration of feeding habit and shyness significantly predicted ECC outcome measures.

Clinical Significance

Temperament alone was not a predictor of duration of feeding habit, but the combination of shyness and greater duration of feeding habit was a risk factor for ECC. More research is needed to better understand the role of temperament in disease and in the development of prevention and treatment strategies in pediatric dentistry. ♦

^aSD = Standard deviation

6 What are the factors that contribute to adverse sedation events in pediatric patients?

Coté CJ, Notterman DA, Karl HW, Weinberg JA, McCloskey C. Adverse sedation events in pediatrics: a critical incident analysis of contributing factors. *Pediatrics* 2000; 105(4 Pt 1):805–14.

Background

Pediatric procedures are increasing in number and complexity. This has given rise to safety concerns relating to the care given by practitioners with variable training and expertise in the treatment of children and the administration of sedating agents. This study performed a critical incident analysis to identify the factors that contribute to adverse sedation events in pediatric patients.

Methods

A database of descriptions of adverse sedation events was developed from existing databases. In total, 118 reports were reviewed for factors that may have contributed to adverse sedation events. Outcomes ranged from death to no harm. Only reports for which there was consensus agreement on contributing factors and outcomes were included in the final analysis (consensus obtained between 4 independent

reviewers trained in pediatric anesthesiology, pediatric critical care medicine or pediatric emergency medicine).

Results

Consensus agreement on contributing factors was reached for 95 reports. Outcomes for these reports were: 51 deaths, 9 cases of permanent neurologic injury, 21 cases of prolonged hospitalization without injury, and 14 cases reporting no harm.

Patients receiving sedation in nonhospital-based facilities were older and healthier than patients sedated in hospital-based facilities. Respiratory compromise as the initial clinical event occurred equally in both settings (> 80%), but cardiac arrests were 3 times more likely to occur as second and third events in nonhospital-based facilities. Adverse events lead to more deaths and permanent neurologic injuries in these settings (92.8% vs. 37.2%).

Inadequate resuscitation contributed more often to adverse outcomes in nonhospital-based events (57.1% vs. 2.3%).

Children monitored with pulse oximetry suffered significantly less adverse outcomes than those who were not monitored at all. Furthermore, patients monitored with pulse oximetry in hospital-based settings did not suffer severe adverse outcomes, whereas 4 out of 5 patients sedated in nonhospital-based settings did. Adverse outcomes that occurred in spite of early warnings about oxygenation are likely the result of a lack of skills in managing the complications of sedating medications.

Clinical Significance

Several factors were associated with adverse sedation events and poor outcome, including venue, inadequate monitoring (particularly failure to use pulse oximetry) and inadequate training of health care providers. The authors suggest that uniform guidelines for monitoring children during and after sedation are needed, and that minimum standards of training, monitoring, advanced airway management, and resuscitation skills should be enforced for all health care providers who sedate children, regardless of practice venue. ♦

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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 Dr. Alan Milnes, a pediatric dentist from Kelowna, British Columbia, and JCDA editorial consultant for the Canadian Academy of Pediatric Dentistry. 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 What are the limitations of direct pulp capping in primary teeth?

Background to the Problem

Direct pulp capping in the primary dentition is a controversial procedure, for which the failure rate is relatively high. It is indicated in situations when a healthy pulp has been inadvertently exposed during an operative procedure. Failure of treatment results in internal resorption or acute dental abscess (Fig. 1). Direct pulp capping of a carious pulp exposure in the primary dentition is not recommended (Fig. 2).

Various theories have been proposed for the high failure rate associated with direct pulp capping in primary teeth. One theory is that failure is due to the relatively high cellular content of the primary tooth pulp. It is thought that subsequent to direct pulp capping, undifferentiated mesenchymal cells differentiate into odontoclasts, which provokes internal resorption.

There have been no long-term clinical trials that compare the various types of pulp therapy, including direct pulp capping. Much of our current knowledge of pulp therapies for primary teeth is based on evidence from short-term trials.

Considerations for Clinical Decision-Making

A tooth considered for direct pulp capping must be asymptomatic. The exposure must be "pinpoint" in diame-

ter. Hemostasis must be easily achieved and the site gently irrigated. The exposure must be free of oral contaminants (this indicates the need for use of a rubber dam). Either a hard-setting calcium hydroxide material, or a bonded dentin adhesive material used with the total etch technique, can be considered for the direct pulp capping technique.

Ranly and Garcia-Godoy urge caution with the latter technique, as clinical studies show conflicting results. However, Kopel recognizes that calcium hydroxide isn't necessarily a superior pulp capping material, because it is not the only material to stimulate dentin bridge formation, it doesn't bond to dentin and it can be pulled off the exposure site if overlain by a composite resin that shrinks on polymerization. Long-term dissolution of the material can lead to failure of the pulp cap. The prevention of marginal leakage in the final restoration is a key factor in the success of direct pulp capping.

A superior alternative to direct pulp capping is indirect pulp capping. Several recent studies have shown that indirect pulp capping in the primary dentition at least rivals the clinical and radiographic success seen with the formocresol pulpotomy. The key to success with indirect pulp capping seems to lie in the selection of a restoration that will seal the cavity indefinitely (Fig. 3). Hence, selection of a stainless

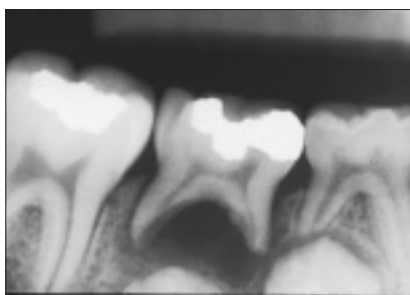


Figure 1: Failure of a direct pulp cap in tooth 85, with furcation involvement and development of a periapical abscess.

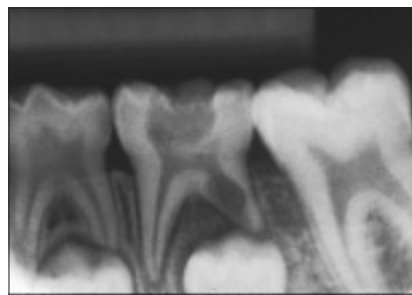


Figure 2: Carious pulp exposure in tooth 75, with radiolucency in the furcation and internal inflammatory resorption in the distal root.

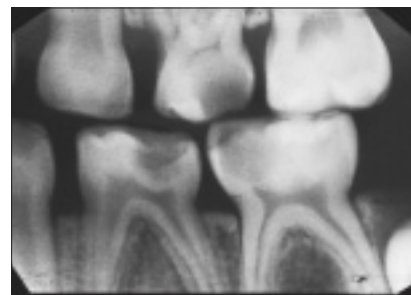


Figure 3: Large carious lesions in teeth 74 and 75, with no evidence of pulpal involvement. Provided there is no spontaneous pain, the teeth are good candidates for indirect pulp therapy. A full-coverage restoration, such as a stainless steel crown, must be placed on the teeth.

steel crown rather than an amalgam restoration would seem appropriate. In very carefully selected cases, when sufficient dentin and enamel remain around a cavity preparation, a bonded and sealed resin can be placed. Appropriate case selection is critical. ♦

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Question 2 What are the indications and contraindications for pulpotomy and pulpectomy in the primary dentition?

Background to the Problem

It is desirable, whenever possible, to maintain the integrity of the primary and mixed dentitions until the complete permanent dentition is established. Failure to do so may result in malocclusion or esthetic, phonetic or functional problems of a temporary or permanent nature.

Pulpotomy and pulpectomy (followed by root canal obturation) are 2 important pulp therapies available to the clinician wishing to preserve carious primary teeth until the time of their natural exfoliation. A thorough medical assessment and dental examination of the presenting condition is required to arrive at an accurate diagnosis of a tooth's pulpal health. Proper case selection is important to ensure a high probability of clinical success.

Considerations for Clinical Decision-Making

Pulpotomy

Indications

A restorable tooth, a vital pulp, carious exposure of the dental pulp, reversible pulpitis, radiographically normal root structure, a healthy child.

Contraindications

Presence of a draining sinus, pathologic mobility, radiographic diagnosis of external root resorption, radiographic diagnosis of internal root resorption, periapical or interradicular radiolucencies, pulp calcifications or excessive bleeding from amputated radicular pulp stumps.

Other Considerations

Other signs, such as history of spontaneous or nocturnal pain or tenderness to percussion or palpation, should be interpreted carefully as these may signify irreversible pulpitis.

Clinicians should carefully select teeth for pulp therapy in children with cardiac disease, children who are immunosuppressed and children undergoing chemotherapy for malignancy. Failure of pulp therapy in any of these situa-

tions may predispose a child to a significant medical complication as a result of dental infection.

The ideal dressing material for radicular pulp stumps should be bactericidal, be harmless to the pulp and surrounding structures, promote healing of the radicular pulp and should not interfere with the physiologic process of root resorption.

Unfortunately, the ideal pulp dressing material has not yet been identified. A great deal of controversy surrounds the selection of the medicaments in pulpotomy procedures.

Pulpectomy

Indications

Evidence of chronic inflammation or necrosis of the dental pulp.

Contraindications

Teeth with gross loss of root structure, internal or external resorption, or periapical infection involving the crypt of the developing permanent tooth. Similar medical cautions exist for pulpectomy as those for pulpotomy.

Other Considerations

Clinicians disagree about the utility of pulpectomy procedures in primary teeth. It is difficult to prepare primary root canals that have both a complex and variable morphology. Uncertainty about the effects of instrumentation, medications and filling materials on developing permanent teeth dissuade some clinicians from using the technique.

Recent research has shown that as little as 1 mm of external root resorption caused by periradicular inflammation leads to an exceedingly high failure rate with pulpectomy procedures (approximately 80%).

Pulpectomy is usually restricted to strategically important primary molar teeth such as second primary molars before or during the eruption of first permanent molars. Indiscriminate use of pulpectomy procedures in primary incisor teeth may result in damage to developing permanent

incisor teeth. Clinicians should resist parental pressures to maintain primary teeth that have a poor prognosis. ♦

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Question 3

What is your preferred restoration for a primary molar tooth following pulpotomy or pulpectomy?

Background to the Problem

The need for pulp therapy in a primary molar usually signifies extensive carious destruction of the primary crown, often with proximal surface involvement. A child who requires pulp therapy in the primary dentition is at significant risk for future caries. Previous caries experience is the best predictor of future disease.

If you will not see a child regularly in your office or if home care will not be adequate to prevent recurrent caries, stainless steel crowns have an advantage over intracoronal restorations (Figs. 4, 5 and 6). Full coverage provides added protection from recurrent caries.

When a Class II restoration fails in a pulp-treated primary molar there is a strong probability of mesial drifting of teeth resulting in space loss in that quadrant. The stainless steel crown is not subject to fracture and improves the chance of successful restoration even without long-term supervision.

Restorative Decision-Making

Restorative decisions in the primary dentition are driven by different goals and expectations than for the permanent dentition. Because primary teeth are “temporary” we choose an appropriate restoration with the goal that it will last for the expected lifespan of the primary tooth.

The strength of the primary tooth rather than the size of the lesion being restored is often the major limiting factor in the choice of a successful restoration (Fig. 7). Primary teeth are small with correspondingly thin layers of enamel and dentin.

Removal of carious enamel and dentin during the performance of the pulp procedure often compromises the structural integrity of primary molars in general and of first primary molars in particular. The contact area of primary molars is broad in a buccolingual

direction. A relatively large proximal box would be required to place a Class II intracoronal restoration with margins in self-cleansing areas. In the first primary molar in particular, buccal and lingual walls can become thin and weak with little remaining supporting dentin. This often dooms Class II restorations to failure due to cuspal fracture.

Studies that have evaluated the durability and lifespan of stainless steel crowns and Class II amalgam restorations demonstrate the superiority of crowns for both parameters (Figs. 8a, 8b). Stainless steel crowns placed in children 4 years of age and younger have a success rate approximately twice that of amalgams for each year up to 10 years of service. This trend is also apparent in children older than 4 years of age.

Following pulp therapy the clinical crown becomes increasingly brittle, such that the tooth restored with an



Figure 4: Failed amalgam in tooth 55 with fracture of the disto-buccal cuspal. Stainless steel crowns would have been better restorative choices for the teeth shown in Figs. 4, 5 and 6.



Figure 5: Failed resin restorations with recurrent caries in teeth 55 and 65.



Figure 6: Failed resin restorations with recurrent caries and cuspal fractures in teeth 84 and 85.



Figure 7: Lingual cervical decalcification in tooth 75 and lingual caries in tooth 74 indicate an extreme caries risk. Stainless steel crowns would be the restoration of choice.

intracoronary restoration will be at increased risk for fracture and subsequent failure of the restoration. Hence, placing a stainless steel crown in this clinical situation enhances the longevity of both the restoration and the tooth until its anticipated exfoliation. ♦

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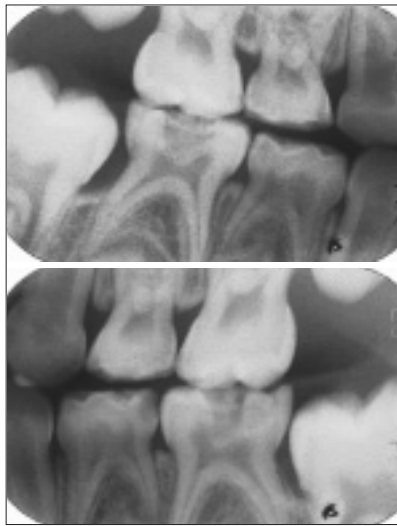


Figure 8a: Preoperative bitewing radiographs showing dental caries with pulpal encroachment in the mandibular primary molars and proximal caries in the maxillary primary molars.

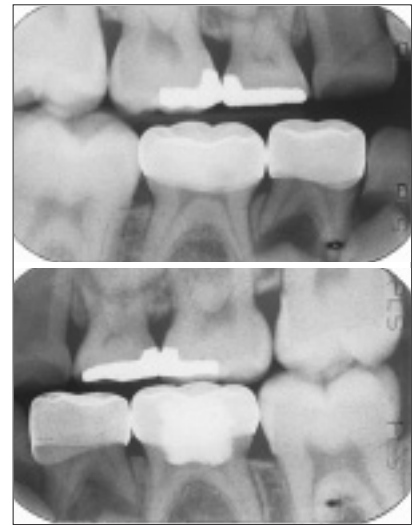


Figure 8b: Postoperative bitewing radiographs taken 4 years later showing well-adapted stainless steel crowns on teeth 74, 75, 84 and 85 and properly contoured Class II amalgam restorations in teeth 54, 55, 64 and 65. Note a successful formocresol pulpotomy in tooth 75.

Question 4

What are the most important considerations when selecting local anesthetic for children?

Background to the Problem

Adequate local anesthesia plays a very important role in providing high-quality oral health care for pediatric patients. While small carious lesions in primary teeth can be restored without local anesthesia, the notion that children do not experience pain during restorative procedures is unfounded. All children discern pain from treatment and local anesthesia should be administered in most cases. With the child patient, we are always particularly conscious of the possibility of anesthetic overdose and of self-inflicted soft tissue damage to the lip, tongue and cheek.

The ideal local anesthetic will be sufficiently potent to be effective, yet low in systemic toxicity. It will not irritate local tissue and will not cause permanent alteration of the nerve structure. Time of onset will be rapid and the period of action will be neither too short nor too long.

Considerations for Clinical Decision-Making

Agent Selection

The selection of a local anesthetic agent is predicated more on operator preference than on pharmacologic superiority. Some authors claim that articaine is preferable to most other local anesthetics because of its supposedly

superior properties of diffusion; however, this claim has been questioned.

Malamed and others recently found no difference between articaine and lidocaine in terms of safety and efficacy. A recent survey of local anesthetic choice among U.S.-based pediatric dentists indicated that 83% use lidocaine and 11% use mepivacaine. This same survey showed that just 49% of respondents calculated the maximum dose of local anesthetic using exact body weight — the technique recommended by Malamed.

Maximum Dosage

A more important consideration in the use of local anesthesia in children is the dosage administered. Local anesthetics in high doses depress both central nervous and cardiovascular systems. All practitioners should be aware of the exact milligram dosage of local anesthetic they have administered to a child.

In general the recommended dose of most amide local anesthetics is 4.4 mg per kilogram of body weight. Some references cite dosages as high as 7 mg per kilogram as being safe. The average U.S. 2-year-old weighs approximately 13 kg; the mean weight for 5-year-olds is approximately 20 kg; and an average 10-year-old weighs about 35 kg.

Malamed's maximum recommended doses of commonly used local anesthetics with vasoconstrictor, for the average 5-year-old, vary between 1.5 cartridges (articaine, mepivacaine 3%, prilocaine) and 2 cartridges (lidocaine, mepivacaine 2%). When no vasoconstrictor is used, these recommendations should be revised downwards.

Vasopressor or No Vasopressor?

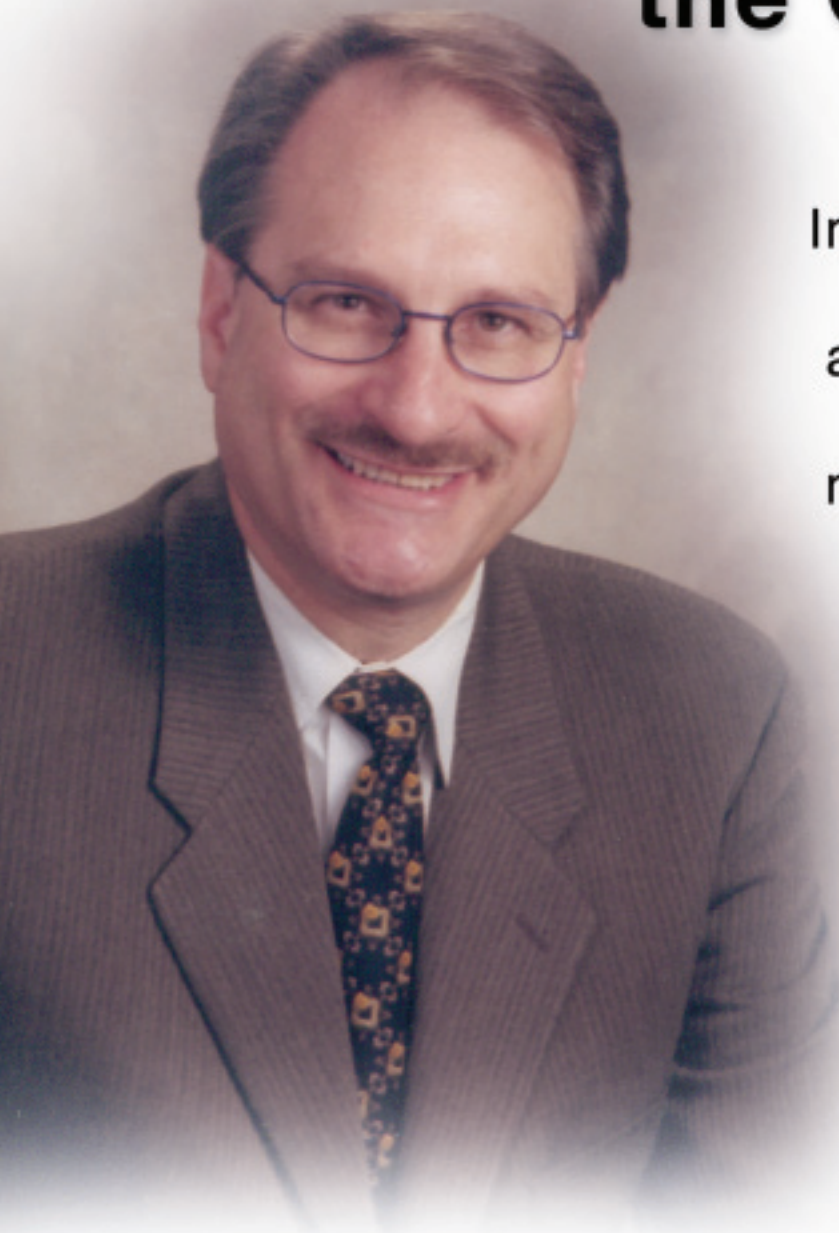
A debate exists about whether or not to use a local anesthetic containing a vasopressor. Some claim it is unnecessary because many pediatric procedures are of short duration and the prolonged soft tissue anesthesia, thought to be enhanced by use of a vasopressor, heightens the risk of self-inflicted injury. Malamed recommends using a local anesthetic with a vasopressor, especially where more than one quadrant is being treated, unless there is a compelling reason to avoid using one.

A recent interesting study has shown that children are far more likely to traumatize their lower lip after a local anesthetic injection when only one side of the mandible is injected, than when bilateral mandibular blocks are given. Not quite what you might expect! ♦

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Common Stock Fund (Altamira)	up to 0.99%.	-22.4%	-12.4%	0.2%	5.2%
Canadian Equity Fund (Trimark)	up to 1.65%.	-19.4%	2.1%	1.3%	7.9%
Special Equity Fund (KBSH)	up to 1.45%.	-26.0%	-24.2%	-1.8%	14.2%
TSX Composite Index Fund (BGI)	up to 0.67%.	n/a	n/a	n/a	n/a
CDA INTERNATIONAL GROWTH FUNDS					
Emerging Markets Fund (KBSH)	up to 1.45%.	-21.7%	-15.3%	-2.5%	n/a
European Fund (KBSH)	up to 1.45%.	-43.4%	-26.1%	-8.2%	n/a
International Equity Fund (KBSH)	up to 1.45%.	-37.5%	-27.3%	-5.0%	n/a
Pacific Basin Fund (KBSH)	up to 1.45%.	-30.1%	-37.5%	-6.4%	n/a
US Equity Fund (KBSH)	up to 1.20%.	-32.5%	-20.4%	-1.4%	9.1%
Global Fund (Trimark)	up to 1.65%.	-22.8%	1.7%	3.4%	11.2%
Global Stock Fund (Templeton)	up to 1.77%.	-33.9%	-12.5%	n/a	n/a
S&P 500 Index Fund (BGI)	up to 0.67%.	-31.3%	-16.5%	-3.7%	9.6%
CDA INCOME FUNDS					
Bond and Mortgage Fund (Elantis)	up to 0.99%.	6.6%	5.9%	4.9%	6.8%
Fixed Income Fund (McLean Budden)	up to 0.97%.	7.3%	6.8%	5.4%	7.8%
CDA CASH AND EQUIVALENT FUND					
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Balanced Fund (KBSH)	up to 1.00%.	-12.4%	-7.0%	1.4%	6.7%
Balanced Value Fund (McLean Budden)	up to 0.95%.	-11.8%	0.6%	3.2%	8.0%

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

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

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CDSPI Reports

PREPARE FOR RETIREMENT — WITH INSIGHT

Professional Guide Line Inc. now offers dentists a no-cost way to see into the future — thanks to a new service called **Retirement InSight™ — Your Personal Wealth-Building Strategy.**

“It’s essentially a retirement savings progress report,” explains Barbara Allen, a certified financial planner for Professional Guide Line Inc. — A CDSPI Affiliate. (CDSPI is a non-profit organization, owned by CDA and 9 provincial dental associations, which administers the Canadian Dentists’ Investment Program.)

“Because most dentists don’t have access to employer-sponsored pension plans, retirement funding is entirely their own responsibility. That’s why it’s imperative for dentists to know whether or not they’re on track with their savings goals. Retirement InSight™ can show them.”

How Does it Work?

Call Professional Guide Line to obtain a **Retirement InSight™** customization form. (Throughout 2003, all Canadian Dentists’ Investment Program participants over age 25 with a CDA RSP will automatically receive a Retirement InSight™ projection.)

Fill out the short form by listing factors such as your age, the age at which you wish to retire, the current value of your RRSP assets and the value of any non-registered investments or savings you’ve earmarked for retirement. If you wish, you can also include similar information about your spouse for a family retirement income analysis. This information will be kept strictly confidential.

When you return the form, a licensed, non-commissioned certified financial planner at Professional Guide Line will calculate and mail you a projection of how much annual income you can expect in retirement, based on your current savings.

“If the figure is below your expectation, we can discuss strategies you may wish to undertake to help reach your goals,” said Barbara Allen. “We’ll look at how much you should be contributing to your RRSP in future years, consider if your savings should be invested more aggressively, or discuss changing the age at which you expect to retire. Additionally, many dentists will learn that to reach their goal, they’ll need a pool of savings on top of their RRSPs.”

The Limitations of RRSPs

The general rule in saving for a comfortable retirement is to aim for an annual retirement income that’s about 70% to 80% of your pre-retirement income. But as **Table 1** illustrates, contributing to an RRSP alone may not provide enough income to achieve that goal.

Even though the federal government has recently raised RRSP contribution limits, it’s still possible for a dentist to make his or her maximum RRSP contributions over the course of decades and still be far short of the 70% mark. It’s certainly much easier

to accomplish with the support of both an RRSP and a company-sponsored pension plan — but that’s a luxury most dentists don’t have because they’re self-employed.

“That’s why some dentists will need to consider setting up a non-registered investment plan — like the CDA Seg Fund Investment Account — to supplement their RRSP savings,” Barbara Allen explains. “It’s a better alternative to leaving your savings in a bank account where they’ll earn a very low interest rate. A non-registered account gives your savings the potential for higher returns, since you can choose your own degree of investment risk.”

Retirement Income vs. Retirement Savings

Why does the **Retirement InSight™** service focus on your future retirement income?

“Often, many dentists just look at the total amount of savings they expect to have at retirement, without taking into account how much annual income those savings will provide while retired,” said John Webster, Professional Guide Line’s vice-president of Financial Planning.

“For example, suppose you’re a dentist with an annual pre-retirement income of \$80,000. You project that

continued on page 338

Table 1 Annual RRSP Contribution Required

Desired annual income at retirement	Years to retirement		
	25	30	35
\$ 70,000	\$18,966*	\$14,298	\$10,825
\$ 85,000	\$23,030*	\$17,362*	\$13,144
\$ 100,000	\$33,774*	\$25,202*	\$19,292*

Note: The calculations used in this table assume you’ll be retired for 20 years and that your investments will earn a 10% rate of return. The annual required contributions shown have been indexed to offset a 4% inflation rate.

** This figure may exceed the annual amount you can currently contribute to your RRSP. In order to achieve this goal, you will have to save outside of a registered plan.*

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THERAPEUTIC CLASSIFICATION

Analgesic anti-inflammatory agent

INDICATIONS AND CLINICAL USE

MOTRIN[®] IB (ibuprofen) is indicated for fast and effective relief of headaches, menstrual pain, toothache (dental pain), pain due to arthritis, minor aches and pains in muscles, bones and joints, such as sprains or strains, backache, the aches and pain due to the common cold and influenza and for the reduction of fever.

CONTRAINDICATIONS

MOTRIN[®] IB (ibuprofen) should not be used in patients who have previously exhibited hypersensitivity to it or in individuals who are known to have a sensitivity (manifested as asthma, bronchospasm, hypotension, angioedema, laryngeal edema, swelling, shock or urticaria) to acetylsalicylic acid or other non-steroidal anti-inflammatory drugs.

MOTRIN[®] IB (ibuprofen) should not be used during pregnancy (see Use in Obstetrics below). Ibuprofen levels in breastmilk are extremely low and are unlikely to affect a nursing infant, however because its safety under these conditions has not been established consult a doctor before use in nursing mothers.

MOTRIN[®] IB (ibuprofen) is contraindicated in patients with Systemic Lupus Erythematosus as an anaphylaxis like reaction with fever may occur, particularly when ibuprofen has been administered previously. Aseptic meningitis has also been reported.

MOTRIN[®] IB (ibuprofen) should not be used in patients with acute peptic ulcer or gastrointestinal bleeding.

WARNINGS

Anaphylactoid reactions have occurred after administration of ibuprofen to patients with known acetylsalicylic acid or other NSAID sensitivity manifested as asthma, swelling, shock or hives.

Gastrointestinal side effects to ibuprofen have been reported including dyspepsia, heartburn, nausea, vomiting, anorexia, diarrhea, constipation, stomatitis, flatulence, bloating, epigastric pain, abdominal pain. Peptic ulceration with GI bleeding or perforation has been reported and has been associated with a fatal outcome. MOTRIN[®] IB (ibuprofen) should therefore be given only under close supervision to patients with a history of upper gastrointestinal tract disease.

PRECAUTIONS

Occasionally serious gastrointestinal side effects have been associated with the anti-inflammatory uses of ibuprofen (See Warnings). Minor gastrointestinal complaints have also been reported during the clinical use of ibuprofen at analgesic doses. The administration of MOTRIN[®] IB with food or milk is recommended since occasional and mild heartburn, upset stomach or stomach pain may occur with its use. Patients should be advised to seek the consultation of a physician if gastrointestinal side effects occur consistently, persist, or appear to worsen.

MOTRIN[®] IB (ibuprofen), like other non-steroidal anti-inflammatory agents, can inhibit platelet aggregation but the effect is quantitatively less than that seen with acetylsalicylic acid. Ibuprofen has been shown to prolong bleeding time (but within the normal range) in normal subjects. Because this prolonged bleeding effect may be exaggerated in patients with underlying haemostatic defects, MOTRIN[®] IB (ibuprofen) should be avoided by persons with intrinsic coagulation defects and by those on anticoagulant therapy.

Tinnitus, blurred and/or diminished vision, scotoma, and/or changes in colour vision have been reported. If a patient develops such complaints while taking MOTRIN[®] IB, the drug should be discontinued. Patients with any visual disturbances should have an ophthalmologic examination.

Advanced age, hypertension, use of diuretics, diabetes, atherosclerotic cardiovascular disease, chronic renal failure, cirrhosis and conditions which may be associated with dehydration appear to increase the risk of renal toxicity. MOTRIN[®] IB should therefore be used with caution when these risk factors are present.

Patients taking MOTRIN[®] IB should be cautioned to report to their physician signs or symptoms of GI intolerance and/or bleeding, blurred vision or other ocular symptoms, skin rash, tinnitus, dizziness, weight gain, edema or respiratory difficulties.

If MOTRIN[®] IB is taken in conjunction with prolonged corticosteroid therapy and it is decided to discontinue steroid therapy, the corticosteroid should be tapered slowly to avoid exacerbation of disease or adrenal insufficiency.

Particular caution should be observed in elderly patients taking MOTRIN[®] IB (ibuprofen), as they are more likely to be taking other medications or have pre-existing disease states which can increase the likelihood of the complications that have been associated with ibuprofen. Elderly patients appear to be more susceptible to the central nervous system reactions: cognitive dysfunction (forgetfulness, inability to concentrate, a feeling of separation from the surroundings) in such patients has been reported.

Use in Obstetrics: No evidence specifically identifies exposure to analgesic doses of ibuprofen as a cause of harm to either mother or fetus during pregnancy. Non-steroidal anti-inflammatory drugs in general, however, are known to affect the action of prostaglandin synthetase which could alter a variety of the physiological functions of prostaglandins or platelets during delivery such as facilitating uterine contraction in the mother, closure of the ductus arteriosus in the fetus, and platelet-related haemostasis. Patients should therefore be advised not to use MOTRIN[®] IB during pregnancy without the advice of a physician, particularly during the last trimester. Clinical information is limited on the effects of ibuprofen in pregnancy.

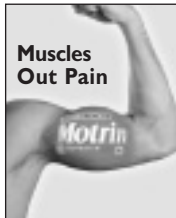
Use in Nursing Mothers: Pharmacokinetic studies indicated that following oral administration of ibuprofen 400 mg the level of drug which appeared in breast milk was below detection levels of 1 µg/mL. The amount of ibuprofen to which an infant would be exposed through this source was considered negligible. However, since the absolute safety of ibuprofen ingested under these circumstances has not been determined, nursing mothers should be advised to consult a physician before using MOTRIN[®] IB (Arthritis Advisory Committee: 1983).

Patients with Special Diseases and Conditions: Several medical conditions which can predispose patients to the adverse effects of non-steroidal anti-inflammatory drugs in general may be applicable to ibuprofen.

MOTRIN[®] IB should be used with caution in patients with a history of cardiac failure or kidney disease because of the possibility of aggravating pre-existing states of fluid-retention or edema. Mild impairment of renal function (decreased renal blood flow and glomerular filtration rate) can occur at maximal doses of ibuprofen. Renal papillary necrosis has been reported.

Also, patients with underlying medical or pharmacologically-induced haemostatic defects could experience further prolongation of bleeding time through the inhibition of platelet aggregation induced to varying degrees by this class of drugs.

Long-term ingestion of combinations of analgesics has been associated with analgesic nephropathy. It is therefore appropriate that patients be discouraged from long-term, unsupervised consumption of analgesics, particularly in combination. Patients should therefore be directed to consult a physician if their underlying condition requires administration of MOTRIN[®] IB for more than 5 days. MOTRIN[®] IB



usually should not be administered along with acetaminophen or acetylsalicylic acid. Patients with any serious medical condition should consult a physician before using MOTRIN[®] IB as an analgesic or antipyretic.

Drug Interactions: The platelet inhibiting effects of ibuprofen, although less potent and of shorter duration than those induced by acetylsalicylic acid, warrant cautionary supervision by a physician before co-administration of MOTRIN[®] IB and anti-coagulants.

Coumarin Type Anticoagulants: Several short-term controlled studies failed to show that ibuprofen significantly affected prothrombin time or a variety of other clotting factors when administered to individuals on coumarin-type anticoagulants. However, bleeding has been reported when ibuprofen and other NSAID agents have been administered to patients on coumarin-type anticoagulants. The use of MOTRIN[®] IB in patients who are taking anticoagulants should therefore be avoided because of the possibility of enhanced GI bleeding or an additive effect due to ibuprofen's reversible anti-platelet actions.

Acetylsalicylic Acid: Animal studies show that ASA given with NSAID agents, including ibuprofen, yields a net decrease in anti-inflammatory activity with lowered blood levels of the non-ASA drug. Single dose bioavailability studies in normal volunteers have failed to show an effect of ASA on ibuprofen blood levels. Correlative clinical studies have not been done.

Other Anti-inflammatory Agents (NSAIDs): The addition of MOTRIN[®] IB to a pre-existent prescribed NSAID regimen in patients with a condition such as rheumatoid arthritis may result in increased risk of adverse effects.

Diuretics: Ibuprofen, because of its fluid retention properties, can decrease the diuretic and anti-hypertensive effects of diuretics, and increased diuretic dosage may be needed. Patients with impaired renal function taking potassium-sparing diuretics who develop ibuprofen-induced renal insufficiency might be in serious danger of fatal hyperkalemia.

Acetaminophen: Although interactions have not been reported, concurrent use with MOTRIN[®] IB is not advisable.

Other Drugs: Although ibuprofen binds to a significant extent to plasma proteins, interactions with other protein-bound drugs occur uncommonly. Nevertheless, caution should be observed when other drugs also having a high affinity for protein binding sites are used concurrently. Some observations have suggested a potential for ibuprofen to interact with digoxin, methotrexate, phenytoin and lithium salts. However, the mechanisms and clinical significance of these observations are presently not known. Patients taking other prescribed medications should consult a physician before using MOTRIN[®] IB to assure its compatibility with the other medications.

ADVERSE REACTIONS

Experience reported with prescription use of ibuprofen has included the following adverse reactions. **Note:** Reactions listed below under Causal Relationship Unknown are those where a causal relationship could not be established; however, in these rarely reported events, the possibility of a relationship to ibuprofen also cannot be excluded. The adverse reactions most frequently seen with ibuprofen therapy involve the gastrointestinal system.

Gastrointestinal:

Incidence 3 to 9%: nausea, epigastric pain, heartburn
Incidence 1 to 3%: diarrhea, abdominal distress, nausea and vomiting, indigestion, constipation, abdominal cramps and pain, gastrointestinal tract fullness (bloating or flatulence)
Incidence <1%: gastric or duodenal ulcer with bleeding and/or perforation, gastrointestinal hemorrhage, melena, hepatitis, jaundice, abnormal liver function (SGOT, serum bilirubin and alkaline phosphatase)
The generally modest elevations of serum transaminase activity that has been observed are usually without clinical sequelae but severe, potentially fatal toxic hepatitis can occur.

Central Nervous System:

Incidence 3 to 9%: dizziness
Incidence 1 to 3%: headache, nervousness
Incidence <1%: depression, insomnia
Also reported but with unknown causal relationship: paresthesias, hallucinations, dream abnormalities, aseptic meningitis has been reported in patients with systemic lupus erythematosus or other connective tissue disease, aseptic meningitis and meningoencephalitis, in one case accompanied by eosinophilia in the cerebrospinal fluids, has been reported in patients who took ibuprofen intermittently and did not have any connective tissue disease, cognitive dysfunction has been observed in elderly patients who took ibuprofen.

Dermatologic:

Incidence 3 to 9%: rash (including maculopapular type)
Incidence 1 to 3%: pruritis
Incidence <1%: vesiculobullous eruptions, urticaria, erythema multiforme
Also reported but with unknown causal relationship: alopecia, Stevens-Johnson Syndrome.

Special Senses:

Incidence 1 to 3%: tinnitus
Incidence <1%: amblyopia (blurred and/or diminished vision, scotomata and/or changes in colour vision). Any patient with eye complaints during ibuprofen therapy should have an ophthalmological examination.
Also reported but with unknown causal relationship: conjunctivitis, diplopia, optic neuritis.

Metabolic:

Incidence 1 to 3%: decreased appetite, edema, fluid retention
Fluid retention generally responds promptly to drug discontinuation.

Hematologic:

Incidence <1%: leukopenia and decreases in hemoglobin and hematocrit
Also reported but with unknown causal relationship, rare cases of hemolytic anemia, thrombocytopenia, granulocytopenia, bleeding episodes (e.g. purpura, epistaxis, hematuria, menorrhagia), auto-immune hematology anemia occurred in one patient taking 400 mg of ibuprofen three times a day for ten days, fatal aplastic anemia was reported in one patient who took 600 mg per day for eight months.

Cardiovascular:

Incidence <1%: congestive heart failure in patients with marginal cardiac function, elevated blood pressure
Conditions such as congestive heart failure and hypertension may be aggravated by sodium retention and edema caused by ibuprofen in such patients.
Also reported but with unknown causal relationship, rare cases of: arrhythmias (sinus tachycardia, sinus bradycardia, palpitations).

Allergic:

Incidence <1%: anaphylaxis (see CONTRAINDICATIONS)
Also reported but with unknown causal relationship, rarely: fever, serum sickness, lupus erythematosus syndrome.

Endocrine: Also reported but with unknown causal relationship, rare cases of: gynecomasia, hypoglycemic reaction, menstrual delays of up to two weeks and dysfunctional uterine bleeding occurred in nine patients taking ibuprofen 400 mg three times a day for three days before menses.

Renal: Also reported but with unknown causal relationship: decreased creatinine clearance, polyuria, azotemia.

Like other non-steroidal anti-inflammatory agents, ibuprofen inhibits renal prostaglandin synthesis which may decrease renal function and cause sodium retention. Renal blood flow glomerular filtration rate decreased in patients with mild impairment of renal functions who took 1200 mg/day of ibuprofen for one week. Renal papillary necrosis has been reported. A number of factors appear to increase the risk of renal toxicity (See PRECAUTIONS).

SYMPTOMS AND TREATMENT OF OVERDOSE

Clinical Features: A clear pattern of clinical features associated with accidental or intentional overdose of ibuprofen has not been established. Reported cases of overdose have often been complicated by co-ingestions or additional suicidal gestures. The range of symptoms observed has included nausea, vomiting, abdominal pain, drowsiness, nystagmus, diplopia, headache, tinnitus, impaired renal function, coma and hypotension. A review of four fatalities associated with ibuprofen overdose indicates other contributing factors co-existed so it would be difficult to identify the toxicity of ibuprofen as a specific cause of death.

Post-ingestion blood levels may be useful to confirm a diagnosis and to quantify the degree of exposure but otherwise have not been helpful in predicting clinical outcome. Generally, full recovery can be expected with appropriate symptomatic management.

The following cases of overdose have been reported. A 19 month old child, 1-1/2 hours after the ingestion of seven to ten 400 mg tablets of ibuprofen presented apnea, cyanosis and responded only to painful stimuli. After treatment with O₂, NaHCO₃, infusion of dextrose and normal saline, the child was responsive and 12 hours after ingestion appeared completely recovered. Blood levels of ibuprofen reached 102.9 µg/mL 8-12 hours after the accident. Two other children weighing approximately 10 kg, had taken an estimated 120 mg/kg. There were no signs of acute intoxication or late sequelae. In one child the ibuprofen blood level at 90 minutes after ingestion was approximately 700 µg/mL. A nineteen year old male who ingested 8000 mg of ibuprofen reported dizziness and nystagmus was noted. He recovered with no reported sequelae after parenteral hydration and 3 days of bed rest.

For perspective, a single 200 mg oral dose study in 6 fasting healthy men produced a peak plasma concentration of 15.0 µg/mL at 0.75 hr. Another study using a single oral 400 mg dose in humans produced a peak serum level of 31.9 ± 8.8 µg/mL 0.5 hour after ingestion, and at 16 hours serum concentrations had dropped to 1 µg/mL.

Management of Overdose: Appropriate interventions to decontaminate the gastrointestinal tract may be beneficial within the first four hours after ingestion. Routine symptomatic and supportive treatment is then recommended. Physicians should contact the Regional Poison Control Centre for additional guidance about ibuprofen overdose management.

DOSAGE AND ADMINISTRATION

Adults:

MOTRIN[®] IB 200 mg:

1 to 2 tablets, caplets or gelscaps as required every 4 hours, not to exceed 1200 mg (6 tablets, caplets or gelscaps) in 24 hours unless directed by a physician.

Extra Strength MOTRIN[®] IB 300 mg:

1 tablet as required every 4 to 6 hours, not to exceed 1200 mg (4 tablets) in 24 hours unless directed by a physician.

Super Strength MOTRIN[®] IB 400 mg:

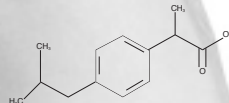
1 tablet as required every 4 to 6 hours, not to exceed 1200 mg (3 tablets) in 24 hours unless directed by a physician.

Children: It is recommended that children under 12 years of age be treated using Children's MOTRIN[®] formulations.

Do not take for pain for more than 5 consecutive days or fever for more than 3 days unless directed by a physician. If the painful area is red or swollen, if condition deteriorates or new symptoms occur, consult a physician.

PHARMACEUTICAL INFORMATION

Drug Substance: Ibuprofen is described chemically as 2-(p-(isobutylphenyl) propionic acid). It has a molecular weight of 206.28 and the following structural formula.



Ibuprofen is a white crystalline powder with a characteristic odour and slight taste. It is very slightly soluble in water and very soluble in alcohol and other common organic solvents. The apparent pK_a of ibuprofen is 5.2 and its melting point is 75°C to 75.5°C.

Composition:

MOTRIN[®] IB 200 mg tablets and caplets include ibuprofen 200 mg and the following non-medical ingredients in alphabetical order: carbon black, carnauba wax, colloidal silicon dioxide, cornstarch, hydroxypropyl methylcellulose, pharmaceutical grade, propylene glycol, stearic acid and titanium dioxide.

MOTRIN[®] IB 200 mg gelscaps include ibuprofen 200 mg and the following non-medical ingredients in alphabetical order: calcium disodium EDTA, castor oil, cellulose, colloidal silicon dioxide, corn starch, FD&C yellow no. 6, hydroxypropyl methylcellulose, polydextrose, polyethylene glycol, pregelatinized starch, sodium cyclamate, stearic acid, and titanium dioxide.

Extra Strength MOTRIN[®] IB 300 mg caplets include ibuprofen 300 mg and the following non-medical ingredients in alphabetical order: carbon black, carnauba wax, colloidal silicon dioxide, cornstarch, FD&C yellow no. 6, hydroxypropyl methylcellulose, polydextrose, polyethylene glycol, pregelatinized starch, sodium cyclamate, stearic acid, and titanium dioxide.

Super Strength MOTRIN[®] IB 400 mg caplets include ibuprofen 400 mg and the following non-medical ingredients in alphabetical order: carbon black, colloidal silicon dioxide, cornstarch, FD&C yellow no. 6, hydroxypropyl methylcellulose, hydroxypropyl methylcellulose, polyethylene glycol, pregelatinized starch, propylene glycol, sodium cyclamate, stearic acid, and titanium dioxide.

Stability and Storage Recommendations:

Tablets and Caplets: Store away from heat and direct light.
Gelscaps: Store in tightly closed container at room temperature; avoid high humidity and excessive heat (40°C, 104°F).

DOSAGE FORMS

MOTRIN[®] IB Ibuprofen 200 mg tablets are available as white, film-coated biconvex tablets, with "Motrin IB" printed in black ink, in bottles of 10, 24, 50, 100 and 150.

MOTRIN[®] IB Ibuprofen 200 mg caplets are available as solid, white, film-coated capsule-shaped tablets, with "Motrin IB" printed in black ink, in bottles of 24 and 50.

MOTRIN[®] IB Ibuprofen 200 mg gelscaps are available as solid, capsule-shaped tablets with white gelatin on one end and orange gelatin on the other end, with "Motrin IB" printed in grey ink, in trial sizes of 2 and in bottles of 20 and 40.

Extra Strength MOTRIN[®] IB Ibuprofen 300 mg tablets are available as solid, light orange-coloured, round, biconvex, film-coated tablets, with "MOTRIN 300 mg" printed in black ink, in bottles of 20 and 65.

Super Strength MOTRIN[®] IB 400 mg tablets are available as solid, orange-coloured, round, biconvex, film-coated tablets, with MOTRIN 400 mg printed in black ink, in pouches of 1 and in bottles of 16 and 50.

Reference: 1. Schatchel BP and Thoden WR. Onset of ibuprofen in the treatment of muscle-contraction headache. *Headache* 1988;28:471-474.

The Product Monograph is available to doctors, dentists and pharmacists upon request from:



McNeil Consumer Healthcare
Guelph, Canada
N1K 1A5



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.



Centerpulse Dental Inc. announces the addition of **disposable, single-patient drills** to its surgical product offering. The new drills — designed for use with the AdVent, Tapered Screw-Vent and Tapered SwissPlus dental implant systems — assure fresh, sharp drills for every patient, and surgical efficiency and timesavings for dental staff. Single-patient drills are discarded after use, so usage tracking is unnecessary. And because they are disposable, these drills eliminate the possibility of cross-contamination between patients.

• Centerpulse Dental, 760-929-4300, www.centerpulse-dental.com •



Dentech Corporation introduces the **Dentech Advance Cabinets** by Conex, a new, value-priced cabinet system that offers dependability and functionality tailored to dentists' unique requirements. The Dentech Advance Cabinets work well in a wide variety of configurations. Cabinets come in several sizes, and styles include 12-o'clock, rear treatment, centre island and doctor's side delivery. Two sizes of assistant support units are also available.

• Dentech Corporation, 800-826-5004, www.dentechcorp.com •



Suni Medical Imaging, Inc. announces 2 new products: the **SuniRay Digital Radiography System** and the **SuniCam Digital Intra-oral USB Cameras**. SuniCam is a precision digital intraoral camera that plugs directly into the USB port on a personal computer without the need for separate image capture electronics. SuniCam also comes in an intraoral/extraoral version, the SuniCam plus. SuniRay is a high-performance digital radiography system that comes with clinical software and a miniature image capture device that plugs directly into a PC's USB port.

• Suni Imaging Microsystems, Inc., 408-227-6698, www.suni.com •



Sirona Dental Systems introduces the **ProSmile Handy air polishing handpiece**. The ProSmile Handy is easy to use and ergonomically designed. The powder is delivered as a focused jet for gentle removal of plaque, film and stains. The large-volume chamber makes it possible to treat several patients without having to replenish the powder. The handpiece moulds itself to the user's hand, is freely rotatable and can be fitted with either a 120° or a 90° nozzle. The ProSmile Handy is fitted with a Click&Go interface for compatibility with a wide variety of high-speed handpiece couplings.

• Sirona Dental Systems GmbH, +49 (0) 6251/ 16 2901, www.sirona.de •

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OFFICES & PRACTICES

ALBERTA - Red Deer area: Busy, modern dental practice for sale. New equipment. Only practice in town of 3,500. Two operatories, room for 3 more. Incredible potential for growth. Priced at \$275,000. Building also available for purchase. Owner willing to associate. Call (403) 314-9655. D1349

ALBERTA - East Central: General dentistry practice for sale in small city with all amenities. Family-oriented centre with strong petroleum, retail, and agricultural economy. Modern office, with well-established recall (1,600 active patients). Gross has been averaging 520,000 with 50% overhead on 4-day week. Reasonably priced. Reply to: email dentgent@shaw.ca D1346

ALBERTA - Foothills/Rockies: Three-operator clinic with extra operatory plumbed. Beautiful design with modern equipment. Computerized with intra-oral cameras. The area offers a wide variety of outdoor recreation and beautiful scenery. Furthering studies. Tel. (780) 405-7032. D1291

ALBERTA - Grande Prairie: Do not read this ad unless you want to buy a busy established dental office. An exceptionally high gross and net income. Suitable for 2 or 3 dentists. Grande Prairie is a hot spot in Alberta for growth. Call Christina, (780) 539-3079. D1273

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 - Victoria: Practice for sale. Retiring from family/residential long-established practice. Broad patient base (approximately 2,000 active charts). Grossing \$460,000/year on 60% leisurely work time. Three operatories - ADEC equipment in shared newer building. Brian Williams, tel. (250) 479-1388 after 6 p.m. Pacific Time or drbcwilliams@shaw.ca D1323

BRITISH COLUMBIA - Vancouver Island: Two successful practices for sale in beautiful Vancouver Island. Gross \$800,000 each, 180 days/year; 3-1/2 operatories each. Motivated staff, 2 hygienists. Nice patients, high proportion insured. Beautiful office, plenty of natural light. Owners going to graduate school. Interested in one or both, please e-mail islanddental@shaw.ca D1304

BRITISH COLUMBIA - Vancouver: Urban sophisticate wanted. Downtown Vancouver waterfront practice grossing \$1.1 million, net \$500,000 on 4-day week - 10 weeks holidays. Beautiful new 4-chair office with spectacular views (20-year lease) and top-of-the-line equipment including digital and lasers. Practice has been established over 60 years. Ideal for 1 or 2 dentists, you must like crown and bridge and routine cosmetic dentistry. Owner will associate back for limited period of time to assist transition. Associate to purchase or purchasing 1/2 of practice possible. Price and terms are flexible, if you are dedicated to quality and gentle dentistry - continuous learning a must. Please send your CV and a covering letter outlining your practice philosophy and goals to Mr. J. Leland, fax (604) 629-0759. D1280

BRITISH COLUMBIA - Prince George: Thriving, well-managed general practice in a friendly central B.C. university city (UNBC). Owner looking to relocate for family reasons. \$750,000 + in 2002 while taking lots of vacation time. Bright, popular, fully loaded (computerized, panorex, intraoral cameras, 4 operatories, etc.) office with fantastic team members and "Grade A" patients. Best of all, there is a wonderful "opposite-partner" to take care of emergencies (while you take time off) and to share some of the overhead. Please call Vicki, (250) 565-7767 or e-mail whistler2804@shaw.ca D1319

BRITISH COLUMBIA - Okanagan Valley: Periodontal practice for sale or partnership with eventual sale. Very attractive Okanagan Valley location. Large referral base. Unparalleled 4-seasons lifestyle. Good potential for growth. Tel. (250) 764-4775. D1213

BRITISH COLUMBIA - Kamloops: Well-established family practice. Downtown location. Three operatories, 1,300 active patients. Gross \$650,000+. Low overhead, very profitable. Nice office, staff and patients. Tel. (250) 851-8901 (evgs. and weekends). D1090

NEW BRUNSWICK - Grand Falls: Well-established family practice, with 6,000 plus patients. Computerized modern equipment with intraoral cameras. Superb building, 6,200 sq. ft., shared with 2 family physicians. Touristic town, bilingual, 1 hour and 15 minutes from Rivière-du-Loup. Lots of entertainment and activities such as a golf course, a bike path and a sports centre. Close to a U.S. airport. Call Marium, after 7 p.m., at (506) 473-9805 or e-mail mlking@nb.sympatico.ca D1332

ONTARIO - Ottawa (Kanata): Office space to share or rent, full- or part-time basis, for endodontist or oral surgeon. Tel. (613) 599-4881, e-mail tryvlad@hotmail.com D1338

ONTARIO - Southwest Mississauga: Dental practice for sale. Located in plaza next to medical practice. Equipment 3 years old, in perfect condition; 1,300 sq. ft. facility, modern decor.

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ONTARIO - Toronto: Established 2-operatorial dental practice set in a house for sale. Steps to subway, High Park area. Owner retiring; will stay for transition. Good potential for growth. Call (416) 762-1201 or (416) 769-7488. D1320

ONTARIO - Ottawa: Busy, growing dental practice for sale. Five operatories; gross revenues of \$1.5 million. Owner returning to school. Will assist in transition. Call Tess at (613) 834-6336. D1325

ONTARIO - Ottawa South: Well-established, 4-operatorial 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

QUEBEC - Îles de la Madeleine: Dental clinic for sale. Diversified practice established for 9 years. Two-storey premises (1,850 sq.ft.) with 4 operatories, a sterilization unit and Triangle office furniture. Ideal practice for 1 dentist, or a couple, in a marvelous setting. Visiting orthodontist and maxillofacial surgeon (minor surgery and implantology). For information, please call (418) 839-8293 or visit <http://www.cliniquedelarchipel.cjb.net> D1277

POSITIONS AVAILABLE

ALBERTA - Calgary: Attention dentists! Westpointe Dental (Dr. Stuart Yaholnitsky) seeks a new associate dentist for our progressive and very busy practice. New graduates or currently practising dentists are welcome. In beautiful Kensington area of Calgary, we are just outside the downtown core. Please send cover letter with resume and references to: Westpointe Dental, Attn. Leah, 430-1167 Kensington Cres. NW, Calgary, AB T2N 1X7; tel. (403) 270-9577, fax (403) 270-9580. We look forward to hearing from you! D1348

ALBERTA - Calgary: Full-time associate position available June 1 for an enthusiastic, personable family dentist seeking unlimited future potential. The clinic is located in a very busy shopping complex situated amongst some of the fastest growing communities in NW Calgary. Good existing patient base with excellent new patient opportunities. Some evenings and alternate Saturdays. Guaranteed minimum income. Please fax resumes to (403) 640-4762. D1344

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Calgary, Alberta

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Please reply to: CDA Classified Box 2813. D991

ALBERTA - Lloydminster: Current associate moving. Long-established, high-volume practice urgently requires associate to take over large existing client base. Opportunity to practise general family dentistry with special need for oral surgery and endodontics. Excellent patient-oriented energetic staff (including 1 full-time and 2 part-time hygienists). No weekend or evening hours unless by choice. Tel. (780) 875-4312, fax (780) 875-0300, mail to: Box 1385, Lloydminster, SK S9V 1K4; e-mail Hyde1@telusplanet.net or Zoob2@shaw.ca D1327

ALBERTA - Calgary: Full-time, experienced associate (5 + years) required for TLC Dental Care starting June 1. Approximately 2,000 patients with 30-40 new patients per month. Some evenings and alternate Saturdays required. Contact: Dr. John Tamminen, e-mail Ejtamm@aol.com or fax (403) 259-2622. D1327

ALBERTA - Edmonton: Associate dentist required for very pleasant office in West Edmonton. Full time. All replies strictly confidential. Fax (780) 474-6308, e-mail hnherch@telusplanet.net D1328



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ALBERTA - Rural: Full-time associate-ship available. Established family practice. Relaxed atmosphere. Ideal for the caring, patient-oriented dentist. Great family town with a myriad of outdoor recreation opportunities; 3 hours from Edmonton. Tel. Constantin, (780) 753-7901 or (780) 753-6676. D1296

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BRITISH COLUMBIA - Squamish: Full-time associate wanted for busy family dental practice in Squamish, B.C., to replace established associate. Good earning potential. Please mail CV with cover and references to: Competition #037, Box 44, 112-1151 Mt. Seymour Rd. N, Vancouver, BC V7H 2Y4. D1350

BRITISH COLUMBIA - New Westminster: Full-time associate required for busy, well-established dental practice. Please fax resume to Dr. Astley Smith at (604) 264-4876. D1345

BRITISH COLUMBIA - Kelowna: Associate wanted for busy general practice 1 day/week. May lead to more days if desired. New office, excellent staff and environment. Please contact: Dr. March, tel. (250) 764-8033 (evgs.). D1339

BRITISH COLUMBIA - Terrace: Service and adventure await you. Associate or locum position available in modern 8-operatory facility. Our caring, flexible team includes 2 dentists and 3 hygienists. A visiting oral surgeon, anesthesiologist and periodontist offer learning opportunities. Whether you are looking to increase your skills and experience, or enjoy our incomparable outdoors, this may be what you are looking for. Please contact: Bonnie Olson, tel. (250) 638-0841, fax (250) 635-4537. D1333

BRITISH COLUMBIA - Kamloops: Busy, family-oriented group practice requires associate 4 days/week including Fridays and Saturdays, starting June 2003. Well-established associate position with good earnings track record. Current associate leaving to attend graduate school. Kamloops has an easy-going, friendly atmosphere and is located close to mountains and lakes for fantastic year-round recreation. New graduates welcome. Fax resume to (250) 374-3499 or call Sue at (250) 374-4643. D1267

BRITISH COLUMBIA - Central: Only dental office in town. Experienced associate required, buy-in possibility. Office and building for sale in Central B.C. Three operatories and room for 3 more. Owner wishes to retire after 24 years and will assist in transition. Great staff. Air-conditioned building, 2,000 sq. ft., has a small apartment for a single dentist. Preventive-orientated office with well-educated patients. The gross is \$337,000 for part-time work "dentist's choice" (160 days/year) and rising. Tel. (250) 699-6969, fax (250) 699-6679. D1128

BRITISH COLUMBIA - Kamloops: Associate required with opportunity to buy into busy, progressive, fun practice. Contact: Dr. D. Barry Dextraze, 21 - 750 Fortune Dr., Kamloops, BC V2B 2L2; tel. (250) 376-5354, fax (250) 376-5367. D693

MANITOBA - Pine Falls: An awesome lifestyle is available in this friendly rural town about 1 hour north of Winnipeg. Just minutes away from Grand Beach and great golf courses with good access to boating, fishing and snowmobiling. Comfortable accommodations available on site, if desired. An excellent opportunity for a new graduate to increase speed and earn incredible income. Please fax resume to: Dr. Alan Grant, (204) 367-4587, Attn: Heather or call us at (204) 367-2208 for more information. D1131

NEW BRUNSWICK - Fredericton: We are currently seeking an associate dentist for our general dental practice. Very busy office with a family focus. Five modern operatories. This is a long-established practice of 18 years with buy-in potential. We are looking for an enthusiastic individual with high energy and excellent clinical and personal skills. Be busy immediately. Please fax your resume to (506) 458-9481, or call Lynne at (506) 458-9584. We look forward to your reply. D1322

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

PARTNER
Nova Scotia - Halifax Area

Modern, attractive 8-operator practice in Lower Sackville, Nova Scotia, with great growth potential. We are a 4-dentist practice with 8 hygienists, a dedicated soft tissue management program, computerized, intraoral cameras, pan. We require a full partner (25%) with above-average personal/professional skills with a passion for quality treatment. This is an exceptional opportunity to live in Halifax. Three-day work week with 30 new patients/dentist/month in this high-visibility clinic.

For further information please contact: **Linda Murphy, Office Manager, Community Dental Center, tel. (902) 865-7260, fax (902) 864-0444, e-mail msalyzyn@dal.ca**

D1343

NUNAVUT - Iqaluit: Canada's newest capital requires associate dentists with all-round clinical skills. Modern office with all usual facilities and usual support. Standard associateships are offered on usual terms. Southern Baffin Island offers many opportunities for outdoor recreation and a wide range of dentistry. Principal of practice has 15 years northern experience and seeks associates willing to give long-term commitment. Apply to: Administration, PO Box 1118, Yellowknife, NT X1A 2N8 or call (867) 873-6940, fax (867) 873-6941.

D1095

NUNAVUT - Iqaluit: Attention overseas graduates. Financial assistance and guaranteed job offer on graduation may be available to selected candidates. Please apply only if you are presently attending or have been accepted for a Canadian dental school. Apply to: Administration, PO Box 1118, Yellowknife, NT X1A 2N8 or call (867) 873-6940, fax (867) 873-6941.

D1096

ONTARIO - Southwestern: Oral and maxillofacial surgeon. Busy group practice is inviting applicants for association leading to partnership. Full scope surgical practice is seeking individual with full scope training. Hospital admitting privileges are now extended to this specialty in Ontario. Applications in writing can be submitted to: CDA Classified Box # 2836.

D1336

ONTARIO - Ottawa Valley: Seeking associate for busy family practice to replace current associate. Part/full time. Position available immediately. New graduates welcome. Call (613) 312-9043.

D1341



The IWK Health Centre, Halifax, Nova Scotia, is located on one of the world's great natural harbours and is home to many fine restaurants, a bustling waterfront and an active theatrical community. The IWK Health Centre provides quality care for children, women and families in the three Maritime provinces and beyond. It is a tertiary care health centre dedicated to family-centred care, education and research.

PAEDIATRIC DENTIST

The Department of Dentistry at the IWK Health Centre is actively seeking a paediatric dentist. The IWK Health Centre is associated with Dalhousie University Faculties of Dentistry, Medicine and Allied Health Sciences. Paediatric dentists must be eligible for licensure with the Provincial Dental Board of Nova Scotia.

The paediatric dentist should have training and demonstrated competence in provision of multidisciplinary care to tertiary care paediatric hospital patients including medically compromised and severely mentally or physically disabled patients, both in the clinic and the operating room. In addition to the clinical activities described, the successful candidate will provide care to secondary care paediatric dental patients referred to the Paediatric Dental Unit in the Children's Acute and Emergency Program at the Health Centre from communities within the province of Nova Scotia.

Active staff paediatric dentists are involved in the teaching of undergraduate dental students on an assigned basis through the Faculty of Dentistry, Dalhousie University. Paediatric dentists also participate in teaching of undergraduate and graduate medical students at the Health Centre.

In accordance with Canadian immigration regulations, priority will be given to Canadian citizens and permanent residents of Canada. Please send a cover letter and curriculum vitae along with two letters of reference to:

Dr. Ross D. Anderson, Chief of Dentistry
C/O Human Resources, IWK Health Centre
5850/5980 University Avenue, PO Box 3070, Halifax NS B3J 3G9
Tel. (902) 470-8678, (902) 470-6957 • Fax (902) 470-6612
E-mail ross.anderson@iwk.nshealth.ca
Web site www.iwk.nshealth.ca

Helping Children, Youth and Women in the Maritimes be the healthiest in the world.
The IWK Health Centre and Dalhousie University are equal opportunity employers and educators.

D1342

ONTARIO - Eastern: (Between Montreal and Ottawa). Associateship available, part time or full time, in a modern and busy practice established for 13 years. Please fax CV to (613) 632-8396.

D1309

ONTARIO - London: Associate required for group practice. Excellent opportunity in state-of-the-art facility. Ten operatories, laser, esthetics centre, etc. Interest in perio an asset. Reply to: CDA Classified Box # 2835.

D1310

ONTARIO - Ottawa: Full- or part-time associate position available in busy, established endodontic practice. Flexible hours and good opportunity to buy into the practice. Contact us by telephone at (613) 722-3636 or e-mail ingmaris@mac.com

D1301

ONTARIO - Fort Frances: Full-time associate needed for extremely busy family dental practice. Dentist and hygienists booked 6 months in advance. High gross, high net. Excellent staff and working conditions. Practice on American border in northwestern

Ontario. Ideal for person with an outdoor, active lifestyle. Emphasis on caring attitude and good quality dentistry. Please call (807) 274-5365 (days), (807) 274-5549 (evgs. and weekends), fax (807) 274-1738 or write to: 1201 Colonization Rd. W, Fort Frances, ON P9A 2T6.

D1223

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 drgearge@altima.ca

D1269

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

D1268

QUEBEC - Gatineau: Family practice in medical and dental setting. Associate needed for replacement during maternity leave. Possible partnership following maternity leave, owner returning part-time. Please call (819) 281-1741. D1295

QUEBEC - Val-d'or (Abitibi area): Associate needed to replace one of the three dentists. Established patient base. Trained staff. Contact: Johanne, tel. (819) 825-2204. D1329

QUEBEC - Hull: Locum dentist needed for maternity leave, mid-September 2003. Very busy clinic. Tel. (819) 777-2902. D1331

QUEBEC - Îles de la Madeleine: Full-time dentist wanted. Serious, dynamic, and multi-talented for multidisciplinary practice with stable and qualified staff. Available starting September 2003. For information, please call (418) 839-8293 or visit <http://www.cliniquedelarchipel.cjb.net> D1278

QUEBEC - Montreal: We are seeking an associate for a busy, well-established periodontal practice in Montreal, Quebec. The practice presently consists of three periodontists and five hygienists. There is definite partnership potential as the partners are phasing into retirement. Tel. (514) 931-2551 or e-mail periomontreal@sympatico.ca D981

SASKATCHEWAN - Melfort: Full-time associate wanted. Make at least \$150,000 your first year, the sky is the

limit. We are the only office in town of 5,000 plus surrounding area. Modern 7-operator office in Melfort, Saskatchewan, just 1-3/4 hours from the city. Don't miss out on this opportunity. Contact: Dr. Tom Carlson or Mrs. Raylene Carlson, tel. (306) 752-2266 (days), (306) 752-5960 (evgs.), or fax resume in confidence to (306) 752-5994. D1302

SASKATCHEWAN - Regina: Associate opportunity. Our patient-centred clinic is seeking an associate to further our ongoing quest for excellence in oral health care. This associate will be sincere, enthusiastic and will be willing to participate in our mission, vision and values. Salary and scheduling to be negotiated. Please send resume or contact: MD Health Management Inc., 224 Windermere Dr., Edmonton, AB T6R 2H6; tel./fax (780) 436-0732. D1312

YUKON TERRITORY - Whitehorse: Associate required for a 5-chair dental clinic. We are looking for a person committed to quality dentistry and interested in a long-term relationship. In the new year we will require a highly motivated, patient-oriented hygienist as well. Tel. (867) 668-6077, fax (867) 667-6824. D1592

MARYLAND, US - Silver Spring: Our rapidly growing practice in Silver Spring, Maryland, U.S.A., is seeking a hard-working, full-time general dentist with excellent clinical skills. Salary US\$75,000 + commission. Malpractice insurance plus benefits paid. Call (202) 966-5357 (evgs.) or fax (301) 603-0861. D1324

*CDSPI Reports
continued from page 330*

by age 65, you'll have \$500,000 of retirement savings. Although a half million dollars may seem like a substantial amount of money, consider just how far that will get you in retirement. Assume you want your annual retirement income to be 80% of that \$80,000 — \$64,000. With your half-million dollars earning a 7.5% interest

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POSITIONS SOUGHT

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LUXURY MEXICAN VACATION CONDOMINIUMS: Featuring on-site beach and golf. Rental weeks are available at fabulous Mayan Palace Resorts throughout the year including Christmas/New Year breaks. Contact: Dr. Clyde Hillier, tel. (519) 433-5111 (bus.), (519) 686-5888 (res.), see Web site www.luvacondo.com D1335

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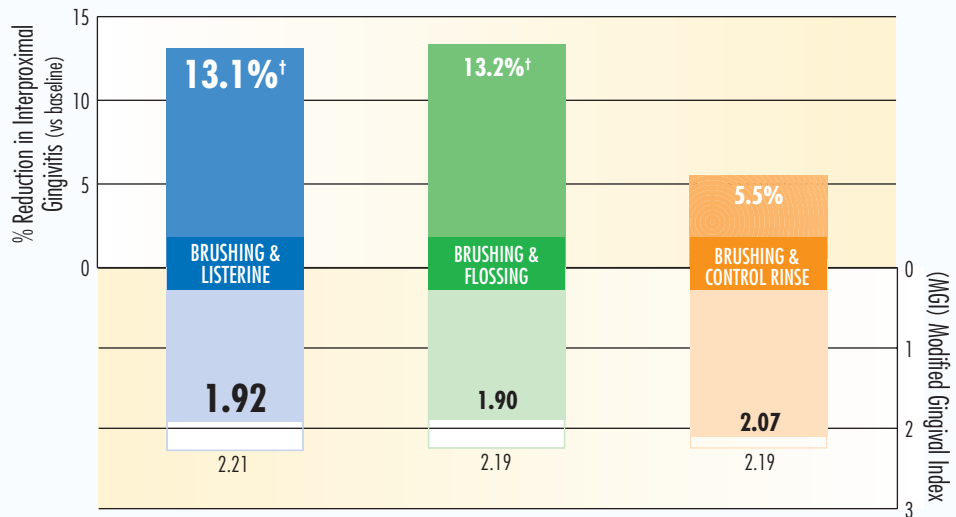
Canadian Gingivitis Study Tests Flossing & Listerine

Results:

Both Listerine and flossing reduced interproximal gingivitis significantly better than control in a study that put flossing and rinsing behaviour to the test

Interproximal Gingivitis Scores

Clinical Study 1 at 6 months



Adapted from Sharma¹ n=301 [†]p<0.001 vs control; p=N/A Listerine vs flossing



Add LISTERINE* Liquid Action to your patients' oral hygiene routine, to help prevent and reduce gingivitis.



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

Indications: Listerine Antigingivitis-Antiplaque-Antiseptic oral rinses kill the germs that cause gingivitis, plaque and bad breath. **Cautions:** Keep out of reach of children. Do not swallow. 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. Gargle to relieve sore throats due to colds. **Medicinal Ingredients:** Eucalyptol 0.091% w/v, Thymol 0.063% w/v, Menthol 0.042% w/v. **Non-medicinal Ingredients:** Cool Mint Listerine contains alcohol, benzoic acid, 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, 500, 1000 and 1500 mL.

1. Sharma, N.C. et al. Comparative effectiveness of an essential oil mouthrinse and dental floss in controlling interproximal gingivitis and plaque. *American Journal of Dentistry* 2003.

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