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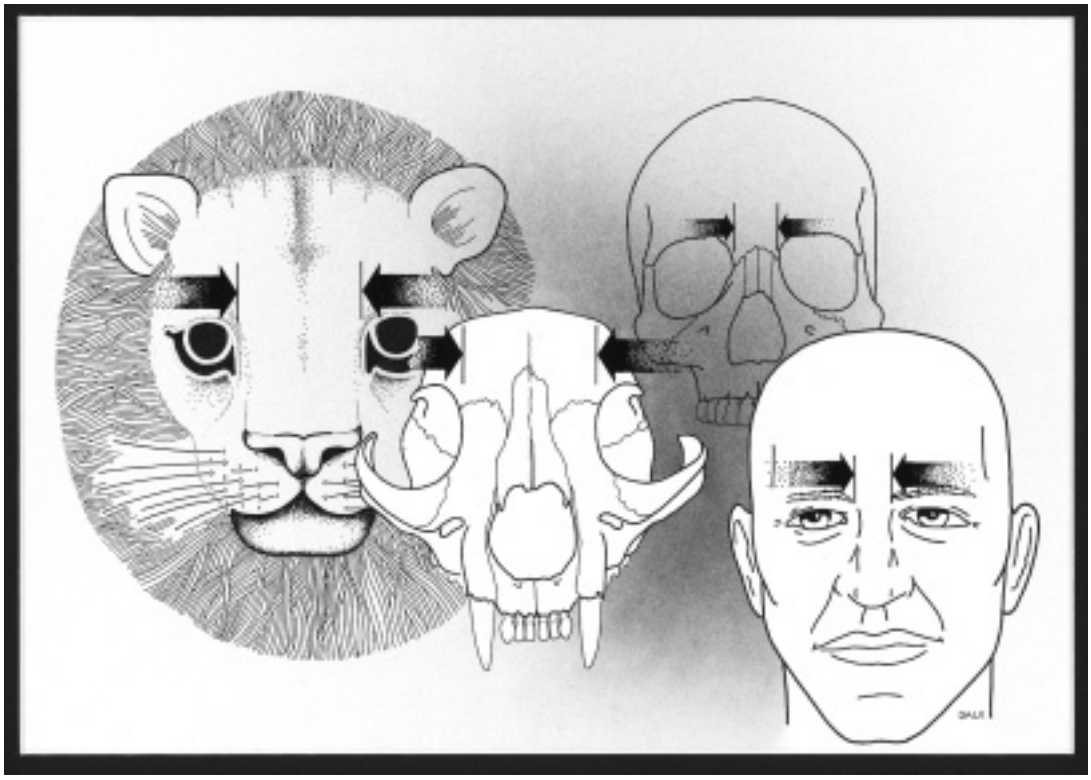

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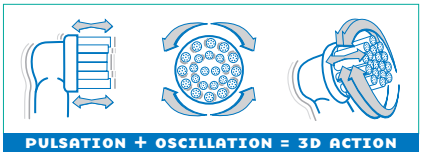

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[1]Sharma NC et al J Dent Res 2002; 81 (Spec Iss): Abstr, 2861.
[2]Danser MM et al J Dent Res 2001: 80 (Spec Iss): 743, Abstr. 1734.
[3]van der Weijden G A et al. J Clin Perio 2002; In Press.

Editorial

TEAMING UP FOR DENTAL EDUCATION

Dr. John P. O'Keefe

The health of dental schools is essential to the vitality of our profession. Without a solid footing in the university, the dental profession would be much diminished indeed. Yet, Canadian dental schools are facing great difficulties now and in the years ahead. Why?

A high proportion of current faculty members will retire in the next few years. While I hear conflicting stories about the ability of schools to recruit faculty members, many say that recruitment and retention are more difficult. Without properly credentialed faculty members, dental schools will be hampered in their mission to graduate new dentists and dental specialists.

Difficulties in the specialist area were highlighted for me last year when I attended a meeting organized by the Canadian Association of Orthodontists aimed at exploring solutions to the looming shortage of faculty members to teach in Canada's 5 graduate orthodontics programs. The big concern among the orthodontists was that if there were insufficient faculty members, there would be insufficient capacity to train enough specialists to meet the treatment needs of Canadians.

In turn, there will be even fewer teachers for the next generation of graduate students — a worrying downward spiral. The orthodontists identified lack of money for attractive salaries for prospective faculty members as the overriding cause for the developing problem.

I was surprised at the modesty of the salary ranges of university-based orthodontists. From what I hear, this problem is mirrored across the clinical disciplines, making recruitment and retention of clinical specialists an uphill struggle.

Granted, salary levels aren't the primary motivator for many dedicated teachers in our dental schools, and private practitioners may argue that employment benefits such as paid vacation and pensions sweeten the deal for tenured academics. However, when compensation differentials between the university and the private office are really large, it is not hard to understand why young specialists might choose private practice over academe.

The debt load that today's dentist graduates with may be a further deterrent to even considering an academic career. Compound this debt with more acquired during specialty training and the allure of the 5-figure university salary dims even more. In tandem with the human resource problem, the shortage of other resources is keeping our deans awake at night.

It is very difficult to make a profit from dental school clinics and there is a shortage of suitable patients in certain disciplines. Research funding is difficult to come by and the physical plant of many Canadian schools is in serious need of upgrading. With so many woes on the horizon, should we just roll over and give up?

We can all do much to ensure a healthy future for our schools and profession. Given that dental care is delivered primarily in the private sector, most of the solutions will have to come from the private sector — the profession itself and the dental industry.

CDA, with generous sponsorship from Procter & Gamble (Crest products), Dentsply, the Dentistry Canada Fund (DCF), Septodont and Sonicare, took a major step along the road to solutions by organizing a Dental Academic Summit last November. This meeting brought together the professional organizations with an interest in the future of dental education. You will be seeing the tangible outcomes of this "education summit" over the coming months.

CDA has stepped up advocacy with the federal government for better dental research and education funding. I believe DCF will soon unveil plans for a major fund-raising campaign to help young practitioners along the training pathway to an academic career.

You can do your bit for dental education. You might consider a complete or partial career change from the private to the university sector. Contributing money to fund-raising activities by either the individual schools or DCF will have a major beneficial impact. You can also speak to political decision-makers about how a vibrant dental education sector contributes to the health of Canadians.

Dentistry has always been an innovative profession ready to adapt to a changing environment. With our best efforts, we can ensure a bright future for the dental education sector.

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

GETTING GOVERNMENT'S EAR IS AN ONGOING EFFORT

Dr. Tom Breneman

National Oral Health Month (NOHM) means a great deal to organized dentistry. Planning starts 11½ months in advance, as we adopt a theme, secure sponsorship, write articles, prepare advertisements, and ensure our spokespersons have the most current information to disseminate to the public and to government decision-makers. This coordinated effort results in extensive media coverage that reinforces our message of preventive dental care — with the dentist as the primary care provider. CDA's annual Day on the Hill event at the end of April is timed to take maximum advantage of the awareness generated by NOHM.

Our government relations strategy and the opportunity to place dentistry's message on the radar screens of Canada's top-level decision-makers is not just a once-a-year event, though. We continually update and fine-tune our messages, as well as the materials we leave behind with Cabinet ministers and members of Parliament. The messaging evolves from CDA's Strategic Plan and is updated to reflect decisions taken by the Board and Executive Council. Messages are further refined by CDA staff, with input from the Government Relations Steering Committee. This year, the issues fell into 3 broad categories — health, financial and professional.

The health issues include the oral health of First Nations people, the National Oral Health Strategy and tobacco control. Professional issues relate to the licensing of foreign-trained professionals, tuition fees and the serious concerns facing our dental faculties. Financial issues include cost-recovery by Health Canada's Medical Devices Bureau, bank mergers and the taxation of dental plan premiums. Our messaging is factual and succinct. It includes policy recommendations and is delivered throughout the year in formal and informal settings. Although delivering a consistent message on the issues is important, the critical part of the strategy is to establish and maintain positive relationships with politicians and their senior-level advisors.

This relationship building begins as our staff and consultants update us on the views of those 30 or so MPs whom we want to visit. This approach enables us to better understand their points of view, and better prepare our presentations and responses to their questions and concerns. As always, our big-picture outlook is aimed at issues and ideas that will positively affect the oral health care needs of Canadians.

Our most recent meeting with Federal Health Minister Anne McLellan went very well indeed. She seems to understand dentists' concerns about the oral health of First Nations people and the impediments that the current Non-Insured Health Benefits dental plan places on us as providers of care. We also discussed the proposed electronic health record to ensure that dentistry is consulted early in the development process, because of its ongoing leadership role in electronic claim transmission.

Federal Immigration Minister Denis Coderre complimented our profession on its current system of upgrading professionals via qualifying programs from non-accredited dental faculties. At the same time, Mr. Coderre advised us that the status quo will not be adequate in a few years' time. In effect, we will need to devise a system to evaluate foreign-trained professionals, either by extended reciprocal accreditation agreements or through individualized gap education programs to ensure full competencies for practise in Canada.

When informed that funds to our teaching faculties had already been cut back to the point where we are close to a crisis situation, Mr. Coderre said that funding could be discussed once we prepared a comprehensive and unified proposal on the accreditation of foreign dentists. "Handshake before handout" was the way he put it. We will definitely hear much more about this issue in the months ahead.

To conclude, I would say that CDA members should be pleased (and indeed proud) of the government relations work that the Association is doing on their behalf. This is a wonderful time to be a member of the dental profession, as there are many on Parliament Hill who knew of our issues and complimented dentistry on an excellent effort in communicating its message in a very transparent and positive way. Government relations are an ongoing investment that will keep on paying dividends, but only so long as we continue to convey quality information to Canada's financial and health care policy-makers.

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.

Evaluation of Proximal Contacts

I am concerned that readers will assume that preparations for amalgam and composite restorations in posterior teeth are the same (March 2003 *JCDA*). Nothing could be further from the truth. Readers are referred to Summit's text *Operative Dentistry*,[1] in particular, to the chapter on "Direct Posterior Esthetic Restorations" by Thomas J. Hilton. There would be much more veracity in the conclusions had the authors tested the techniques using 2 types of teeth — one prepared for amalgam and one for posterior composite.

At the University of British Columbia's faculty of dentistry, students are taught that the amalgam and posterior composite preparations are completely different. They use this fact during their integrated care clinics, when dealing with patients who request that their fillings be changed to composite restorations, by pointing out that this is not advisable, due to the physical differences of the materials.

For a tooth originally prepared for amalgam, particularly a large one, the options are only another amalgam or (possibly) a cast restoration.

The authors are to be commended for their innovative approach to dealing with this particularly vexatious problem of how to establish tight proximal contacts while restoring posterior teeth.

Dr. William Brymer
Division of Operative Dentistry
Faculty of Dentistry
The University of British Columbia,
Vancouver

Reference

1. Summit JB. Operative dentistry. 2nd edition, Quintessence Publishing Company, Inc.; 2001.

Response from the Authors

We would like to thank Dr. William Brymer for his interest in our paper. We received a number of responses to this paper from *JCDA* readers, reflecting dentists' genuine interest in this timely subject. Rather than examining minor variability in Class II preparation designs for resin composite versus amalgam, our work focused on an important issue — testing available methods for producing proximal contacts with resin composites.

We believe that variability in Class II cavity preparation designs between resin composite and amalgam has little or nothing to do with the quality of proximal contacts, when dealing with relatively larger restorations. The reason for this is that the problem of producing acceptable proximal contacts with Class II resin composite restorations has more to do with the handling characteristics of the material than the cavity design.

Dr. Brymer need not be concerned that "readers will assume that preparations for amalgam and composite restorations in posterior teeth are the same," as this was not the intent of our investigation. Nor does our paper focus on this area. However, in view of the current environmental concerns with amalgam, many practising dentists are routinely placing large-size resin composite restorations. As a matter of fact, the current fee guide for dentists published by the Ontario Dental Association does have a code for a 5-surface resin composite restoration for permanent molar teeth. Our goal with this work was to provide helpful information to dentists on how to obtain clinically acceptable proximal contacts; it was not to discuss minor preparation design issues.

Dr. Wafa A. El-Badrawy
Assistant Professor in Restorative Dentistry
Department of Clinical Dental Sciences
Faculty of Dentistry
University of Toronto
Toronto, Ontario

I was very disappointed to see this study, which did not include the sectional matrix and ring technique developed by Dr. Alvin Meyer and marketed by several companies, arguably the most effective and widespread method of achieving excellent proximal contacts.

It also made no sense to carry this out with ivorine teeth in rigid models, without taking into account the elasticity of the periodontal ligament and the associated temporary moving of teeth under pressure. This poorly designed study does not serve the practising dentist in any realistic way and should not have been published.

Dr. Roel Wyman
Toronto, Ontario

Response from the Authors

We would like to thank Dr. Wyman for his interest in our paper. It seems to us that Dr. Wyman did not read our paper carefully. We did mention in the discussion section (page 165, paragraph 1) that we had originally planned to have one experimental group for the sectional matrix/ring technique. However, due to the relatively wide proximal box preparation, the ring jaws did not engage the proximal embrasure area, but rather sank into the proximal box, causing the

sectional matrix to collapse. We had to remove this group from our research protocol because of this problem, although we did mention that we do use this technique with great success when dealing with smaller-size Class II restorations. We also did point out that it is easier than the insert technique.

Further, in the discussion section, we addressed the limitations of our in vitro study (page 165, paragraph 2), including the lack of the periodontal ligament in the simulation model we used and how this may have affected our findings.

For future reference, we ask Dr. Wyman to read papers carefully from beginning to end before making strong unfounded statements about their quality or usefulness. Instead of being disappointed with our research, Dr. Wyman needs to have more appreciation for in vitro research, which provides an important foundation for clinical research.

Dr. Wafa A. El-Badrawy

Dry Socket

In response to Dr. Lung's excellent article in *Point of Care* (*JCDA*, July-August 2002), I would like to add a page out of my notebook. We are all aware of the difficulties associated with dry socket and the repeat visits as the dressing washes out. I have found an almost infallible one-visit treatment. Once some patency is established by removing necrotic debris with tweezers, chlorhexidine syringing and small cotton pellets, a small cone of Coe-Pak is placed in the socket, ensuring that the socket margins overlap the plug slightly to prevent early loss. The patient must be instructed that the Coe-Pak dressing will extrude as the tissues heal and may fall out in a few days. This is enough to ensure that a painless healing process will commence almost immediately.

Useful hints:

1. Spraying topical anesthetic into the socket will almost always do the trick. Occasionally, a local anesthetic will be needed.
2. Use soap solution as a lubricant to handle the Coe-Pak — it should be a little doughy, to shape it to the right size.
3. Use a wet soapy cotton pellet to gently press and mould the Coe-Pak into the socket.

I have used this for more than 25 years with great success and pass it onto the profession, as I fade into dental twilight.

Dr. Russell M. Gawron
Thornhill, Ontario

April Point of Care

I am writing in response to *Point of Care* Question 4: "At what age should a child's first oral exam be scheduled?"

I agree with the author's conclusion. However, I would like to add that the first dental exam could provide a potentially positive behavioural component to the first dental visit, whereby the child associates an atraumatic and painfree experience with dentistry.[1]

Dr. Elvine Y.W. Jin
North York, Ontario

Reference

1. De Jongh A, Muris P, ter Horst G, Duyx MP. Acquisition and maintenance of dental anxiety: the role of conditioning experiences and cognitive factors. *Behav Res Ther* 1995; 33(2):205–10.

Factor Missing

The article entitled "Dental Care for the Patient with Bipolar Disorder" (January 2003 *JCDA*) is clear and hopefully will educate many, while alleviating some of the misconceptions that general dental practitioners may have about treating patients with psychiatric disorders.

However, the author has not taken into consideration a major and very important factor about why there is a general lack of good dental care for psychiatric disorder cases. People whose illness has led them into poverty often can't get dental care in the first place.

Many dentists who are asked to treat patients will not do so unless they have a dental plan. And many dentists refuse service to people who are dependent on welfare programs, which do not fully cover their costs. And when a person is too poor to buy food, dental floss is an unaffordable luxury.

These realities must be addressed if the knowledge the author imparts is to be useful.

Lenore S. Clemens
Vancouver, British Columbia

Editor's Note: This letter was written by a patient who was referred to CDA's Web site by her dentist.

Surgery Codes

Re the letter on dental extractions (March 2003 *JCDA*): The cases referred to oral surgeons are by definition supposed to be the more complicated ones. Why then are we surprised that oral surgeons have a higher percentage of difficult codes?

Dr. Arnold Abramson
Windsor, Ontario

Poet's Pen

Due to our success in showcasing works of art by dentists on the cover of JCDA, *we're interested in finding out if there are any poets in the Canadian dental community who would like their work featured in these pages. We welcome short poems of 300 words or less on any subject within the boundaries of good taste. We will present poems in either of Canada's official languages. Poems will be published in the language in which they are submitted. Our first offering is by James Noble, a student at the University of Toronto's faculty of dentistry.*

Gerstein

By James Noble

Note: *"Gerstein" is the Gerstein Science Information Centre, the University of Toronto's library serving all science and health science disciplines.*

Here on the shelves in the basement of Gerstein library,
thousands upon thousands of bound Ph.D. theses sit,
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by the most imaginative minds in this country
through this past century.

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echoes of an ambulance, saving life;
buildings stand tall, heated at night.
The girl to my right takes her insulin injection.
We walk immune to many deadly diseases
and have therapy for diseases of the mind.
Tomorrow I know it will be partially cloudy with chances of rain.
The elevator takes me up and I check my e-mail.
The exit door opens automatically for me
to stare in awe at the CN Tower.

A beautiful butterfly lands on my shoulder
and sits so peacefully.
I cannot believe
that it once was a crawling caterpillar
who then hid in a cocoon.
And I smile at it, reverent,
for now I know the mechanism of its metamorphosis!

All the hard student work that sits
in the basement of Gerstein library
at this glorious university indeed,
was not in vain.

Yet humbled, I remain,
sick in this wheelchair.

Continuing Dental Education

CDA maintains a current listing of continuing dental education courses to help dentists stay informed about various learning opportunities offered to them in Canada and abroad. For more information about continuing education events listed on the calendar, please contact the organization hosting the event. To view the complete calendar of CDE events, visit CDA's Web site at www.cda-adc.ca.

Canada

September 3–6, 2003

Halifax 2003 AGM Canadian Academy of Endodontics
Halifax
E-mail: imcdougall@ns.sympatico.ca
Web site: www.caendo.ca/upcoming/halifax/halifax.htm

USA

July 17–20, 2003

Academy of General Dentistry Annual Meeting
Nashville, Tennessee
Tel.: 888-243-3368, ext. 4339
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Web site: www.agd.org

July 18–19 or July 20–21, 2003

Dental Mass Disaster Training and Mock Disaster Exercise – American Dental Association
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International

July 4 and 5, 2003

ESDE European Society of Dental Ergonomics, 17th Annual Congress
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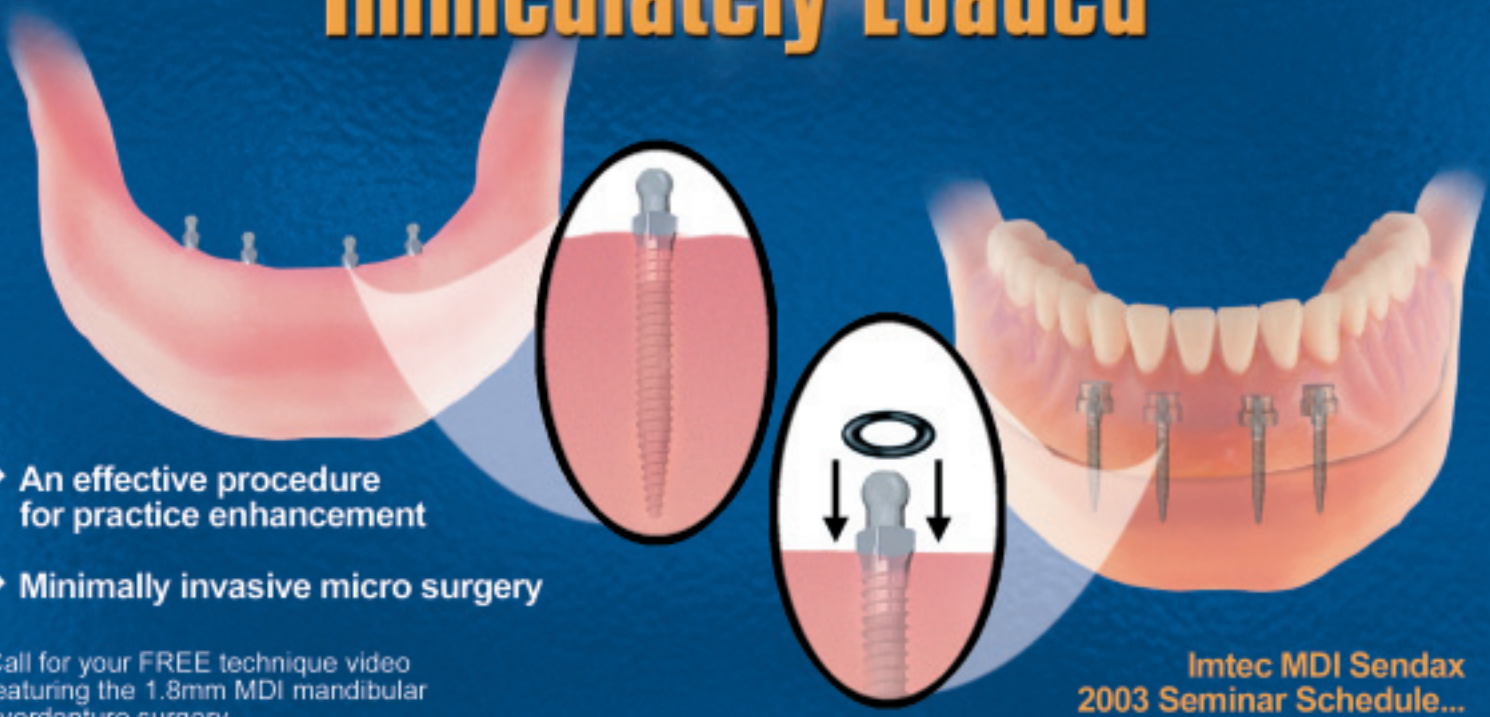

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News

DIS Survey Contest Winner

Dr. Sunjay Gandhi is the winner of a Palm Pilot for his participation in CDA's Dental Information Services (DIS) booklet survey distributed electronically to dentists across Canada earlier this year. Dr. Gandhi is a recent graduate and current CDA member who now practises in Whitby, Ontario.

CDA would like to thank everyone who participated in the survey, the results of which will help the Association further improve patient information resources to better meet dentists' needs.

As part of CDA's Public Education Program, a series of 14 colourful and comprehensive DIS booklets educating patients on dental procedures and other essential oral health facts is produced by CDA, in partnership with Colgate-Palmolive and Canadian Dental Service Plans Inc. (CDSPI).

To place an order for DIS booklets, call 1-800-561-9401 or (416) 296-9401, ext. 5030. ➧

COVER ARTIST

Dr. Jack Dale's cover art for the June edition is a pen, airbrush and ink diagram, illustrating orbital rotation toward the midline (biorbital convergence) and decreasing relative dimensions of the interorbital region in the human. This, together with other rotations, brain enlargement, facial reduction and realignment adaptations, contribute to the anatomical basis for the various malocclusions that can occur in the human face.

Dr. Dale has been involved as an artist and writer in over 75 publications, including 18 books. He is constantly creating illustrations for lectures that he has presented throughout the world over the past 45 years.

The cover illustration originally appeared in A.R. Ten Cate, editor. *Oral histology, development, structure and function.* 5th edition. Mosby; 1998. p. 429, Figure 19-7.

Dr. Dale enjoys writing and drawing at his home in Toronto, because it provides more opportunity to spend time with his family (shown in photo): Anne Sr., his wife of 51 years, classmate in dentistry and associate professor at the faculty of dentistry of the University of Toronto, and daughters Hali (right), orthodontist, practising with her father, and Anne, mathematics and physics teacher at Weston Collegiate in Toronto and next-door neighbour. ➧

Dentistry Oral History Project

An undergraduate dental student at the University of Toronto is documenting the post-World War II oral history of the school's faculty of dentistry.

Howard B. Cohen, PhD, explains why he embarked on this project: "Having spent the last 2 years searching for materials pertaining to the founding of this institution in the latter half of the 19th century, I have been repeatedly frustrated by the lack of materials available documenting the texture of the day-to-day lives of individuals who were associated with the faculty."

Dr. Cohen's proposed solution is to take steps to ensure the relatively recent past does not go undocumented. He has therefore undertaken to document the student experiences of several prominent graduates. He has chosen to focus on the period 1945–1965, because this period witnessed an unprecedented boom in dental research, leading to the establishment of the U of T as Canada's most research-intensive faculty of dentistry. With several first-hand accounts of prominent graduates, Dr. Cohen believes it will be possible to develop a much fuller understanding of the people and events of that exciting era. Audio recordings of the interviews and supporting documentation will be donated to the U of T's archives.

For more information, contact Dr. Cohen, tel.: (416) 585-9889; fax: (416) 585-9521; e-mail: howard.cohen@utoronto.ca. ➧

Stem Cells in Tooth Pulp: Future Research Tool

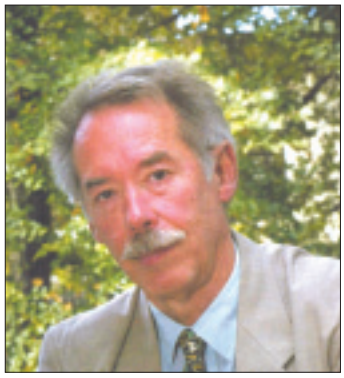
Researchers from the United States and Australia have found that the deciduous teeth of children aged 7 to 8 years have robust stem cells in their dental pulp. This finding is important, because such teeth may serve as an easily obtainable alternative to embryonic stem cells, the use of which has proven controversial. The teeth may also serve as a ready source of bankable stem cells, the study's authors claim.

The findings have potential clinical applications. Stem cells exfoliated from human deciduous teeth may one day be used to regenerate native teeth or to secrete dentin, obviating the need for composite bone or metal implants.

The report, entitled "Stem cells from human exfoliated deciduous

teeth," was published in the *Proceedings of the National Academy of Sciences of the United States of America* (May 13, 2003; 100(10):5807–12, www.pnas.org).

First University Chair in Oral Health Development



Prof. Wim van Palenstein Helderman

A new university post — financed mainly by the Dutch Dental Association (DDA) — will look at ways for poor communities to have access to affordable basic oral health care.

Professor Wim van Palenstein Helderman becomes the first University Chair in Oral Health Development at the College of Dental Science, University of Nijmegen in the Netherlands.

He will explore new concepts for oral development through partnerships between government health departments, dentists and health care workers in some of the world's poorest countries. "Looking at new ways to solve old problems can bring affordable ideas and results," Prof. van Palenstein Helderman notes.

The professor will work on oral care projects in deprived communities *inside* local health systems. Prof. van Palenstein Helderman aims to demonstrate to communities and governments that basic affordable oral health care is possible, using funds and resources that already exist.

"Even the poorest countries have some money in their national budgets for oral health care," he says. "And people living in poverty spend some of their resources for the relief of oral pain, often through the unfortunate use of inappropriate local medicines, since oral health care is not available. The important question is how existing funds for oral treatment can be used to enable the poorest communities to have affordable basic oral care *and* fewer oral diseases."

The College of Dental Science of the University of Nijmegen is a World Health Organization (WHO) Collaborating Centre for Oral Health Care Development. Professor van Palenstein Helderman is a member of FDI World Dental Federation's World Dental Development Committee.

More information about this can be found on www.fdiworldental.org.

WHO Adopts Tobacco Control Convention

The Geneva-based World Health Organization (WHO) has adopted the Framework Convention on Tobacco Control, aimed at curbing tobacco-related deaths and disease.

The Convention requires countries to impose restrictions on tobacco advertising, sponsorship and promotion, establish new labelling and clean indoor air controls, and strengthen legislation to clamp down on tobacco smuggling.

Tobacco now kills some 5 million people each year. This death toll could double by 2020, if countries do not ratify the Convention, according to the WHO's director-general Dr. Gro Harlem Brundtland. While smoking rates are declining in some industrialized countries, they are increasing in many developing countries, especially among the young, and these countries will account for over 70% of the projected death toll of 10 million people.

To bring the Convention into force, 40 countries are needed to ratify or otherwise accept it. Canada is committed to working with the international community to make the Convention a success.

For more information, visit the WHO Web site at www.who.int.

New Fact Sheets on West Nile Virus

Health Canada has released new fact sheets on the mosquito-borne West Nile virus. Subjects range from *How to Protect Yourself and Your Family* to *Symptoms and Treatments*. For the latest updates and information, visit Health Canada's West Nile virus site at http://nile.healthcanada.net.

New Dental Hygiene Program in B.C.

The Canadian Healthcare Academy (CHCA) has announced a September startdate for a 2-year dental hygiene program in British Columbia's Lower Mainland. The program is expected to attract about 24 students in its first year. CHCA is a fully accredited private post-secondary school that specializes in health care training programs. The first crop of students can expect to be eligible for licensure in B.C. shortly after graduation. The province is currently experiencing a shortage of dental hygienists and could easily accommodate 500 more, according to Jocelyn Johnston, executive director of the Association of Dental Surgeons of British Columbia.

Heart and Stroke Risk Grows in Canada

Eight in 10 Canadians have at least one risk factor for cardiovascular disease, and 11% have 3 risk factors or more, according to *The Growing Burden of Heart Disease and Stroke in Canada 2003*, a report published by the Heart and Stroke Foundation.

One of the most alarming trends is the growing prevalence of risk factors among young Canadians. "It's really a ticking time bomb," says the report's editor Dr. Andreas Wielgosz. "Almost 40% of teenage girls are physically

inactive. The largest proportion of smokers is among young men and women 15 to 29 years old. Over 30% of men and women in their twenties are overweight. We have to act now. If we don't, thousands of Canadians will die premature deaths that could be avoided."

More investment in cardiovascular health and research is essential, according to the report. The Pan-Canadian Healthy Living Strategy now being developed by health ministers with partners across Canada is a positive step in addressing the risk factors that cause cardiovascular and other chronic diseases.

The full report is available in pdf and html at www.heartandstroke.ca/growingburden.

Increase in Uninsured Dental Visits in U.S.

Uninsured people recorded a double-digit increase in visits to the dentist, but the improvement still left them far behind the percentage of those with private dental insurance seeing a dentist, according to a study that appears in the May 2003 edition of the *Journal of the American Dental Association* (*JADA*).

The *JADA* study — entitled "Recent Trends in Dental Visits and Private Dental Insurance, 1989 and 1999" — reveals that people with private dental insurance visited a dentist more often than those without private dental insurance in both 1989 and 1999. Among the insured, the percentage reporting a visit rose to 75.2% in 1999, up 5% from 71.4% in 1989. However, the increase among those without dental insurance jumped to 58.1% in 1999 from 47.6% in 1989 — an increase of 22%.

This study is available to CDA members at no cost through the Association's Resource Centre. To obtain a copy, contact Marsha Maslove, senior library technician at CDA; tel.: 1-800-267-6354, ext. 2271; fax: (613) 523-6574; e-mail: mmaslove@cda-adc.ca.

OBITUARIES

Dr. Clyde Covit

Covit, Dr. Clyde: Former CDA president Dr. Clyde Covit has passed away at age 59. A native of Montreal, Dr. Covit graduated from the University of Montreal's faculty of dentistry in 1968. Dr. Covit was elected CDA president in 1979. He had served as a governor of CDA since 1976 and as a member of the Executive Council since 1977. Dr. Covit was a past president and board chair of the Quebec Dental Surgeons Association, very active in the political and insurance fields as these related to dentistry. He also served as vice-president of the Order of Dentists of Quebec from 1986 to 1990. In November 2002, Dr. Covit was elected to ODQ's Board of Directors. In 1997, Dr. Covit received the Certificate of Merit from the Board of Governors, in recognition of his past service to CDA. He leaves behind his wife Sharon and 3 children — Brandee, Hayley and Barrie.

Demers, Dr. Paul J.: Dr. Demers of Sarnia, Ontario, died on April 29 at age 44. He graduated from the University of Toronto in 1982.

Hann, Dr. Jack: Dr. Hann of Vancouver died on March 5 at age 75. After graduating from Dalhousie University in 1954, Dr. Hann practised in St. John's until 1963. He then moved to British Columbia, where he was a regional dental director with the B.C. Ministry of Health, associate professor in the division of preventive and community dentistry and later assistant dean of clinical affairs at the University of British Columbia, among other positions. Dr. Hann retired in 1992, but maintained a connection with UBC as clinical director emeritus. Those wishing to contribute to a memorial in his name are asked to forward gifts to Andrea Wink, Senior Development Officer, UBC Faculty of Dentistry, 2194 Health Sciences Mall, Room 350, Vancouver, BC V6T 1Z3. For more information, contact Ms. Wink at awink@interchange.ubc.ca.

Mercier, Dr. Maurice: Dr. Mercier of Sainte-Foy, Quebec, died on March 26. He was a 1945 graduate of Montreal University's faculty of dentistry and a life member of CDA.

Oliver, Dr. Michael J.: Dr. Oliver of Burlington, Ontario, graduated from McGill University in 1970. He passed away on March 5.

Parker, Dr. Frank R.: A 1986 graduate of the University of Toronto, Dr. Parker of Keswick, Ontario, died on April 29.

Rothstein, Dr. Abraham L.: A 1943 graduate of the University of Toronto, Dr. Rothstein of Winnipeg passed away on March 14 at the age of 84. He was a life member of CDA.

Vogel, Dr. Donald: Dr. Vogel of Chase, British Columbia, passed away in January at age 76. A 1963 graduate of the Oregon Health Sciences University in Portland, Dr. Vogel practised dentistry for the next 40 years in Kamloops.

Yaholnitsky, Dr. Steve: Dr. Yaholnitsky of Yorkton, Saskatchewan, passed away on March 30 at the age of 80. A 1951 graduate of the University of Toronto, Dr. Yaholnitsky practised in Yorkton until his retirement on December 31, 1999. He was a life member of CDA and an honorary member of the College of Dental Surgeons of Saskatchewan.

For direct access to the Web sites mentioned in the News section, go to the June *JCDA* bookmarks at http://www.cda-adc.ca/jcda/vol-69/issue-6/index.html.

Why did I switch from Vitrebond[1]?

It is just *too expensive.*

Product	Vitrebond	Fuji Lining LC
Powder	9g bottle	10g bottle
Liquid	5.5ml	6.8ml
Color	yellow	A3.5
Working Time	3 minutes	3 minutes
REALITY	Rated ★★★★	Rated ★★★★
Independent Research Institute	#1 for reducing or eliminating post-op sensitivity	#1 for reducing or eliminating post-op sensitivity
Light-cure	30 seconds	30 seconds
Radiopaque	YES	YES

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Vitrebond[1] is as good as Fuji Lining LC for minimizing sensitivity and providing fluoride release as a dentin substitute, but...it is just *too expensive*. Line your prep to minimize sensitivity, provide therapeutic fluoride release and improve the integrity of the bond by providing a foundation which is extremely close to dentin in its coefficient of thermal expansion.

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CAO News

*The **Canadian Association of Orthodontists** is the national organization of educationally qualified orthodontic specialists. We are dedicated to the advancement of orthodontics and the promotion of quality orthodontic care in Canada. By representing the orthodontic specialty in Canada it is the official voice of Canadian orthodontists.*

Dr. Donald G. Robertson
CAO President

Dr. Gerald A. Zeit
CAO Editor

Message from the president and the editor

Although modern orthodontics originated around the turn of the 20th century, it wasn't until mid-century that the Canadian Association of Orthodontics (CAO) was established. The date can be pinpointed to May 1949, when 14 founding members gathered to form the fledgling CAO at the Commodore Hotel, in New York City, in conjunction with a meeting of the already well-established American Association of Orthodontists.

Today, CAO is involved in many aspects of professional life. The association supports its members and their patients through continuing education opportunities at the CAO annual convention. The association also provides support for education and research through the Canadian Fund for the Advancement of Orthodontics. Bulletins are published semi-annually and a CAO Web (www.cao-aco.org) site is maintained for the public and the membership. A well-maintained membership directory facilitates the continuation of care for patients who relocate from one part of Canada to another.

As the official voice of Canadian orthodontists, CAO acts as a media contact and information resource for public issues relating to orthodontics. It also acts as a contact for the federal and provincial governments and other third parties.

Orthodontics remains the only specialty in Canada that is unburdened by fee guides or procedure codes. In addition, CAO strongly encourages the non-assignment of third-party benefits. For these reasons, patients seeking specialist orthodontic care in Canada remain free to make their own treatment choices and to establish treatment plans exclusively between themselves and their practitioner. We believe patients should remain free of third-party influence, yet still maintain full access to any personal benefit plans that might apply.

Perhaps the biggest challenge facing orthodontics in Canada is the escalating shortage of orthodontic educators. At present, as many as 40 full-time teaching positions remain vacant in graduate orthodontic departments across North America. Without qualified educators, the future of the specialty is clearly at risk. This is a problem that is beginning to affect all fields of dentistry, including general practice. CAO has taken a leadership role in initiating and coordinating orthodontic educator conferences in an attempt to address this problem and seek solutions.

In the interest of optimal patient care, orthodontists in Canada are committed to maintaining an ongoing and mutually supportive relationship with our friends and colleagues in general dentistry and the other specialties. We are especially proud to be able to be a part of *JCDA* with the publication of this special orthodontic edition. Many thanks are extended to the numerous contributors and to Dr. John O'Keefe, editor-in-chief of *JCDA*, for his support, expertise and hard work.

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Mesiodens — Diagnosis and Management of a Common Supernumerary Tooth

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• **Magdalena A. Folwarczna,** BSc, DDS •

Abstract

Mesiodentes are the most common supernumerary teeth, occurring in 0.15% to 1.9% of the population. Given this high frequency, the general dentist should be knowledgeable about the signs and symptoms of mesiodentes and appropriate treatment. The cause of mesiodentes is not fully understood, although proliferation of the dental lamina and genetic factors have been implicated. Mesiodentes can cause delayed or ectopic eruption of the permanent incisors, which can further alter occlusion and appearance. It is therefore important for the clinician to diagnose a mesiodens early in development to allow for optimal yet minimal treatment. Treatment options may include surgical extraction of the mesiodens. If the permanent teeth do not erupt in a reasonable period after the extraction, surgical exposure and orthodontic treatment may be required to ensure eruption and proper alignment of the teeth. In some instances, fixed orthodontic therapy is also required to create sufficient arch space before eruption and alignment of the incisor(s). Early diagnosis allows the most appropriate treatment, often reducing the extent of surgery, orthodontic treatment and possible complications. This paper outlines the causes and modes of presentation of mesiodentes, and presents guidelines for diagnosis and management of nonsyndromic mesiodentes.

MeSH Key Words: *incisor abnormalities; malocclusion therapy; tooth, supernumerary/diagnosis*

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Supernumerary teeth are teeth in excess of the normal number. The prevalence of hyperdontia is reportedly between 0.15% and 3.9%.[1–5] Extra teeth may present in both the permanent and the primary dentitions but are 5 times less frequent in the primary dentition.[6,7,8] A mesiodens is a supernumerary tooth located in the maxillary central incisor region; the overall prevalence of mesiodentes is between 0.15% and 1.9%.[7–9] Mesiodens can occur individually or as multiples (mesiodentes), may appear unilaterally or bilaterally, and often do not erupt.[9] Mesiodentes can significantly alter both occlusion and appearance by altering the eruption path and the position of the permanent incisors.[9–11] This paper outlines the causes and modes of presentation of mesiodentes and discusses their diagnosis and management. Whether there are one or multiple supernumerary teeth, management and treatment are the same.

Incidence and Causes

The literature reports that 80% to 90% of all supernumerary teeth occur in the maxilla.[1,9,12] Half are found in the anterior region.[9–12] One-third of all patients with a mesiodens also have other supernumerary teeth; however, some patients present with mesiodentes in conjunction with congenitally missing teeth.[11,13] Mesiodentes are frequently associated with various craniofacial anomalies, including cleft lip and palate, Gardner's. syndrome and cleidocranial dysostosis, but these conditions are beyond the scope of this paper.[14]

The literature reports 3 theories concerning the cause of mesiodentes but this subject remains controversial.[9] It was originally postulated that mesiodentes represented a phylogenetic relic of extinct ancestors who had 3 central incisors.[11] This theory, known as phylogenetic reversion (atavism), has now been largely discarded by embryologists. A second theory known as dichotomy suggests that the tooth bud is split to create 2 teeth, one of which is the mesiodens.[7] Supporters of this theory believe that dichotomy represents complete germination, which also occurs frequently in the anterior maxilla. The third theory, involving hyperactivity of the dental lamina, is the most widely supported.[9] According to this theory, remnants of

Figure 1: *Tooth 51 is overretained, and asymmetric eruption of the permanent central incisors is evident. An enamel pearl can be seen overlying the crown of the unerupted tooth 11.*

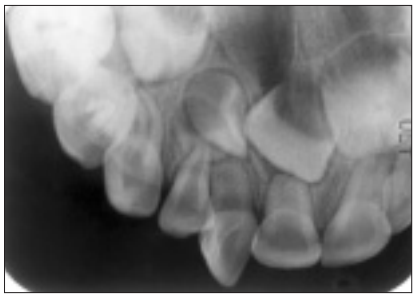

Figure 2: *Teeth 11, 12 and 21 are unerupted, whereas tooth 52 is erupted. A supernumerary tooth 52 has erupted into the oral cavity, and a supernumerary tooth 12 is evident radiographically.*

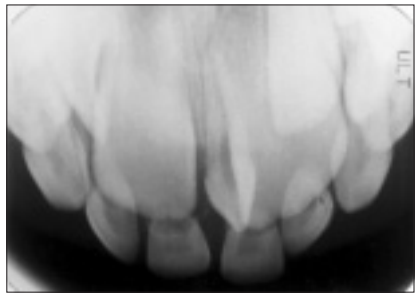

Figure 3: *A conical mesiodens can be seen between teeth 11 and 21.*

the dental lamina or palatal offshoots of active dental lamina are induced to develop into an extra tooth bud, which results in a supernumerary tooth.

Genetics are also thought to contribute to the development of mesiodentes, as such teeth have been diagnosed in twins, siblings and sequential generations of a single family.[5,15] Autosomal dominant inheritance with incomplete penetration has been the proposed genetic theory.[7] A sex-linked pattern has also been proposed, as males are affected twice as frequently as females.[1,6,12,16] In twins, unilateral mesiodentes may present as mirror images, and the same number of supernumerary teeth are located in similar regions of the mouth.[17]

Diagnosis

Types of Mesiodentes

Mesiodentes can be classified on the basis of their occurrence in the permanent dentition (rudimentary mesiodentes) or the primary dentition (supplementary mesiodentes) and according to their morphology (conical, tuberculate or molariform).[9,16] Enamel pearls, although much smaller than and developmentally distinct from mesiodentes, may also be sufficient to impede eruption of the permanent teeth (**Fig. 1**).[18]

Supplementary mesiodentes resemble natural teeth in both size and shape, whereas rudimentary mesiodens exhibit abnormal shape and smaller size.[9] Supernumerary primary teeth are most often mesiodentes or supernumerary laterals.[2,19] If a supernumerary primary tooth is present clinically, a supernumerary permanent tooth is often evident radiographically (**Fig. 2**).

Conical mesiodentes usually occur singly. They are generally peg-shaped and are usually located palatally between the maxillary central incisors, tending to displace the erupting permanent central incisors (**Fig. 3**).[9,12,16] Conical mesiodentes often have a completely formed root and can erupt into the oral cavity.[9,20,21] However, they may be inverted, with the crown pointing superiorly, in which case they are less likely to erupt into the oral cavity; inverted conical mesiodentes have occasionally erupted into the nasal cavity.[22] Tuberculate mesiodentes are barrel-shaped, with several tubercles or cusps, and have incomplete or abnormal root formation. In contrast to conical mesiodens, tuberculate mesiodentes rarely erupt themselves but rather delay eruption of the permanent incisors.[9,16] They can develop either unilaterally or bilaterally and are commonly associated with other supernumerary teeth.[12] Tuberculate mesiodentes develop later than conical mesiodentes and usually occupy a more palatal position.[23] A third, much rarer type is the molariform mesiodens, which has a premolar-like crown and a completely formed root.[9]

Clinical and Radiographic Diagnosis

A mesiodens should be suspected when there is asymmetry in the eruption pattern of the maxillary incisors; the maxillary primary incisors are overretained, especially if the over-retention is asymmetric; or there is significant ectopic eruption of one or both permanent maxillary incisors.[9,11,24] Given that only 25% of supernumerary teeth erupt, it is important to have a high index of suspicion in these situations.[17] Panoramic, maxillary occlusal and periapical radiographs are indicated to assist in the diagnosis of mesiodentes. A panoramic radiograph serves as a screening aid and provides additional information about the associated supernumerary or congenitally missing teeth that are frequently seen with mesiodentes, but this type of imaging often yields limited evidence of the mesiodens itself because of lack of clarity in the midline region. The most diagnostic radiographic method to identify and locate a mesiodens involves obtaining 2 periapical or maxillary occlusal films, which are analyzed according to the parallax rule.[25] Such

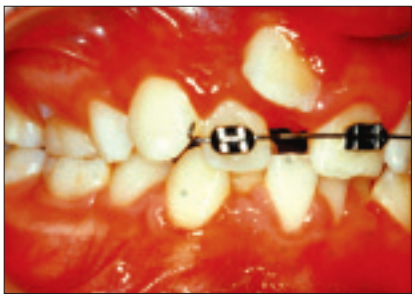

Figure 4: *Labial eruption of tooth 11 has occurred after extraction of a mesiodens.*

Figure 5a: *An enamel pearl has prevented eruption of tooth 11. Consequently, teeth 21 and 12 have drifted into the space for the 11 central incisor, and a midline shift has also occurred.*

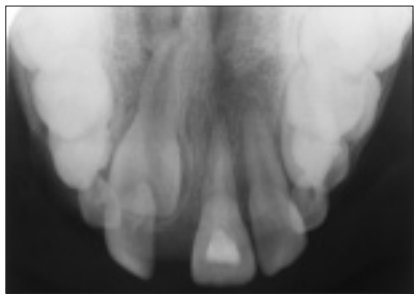

Figure 5b: *Tooth 11 is unerupted and teeth 21 and 12 have drifted into the arch space.*

analysis of these films allows identification of the path of eruption (normal, inverted or horizontal) and the location (palatal or labial, superior or inferior) of the impacted mesiodens relative to adjacent structures and development of an appropriate treatment plan.

Sequelae

Mesiodentes frequently interfere with the eruption and alignment of the maxillary incisors.[6,26–29] They can delay or prevent eruption of central incisors in 26% to 52% of cases; cause ectopic eruption, displacement or rotation of a central incisor in 28% to 63% of cases; and labially displace incisors in 82% of cases (**Fig. 4**).[9,26] Less common complications involving the permanent incisors include dilaceration of the developing roots, root resorption and loss of tooth vitality. Complications involving the mesiodens itself include eruption of the mesiodens into the nasal cavity; development of a dentigerous cyst has been reported in 4% to 9% of cases[11,15,20–22,30–33]

Management

Only 25% of all mesiodentes spontaneously erupt into the oral cavity. If unerupted, the tooth can alter both the eruption of the permanent incisors and the resulting occlusion.[12] Furthermore, in 75% of cases, the incisor erupts spontaneously once the mesiodens has been removed.[21,28] Therefore, once a mesiodens has been diagnosed, the clinician must decide on treatment to minimize further sequelae. Management is discussed here according to the developmental stage of the dentition: primary, mixed or permanent.

Extraction of a supplementary mesiodens in the primary dentition is usually not recommended because supernumerary primary teeth often erupt into the oral cavity and surgical extraction of unerupted teeth may increase the risk of displacing or damaging the developing permanent incisors.[34–36] However, extraction during the *early* mixed dentition stage allows normal eruptive forces to promote spontaneous eruption of the permanent central incisors after the extraction.[31,35,37] Extraction of a mesiodens at a time appropriate for promoting self-eruption in the early mixed dentition may result in better alignment of the teeth and may minimize the need for orthodontic treatment. Delayed treatment involves extraction of the mesiodens when the unerupted central incisor's apex is almost mature, usually around 10 years of age.[36] The later the extraction of the mesiodens, the greater the chance that the permanent tooth either will not spontaneously erupt or will be malaligned when it does erupt. Unfortunately, by this time the forces that cause normal eruption of the incisors are diminished, and surgical exposure and subsequent orthodontic treatment are more frequently required.[31,37] Also, space loss and a midline shift of the central incisors may have already occurred by this age, since the lateral incisors will have erupted and may have drifted mesially into the central space (**Figs. 5a** and **5b**).[12] Thus, a significant delay in treatment can create the need for more complex surgical and orthodontic management.

Close monitoring of the dentition is required after the extraction of a mesiodentes. Approximately 6 months after extraction of a mesiodens, clinical and radiographic reassessment is recommended to determine if the tooth has erupted. Lack of eruption has been attributed to diminished eruption rate, significant root development, displacement of the tooth from its normal position in the alveolar bone or insufficient arch space into which the tooth can erupt.[37] When there is insufficient arch space, additional space can be created orthodontically by means of a compressed coil spring inserted before active eruption starts. If a tooth does not start erupting within 6 to 12 months after extraction of the mesiodens and sufficient arch space is available, surgical exposure and orthodontic eruption of the unerupted incisor are recommended. Closed exposure with simultaneous bonding of an orthodontic attachment allows for orthodontic eruption of the tooth along with its periodontal attachment.[37,38] Before the surgical procedure, orthodontic appliances should be placed on as many maxillary teeth as possible to serve as appropriate anchorage to facilitate eruption of the incisor. Before active orthodontic extrusion of the tooth begins, arch

alignment should have progressed to a stable arch wire that will maintain the integrity of the maxillary arch and prevent intrusion or canting of the maxillary teeth as the impacted incisor is erupted. Various elastic ligatures can be tied from the arch wire to the bonded bracket, with or without a chain on the unerupted incisor; this allows the tooth to be erupted by the application of light forces, which avoids sequelae such as root resorption, ankylosis or devitalization.[39] The eruptive process may take 6 to 18 months, depending on the original position of the tooth. Care must be taken to erupt the tooth along the correct path in 3 dimensions using only light forces; heavy forces may cause devitalization of the tooth, in addition to the known detrimental effects of heavy forces in orthodontic tooth movement.

As outlined above, in most cases the incisors will erupt spontaneously or can be orthodontically erupted following extraction of the mesiodentes. In some cases, the adjacent primary teeth may also have to be extracted to create sufficient space for eruption of the permanent teeth. In the rare case that a central incisor cannot be erupted orthodontically because of its position or ankylosis, 2 treatment options exist: surgical repositioning or extraction and placement of an implant. Prabhu and Manshi[40] recommended surgical repositioning when adequate space is available for the incisor, the mesiodens is located parallel to where the root of the aligned incisor would be, and slight modifications to the socket can be made to accommodate the incisor. Because there is a high risk of ankylosis after repositioning of teeth, any malocclusions should be diagnosed and comprehensive orthodontic treatment options presented to the patient or the parents before surgical repositioning is performed. Replacing an ankylosed tooth with an implant may be a better option, as the risks of root resorption, discolouration and periodontal compromise associated with repositioning may be reduced. In such cases, orthodontic treatment followed by prosthetic treatment with an implant may be the optimal treatment. However, treatment options must be considered individually in each case.

After eruption of the incisor(s), adjunctive procedures may be appropriate. For example, gingival surgery might be performed to recontour the attachment levels between the adjacent incisors, as the gingival heights are often not symmetric after delayed or orthodontic eruption. As well, because of the increased potential for tooth position to relapse once appliances have been removed, long-term retention is recommended. The increased risk of relapse most likely results from the significant initial displacement and rotation of the tooth. A bonded lingual retainer is often recommended if the occlusion (overbite) will allow its placement. If the occlusion is such that a bonded maxillary lingual retainer cannot be placed, a standard Hawley or vacuum form retainer may be used. Regardless of the type of retainer, a longer than average retention period should be used.

Conclusions

Delayed, ectopic or asymmetric eruption of the central incisors should alert the clinician to the possibility of a mesiodens. The clinician should obtain accurate radiographs including panoramic, periapical and occlusal views. Early diagnosis of a mesiodens minimizes the treatment required and prevents development of associated problems. Extraction of the mesiodens in the early mixed dentition stage may facilitate spontaneous eruption and alignment of incisors, while minimizing intervention, space loss and midline shift. Should the incisors not erupt spontaneously, further surgical and orthodontic treatment may be required. ◆

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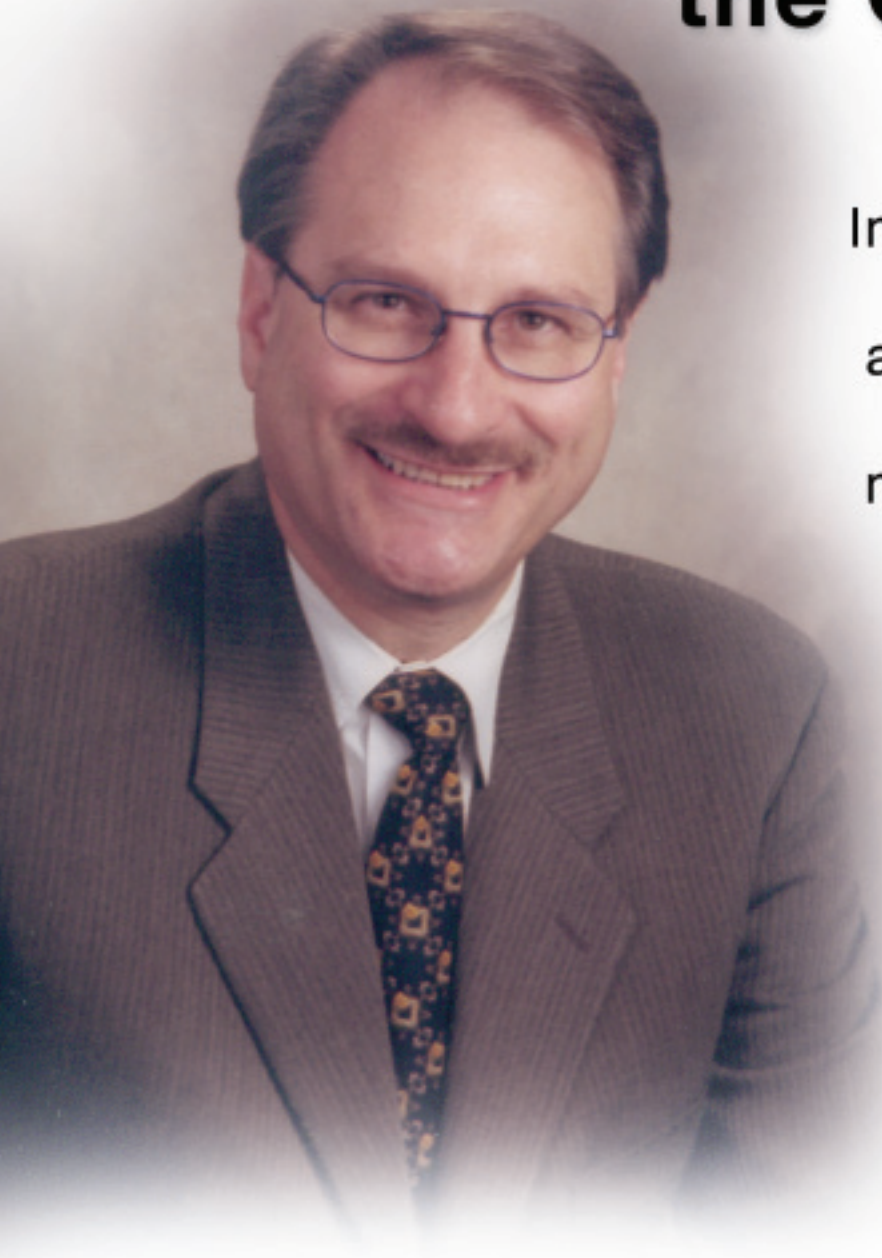

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Esthetic Periodontal Considerations in Orthodontic Treatment — The Management of Excessive Gingival Display

• **Timothy F. Foley,** DDS, MClD •
• **Harinder S. Sandhu,** DDS, PhD, Dip Perio •
• **Constantine Athanasopoulos,** BSc, DMD •

Abstract

This paper examines various esthetic periodontal considerations during orthodontic treatment. The management of excessive gingival display caused by altered passive eruption is reviewed, with emphasis on causes, recognition, diagnosis and surgical management of this problem. A case of orthodontic treatment of excessive gingival display associated with altered passive eruption of the maxillary incisors is reviewed to demonstrate appropriate management. With proper diagnosis, soft-tissue periodontal procedures after completion of orthodontic treatment can enhance the patient's final appearance.

MeSH Key Words: *crown lengthening/methods; epithelial attachment/physiopathology; malocclusion therapy*

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Various published reports discuss the management of gingival display to provide an esthetically pleasing smile.[1–18] In recent years, more attention has been given to the problem of excessive gingival display[2,3,5,10–15] and the potential of plastic periodontal surgical procedures to enhance the smile line. Garber and Salama[12] have suggested that the relationships among 3 primary components — the teeth, the lip framework and the gingival scaffold — determine the esthetic appearance of the smile. Previously, perceptions of dental esthetics by the public and dental professionals were related principally to alterations of the teeth;[12] however, this perception has changed, and there is now increased emphasis on smile enhancement through cosmetic dentistry, in particular plastic periodontal procedures.[1–18]

Excessive gingival display is a condition characterized by excessive exposure of the maxillary gingiva during smiling, commonly called a "gummy smile."[1,4,7,14] This condition is caused primarily by a skeletal deformity in which there is vertical excess of the maxillary tissue, a soft-tissue deformity in which there is a short upper lip or a combination of the 2.[1,4,10,12] Another cause of excessive gingival display is insufficient clinical crown length.[1,4,9–15] Evaluation of clinical crown length is important because it may be the principal cause of excessive gingival display.[1,4,9–15] Common causes of short clinical crowns include coronal destruction resulting from traumatic injury, caries or incisal attrition, as well as coronally situated gingival complex resulting from tissue hypertrophy or a phenomenon known as altered passive eruption.[14]

The protocol for diagnosing and managing excessive gingival display in orthodontic cases may not be apparent. The aims of this paper are to describe normal eruption, the normal smile line and normal gingival architecture and to suggest methods of dealing with excessive gingival display, in particular the soft-tissue management of altered passive eruption. The principles of management are exemplified by a case report.

Variables Influencing Gingival Display

Before any treatment is initiated, an understanding of normal eruption, gingival architecture and maxillary development is necessary. In a person with healthy dentition, each tooth and its alveolus actively emerges from its crypt.[8,19] The teeth continue to erupt through the gingiva until they make occlusal contact with the teeth in the

opposing arch. This stage is followed by passive eruption, the apical migration of the dentogingival unit adjacent to the cementoenamel junction (CEJ).[8,19]

Passive eruption can be divided into 4 stages according to the relationship between the epithelial attachment and the CEJ.[19] In stage 1, the epithelial attachment —the junctional epithelium — rests on the enamel surface. In stage 2, the epithelial attachment rests on the enamel surface and the cemental surface apical to the CEJ. In stage 3, the epithelial attachment rests on the cemental surface, and in stage 4, inflammation causes the epithelial attachment to migrate apically.

Throughout passive eruption, the width of the junctional epithelium diminishes,[8,15,19] and the width of the connective tissue attachment remains fairly constant (mean 1.07 mm[8]). Normally, the junctional epithelium averages 0.97 mm.[8] Together, these tissues have an average minimal dimension of 2.04 mm, commonly called the biologic width.[8] When passive eruption does not progress past stage 1 or stage 2, it is referred to as altered passive eruption. In this situation, the gingival margin does not migrate to its final position on the cemental surface. Instead, it remains positioned on or near the enamel surface. The occurrence of altered passive eruption is unpredictable, but the frequency in the general population is about 12%.[8,15,19] The gingiva of any patient with altered passive eruption is usually healthy in the absence of plaque.[13]

Smile analysis is an important part of the diagnostic regimen in cases of altered passive eruption. Several authors have outlined the following principles for analysis of the smile.[2,5,10,12,18]

- The elevation of the maxillary lip for posed (staged) and unposed (involuntary) smiles should be determined.
- Most clinicians evaluate the posed smile for gingival harmony, which has been described as the gingival margins of the maxillary teeth being positioned parallel to or following the form of the upper lip.
- The smile arc reflects the position of the maxillary incisors relative to the lower lip; ideally the incisal edges of the maxillary incisors follow the curvature of the lower lip.
- In the transverse dimension, the teeth extend posteriorly and laterally to fill the buccal vestibule.

In summary, under normal circumstances the maxillary gingival line follows the maxillary lip line and the maxillary incisal line follows the mandibular lip line (**Figs. 1a** and **1b**). Vertical maxillary excess can occur when there is excessive growth of the maxilla.[12,13,20] If a "gummy smile" occurs when the incisal and occlusal planes are coincident, maxillary surgery is usually required to correct vertical overdevelopment of the maxilla.[5,6,20] Surgical management of the gummy smile has been described previously.[20–22] Clinical examination and radiographic interpretation of cephalograms generally permit the clinician to correctly diagnose vertical maxillary excess. Even if the patient chooses not to undergo maxillary surgery, gingival surgery may help to improve the esthetic result and provide a reasonable compromise for the patient.[23] The timing of gingival surgery is debatable. Orthodontic treatment typically precedes periodontal therapy, since extrusion or intrusion of teeth may influence gingival harmony. Dolt and Robbins[13] recommended that, if the clinical crowns are short as a result of altered passive eruption, clinical crown lengthening should be performed before orthognathic surgery. However, Garber and Salama[12] have suggested a two-phase approach: initial gingival surgery before the orthognathic procedure, with a second possible alteration of gingival display following orthognathic surgery. The definitive diagnosis of the type of gummy smile determines the treatment.

Esthetic Periodontal Surgery

The type of periodontal surgical procedure depends on a number of factors. If the osseous level is appropriate, if there is more than 3 mm of tissue from bone to gingival crest and if it is determined that an adequate zone of attached gingiva will remain after surgery, a gingivectomy is indicated.[13] To help in outlining the initial incisions, a symmetric stent made of acrylic may be used as a surgical guide.[7,13] A full-thickness bevelled incision, accompanied by removal of tissue from the facial surface with the papillary tissue left undisturbed, completes the gingivectomy.[4,7,9,11–13] If the diagnostic procedures reveal osseous levels approximating the CEJ, a gingival flap with ostectomy is indicated.[4,7,9,11–13] The initial incision can be similar to that for gingivectomy or it can be sulcular. If the gingival heights of the anterior teeth are asymmetric, the initial incision should be a gingivectomy-type incision so that the final tissue contour will be symmetric. If the preoperative tissue contours are symmetric, a sulcular incision can be used and the flap apically repositioned. The inferential incision should always be a sulcular incision, leaving the papilla totally intact interproximally. A full-thickness flap is reflected beyond the mucogingival junction, and the positions of the CEJ and crestal bone are verified visually. Ostectomy is then performed so that the crestal bone is approximately 2.5 to 3.0 mm from the CEJ, which provides for a biologic width that is physiologically adequate. The bony architecture should exactly reflect the desired soft-tissue architecture. The gingiva is then repositioned apically to the CEJ and sutured.[4,7,9,11–13]

Case Report

A 15-year-old female was referred from a general practitioner to the Graduate Orthodontic Clinic at the University of Western Ontario for orthodontic care. The chief complaint was "crooked teeth." The general medical history

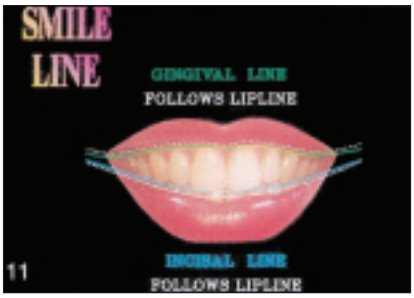

Figure 1a: *In people with esthetically pleasing smile lines, the maxillary gingival line follows the lip line and the maxillary incisal line follows the mandibular lip line. Reprinted from Garber and Salama,[12] with permission from Munksgaard.*

Figure 1b: *Clinical example of the smile line of an esthetically pleasing smile.*

Figure 2a: *In a 15-year-old female with "crooked teeth," extraoral evaluation revealed good facial esthetics, a straight facial profile and a mesiognathic facial type.*

Figure 2b: *Frontal view of patient.*

Figure 3: *There was excessive maxillary gingival display and altered passive eruption of the maxillary left central incisor (tooth 21).*

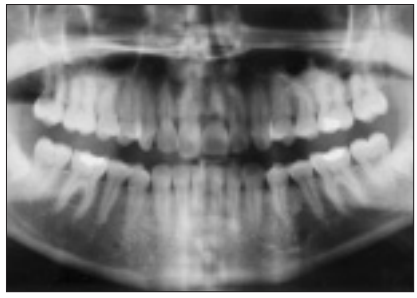

Figure 4: *Panoramic radiograph of patient.*

Figure 5: *Cephalogram of patient.*

Figure 6a: *The orthodontic goals were achieved with an acceptable occlusal result (left view).*

Figure 6b: *Acceptable occlusal result (right view).*

Figure 7: *Gingival smile line after orthodontic treatment.*

Figure 8: *Postoperative intraoral view.*

Figure 9: *An esthetically pleasing smile line was achieved after orthodontics and periodontal surgery (5 years after treatment).*

was not significant, and there was no family history of oral or dental anomalies. Extraoral evaluation revealed good facial esthetics, a straight facial profile and a mesiognathic facial type (**Figs. 2a** and **2b**). On full smile, the patient presented 3–4 mm of gingival display. There was excessive display of the maxillary gingiva and altered passive eruption of the maxillary left central incisor (tooth 21) (**Fig. 3**). There was lip competence at rest and a slightly prominent soft-tissue pogonion. Intraoral examination revealed a Class I deep-bite malocclusion in the permanent dentition. The patient had a 2 mm overjet and a 95% overbite. The DMF was low, but oral hygiene was poor. There was no history of extractions of the permanent dentition or dental anomalies in the primary dentition.

Radiographic examination revealed that all permanent teeth were present (**Fig. 4**), excluding the maxillary third permanent molars (teeth 18 and 28). Radiologic examination revealed no neural or bony abnormalities. The root of the maxillary second bicuspid (tooth 25) was dilacerated. A dome-shaped soft-tissue mass was present in the left antrum; this might have represented a maxillary mucous retention cyst (**Fig. 4**). Analysis of the cephalogram (**Fig. 5**) revealed a Class I skeletal pattern (SNA = 84, SNB = 81, ANB = 3) with normal vertical face height and retroclined maxillary and mandibular incisors (U1-SN = 89, L1-MP = 83).

Treatment Plan

A nonextraction treatment plan was established to manage the patient's malocclusion. The following treatment sequence was planned:

1) Improvement of oral hygiene.
2) Use of fixed edgewise appliances and preadjusted appliance system.
3) Proclination of incisors.
4) Application of intrusion mechanics.
5) Periodontal consultation to manage excessive gingival display.
6) Use of retainers.

The orthodontic goals were achieved, with an acceptable occlusal result (**Figs. 6a** and **6b**); however, gingival harmony was not achieved. The upper left second bicuspid (tooth 25) had minimal attached gingiva, which might have been the result of plaque and possible trauma in this area.

Periodontal Assessment and Management

After completion of the orthodontic treatment, the patient was referred to a periodontal practice for management of the smile line (**Fig. 7**). Diagnostic records, including study models and photographs, were obtained. A smile analysis indicated that the patient had a crown size discrepancy between the 2 maxillary incisors and a mild case of altered passive eruption. The esthetic periodontal procedure was explained and informed consent obtained.

Surgical exposure of the crown and gingival recontouring were completed by lifting a full-thickness mucoperiosteal flap from the maxillary right first premolar (tooth 14) to the maxillary left first premolar (tooth 24). The alveolar crest was less than 1 mm distant from the CEJ. Ostectomy with a surgical bur was performed with constant saline irrigation, and osteoplasty was completed with a chisel and osseous files. To minimize interdental tissue recession, a palatal flap was not raised during the surgical procedure. Mucoperiostal flaps were closed with 4-0 silk and a CE-2 needle (**Fig. 8**); vertical mattress periosteal sutures were used. The sutures were removed 7 days after the procedure, and the patient was followed at 6-week intervals for the next 6 months. The treatment outcome was considered successful, and an esthetically pleasing smile was achieved. The photograph in **Fig. 9** was taken more than 5 years after treatment and although the final result is not perfect, there was significant improvement over this interval.

Discussion

The first step in diagnosing altered passive eruption is to observe the patient in repose and smiling naturally.[10,12,13,18] Several authors[2,10,12–14] have suggested evaluating the smile for the amount of incisor and gingival display and the transverse dimension of the smile, whereas Sarver[18] suggested evaluating the patient with a posed (voluntary) and unposed (involuntary) smile. If there is an excessive display of gingiva during the smile, further diagnostic data are required. First, the length and activity of the upper lip must be evaluated. If the gummy smile is due solely to inadequate lip length or hyperactivity, no treatment is indicated.[13] Some degree of gingival display may be esthetically pleasing and, according to Sarver,[18] may be considered youthful (one characteristic of aging is to show less of the maxillary incisors, so a greater incisal display may indicate youth). With the lips in repose, males typically show less of the maxillary incisors and more of the mandibular incisors than females.[2,18]

The clinician should then attempt to locate the CEJ to determine the presence or absence of altered passive eruption.[11,12,13,15] If the CEJ is located in a normal position in the gingival sulcus, then the patient does not have altered passive eruption. In this situation, the short teeth are due to incisal wear or a variation of normal anatomy.[5,10,13,14] Periapical radiographs of the teeth involved will provide evidence of adequate root length and bony support and may serve as a guide for locating the CEJ.[14]

There is no predictable procedure available to correct a short or hyperactive lip; therefore, communicating this diagnosis to the patient allows for realistic treatment expectations.[13] Dentoalveolar extrusion occurs when the maxillary incisors overerupt. As the teeth erupt, the alveolar bone and the gingiva move down with the teeth.[13] Dentoalveolar extrusion is commonly treated by means of orthodontic

intrusion.[10,12,13] For each millimetre that the tooth is intruded, the gingival margin moves apically the same distance.[5] The amount of intrusion needed is estimated by measuring pretreatment differences in the gingival heights.[5,10]

Ideally, the smile should expose a minimal amount of gingiva, the gingival contour should be symmetric and in harmony with the upper lip, the anterior and posterior segments should be in harmony and the teeth should be of normal length.[1] Because of the various factors involved, a multidisciplinary approach is essential for successful treatment of the gummy smile.

Conclusions

With correct diagnosis of and appropriate therapy for excessive gingival display, dental esthetics can be improved, as demonstrated by the case reported here. The disciplines of oral surgery, orthodontics, periodontics and restorative dentistry all play a role in the treatment of excessive gingival display. ◆

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Rapid Palatal Expansion in the Young Adult: Time for a Paradigm Shift?

• **Dan A. Stuart,** DDS •
• **William A. Wiltshire,** BChD, BChD (Hons), MDent, MChD, DSc •

Abstract

A 19-year-old man presented for correction of a malocclusion that included a transverse maxillary deficiency. The patient was informed that he required orthognathic surgery to expand his upper jaw and correct his malocclusion, but he refused surgical expansion. Recent evidence indicates that rapid palatal expansion can be used without surgery in young adults; the decision was therefore made to treat the patient nonsurgically. Rapid palatal expansion of the maxillary arch was accomplished by means of a Hyrax appliance, with post-treatment radiographs revealing an opening of the midpalatal suture. The belief still persists among some clinicians that young adult patients require orthognathic surgery for palatal expansion, despite recent evidence supporting a nonsurgical approach after closure of the midpalatal suture.

MeSH Key Words: *adult; dental arch/abnormalities; palatal expansion technique*

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Maxillary width deficiencies normally do not present an orthodontic challenge if they are detected before or during the adolescent growth spurt. Correction of these deficiencies with a maxillary rapid palatal expander, first popularized more than 40 years ago by Haas,[1] yielded well-controlled and predictable results. However, once patients are past their growth spurt, which occurs at about the age of 12–13 years in females and 14–15 years in males,[2] the protocol for rapid palatal expansion (RPE) is not quite so clear. According to some authors, expansion of the maxillary arch in mature patients is not feasible.[3–5] Proffit[3] reports that "by the late teens, interdigitation and areas of bony bridging across the suture develop to the point that maxillary expansion becomes impossible," a belief based on Melsen's[6] study on histological suture appearance. Other recent evidence suggests that it is indeed possible to successfully expand the palate in young adults.[7–11] This article reviews the recent literature on nonsurgical RPE in young adults and provides a rationale for using this approach based on a case the authors successfully treated by RPE alone.

Patients and parents are sometimes reluctant to accept treatment plans that incorporate surgically assisted RPE, because they are concerned about the inherent risks of surgery and the gravity of the procedure. Clinicians are thus faced with a dilemma when treating patients after the palatal sutures have closed. The palatal sutures reportedly close as early as when a patient reaches 12–13 years of age.[12] Furthermore, other sutures adjacent to the midpalatal suture reportedly are too rigid to expand past the late teens.[3,4,6,13] A popular treatment option from early adulthood onwards is the LeFort 1 osteotomy, or osteotomies of the palatal midline and the lateral aspects of the maxillae combined with orthodontics. However, many patients decline surgery, and until recently, no other alternative was readily available for late teens and young adults. The following case report presents the authors' experience of treating one patient with maxillary deficiency using nonsurgical RPE.

Case Report

A young adult male (19 years, 7 months of age) presented for the orthodontic correction of a malocclusion. Clinical examination and orthodontic records revealed a skeletal deficiency in the transverse dimension of the maxillary arch. The patient had been informed that surgery would most likely be required to expand the palate, but he had concerns regarding this approach and refused the surgical option. Given the

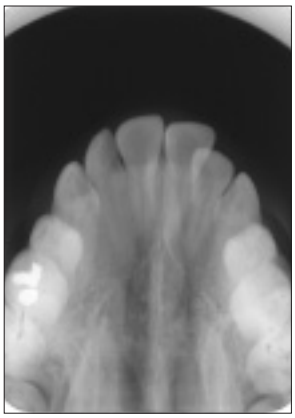

Figure 1: *Pretreatment radiograph of the midpalatal suture.*

Figure 2: *Pretreatment occlusal view. The patient had his first premolars extracted 2 years before being evaluated by the authors.*

Figure 3: *Occlusal view of diastema between the central incisors after 3 weeks of rapid palatal expansion.*

Figure 4: *Frontal view of diastema after 3 weeks of rapid palatal expansion.*

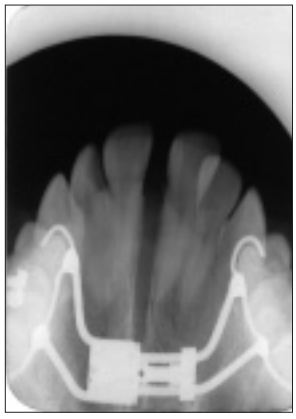

Figure 5: *Post-treatment radiograph revealing an opening of the midpalatal suture following rapid palatal expansion.*

Figure 6: *Palatal view of self-closed diastema due to transseptal fibre forces.*

Figure 7: *Frontal view of self-closed diastema due to transseptal fibre forces.*

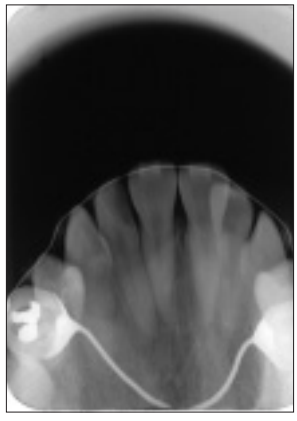

Figure 8: *Occlusal radiograph taken 6 months after rapid palatal expansion. The molar width has been maintained and new bone has formed at the midpalatal suture.*

patient's reluctance to undergo surgery, it was decided that nonsurgical RPE should be performed before placing full-fixed orthodontic appliances. The patient was informed of all possible sequelae, risks and benefits, including possible termination of the nonsurgical treatment and use of surgical expansion should the nonsurgical RPE procedure fail.

As part of a thorough clinical assessment, an anterior maxillary occlusal radiograph (**Fig. 1**) was taken to record the midpalatal suture before treament (the corresponding occlusal view is shown in **Fig. 2**). A maxillary Hyrax appliance (Dentaurum, Germany) was designed for the patient, with full acrylic coverage of the maxillary posterior teeth to maintain the vertical dimension and prevent cuspal interferences during the expansion procedure. The patient was instructed to turn the screw only once a day for the first few days to loosen the sutural juncture and keep pain to a minimum. The patient turned the screw once a day for 7 days. The expansion measured on the Hyrax appliance was approximately 1.5 mm at the expansion screw. No midline diastema was present and the patient did not report any pain. The patient was then instructed to continue turning the expansion screw twice a day, once in the morning and once in the evening for the next 5 days. One week later the

expansion measured 5 mm and there was still no midline diastema present. The patient was then instructed to continue turning the screw twice a day for 3 days, then once a day for2 days. Twenty-four days after initial activation, the expansion measured on the Hyrax appliance was 7 mm and the patient presented with a midline diastema of 3 mm (**Figs. 3** and **4**). A post-treatment maxillary anterior occlusal radiograph was taken to verify that the midpalatal suture had opened (**Fig. 5**). A stainless steel ligature was placed through the expansion screw to fixate its position. The patient's midline diastema self-closed completely after approximately 6 weeks, as a result of periodontal transseptal fibre forces (**Figs. 6** and **7**). The patient reported minor discomfort for one short period when he thought he had mistakenly activated the appliance more than twice on the same day. Following RPE, a 3-month retention phase was instituted to allow for osteogenic formation in the midpalatal suture. Six months following RPE, an occlusal radiograph revealed the presence of new bone formation in the midpalatal suture area (**Fig. 8**).

Discussion

When RPE is being considered for a young adult, the palatal suture is often evaluated on an occlusal film. Radiographic studies[14] have demonstrated that the midline palatal suture frequently begins to close during the early teens and that maxillary expansion is best performed before the end of adolescence. It is generally assumed that the palatal suture is a straight-running oronasal suture and that the radiographic path projects through this suture.[15] Midpalatal sutures, however, do not always run straight.[6] If an occlusal film does not show a suture, it may be because the suture runs in an oblique direction in relation to the radiographic path or because the bone structures (such as the vomer) project above the suture.[15] Results of one study[15] found that 9 out of 10 individuals (ranging in age from 18 to 38 years) examined post mortem could have undergone successful RPE, because less than 5% of the midpalatal suture was obliterated. This finding is based on earlier research,[16] which found that if a 5% midpalatal sutural closure is set as a limit for splitting the intermaxillary suture, this 5% closure will not have been reached in most patients younger than 25 years of age. Recent research[15] indicates that a "radiologically closed" midpalatal suture is not the histological equivalent of a fused or closed suture.

Researchers[9] attempting RPE in 38 patients ranging in age from the late teens to adulthood (7 males aged 17 years to 23 years [mean age: 21 years, 4 months] and 31 females aged 15 years to 44 years [mean age: 20 years, 6 months]) found that although nonsurgical expansion failed in some subjects because of painful reactions, RPE in younger adults was completed successfully. The definition of "successful" expansion was judged by clinical evidence of the creation of a midline diastema. Out of the 38 patients, 33 were successfully treated with RPE alone in the age group 15 years to 28 years (mean age of 18 years, 9 months). The 5 individuals who required RPE with surgery ranged in age from 22 years to 44 years (mean age of 30 years, 7 months). It should be noted that most subjects in this study experienced a significant amount of pain, which can be attributed to the very rapid expansion regimen of 4 turns per day of the expansion screw until the appearance of a midline diastema. This very rapid rate of expansion reportedly creates pain and discomfort; the authors of this article and other researchers[1,8,11] disagree with this protocol and prefer an expansion rate of a maximum of 2 turns per day.

Other similar studies also support the use of nonsurgical RPE in young adults. One such study[11] assessed 82 patients under the age of 25 who underwent successful RPE without surgery. Of the 82 patients, 12 were female (mean age of 16 years, 6 months), with the oldest being 20 years of age. The oldest male to undergo expansion without surgery was 25 years of age. Studies[7,8] evaluating long-term stability have also produced encouraging results. Fifteen patients ranging in age from 15 to 39 (mean age of 22.3) were followed for 11 years; none of the patients experienced a recurrence of their crossbite, although the authors reported concerns over the level of gingival recession that was observed.[8]

Another recent report[7] concluded that nonsurgical RPE in adults is a clinically successful and safe method for correcting transverse maxillary arch deficiency. This finding is based on comparisons of 47 adults and 47 children treated with nonsurgical RPE and a control group of 52 adult orthodontic patients who did not require RPE. The 47 adults ranged in age from 18 years to 49 years (mean age of 29 years, 9 months ± 8 years). There was no relapse of the crossbite in the adults treated with RPE following discontinuation of retainers for at least one year (mean time of discontinuation of 5.9 ± 3.9 years). The method of expansion used in this study was a Haas-type expander with acrylic pads on the hard palate. The expansion screw was turned once per day, which is a different method of achieving expansion. With this technique, no midline diastema appeared in any of the patients. The authors demonstrated that the alveolar bone was in fact translated with minimal molar tipping and the maxillae were not separated in their sample of successfully treated adults. Nine of the 47 subjects experienced pain or tissue swelling, but all were able to complete their expansion regimen after a rest period of one week, with the appliance turned back a few times and a slower expansion schedule every other day. Some buccal gingival attachment loss was seen in the female subjects but the attachment loss was deemed clinically acceptable.

Conclusions

Histological and radiological evidence indicates that the maxillary suture is not fused enough to inhibit the opening of the maxillary palatal suture in patients who are in their late teens or their early twenties. Clinical evidence supports this finding. RPE should be limited to 2 turns per day and may have to be reduced to only one turn every other day to ensure patient comfort. A growing body of evidence is refuting the belief that palatal expansion without surgery is not possible in patients older than 15 or 16 years of age. Our case report and the literature provide clinically based evidence indicating that although the midpalatal suture may be closed when evaluated radiographically, it is not necessarily fused. Therefore, the midpalatal suture can be orthopedically manipulated through RPE in patients at least into their early twenties. Some authors even provide evidence of success beyond this age. There are 2 distinct nonsurgical approaches to expanding maxillary arch width in young adults: the palatal suture may be opened with an RPE appliance, or teeth and alveolar processes can be expanded with a Haas-type expansion appliance. Both methods are stable expansion methods. Clinicians are cautioned that proper case selection is critical to the success of these 2 methods; consultation with an orthodontist or an oral surgeon may be prudent in some cases.

There is an increasing body of evidence that supports nonsurgical RPE in young adults. A comprehensive review of clinical outcomes indicates that it is time for a paradigm shift. Nonsurgical RPE is a viable procedure for young adults who are well into their early twenties. ◆

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Enamel Reduction Procedures in Orthodontic Treatment

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Abstract

Various combinations of enamel reduction procedures can be used to create space between teeth, to correct discrepancies between mandibular and maxillary teeth and to correct morphologic anomalies during orthodontic treatment. In particular, acid-enhanced interproximal enamel reduction significantly reduces surface roughness. This article presents a review of the literature on enamel reduction procedures.

MeSH Key Words: *dental enamel/surgery; malocclusion/surgery; orthodontics, corrective/methods*

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Dr. Charles H. Tweed, the first certified specialist in orthodontics in the United States, devoted a lifetime (1918–1970) to the advancement of the edgewise orthondontic appliance. He proposed universal goals for comprehensive orthodontic treatment: a healthy, esthetically pleasing, functional and stable occlusion, which should match an esthetically harmonious soft-tissue profile.[1] Various treatment options exist to achieve these goals. Interproximal enamel reduction, also known as interdental stripping, enamel approximation or slenderizing, is a well-known technique that is frequently applied during orthodontic treatment. Not only can the clinician achieve better alignment and occlusion of the teeth through this adjunct to overall treatment, but it also simplifies the long-term maintenance of tooth alignment. Many factors influence whether these goals can be attained, one of which is the relationship of the total mesiodistal width of the maxillary teeth to that of the mandibular teeth (the Bolton tooth-size discrepancy).[2] Orthodontic treatment should compensate for any significant variation in this relationship, and treatment planning should therefore incorporate consideration of esthetic bonding, prosthetic recontouring, stripping of enamel, extraction of teeth, allowance for spaces after tooth alignment, prosthodontic replacement of missing teeth (**Figs. 1a** and **1b**) or a change in the desired anterior overjet or overbite.[3] This literature review examines indications for and methods of enamel reduction procedures.

Indications for Enamel Reduction

The reduction of the mesiodistal dimensions of the teeth by means of interproximal enamel reduction is intended to achieve better alignment of the teeth or to maintain alignment over the long term.[4–8]

Stroud and others[9] suggested that interproximal reduction may be indicated for patients with good oral hygiene and who have either Class I arch-length discrepancies with orthognathic profiles, minor Class II dental malocclusions (particularly in patients who have stopped growing) or Bolton tooth-size discrepancies.

Space-Gaining Procedures

Space-gaining procedures have been discussed in the literature for decades.[1–3] These methods include distalization of the molars, protrusion of the incisors, expansion in width of the dental arches and extraction of teeth. Other natural means of space gaining are proper maintenance of the primate spaces (in the primary dentition) and of the leeway space or, eventually, the E space (in the mixed dentition), which is the difference in mesiodistal width between the primary second molar and the permanent second molar. Enamel reduction is an alternative method of gaining the space needed to align irregularly positioned teeth. Sheridan[10] proposed that interproximal enamel reduction with an air-rotor technique is similar to the natural process of interdental abrasion.[11] Moreover, enamel reduction has recently increased in popularity as clinicians have become more involved in the long-term maintenance of alignment of the

Figure 1a: *Patient with a Bolton tooth-size discrepancy. The patient has congenitally missing maxillary lateral incisors.*

Figure 1b: *The missing maxillary lateral incisors were replaced with a Maryland acid-etched bridge, and lower incisor interproximal enamel reduction was performed. This example illustrates a simple method of correction, which is typically applied in cases with straight soft-tissue profiles, and could provide a semipermanent replacement during growth phases or during an interim phase before placement of an implant.*

Figure 2a: *Typical use of enamel reduction in nonextraction treatment with metal strips.*

Figure 2b: *Typical use of enamel reduction in nonextraction treatment with metal disks.*

lower incisors, as well as nonextraction treatment (**Figs. 2a** and **2b**) in cases of minor to moderate crowding.[2,4,5,12–15]

In untreated normal individuals, as well as those who have undergone orthodontic treatment, the dimensions of the dental arch (arch length, arch depth and intercanine width) are continually decreasing.[16–21] This decrease in arch dimensions eventually results in a shortage of space and is expressed as crowding or tooth irregularity. It has been suggested that the clinician has a responsibility to inform patients about changes in the dentition that may occur after orthodontic treatment and to stress the importance of retention in maintaining long-term alignment (**Figs. 3a, 3b, 3c** and **3d**).[19,22,23]

Interproximal enamel reduction may be used in adult patients with crowding, where extraction of teeth is not an option.[10] The early mixed dentition often presents with incisor irregularity of 3–4 mm.[24] Preservation of the leeway space, selective disking and extraction of primary teeth to help correct a shortage of space for the permanent incisors have thus become important processes (**Fig. 4**).

Disking of the primary teeth may also be used before a decision is made to either initiate a serial extraction regimen (for selective removal of the primary and secondary teeth) or pursue nonextraction therapy.[25] Not only does mesial stripping of the primary canines provide space, but maintenance of the canines in the arch aids in the natural expansion of the permanent canines during eruption.[25] This phenomenon is particularly important in cases where the decision to extract is not clear cut.

Enamel Thickness Available for Reduction

It has been suggested that approximately 50% of the interproximal enamel can be safely removed.[5,22,23,26] Estimates of the amount of tooth structure that can be removed depend on accurate reference data for enamel thickness, which are currently unavailable. However, reduction of the interproximal surfaces of the anterior teeth has not resulted in increased susceptibility to caries or periodontal disease.[4,7,8,22,23,27,28] Although Radlanski and others[29] suggested that there was an increase in caries with interproximal reduction of the posterior segment, Crain and Sheridan[30] did not find any increase in the incidence of caries or periodontal disease 2 to 5 years after interproximal reduction. In the absence of inflammation, close root proximity after orthodontic treatment does not cause greater susceptibility to bone loss.[31] However, the smaller distance between the roots of interproximally reduced teeth may predispose patients with inflammation to more rapid progression of periodontal disease. Bitewing radiographs provide information as to the thickness of the interproximal enamel. Enamel and dentin thickness were measured by Stroud and others,[9] who reported that the enamel on the second molars was significantly thicker (by 0.3 to 0.4 mm) than enamel on the premolars. In addition, distal enamel was significantly thicker than mesial enamel. Assuming that 50% enamel reduction leaves adequate protection for the tooth, applying this procedure to the premolars and the molars should yield 9.8 mm of additional space for realignment of mandibular teeth.

Anomalies in Tooth Morphology

Many patients presenting for orthodontic treatment have a Bolton tooth-size discrepancy that may influence treatment goals and results. Freeman and others[32] found that 30.6% of orthodontic patients had a significant anterior tooth-size discrepancy, whereas Crosby and Alexander[33] reported only 22.9% in a different sample.

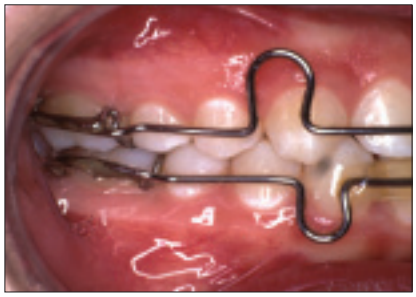

Figure 3a: *Removable, modified Hawley retainers are recommended to assist in long-term tooth alignment. This type of retainer contributes to a healthy periodontium and also allows for interproximal enamel reduction, which combats the effects of longitudinal arch-length reduction.*

Figure 3b: *Anterior view of removable, modified Hawley retainers.*

Figure 3c: *Mandibulor occlusal view of removable, modified Hawley retainers.*

Figure 3d: *Maxillary occlusal view of removable, modified Hawley retainers.*

Given these findings, it would seem prudent for clinicians to routinely include a tooth-size analysis in their treatment planning. Identifying such discrepancies before final tooth alignment should prove beneficial in defining the final expectations of both the clinician and the patient. Although such an analysis may be time-consuming, the benefits of interproximal stripping to correct any discrepancies would seem to outweigh the minor inconvenience of performing the analysis, which should allow more efficient diagnosis of problems, more specificity in treatment planning and a higher success rate in achieving optimal functional, stable and esthetically pleasing occlusions.

Enamel reduction also suffices for correction of a Bolton tooth-size discrepancy.[2,34] The Bolton tooth-size analysis comprises the anterior ratio (mean 77.2 ± 1.65%; range 74.5–80.4%) and the posterior ratio (mean 91.3 ± 1.9%; range 87.5–94.8%) of tooth-size differences between the mandibular and maxillary mesiodistal teeth. Interproximal enamel reduction can be used to correct the ratio and ensure well-aligned and properly occluding dentitions. In certain circumstances the ratio may even indicate the feasibility of extracting one lower incisor.

It has been shown that naturally well-aligned mandibular incisors have distinctive dimensional characteristics. Such teeth have significantly smaller mesiodistal (MD) dimension and significantly larger faciolingual (FL) dimension than mandibular incisors in the average population.[12] It appears, therefore, that tooth shape (MD and FL dimensions) may be a factor in determining whether crowding of the lower incisors will occur (**Fig. 5**).

In 1918 Ramström employed a breadth-length index in reporting the dimensions of fossilized lower molars.[12] Since then, FL and MD crown dimensions have been advantageously employed in indices to facilitate anthropologic communication.[35–43] In addition, these indices have been applied in studies of approximal and occlusal tooth wear.[44,45]

Peck and Peck[12] used this information to develop their index for use in clinical orthodontics. The index uses an MD/FL ratio, which determines whether a lower incisor is favourably or unfavourably shaped to achieve good lower anterior alignment.[12] The following ranges are employed as clinical guidelines for the maximum desirable MD/FL index values for the lower incisors: 88% to 92% for the mandibular central incisor and 90% to 95% for the mandibular lateral incisor. Enamel reduction assists in adjusting values to within these ranges.

Cosmetic Recontouring

Extensive remodelling of teeth by enamel grinding is sometimes necessary in orthodontic treatment to attain the desired esthetic objectives (**Figs. 6a** and **6b**).[46–48] In one study, canines were ground to the shape of the lateral incisors as part of orthodontic treatment, and subsequent recall clinical examinations after 10 to 15 years indicated favourable long-term results.[49] No significant colour differences were observed, nor were there any significant differences between ground and unground teeth with regard to mobility, reaction to percussion or temperature sensitivity. Electric pulp testing also revealed no statistically significant differences between test and control teeth. Marked radiographic changes (pulp obliteration) were evident in 2 of the 37 ground canines. Scratches were observed with stereomicroscope investigation on only 2 of the ground labial surfaces. Thordarson and others[49] reported that these scratches and grooves were originally produced by the diamond recontouring instrument and were still evident more than 10 years after the procedure. In all other instances the ground surfaces were indistinguishable from normal adult enamel surfaces. The authors concluded that

Figure 4: *Reduction of the mesial enamel of the primary cuspid to assist in alignment of the permanent incisors.*

Figure 5: *Successful long-term maintenance of lower incisor alignment. The patient received nonextraction treatment, including minor interproximal enamel reduction, with fixed orthodontic appliances to create space for incisor alignment. The active orthodontic treatment was followed by placement of a removable, modified Hawley retainer.*

Figure 6a: *Orthodontic appliances were used to close the lateral incisor spaces. The canines were positioned to replace the congenitally missing maxillary lateral incisors. The mandibular second premolars were extracted to correct the mandibular crowding and to establish a functional anteroposterior occlusion.*

Figure 6b: *Cosmetic reshaping of the maxillary canines and esthetic bonding were completed. This method is usually followed by lower interproximal enamel reduction to ensure appropriate Bolton tooth-size harmony.*

extensive cuspal, labial, lingual and interproximal recontouring accomplished by the grinding of young teeth in association with orthodontic treatment can be performed without discomfort to the patient and with only minor or no long-term clinical or radiographic reactions.

Methodological Advantages and Disadvantages

Despite its advantages, enamel reduction also presents some disadvantages. In operative dentistry it is of the utmost importance to avoid touching a neighbouring tooth during preparation of an approximal cavity, although in orthodontic treatment the interdental tooth enamel is ground down therapeutically. The potentially iatrogenic effects of interproximal reduction include increased frequency of caries, periodontal disease and temperature sensitivity.[50–52]

Air-rotor stripping may increase the susceptibility of proximal enamel surfaces to demineralization relative to that of nontreated surfaces.[53] However, ideal alignment by enamel reduction was reported to improve interproximal gingival health.[4] Enamel reduction could also lead to greater plaque retention (relative to untreated enamel) because of residual furrows left on the enamel surface by the scouring effect of the stripping procedure.[54]

Crain and Sheridan[30] did not find a statistically significant relationship between interdental enamel reduction (performed 2 to 5 years earlier) and caries susceptibility or periodontal disease. Similarly, el-Mangoury and others[55] performed scanning electron microscopy (SEM) and concluded that interproximal enamel reduction in the posterior segments did not expose the teeth to pathologic caries and that spontaneous remineralization of the hard tissue followed after a demineralization period of approximately 9 months. A mechanical stripping procedure combined with the chemical action of 37% phosphoric acid produced enamel surfaces that encouraged "self-healing" on the basis of remineralization enhanced by the application of fluoridating or remineralizing solutions.[54] Leclerc[56] carried out a complete analysis, using SEM to investigate existing stripping procedures. The author proposed using a diamond disk, followed by a diamond bur, 16- and 30-blade tungsten carbide burs and a polishing paste.

Various other techniques have been described to reduce the mesiodistal dimension of teeth, including use of special hand instruments and motorized handpieces such as the Profin Directional System (Dentalus, New York).[57,58] Piacentini and Sfondrini[59] tested healthy human teeth obtained after extraction for orthodontic or periodontal reasons. The teeth underwent enamel stripping according to various techniques, including mechanical stripping with burs and chemical stripping with phosphoric acid. SEM demonstrated that, with normal polishing and cleaning methods, it is impossible to eliminate the furrows left on the enamel by diamond burs and disks and 16-blade tungsten carbide burs. In addition, mechanical and chemical reduction techniques were ineffective when performed according to accepted methods. In contrast, Piacentini and Sfondrini[59] showed that well-polished enamel surfaces can be obtained by using a tungsten carbide bur with 8 straight blades, followed by Sof-Lex disks (3M, St. Paul, Minnesota) These authors noted that the enamel surfaces were smoother than intact or untreated enamel.

Polishing enamel after reduction to make it appear similar to normal tissue before treatment is extremely difficult.

In addition, the abraded areas may favour the adherence of bacterial plaque and may offer little resistance to breakdown.[61] Joseph and others[54] proposed a combined mechanical and chemical technique in an effort to create a smooth enamel surface. However, Piacentini and Sfondrini[59] reported that use of phosphoric acid yielded only an etched adamantine surface, which they maintained was susceptible to decalcification, despite the application of calcifying or fluoridating solutions, as suggested by Joseph and others.[54] Piacentini and Sfondrini[59] believed that such a method could be risky because of rapid plaque accumulation on the enamel surface, which might result in greater exposure to carious agents. They showed that satisfactory results could be achieved with their technique, whereby a tungsten carbide bur is used as the first bur and polishing is accomplished with a series of fine Sof-Lex disks.[59]

Conclusions

Interproximal enamel reduction has been suggested as a preventive[61,62] and therapeutic[63] measure. It is a valuable clinical technique that increases the orthodontic armamentarium. To eliminate the disadvantages that have been described, testing and development of various techniques are imperative to ensure that the procedure yields a smooth enamel surface. ◆

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CDA'S DEFINITION OF ORAL HEALTH

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

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A Pilot Investigation of Enamel Reduction Procedures

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• **Andrew Tortorella,** BSc, DDS •

Abstract

Objective: *To test and describe the use of various combinations of mechanical and chemical techniques for enamel reduction to obtain a smooth surface.*

Methods: *Bovine teeth (2 surfaces on each of 32 teeth) were used. The teeth were mounted in blocks of dental plaster, which were then mounted in a vise. The mesiodistal enamel contact areas were reduced by various combinations of mechanical and chemical aids. The mesiodistal width of each tooth was measured with a digital caliper after initial reduction of the enamel surface and again after polishing. The teeth were subsequently prepared and mounted for scanning electron microscopy.*

Results: *All combinations yielded statistically significant enamel reduction ($p < 0.05$). The use of acid stripping in conjunction with mechanical procedures produced especially smooth enamel surfaces.*

Conclusions: *Steps must be taken to ensure that a smooth enamel surface remains after enamel reduction and polishing. It is recommended that conventional enamel etchants be added to the polishing procedure. Enamel reduction can increase available space, but the quantity of enamel that can be removed without adverse consequences should be carefully evaluated.*

MeSH Key Words: *dental enamel/surgery; malocclusion/surgery; orthodontics, corrective/methods*

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This article has been peer reviewed.

Interproximal enamel reduction is a technique with tremendous flexibility. It can be used as a stand-alone procedure to contour a tooth surface or as an adjunct procedure during other restorative, prosthodontic and orthodontic treatments.

The purpose of this pilot project was to test and describe the use of various combinations of mechanical and chemical techniques for enamel reduction to obtain a smooth enamel surface and to evaluate the residual smoothness of the enamel of bovine teeth after application of these different methods.

Materials and Methods

Bovine teeth were used for this study. They are readily available, and bovine enamel is an acceptable substitute for human enamel in research projects,[1,2] because histochemically all mammalian teeth appear essentially similar.[3] In the present study, the mesial and distal surfaces of 32 bovine teeth were used (total of 64 surfaces). The pulp of each tooth was mechanically removed, and the teeth were mounted in blocks of dental plaster to simulate a dental arch. The blocks were then mounted in a vise for stability, and the mesiodistal enamel contact areas were subjected to reduction by combinations of mechanical and chemical aids (**Table 1**).

The mechanical techniques included removal of the enamel by Midwest high-speed and low-speed handpieces (Midwest Dental Products Corp. Des Plaines, Illinois) equipped with 16-blade tungsten carbide burs (Brasseler, Savannah, Georgia), superfine needle diamond burs (Brasseler), diamond disks (Brasseler) and diamond Lightning strips (Moyco Union Broach, York, Pennsylvania). The stripped enamel surfaces were polished with 3M Sof-Lex extra-thin polishing disks attached to mandrels (3M Dental Products, St. Paul, Minnesota) and 3M Sof-Lex finishing strips (coarse and medium aluminum oxide, as well as fine and superfine) (3M Dental Products) in combination with various enamel acid etching solutions

Table 1 **Results of interproximal enamel reduction (mean ± standard deviation of 9 measurements for each method)**

Method	Enamel loss after initial reduction (mm) (IR)	Enamel loss after polishing (mm) (P)	Enamel reduction by polishing only (mm) (P – IR)
TB + D	0.17 ± 0.02	0.38 ± 0.08	0.21 ± 0.06
TB + S	0.44 ± 0.06	0.54 ± 0.01	0.10 ± 0.06
TB + D + Ph	0.03 ± 0.04	0.07 ± 0.03	0.04 ± 0.02
TB + D + M	0.51 ± 0.04	0.64 ± 0.05	0.13 ± 0.03
TB + D + Pr	0.55 ± 0.05	0.64 ± 0.02	0.09 ± 0.06
TB + S + Ph	0.44 ± 0.09	0.67 ± 0.03	0.23 ± 0.06
TB + S + M	0.29 ± 0.06	0.42 ± 0.03	0.13 ± 0.08
TB + S + Pr	0.17 ± 0.06	0.16 ± 0.09	–0.01 ± 0.06
DS + D	0.19 ± 0.12	0.24 ± 0.06	0.06 ± 0.07
DS + S	0.15 ± 0.04	0.14 ± 0.09	–0.01 ± 0.09
DS + D + Ph	0.22 ± 0.11	0.27 ± 0.07	0.05 ± 0.18
DS + D + M	0.08 ± 0.08	0.19 ± 0.05	0.11 ± 0.07
DS + D + Pr	0.17 ± 0.15	0.33 ± 0.16	0.16 ± 0.03
DS + S + Ph	0.22 ± 0.02	0.26 ± 0.02	0.04 ± 0.02
DS + S + M	0.08 ± 0.01	0.17 ± 0.06	0.09 ± 0.07
DS + S + Pr	0.08 ± 0.03	0.14 ± 0.02	0.06 ± 0.01
DB + D	0.39 ± 0.04	0.53 ± 0.03	0.14 ± 0.03
DB + S	0.24 ± 0.12	0.38 ± 0.12	0.13 ± 0.01
DB + D + Ph	0.28 ± 0.11	0.38 ± 0.08	0.10 ± 0.05
DB + D + M	0.28 ± 0.09	0.49 ± 0.04	0.21 ± 0.12
DB + D + Pr	0.09 ± 0.12	0.02 ± 0.07	–0.07 ± 0.05
DB + S + Ph	0.34 ± 0.11	0.45 ± 0.11	0.11 ± 0.09
DB + S + M	0.37 ± 0.04	0.40 ± 0.05	0.03 ± 0.01
DB + S + Pr	0.39 ± 0.04	0.59 ± 0.06	0.20 ± 0.02
DD + D	0.22 ± 0.06	0.34 ± 0.08	0.12 ± 0.07
DD + S	0.16 ± 0.06	0.22 ± 0.05	0.05 ± 0.05
DD + D + Ph	0.23 ± 0.03	0.39 ± 0.01	0.16 ± 0.03
DD + D + M	0.01 ± 0.12	0.14 ± 0.03	0.13 ± 0.11
DD + D + Pr	0.43 ± 0.07	0.62 ± 0.08	0.19 ± 0.04
DD + S + Ph	0.56 ± 0.09	0.74 ± 0.09	0.18 ± 0.16
DD + S + M	0.36 ± 0.09	0.43 ± 0.03	0.07 ± 0.07
DD + S + Pr	0.28 ± 0.12	0.43 ± 0.01	0.15 ± 0.12

TB = tungsten carbide bur, D = 3M polishing disks, S = 3M polishing strips, Ph = 35% phosphoric acid, M = 10% maleic acid, Pr = Prema enamel microabrasion kit, DS = diamond (Lightning) strip, DB = diamond bur, DD = diamond disk.

in some of the groups. The chemical etching products were the Transbond XT etching gel delivery system containing 35% phosphoric acid (3M Dental Products), Scotchbond Multi-Purpose etchant containing 10% maleic acid (3M Dental Products) and the Prema enamel microabrasion kit containing an abrasive powder in a water-soluble gel combined with a mild concentration of hydrochloric acid (Premier Dental Products, King of Prussia, Pennsylvania). The enamel surfaces were rinsed with distilled water for 60 seconds after the application of the acid compounds.

Three measurements of the mesiodistal width of each tooth were obtained before each method of enamel reduction. A total of 32 methods of enamel reduction were completed, with 9 repetitions of each method, for a total of 288 observations. The measurements were obtained with a digital caliper (Mitutoyo Corporation, Kawasaki, Japan), calibrated to 0.01 mm, after initial reduction of the enamel surface and again after polishing. The caliper tips were specially sharpened to a knife-edged point to make accurate measurement possible (**Fig. 1**).

The average mesiodistal width before enamel reduction and after polishing was determined and used for statistical analysis. The teeth were immersed in 100% ethanol for 1 week after the stripping procedures and then allowed to air dry to remove all moisture. The teeth were then individually mounted on aluminum scanning electron microscopy (SEM) stubs and coated with 3 nm of platinum in a Polaron E 5100 SEM coating unit (Quorum Technologies, East Sussex, England). The samples were then viewed with a scanning electron microscope (Hitachi S-2500, Mito City, Japan) at an operating voltage of 10 kV. Images were photographed at 100× and 500× magnification for descriptive purposes.

Statistical analyses included descriptive statistics and Duncan's multiple range test. The level of significance was set at $p < 0.05$.

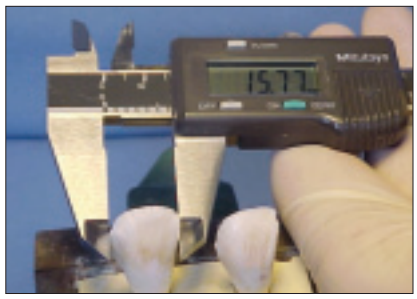

***Figure 1**: Digital calipers indicating measurement to 0.01 mm.*

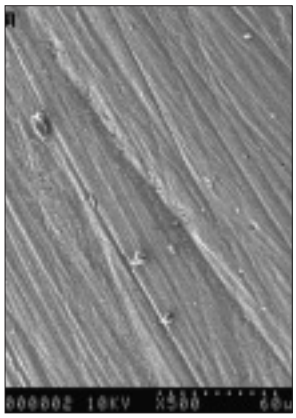

***Figure 2a:** Bovine tooth after enamel reduction with a 16-blade tungsten carbide bur plus 3M polishing disks.*

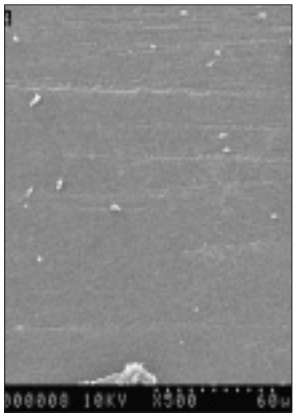

***Figure 2b:** Bovine tooth after enamel reduction with a 16-blade tungsten carbide bur plus 3M polishing disks plus 10% maleic acid.*

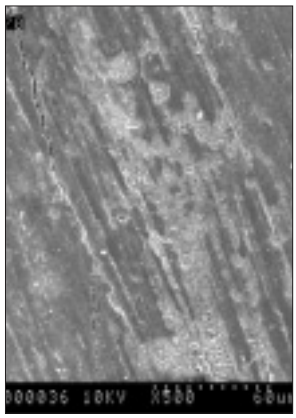

***Figure 2c:** Bovine tooth after enamel reduction with a 16-blade tungsten carbide bur plus 3M polishing disks plus Prema enamel microabrasion kit.*

Results

The differences in enamel surface after the initial reduction and after polishing are presented in **Table 1**. There were no significant differences among the groups (Duncan's multiple-range text, $p > 0.05$). However, there was a statistically significant difference between the initial and final enamel measurements ($p < 0.05$) for all procedures, which indicates that all of the techniques removed enamel from these bovine teeth.

Examples of the results of the various procedures, including acid polishing, are shown in **Figs. 2** and **3**. These SEM images revealed that the use of acids in polishing the enamel after initial stripping resulted in a smoother surface. In particular, maleic and phosphoric acids (**Figs. 2b, 3b** and **3c**) yielded equivalent smoothness, whereas the use of the Prema enamel microabrasion kit reduced surface roughness but left visible furrows (**Figs. 2c** and **3d**).

Discussion

Interproximal enamel reduction, also known as interdental stripping or slenderizing, is a well-known technique that is commonly applied during orthodontic treatment. Better alignment and better occlusion of the teeth, as well as simplification of long-term maintenance of tooth alignment, have been reported.[4–8]

In the study reported here, bovine enamel surfaces were subjected to conservative reduction with a variety of orthodontic grinding and finishing techniques and materials, the amount of enamel removed was measured, and the enamel surfaces were evaluated by SEM. Even when the teeth were polished with the finest finishing strips, it was impossible to produce an enamel surface free of the furrows caused during initial abrasion by coarse reduction procedures. This phenomenon has also been recognized by researchers using human enamel.[9–11] The furrows caused by mechanical reduction may enhance the predisposition for plaque retention.[12–14] The use of dental floss apparently cannot prevent plaque accumulation at the bottom of furrows cut into the approximal enamel in this way.[10] A vicious cycle is thus established, with subsequent risk of decalcification, gingivitis, caries or some combination of these problems.[15] The grinding-down of enamel by diamond-coated disks, burs or finishing strips remains the subject of controversy. Although injuries to the enamel surface caused by grinding instruments can predispose the patient to caries and periodontal disease,[12–14] interdental reduction is not yet considered by orthodontists as a problem. Development of a technique that yields a smooth enamel surface after enamel reduction is recommended to prevent iatrogenic lesions.

It is common to reshape the approximal contacts in the anterior region to solve crowding problems[4–8,16,17] and to stabilize the dental arch.[18] This approach to treatment seems to have originated from the finding that aboriginal and prehistoric humans usually exhibited not only occlusal[19,20] but also approximal[19,21] wear of the dentition. The perceived impossibility of artificially producing highly polished surfaces has resulted in a preference to avoid reduction and accept slight crowding as a natural phenomenon.[22] Nonetheless, there is a need for this procedure in clinical practice, as reduction is rapidly becoming a common procedure for the treatment of minor discrepancies in arch length. The reduction procedure is usually limited to the lower anterior dental

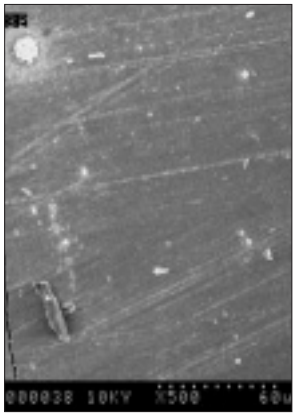

Figure 3a: *Bovine tooth after enamel reduction with a diamond disk plus 3M polishing disks.*

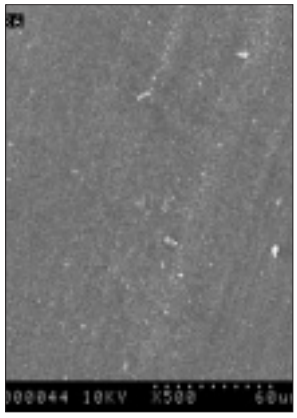

Figure 3b: *Bovine tooth after enamel reduction with a diamond disk plus 3M polishing disks plus 35% phosphoric acid.*

Figure 3c: *Bovine tooth after enamel reduction with a diamond disk plus 3M polishing disks plus 10% maleic acid.*

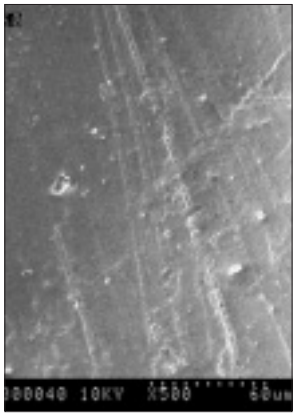

Figure 3d: *Bovine tooth after enamel reduction with a diamond disk plus 3M polishing disks plus Prema enamel microabrasion kit.*

segment, where caries seldom develop. However, it has recently been proposed that such therapy be extended to the premolar and molar regions[5] to gain space along the dental arch. This method might allow for just as much space as can be achieved by the extraction of premolars. The in vitro study presented here confirms that enamel can be successfully removed by a variety of methods (**Table 1**). Because the results of Radlanski and others[10] indicate that reduction leads to plaque accumulation, careful evaluation is needed to determine whether potential damage to multiple approximal tooth surfaces by enamel reduction is preferable to extraction and other space-gaining procedures. The SEM images obtained in the present study clearly show roughening of the enamel surfaces if left unpolished (**Figs. 2** and **3**).

The etching pattern of enamel appears to play a part in the bond strength of dental resins. However, Denys and Retief[23] stated that it is impossible to define an etched enamel surface as retentive to dental resins only on the basis of distribution of the etching patterns, an observation apparently confirmed by Carstensen.[24] Phosphoric acid concentrations greater than about 27% produce monocalcium phosphate monohydrate, whereas concentrations less than about 27% yield dicalcium phosphate dihydrate.[25] The former is readily soluble and would be completely washed away in the clinical situation, whereas the latter is less soluble. This seems to be a disadvantage in providing a retentive surface for resin bonding following application of low-concentration acids. Conversely, the overall loss of superficial enamel, which is especially rich in fluoride,[26] is probably less after etching with 2% or 5% phosphoric acid than with a 40% solution.[27–30] Also, the depth of acid penetration into the deeper enamel layers seems to be less at low acid concentrations.[31] Therefore, using low-concentration acids could diminish the risk of decalcification in the enamel regions around orthodontic attachments. For this reason acid stripping or polishing in the present study was performed with low-concentration acids.

Light microscopic studies have shown that an enamel surface stripped by abrasive means cannot be highly polished.[22] Hence, acid stripping was tested in the present study, and SEM was used to determine the differences between acid and non-acid polishing (**Fig. 2** and **3**). In addition, it is known that artificially roughened enamel is less resistant to penetration of a lactate buffer[32] and that fluoride treatment must be applied for a lengthy period after stripping.[9,33]

Conclusions

Interproximal enamel reduction is an important auxiliary orthodontic treatment. However, the clinician must take steps to ensure that a smooth enamel surface remains after the polishing procedures described in this article, to ensure that the negative effects of abrasive stripping are eliminated. It is recommended that conventional enamel etchants, as used in orthodontic practice, be added to the polishing procedure during the reduction technique. A rubber dam may be used when any acidic products are included as part of the polishing procedure to prevent further irritation of the gingiva. However, this is a minor consideration, as similar acids are typically used in bonding of brackets.

Given the current emphasis on nonextraction treatment in orthodontics today, enamel reduction is a technique that can increase available space in the dentition, but the quantity of enamel that can be removed without adverse consequences must be carefully evaluated. Reduction should incorporate the best possible finishing of the interproximal enamel surface to meet the biologic requirements of the oral cavity. ◆

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The authors have no declared financial interests in any company manufacturing the types of products mentioned in this article.

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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 the management of space problems in the mixed dentition. The articles were chosen by Dr. Paul W. Major, director of the orthodontic graduate program, department of dentistry, University of Alberta, and Dr. Carlos Flores-Mir, a postdoctoral fellow in the orthontic graduate program at the University of Alberta. A commentary is provided that puts these articles into context for readers.*

Commentary

Clinical Management of Tooth-Size and Arch-Length Discrepancies during the Mixed Dentition Stage

Carlos Flores-Mir, DDS, Cert Orthod, MSc, PhD
Paul W. Major, DDS, MSc, MRCD(C)

Malocclusions can be caused by skeletal, functional or dentoalveolar problems, or a combination of these problems. Over the last years, there has been considerable interest in the appropriate timing of interceptive or corrective treatment of these problems. Indeed, controversy still exists regarding the advantages and disadvantages of early orthodontic treatment. Justification for early intervention needs to be based on an evaluation of the potential benefit of reducing future treatment needs or treatment complexity; the cost of the intervention (i.e., direct financial burden on the patient and use of professional resources); and the potential risk of delaying treatment. This month's selection of abstracts provides an update on the management of leeway space, serial extractions and arch expansion to intercept or correct tooth-size discrepancies and arch-length deficiencies (crowding).

Leeway space is the difference between the mesiodistal diameters of the deciduous canine and molars and the permanent canines and premolars. Leeway space can be as much as 4.8 mm in the mandibular arch.[1] If the leeway space is not maintained by some mechanical appliance, the lower first permanent molars could drift mesially into the space. Gianelly[2] predicted that maintenance of normal leeway space, especially in the lower arch, could prevent the need for extractions to correct tooth-width or arch-length discrepancies in 77% of cases. Furthermore, considering that interproximal stripping or slight arch expansion can easily correct 1-mm to 2-mm discrepancies, the percentage of cases not requiring extraction could be as high as 84%.[2] However, this approach solves only possible intra-arch crowding problems, not inter-arch occlusal relationships.

Lingual arches and other space maintainers can maintain the leeway space. Two review articles[3,4] about the management of space problems have recently been published. We encourage readers to take a look at them.

Serial extraction is a planned sequence of extractions of the deciduous dentition followed by extractions of the permanent dentition (usually of premolars). This treatment has been controversial from the beginning. Some authors[5,6] have been in favour of this approach for cases of severe crowding. However, serial extraction can result in tooth tipping, such as distal tipping of the permanent canines, lingual tipping of the mandibular incisors and mesial tipping of the first molars, and shows no better long-term stability than extractions after full eruption.[7] Displacing the problem from primarily an esthetic concern (i.e., crowding) to a functional problem (inadequate posterior occlusion) may not be in the patient's best interest. We believe that serial extraction should be reserved for specific cases where irreversible periodontal problems (recession) or midline deviation may occur as a result of severe incisor crowding in the mixed dentition.

Simple and economical space management appliances can significantly improve malocclusions caused by dentoalveolar problems before comprehensive orthodontic treatment needs to be undertaken, thereby making the second phase of treatment less complex. ◆

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1 Can lingual arches maintain arch length during the transition from the mixed to the permanent dentition?

Brennan MM, Gianelly AA. The use of lingual arch in the mixed dentition to resolve incisor crowding. *Am J Orthod Dentofacial Orthop* 2000; 117(1):81–5.

Background

Management of leeway space can theoretically provide enough space to relieve most cases of mandibular incisor crowding during the transitional dentition stage. This clinical study evaluated the amount of space that can be maintained with a passive lingual arch during this transitional period.

Methods

Lingual arches were inserted in 107 patients with mixed dentition. Different arch measurements were compared between the lingual arch insertion date (T1) in the mixed dentition and removal date (T2) in the permanent dentition.

Results

At T1, mean incisor crowding was –4.85 mm (± 2.14 mm), whereas at T2, crowding was +0.2 mm (± 2.75 mm). There was a decrease in arch length of –0.44 mm (± 1.35 mm), an increase in intercanine width of 1.49 mm (± 1.76 mm), an increase in interpremolar width of 2.27 mm (± 1.74 mm) and an increase in intermolar width of 0.72 mm (± 0.96 mm).

Clinical Significance

A mean of 5 mm (± 2.1 mm) of crowding was corrected with the use of passive lingual arches to maintain leeway space in the mandibular arch. Crowding was eliminated in 61% of patients. If we consider that up to 2 mm of crowding can be relieved by slight arch expansion or interproximal reduction, 26% more cases could avoid nonextraction orthodontic treatment. ◆

2 What are the causes of failure of space maintainers?

Qudeimat MA, Fayle SA. The longevity of space maintainers: a retrospective study. *Pediatr Dent* 1998; 20(4):267–72.

Background

Factors influencing the choice of space maintainers include missing primary teeth, patient cooperation, occlusal relationships and stage of dental development. The causes of failure of these appliances have not been adequately evaluated in the literature. The purpose of this study was to determine the survival rate of space maintainers fitted at a dental school in the United Kingdom.

Methods

All fixed and removable space maintainers installed during a 5-year period were evaluated. The fate of appliances was classified as successful, withdrawn, failed or lost to follow-up.

Results

In total, 301 space maintainers in 141 patients were evaluated. Sixty-three per cent of space maintainers failed (36% because of cement loss, 24% because of breakage, 10% had design problems, and 9% were lost), 21% were lost to follow-up, and 15% were successful or remained at the end of the study. Mean survival time of the space maintainers was 7 months (lingual arch: 4 months; Nance button: 6 months; removable maintainers: 9 months; and band and loop: 13 months).

Clinical Significance

Longer follow-up periods may explain the higher failures in this study compared to previous studies. Control appointments should be scheduled every 2 months, especially when lingual arches are used. ◆

3 What factors affect the survival time of space maintainers?

Rajab LD. Clinical performance and survival of space maintainers: evaluation over a period of 5 years. *ASDC J Dent Child* 2002; 69(2):156–60.

Background

Space maintainers can prevent both primary and permanent teeth adjacent to extraction sites from drifting into the space during the mixed dentition stage. The longevity of space maintainers has not been adequately evaluated. The aim of this study was to determine the longevity of space maintainers and the factors that may affect their survival.

Methods

This study evaluated 355 passive fixed space maintainers and 32 removable space maintainers in 358 patients for a period of 5 years; follow-up recalls took place every 6 months. Outcomes were categorized as successful (appliance still functioning or removed because no longer needed), failed or lost to follow-up.

Results

Overall failure rate was 31%, with a median survival time of 18 months. Causes of failure (and failure times) were: cement loss (17 months, SD ± 5 months); solder breakage (12 months, SD ± 2.5 months); soft-tissue lesions (15 months, SD ± 7 months); interference with interruption (24 months, SD ± 6.5 months); and loss of appliance (14 months, SD ± 3.5 months). Lingual arches had a failure rate of 47%, with a median survival time of 14 months. No differences were found between the median survival time of appliances fitted for the maxillary and the mandibular arches.

Clinical Significance

Solder breakage was the most common cause of failure, followed by cement loss. The authors conclude that lingual arches should be avoided, because they have a high failure rate. All types of space maintainers, especially lingual arches, should be carefully monitored, with a strict follow-up protocol. The failure rate of lingual arches should be taken into consideration when evaluating the cost (both in terms of financial cost and human resources) of these appliances. Appliances must be monitored, adjusted, repaired and possibly replaced during the course of treatment. ➧

4 Does tooth movement after serial extraction contribute to the correction of crowding?

Yoshihara T, Matsumoto Y, Suzuki J, Sato N, Oguchi H. Effect of serial extraction alone on crowding: spontaneous changes in dentition after serial extraction. *Am J Orthod Dentofacial Orthop* 2000; 118(6):611–6.

Background

Different studies have reported spontaneous drifting and tipping of the teeth adjacent to extraction sites following the serial extraction of premolars. However, the results of these previous studies were contradictory. The present study aimed to quantify these movements and relate them to improvement in dental crowding.

Methods

Thirty-one children (17 females and 14 males) who underwent serial extraction participated in this study. Mandibular plaster models and lateral radiographs were analyzed. The mean time interval between extraction of the deciduous canines and the end of the observational period was 6 years.

Results

Crowding significantly decreased. Distinctive inclination and apex and crown movements were found for each tooth class (first molars, second premolars, canines and incisors). There was a significant correlation between the annual change in canine movement and the irregularity index.

Clinical Significance

Reduction of anterior crowding following serial extraction can be explained by the lingual tipping of the incisors after extraction of the deciduous canines and the distal movement or tipping of the canines after extraction of the premolars. These results highlight the need for planning and realistic expectations with this type of early orthodontic treatment. ➧

5 Is slow maxillary expansion a viable alternative to rapid maxillary expansion?

Karaman AI. The effects of Nitanium maxillary expander appliances on dentofacial structures. *Angle Orthod* 2002; 72(4):344–54.

Background

Some degree of maxillary constriction is present in approximately one-third of orthodontic patients. Maxillary expansion produces both short-term and permanent dentoalveolar and skeletal changes. Numerous reports have been published on the changes produced by rapid maxillary expansion, but very few articles have dealt with slow maxillary expansion. The purpose of this study was to analyze the dentofacial effects of the Nitanium maxillary expander, a slow maxillary expansion appliance.

Methods

Sixteen patients (4 males and 12 females) with an average age of 13.8 years were treated with the Nitanium maxillary expander. The average active treatment phase was 3.6 months and the retention phase, 2.8 months.

Results

Molar extrusion resulted in an increased vertical dimension of the face, producing a backward and downward rotation of the mandible. Transverse skeletal and dental expansion was also attained. Upper incisors were extruded and underwent distal tipping.

Clinical Significance

The slow maxillary expander is a viable alternative to conventional rapid maxillary appliances. The decision as to which one the clinician should use is primarily a personal choice, since the final results are similar. ➧

6 Are the effects of rapid maxillary expansion still visible after the completion of growth?

Cameron CG, Franchi L, Bacetti T, McNamara JA Jr. Long-term effects of rapid maxillary expansion: a posteroanterior cephalometric evaluation. *Am J Orthod Dentofacial Orthop* 2002; 121(2):129–35.

Background

The use of rapid maxillary expansion (RME) to correct skeletal or dental crossbites has been widely studied. However, despite widespread use of this appliance, the long-term stability of transverse changes has not been evaluated. The aim of this study was to evaluate the long-term effects of RME therapy.

Methods

The sample group for this study consisted of 42 patients (25 males and 17 females) for whom long-term posteroanterior cephalograms (i.e., taken 5 years after active maxillary expansion treatment with a Haas-type appliance) were available. The subjects underwent fixed appliance therapy immediately after the active expansion phase. The control group consisted of 20 subjects (11 males and 9 females) who did not undergo orthodontic treatment.

Results

RME produced significant craniofacial changes that were not limited to the maxilla. Dental changes were also recorded, including increased mandibular first molar width.

Clinical Significance

Long-term effects of RME showed a normalization of the altered dental and skeletal values in patients with a constricted maxillary arch. The changes were not only attained in the maxillary region, but also in the orbital and mandibular regions. There was good long-term stability. ➧

What CDA Does for New Dentists

CDA offers a number of programs and services that ease the transition from dental student to new practitioner.

Practice Management

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Coming soon from CDA: An e-mail newsletter for dentists who have graduated within the past five years.

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For more information on membership in CDA and what the Association can do for new dentists, contact *Bernadette Dacey, Manager, Membership Promotion & Administration, Canadian Dental Association, 1815 Alta Vista Drive, Ottawa, ON K1G 3Y6 Tel.: (613) 523-1770, ext. 2229, e-mail: bdacey@cda-adc.ca.*

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. Jean-Marc Retrouvey, director, division of orthodontics, McGill University, Montreal. 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 When is maxillary expansion indicated, and how can I perform it effectively?

Background to the Problem

The primary indication for rapid maxillary expansion is a functional posterior crossbite in a growing child (**Fig. 1**).

The main cause of this problem is lack of transverse development of the maxilla, which results in unilateral functional crossbite of the dentition in maximum interdigitation. The mandibular midline is deviated in the direction of the crossbite, and the problem presents as an asymmetry in maximum interdigitation.

To verify if the crossbite is functional rather than skeletal in nature, manipulate the patient's mandible to obtain centric relation and observe the position of the mandibular midline in relation to the maxillary midline. If the crossbite is functional, the 2 midlines will coincide, and the upper and lower buccal cusps of the posterior teeth will be in an "edge-to-edge" relationship. The patient's mandible then slides into a unilateral crossbite in centric occlusion. Otherwise, the crossbite is skeletal, and other modes of treatment are needed.

Figure 1: *Pretreatment view of a functional posterior crossbite.*

Figure 2: *Post-treatment view of crossbite corrected with a rapid palatal expander.*

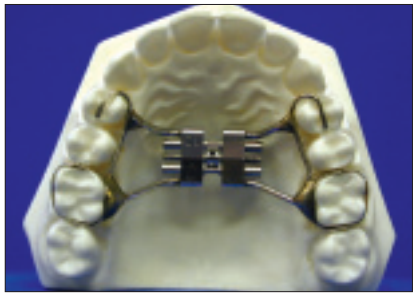

Figure 3: *Hyrax-type appliance on stone model.*

Figure 4: *After the activation period, the appliance is locked in place.*

A functional crossbite must be resolved as quickly and efficiently as possible to take advantage of maxillary sutures that have not yet closed. The response of the sutures to expansion is much better at a younger age (i.e., the effect is more skeletal than dentoalveolar). Some practitioners prefer to correct the crossbite while the patient still has the primary dentition, whereas others wait until the permanent teeth have erupted, incorporating correction of the crossbite within comprehensive orthodontic therapy.

In fact, for convenience and maximum cooperation on the part of the child, the best time to correct a crossbite appears to be in the mixed dentition stage, when the first permanent molars are fully erupted (which allows for ease of banding) but there has been only minimal resorption of the roots of the primary first maxillary molars. We routinely treat patients around the age of 8 years, cementing bands on the upper permanent molars and placing occlusal or lingual rests on the primary first molars. The patient's cooperation is good at this age and our success rate approaches 100%.

The appliance of choice is the rapid palatal expander (Hyrax- or Haas-type appliance), which opens the midpalatal suture to widen the maxilla. The problem is usually corrected in 1 or 2 months of active treatment. This active treatment phase is followed by a retention period of 6 months (**Fig. 2**).

A 20% overcorrection is necessary to ensure therapeutic success. To verify that this degree of overcorrection has been attained, check the position of the lingual cusps of the

upper permanent first molar — they should be in contact with the lingual inclines of the buccal cusps of the lower permanent first molars. Once the expansion is complete, the deviation of the mandibular midline in centric occlusion will spontaneously correct itself.

The maxillary expansion appliance has been used successfully for the past 50 years to correct functional crossbites. In addition, numerous articles have been published on the efficacy of this type of appliance in developing the transverse dimension of the maxilla, even in the absence of posterior crossbite.

These appliances are also used in cases of mild crowding and Class II division 1 malocclusions in which there is a lack of transverse development of the maxilla. When the rapid palatal expander is used for these purposes, great care should be exercised in diagnosing the malocclusion. In this situation, the transverse correction becomes part of the total orthodontic correction.

Technique for Maxillary Expansion

1. Place separating elastics mesial to the permanent first molars 1 week before the fitting appointment.
2. During the fitting appointment, fit bands with buccal attachments on the permanent first molars, and take a good alginate impression.
3. Remove the bands and place in the impression. Hold the bands in place with wire (0.024) or sticky wax.
4. At a subsequent appointment, place new separating elastics. Book the appointment for this step such that there is a maximum of 1 week between steps 3 and 4.
5. Pour the impression and send it to the laboratory with your instructions. Request that the screw be positioned as high up in the palate as possible (**Fig. 3**).
6. Try the rapid palatal expander in the mouth, cement the bands on the permanent first molars, and use composite to bond the arms on the primary first molars.
7. Explain the method of appliance activation to the parents and have them practise the activation procedure in the office.
8. Give the parents precise instructions as to the number of activations. As a rough guide, there should be about 28 activations, once daily, which should result in an expansion of 7 mm.
9. See the patient after 4 weeks.
10. Once the activations are finished, lock the screw with composite and leave the appliance in the patient's mouth for 6 months (**Fig. 4**). ◆

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McNamara JA. Maxillary transverse deficiency. *Am J Orthod Dentofacial Orthop* 2000; 117(5):567–70.

Wertz RA. Changes in nasal airflow incident to rapid maxillary expansion. *Angle Orthod* 1968; 38(1):1–11

Question 2 What are the basic principles for treating an anterior open bite caused by a functional disturbance?

Background to the Problem

When examining a young patient with an anterior open bite for the first time (**Fig. 1**), it is imperative to "quantify" the genetic component of the malocclusion. For example, a severely dolichocephalic patient (long and narrow face) presenting with vertical maxillary excess may have an open bite of genetic origin that will probably prove very difficult to correct (**Fig. 2**). Once you have analyzed the facial structures and quantified the genetic component of the malocclusion, you should question the parents regarding the presence of a speech impediment or an oral habit.

You should also perform a facial and functional examination, paying particular attention to:

Figure 1: *Patient with an anterior open bite.*

Figure 2: *Dolichocephalic facial type.*

Figure 3: *Intraoral view of an anterior open bite.*

Figure 4: *Removable appliance with tongue crib.*

Figure 5: *Hawley-type appliance with light elastics.*

- facial type
- the patient's profile (the chin position in relation to the philtrum)
- lips at rest
- tongue posture at rest
- swallowing pattern
- molar Class of occlusion
- extent of the open bite in the A-P dimension
- arch form (**Fig. 3**).

The 2 main functional causes of an anterior open bite are an oral habit and poor tongue posture. Oral habits (such as thumb sucking) are usually transitory. Once the habit is discontinued, interceptive or comprehensive orthodontic treatment may be necessary to correct the open bite. Many anterior open bites are created by poor tongue posture, which disturbs the equilibrium necessary for optimal development of the anterior dentoalveolar component of the maxilla. Constant light pressure of the tip of the tongue against the lingual surface of the anterior teeth will create an "orthodontic force" that will displace these teeth labially and superiorly. Sometimes, the lower incisors will be undererupted because of the vertical vector of tongue pressure. The anterior posture of the tongue may result in a narrow and more tapered maxilla, encouraging a Class II molar relationship (mesial rotation of the upper molars).

An important diagnostic clue is the origin of the open bite on the occlusal plane. If only the anterior teeth are involved and a fairly good occlusion is present in the posterior segments, the open bite is probably of functional origin and interceptive treatment has a good chance of being successful.

Treatment Principles

First, it must be recognized that open bites in young children tend to self-correct with age. A period of observation may be indicated if the problem is not too severe. It must also be recognized that the prognosis for correction is age-dependent. Open bite corrections in adolescents are usually a challenge to successfully treat orthodontically and retention is often problematic.

An accurate differential diagnosis is important to avoid unnecessary treatment or a treatment protocol with little chance of success (i.e., attempting to treat an open bite of skeletal origin that may increase in severity with growth).

Once the decision is made to intervene, several treatment modalities exist.

Removable appliance with tongue crib (Fig. 4): This is usually an upper Hawley-type appliance with a crib placed lingual to the upper incisors in order to displace the tongue posteriorly and let the eruption potential of the anterior teeth express itself. Lip pressure alone can bring about full or partial correction. If lip pressure is insufficient for complete correction, a retraction force (applied with either a removable or a fixed appliance) should be used.

The crib must be big enough to ensure that the tongue will not position itself anteriorly underneath it. Some practitioners advocate using "spurs" (instead of or in addition to the crib) to provide a nociceptive stimulus that will initiate an avoidance reflex and increase the probability of correction (**Fig. 5**).

Fixed crib: Crib attached to 2 molar bands. This is an efficient appliance but it has the potential to move the upper molars mesially in case of failure to correct the anterior positioning of the tongue, thereby displacing the problem. In such a case it may be advisable to use the fixed crib with a headgear to compensate for the mesial vector of force placed on the molars.

Tongue guard: An efficient appliance that is used only at night.

Speech therapy: A long procedure that requires a very cooperative patient. Success with this strategy is unpredictable. ◆

Further Reading

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Question 3

How can I lower the probability of a 9-year-old patient developing impacted maxillary canines?

Background to the Problem

The upper canine has the longest and most difficult path of eruption of all the teeth. For successful eruption it usually requires a mesial angulation of the upper lateral incisor root (ugly duckling stage), and its path of eruption must not be obstructed by the first premolar. It is the last tooth to erupt in the anterior part of the upper arch and must create space for itself.

Sometimes a routine panoramic radiograph of a 12-year-old will demonstrate retained primary canines and impacted permanent canines. A large percentage of these permanent canines will be palatally impacted. The treatment for this condition is usually complex, and carries a certain amount of risks (orthodontic as well as periodontic) (**Fig. 1**).

The best way to reduce the probability of impacted canines is to prevent the problem. Ericson and Kurol have extensively studied the causes of impacted canines and have come up with easy-to-follow guidelines to reduce their incidence.

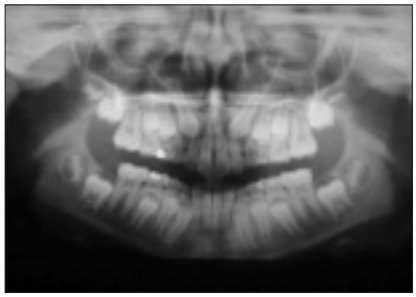

Figure 1: *Impacted maxillary canines.*

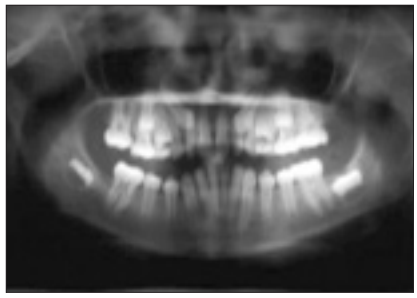

Figure 2: *Poor angulation of the upper permanent canines and lack of resorption of the primary canine root.*

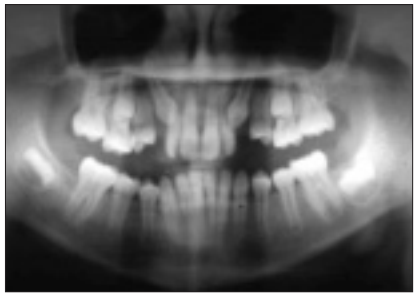

Figure 3: *Three months after the extraction of the primary canines. Canine impaction has been avoided.*

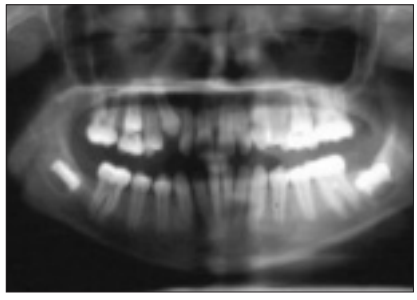

Figure 4: *The canines are erupting normally.*

Management of the Problem

For girls, a panoramic radiograph should be taken around 9 years of age (10 for boys). The exact timing depends on the dental age of the patient. The radiograph should show the crown of the upper permanent canine positioned between the upper lateral incisor and the upper primary canine. Ideally, some sign of resorption of the primary canine should be evident.

If the crown is properly positioned, no intervention is necessary. However, if there is no resorption of the primary canine and the crown of the permanent canine is starting to overlap the root of the lateral incisor, a second radiograph should be scheduled in 6 months. At the time of the second radiograph, the angulation of the permanent canine and the amount of crown overlap of the lateral incisor root should be recorded.

If the overlap has increased and the angulation of the canine is more than 30 degrees to the vertical, extraction of the primary canine is indicated. This simple procedure will reduce the potential for impaction of the permanent canine by more than 60% (**Figs. 2** to **4**).

The procedure described here is very simple and effective. However, proper case selection is important. Practitioners are reminded that the success rate of this treatment is not 100%. ◆

Further Reading

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Jacobs S. Reducing the incidence of palatally impacted maxillary canines by extraction of deciduous canines: a useful preventive/interceptive orthodontic procedure. Case reports. *Aust Dent J* 1992; 37(1):6–11.

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Question 4

When is forced eruption of a tooth indicated, and how can I perform it effectively?

Background to the Problem

The 2 main indications for forced eruption of teeth are to establish a better gingival contour in the upper anterior segment, especially before undertaking cosmetic restorations, and to recreate the biological width of a fractured or extensively decayed tooth before restoring the tooth. In the former situation, forced eruption is done without adjunctive fiberotomy, while in the latter, forced eruption is combined with fiberotomy.

Extrusion without Fiberotomy

In an esthetic smile the gingival margins must be symmetrical, with a pleasant and esthetic line of emergence for the anterior teeth (**Fig. 1**). The gingival line of the lateral incisors must be slightly lower than the gingival line of the central incisors and canines. Gingival contour should be in harmony with the shape of the crowns. Creation of an attractive gingival contour may involve periodontal or orthodontic treatment (i.e., selective intrusion and extrusion of anterior teeth), or a combination of both.

Technique for Forced Eruption without Fiberotomy

Dr. Retrouvey's preferred technique for this type of procedure is the indirect bracketing method. A diagnostic wax-up of the planned restorations should be made before performing the procedure.

Precision in bracket positioning is essential. The standard technique of bracket positioning, which uses the incisal edge as a reference, will not function in this type of case because the landmark will be the planned gingival contour.

You must calculate the amount of gingival displacement desired and position the bracket accordingly. After proper bracketing, a nickel-titanium wire is used to extrude the teeth into their new position. A beta-titanium wire with compensating bends is then used to finalize tooth position (**Fig. 2**).

Once gingival contour is finalized, proceed with fixed retention to avoid reintrusion or the undesired side effects of orthodontic therapy. You can restore the crowns with porcelain veneers or crowns (**Fig. 3**).

Tooth Extrusion with Fiberotomy

Two procedures can be used to re-establish the biological width of the periodontal ligament before restoring a tooth. Crown lengthening may be performed, but this procedure will sometimes result in a poor line of emergence and a less-than-optimal periodontal result. Another solution is to orthodontically extrude the root of the affected tooth *without* changing the gingival contour. This method is performed by selective extrusion combined with several fiberotomies (**Fig. 4**).

Figure 1: *Asymmetric gingival margin requiring recontouring.*

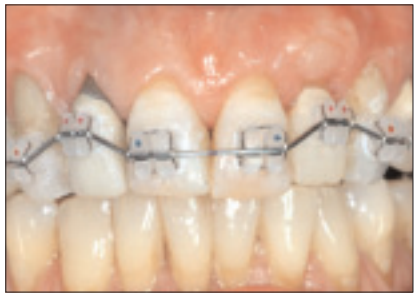

Figure 2: *Forced eruption using beta-titanium wire.*

Figure 5: *Radiographic view of extruded tooth.*

Figure 3: *Post-treatment view.*

Figure 4: *Initial bracketing to extrude tooth 11.*

Technique for Extrusion with Fiberotomy

"Passively" bracket the teeth adjacent to the tooth being extruded to avoid any movement. These teeth are used only as support (anchorage). As in the technique described above, you cannot use only the incisal edge as a reference.

The tooth being extruded should have an acceptable post and core build-up and a composite or acrylic temporary restoration that will facilitate bonding the bracket in place.

Place the bracket as gingivally as possible. If the bracket slot is 0.018 inches, use a square 0.016-inch Copper NiTi (Ormco Orthodontics, West Collins Orange, California) to deliver a light and continuous force and to control the extrusion in a labiolingual axis.

Occlusal reduction and fiberotomy must be performed at the same time as bracketing and must be repeated every 3 weeks to avoid an incisal displacement of the dentoalveolar crest.

Once the extrusion is satisfactory (**Fig. 5**), a final provisional restoration may be constructed and the tooth reattached passively to a metal wire (new bracket) for retention and bone reorganization. The final restoration should be done 3 months later. ◆

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

A Message to Clinicians

The *Journal of the Canadian Dental Association* (*JCDA*) is introducing a new feature in an upcoming edition, which we are calling "Clinical Showcase." As the title indicates, this will be a very clinically oriented feature, long on photos and short on words. The feature will be a series of pictorial essays showing how respected clinicians handle particular cases. Clinical Showcase focuses on the technical art of clinical dentistry. Based on surveys and conversations with dentists, this feature should be a popular one.

A Clinical Showcase article will contain a short introduction, a step-by-step case demonstration and a wrap-up section outlining the lessons learned from working on the case. Let's aim to show a case using an average of 20 images. If these images come in a digital format, they should have a resolution of 300 dpi at final size (2.25" × 3.33"). Figure captions should be concise and descriptive.

Would you be interested in being "showcased" in this manner? Also, do you know other dentists who have gifted hands and who take nice photos? If so, could you ask them to contact me, or can you please give me their names, so that I can invite them to participate? I would appreciate getting your referrals to these "dentist's dentist" types. I look forward to hearing from you at your convenience by e-mail at jokeefe@cda-adc.ca or by telephone at 1-800-267-6354, ext. 2297.

— John O'Keefe, Editor-in-Chief

THE CCCD NEEDS YOU!!

The Canadian Collaboration on Clinical Practice Guidelines in Dentistry (CCCD) is the national, autonomous body responsible for the creation of evidence-based guidelines for dentistry in Canada. Clinical practice guidelines (CPGs) summarize the best available research evidence on a particular topic to provide guidance for dentists and patients. One of the key principles of the CCCD is that CPGs in Canada will be developed BY dentists, FOR dentists.

Who can be involved?

All dentists practising in Canada are eligible to be entered into the database of potential reviewers. An academic, research or specialty background is NOT necessary.

What does a reviewer have to do?

For each guideline, a random sample of reviewers will be drawn from the database. Each reviewer will be sent a preliminary draft of the guideline under development and a structured questionnaire. Feedback will be sought regarding the methods used to create the guideline and the importance, usefulness and implications of the draft recommendations for practice. The information from this feedback will be used to modify the clinical recommendations as necessary.

What about confidentiality?

Your privacy in registering for the database will be assured. The information you provide will ONLY be used to contact volunteers for this initiative. Confidentiality of the reviewers will be maintained. No individuals will be identified in any report or publication of the CCCD.

How do I register for the CCCD database?

Please contact: Dr. Debora Matthews, c/o Department of Dental Clinical Sciences, Dalhousie University, 5981 University Avenue, Halifax NS B3H 3J5
Fax: (902) 494-1662; e-mail: dmatthew@dal.ca
For online registration, please visit our Web site at www.cccd.ca.

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.*

Pulpdent's **Kool-Dam Heatless Liquid Dam and Block-Out Resin** protects the gingiva during power bleaching, sandblasting or other procedures that require shielding of surrounding areas. Kool-Dam remains cool, thereby assuring patient comfort. Kool-Dam creates a flexible, rubbery dam that offers full protection, yet is tear-resistant and easy to remove. The material does not run, so clinicians can cover all necessary areas in one application, which saves time and eliminates repeated light-cure procedures. It can also be used to block out undercuts before taking impressions.

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

Crosstex **IC Eyewear** allows clinicians to secure their masks to the eyewear, eliminating the discomfort of mask loops around the ears. Hooks molded into the eyewear's temple arms hold the mask snugly in place, assuring maximum protection and comfort. Attaching the mask to the eyewear (rather than the ears) also allows easy placement and removal of both the eyewear and mask, without sacrificing protection. Crosstex IC Eyewear accepts most eyewear-attached loupes.

• Crosstex, 888-Crosstex •

Microbrush Corp. introduces the **Microbrush X**, the newest member of its family of Microbrush applicators. The applicator is designed with a thinner, longer brush tip to simplify application for procedures involving confined spaces such as bonding posts, inlay, onlay cementation and subgingival application. The shorter, stiffer brush fibers hold a fraction of a drop of material for precise placement and allow for scrubbing. The applicator bends firmly to 90 degrees for ease of use. The Microbrush X kit includes a cartridge of applicators and a Microbush X dispenser. The cartridge dispenses one applicator at a time, eliminating cross-contamination.

• Microbrush Corporation, +1-262-375-4011, www.microbrush.com •

Sirona Dental Systems presents 2 additions to its hygiene systems. **Siroclean** is a compact and user-friendly system designed for machine-based cleaning and thermochemical disinfection of dental instruments. Compared with manual cleaning, Siroclean significantly reduces labour input and minimizes the risk of contamination caused by sharp instruments. The **Siromini B** is a high-speed sterilizer designed to handle difficult sterilization loads (e.g., hollow objects like dental handpieces). The system is easy to use; the 4 standard programs and a variety of other options can be selected at the touch of a button. Its compact footprint means it can be accommodated virtually anywhere in a dental practice.

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

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Offices & Practices

ALBERTA - Calgary: Dental practice for sale producing $950,000 on a 4-day week. Located in north west Calgary. Please reply to: CDA Classified Box # 2837. D1366

ALBERTA: Wanting to slow down? Energetic dentist looking for a progressive practice to purchase. I prefer a modern practice focused on comprehensive care. I am open to a transitional phase. If you want your clients well taken care of, e-mail me: stardentist@hotmail.com D1359

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: e-mail dentgent@shaw.ca D1346

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

BRITISH COLUMBIA - Vancouver: Surrey; Newton and 72nd Avenue, adjacent to established medical clinic, wade pool and superstore. High traffic location. Four operatories, wired and plumbed. Dentist's lease expires May 31, 2003. Tel. (604) 261-2014. D1352

BRITISH COLUMBIA - Sparwood: (Two hours southwest of Calgary). Soon to be vacated 5-operatory dental space. Stable industrial base. High percentage of dental plans. Twenty minutes to world-class ski resort. Supernatural environment. First year rent free. Join Western prosperity! Call Cal, (250) 425-2616 (days), (250) 425-0567 (evgs.). D1353

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 - 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

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, intra-oral 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

ONTARIO - North York: Practice for sale at Yonge and Steeles. One operatory - gross $300,000+, 2 operatories newly equipped. More potential for growth. Pleasant staff and patients. Fax (416) 229-6114. D1367

ONTARIO - Downtown Toronto: Bay Street, newly renovated building. Suitable for medical/dental/optical and other professional uses. New cabinets, reception, counter and displays. Entire floor, 3,003 sq. ft., dividable; tax, maintenance, insurance at $17.50/sq.ft. includes utilities and janitorial service. Call Betty, (416) 543-1300. D1248

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. New development in area. Please leave message, tel. (416) 892-3240. D1334

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

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 - Banff: Associate required for progressive dental practice that is experiencing dynamic growth. Associate must have exceptional patient communication skills, be committed to excellent dentistry and have a strong interest in continuing education. Please e-mail resumes and cover letter to saurora@telusplanet.net or fax to (403) 762-8095. D1368

ALBERTA - Elk Point: Full-time associate required for August 2003. Unique opportunity to be your own boss with no investment as the only dentist in this charming town just 2 hours from Edmonton. This is a satellite practice, long term and established over 25 years with a large clientele. Long-term experienced staff, easy transition. Four clean, bright, spacious operatories, hygienist 2 days/week, good equipment, panorex, air abrasion, intra-oral cameras, etc. An exceptional opportunity to provide lots of high-quality dentistry to clients who really need and appreciate your services while earning an income substantially above average. Current associate leaving to pursue postgraduate studies. For details contact: Dr. Eric Hansen, tel. (780) 594-5150 (Cold Lake) or e-mail ehan@telusplanet.net D1363

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

ALBERTA - Edmonton (South): Exciting and fulfilling associate opportunity available immediately. Position is full time in an established, fast-paced family practice. We are seeking an individual who is enthusiastic, motivated and looking to complement a great team. Please call (780) 465-0994 or fax in confidence (780) 463-4691. D1326

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 D1337

ASSOCIATE

Calgary, Alberta

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

Please reply to: CDA Classified Box 2813. D991

ALBERTA: Associate positions available immediately at busy, relaxed and friendly dental office. Excellent energetic support staff. Just quick 2 hours west of Edmonton. Great family-oriented town. Excellent opportunity for a self-motivated, conscientious individual. New graduates welcome. Also open for purchase option. For more information, tel. (780) 779-0030 (res.), (780) 778-4646 (bus.), (780) 706-6142 (cell). D1321

ALBERTA - Rural: Full-time associateship 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

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

BRITISH COLUMBIA - Central: Associate wanted. Real small-town practice. Do it all, endodontics, crown and bridge, orthodontics, general anesthetics hospital setting, extended care, etc. Learn from over 30 years experience. Owner needs time for other interests and will mentor a few days a week. Full appointment book and excellent staff support and hygiene. Progressive practice with air-abrasion, microscope, new panorex, etc. E-mail collardp@telus.net D1364

BRITISH COLUMBIA - West Kootenay: Locum/associate. Maternity locum required for a very busy family practice. Lots of new patients, active periodontal program, all aspects of general dentistry practised. If you enjoy the outdoors, you'll love the area. Lots of great cycling in the mountain bike capital of Canada, golfing, hiking, awesome downhill skiing at Red Mountain and great cross-country skiing. Potential for associateship if you decide you love the area. Please contact: Dr. Jillian Sibbald, tel. (250) 367-6494 or at home, (250) 362-2130. D1362

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, anesthetist 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: 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 - Winnipeg: Associate required immediately for established Winnipeg practice. Current associate is leaving the province. This position will allow you to utilize the full range of your skills in a relaxed and supportive environment. Suitable for a new graduate or experienced practitioner. Contact: Dr. Grant Ferens, tel. (204) 667-2486 or e-mail gtferens@shaw.ca D1356

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

PARTNER

Nova Scotia - Halifax Area

Modern, attractive 8-operatory 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

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

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

NUNAVUT - Iqaluit: 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 - Toronto (East York): Associate required. We are looking for a dentist with 5 years experience, good clinical skills and a warm, outgoing personality. Please contact Carmen, tel. (416) 421-3751. D1361

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 - Ottawa: Endodontist required. 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 - 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 - 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 - Kanata: Associate: seeking a dynamic, outgoing, team-oriented individual to join a large, well-established group practice in Kanata, Ontario. Our team of family dentists, hygienists, specialists (orthodontist, periodontist) and denture therapist provide progressive, preventive treatment to patients in the fastest growing area of the Nation's Capital. We provide on-site lab services for high-quality crowns, bridges, veneers and implants. Please call Catherine or Kaarla at (613) 592-2900, Monday to Thursday, between 8 a.m. - 3 p.m. Forward resume to the attention of: Dr. Burton Merkley, Hazeldean Dental Group, 300 Eagleson Rd., Kanata, ON K2M 1C9; fax (613) 592-4028. D1354

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

QUEBEC - South Shore Montreal: Looking for associate, multifaceted and dynamic, to work full- or part-time (must include Thursdays, Fridays, and every other Saturday). A hygienist is on site for those 3 days. Great patient base. Multidisciplinary practice continually growing and located in a medical clinic. Tel. (450) 462-4975 D1365

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

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. D592

OMAN: General dentist required for the Gulf area. Applicant should have a minimum 5 years experience, pleasant personality and be self-motivated. Initial 1-year contract, renewable based on performance. Tax-free package plus profit share. Call Dr. Khaled, 011 968 9310035, e-mail drkhaled@omantel.net.om D1357

CONFERENCES

NORTHWEST DENTAL EXPOSITION 2003: Presented by the Edmonton and District Dental Society, Friday, Sept. 26, 2003. Featuring Gerald Kugel and keynote speaker Eveline Charles. Enquiries, tel. (780) 459-1275. D1360

PROFESSIONAL SERVICES

www.dentaljobs.ca: Dentists, dental hygienists, CDAs, and all other dental personnel interconnect here with long- and short-term jobs. Search for jobs and available personnel; list a vacancy or personal availability on this user friendly web site. D1230

ADVERTISERS' INDEX

Canadian Dental Association
L'Association dentaire canadienne

A Plea for Better Interconnectedness with CDA Members

CDA **urgently** requests that its members provide the Association with their e-mail addresses. Electronic communication is the most efficient method to alert you about urgent matters of public health and practice viability.

This year alone, we have sent out two extremely important alerts — one dealing with the fraud perpetrated by the fictitious Dental Association of Canada, the other advising dentists on how to come to grips with the outbreak of Severe Acute Respiratory Syndrome (SARS).

Yet to ensure that our messages reach all CDA members, we must supplement our e-mail communications with faxes, letters and phone calls — an expensive and time-consuming process.

By giving us your e-mail address, you are making it possible for us to 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 by sharing your e-mail address with others or by sending you information that is not pertinent to your interests.

We ask that you send your e-mail address right away to **reception@cda-adc.ca**. If your e-mail address has recently changed, please contact CDA so we can update it in our records. Or you can access your member profile on CDA's Web site and update your e-mail address online.

CDA Funds

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CDA Fund Performance (for period ending April 30, 2003)

	MER	1 year	3 years	5 years	10 years
CDA CANADIAN GROWTH FUNDS					
Aggressive Equity Fund (Altamira)	up to 1.00%	-9.7%	-1.5%	-1.4%	n/a
Common Stock Fund (Altamira)	up to 0.99%	-15.9%	-11.1%	0.3%	5.2%
Canadian Equity Fund (Trimark)	up to 1.65%	-13.8%	2.1%	2.5%	8.1%
Special Equity Fund (KBSH)	up to 1.45%	-18.6%	-21.9%	-1.2%	14.4%
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%	-13.7%	-9.5%	-1.0%	n/a
European Fund (KBSH)	up to 1.45%	-32.3%	-23.2%	-7.3%	n/a
International Equity Fund (KBSH)	up to 1.45%	-31.0%	-24.7%	-4.5%	n/a
Pacific Basin Fund (KBSH)	up to 1.45%	-32.1%	-36.4%	-6.3%	n/a
US Equity Fund (KBSH)	up to 1.20%	-26.9%	-20.0%	-1.5%	9.7%
Global Fund (Trimark)	up to 1.65%	-17.1%	3.9%	4.7%	11.8%
Global Stock Fund (Templeton)	up to 1.77%	-27.1%	-9.9%	n/a	n/a
S&P 500 Index Fund (BGI)	up to 0.67%	-21.4%	-14.6%	-3.1%	10.3%
CDA INCOME FUNDS					
Bond and Mortgage Fund (Elantis)	up to 0.99%	7.5%	6.7%	5.1%	6.9%
Fixed Income Fund (McLean Budden)	up to 0.97%	7.4%	7.6%	5.6%	7.9%
CDA CASH AND EQUIVALENT FUND					
Money Market Fund (Elantis)	up to 0.67%	2.1%	3.4%	3.8%	4.3%
CDA GROWTH AND INCOME FUNDS					
Balanced Fund (KBSH)	up to 1.00%	-8.6%	-6.3%	1.4%	6.7%
Balanced Value Fund (McLean Budden)	up to 0.95%	-7.7%	1.4%	3.7%	8.2%

CDA figures indicate annual compound rate of return. All fees have been deducted. As a result, performance results may differ from those published by the fund managers. CDA figures are historical rates based on past performance and are not necessarily indicative of future performance. The annual MERs (Management Expense Ratios) depend on the value of the assets in the given funds. MERs shown are maximum.

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

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

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