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Restorative Dentistry & Prosthodontics

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Restorative Dentistry and Prosthodontics

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JCDRP

Journal canadien de
dentisterie restauratrice et de prosthodontie

Publication officielle de l'Académie canadienne
de dentisterie restauratrice et de prosthodontie

**CAD/CAM Dentistry /
CAO/FAO dentaire**

**CAD/CAM Product Profile /
Profil de produits CAO/FAO**

**Dental Materials /
Matériaux dentaires**

**Fixed Prosthodontics /
Prosthodontie fixe**

**Practice Management /
Gestion de cabinet**

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MESSAGE FROM THE EDITOR-IN-CHIEF
MESSAGE DU RÉDACTEUR EN CHEF

Computerized Dentistry: Benefits and Challenges

Over 20 years ago Siemens introduced Cerec I (Dr. Mörmann, University of Zurich) to the profession and marketed the *Fascination of Dental CAD/CAM*. Soon thereafter, Dr. François Duret from Lyon, as well as his uncle Bernard, also a dentist, lectured internationally, presenting the innovative Hennson Dental CAD/CAM system. In fact, the latter was keynote speaker at CARD's 1987 Annual Scientific Meeting in Québec City.

Since the mid-80s, chair-side and laboratory-specific CAD/CAM systems have been flourishing and have come a long way. And they continue to integrate state-of-the-art, sophisticated hardware and software, representative of prevailing computer technology. Other computer applications have also greatly modified dental practice, such as digital radiography and photography, computer-guided surgeries, shade selection, periodontal charting, and jaw tracking systems, to name a few. The aim of these applications is to objectively measure patient data in order to support and facilitate diagnostic and treatment modalities, as well as practice management requirements. The operative words are *support and facilitate* the dentist's practice. The dental industry has painstakingly sought to integrate hardware and software components with an eye to their upgrading capabilities for the current dental office. Consequently, the overall results have changed the patient's dental experience for the better by reducing the duration of many chair-side procedures with the added value of built-in treatment quality control.

Computerized dentistry has significantly facilitated the spread of tele-dentistry as well as Internet-based professional training

and interactions, such as referrals and patient follow-ups, including dental laboratory and third party payment communications. Broadband connectivity is now able to store digitalized patient data and procedures allowing for quick and easy participation of colleagues and collaborators in our diagnostic/treatment outcomes. All of this can be done selectively, under secure and encrypted transmissions that can be authenticated and stored long term. Such practice oriented information is therefore made available to the profession for the purpose of improving patient care and practice building decisions.

Now that we recognize some of the benefits of computerized dentistry, let's look at some of its challenges. Overall, there has been a decreasing resistance to computerized technologies invading the dental office environment. This is mainly due to the younger techno-savvy dentists who are now buying into such applications and feeling comfortable doing so. Accordingly, such a reality entails the challenge for our dental faculties to work closely with the dental industry in order to introduce such widespread practice environments to dental students at all levels. Creative and participatory funding from the profession for these important and pressing up-to-code expenses must be addressed now!

MESSAGE FROM THE EDITOR-IN-CHIEF

A further challenge is for dentists to continue receiving comprehensive support from the dental laboratories of their choice. Internet labwork outsourcing could drive a wedge in this privileged collaboration as additional CAD/CAM options appear. We have all experienced the frustration of trying to communicate with outsourced computer support services offered by reputable manufacturers. And we should ask ourselves whether dictates from milling centres half way around the world will replace the knowledge and decisions that dentists should be making. It is becoming apparent that the emerging dynamics and increased possibilities of CAD/CAM can no longer be relegated to a marginal role in our daily practices. The challenge of integrating interactive diagnostic and treatment plan softwares to restorative design softwares is, in my view, the next logical step in computerized dentistry.

We are welcoming new contributors in this Issue. LCol Martin Brochu's article "Focus on Dental Scanners: The Science Behind" is a timely contribution and a welcome resource as we seek to assimilate the various characteristics of updated and emerging dental scanners. Technologies pertaining to laboratory scanners and intra-oral scanning devices with either open or closed architec-

ture are explained with reference to their respective manufacturers. The need for further documentation using comparative randomized clinical trials with these various scanners as well as objective practice learning curve integrations is quite apparent as we massively prepare to leave the "Stone Age" behind.

In our second series on Practice Management, we begin with the first of three articles by Mr. Jacques Marois. "Dental Leadership" and its intricacies will be systematically presented so that genuine and relevant leadership skills become achievable by all. Four dimensions of leadership are exposed with reference to integrated models. This article calls upon our introspective skills and underlines the benefits we can reap by adopting the author's visionary strategies.

Dr. Harry Rosen presents a restorative clinical case report that highlights the alternatives to contra-indicated invasive procedures, such as dental implants or extensive periodontal surgeries, for medically compromised patients. Controlled and selective crown lengthening using the metal band impression technique is extensively illustrated and contrasts with the present limitations of intra-oral digital scanners.

Dr. Gildo Santo's second article contribution

on Restorative Dental Materials details an in vitro study comparing the significantly lower shear bond strength of self-etching adhesive systems to two- and three-step adhesive systems. The author also highlights the similarities between two- and three-step adhesive systems.

We are inaugurating a Computerized Dentistry section and are calling for scientific as well as product profile articles that disclose useful information, relevant to practitioners, and which document both the benefits and challenges of computerized dentistry.

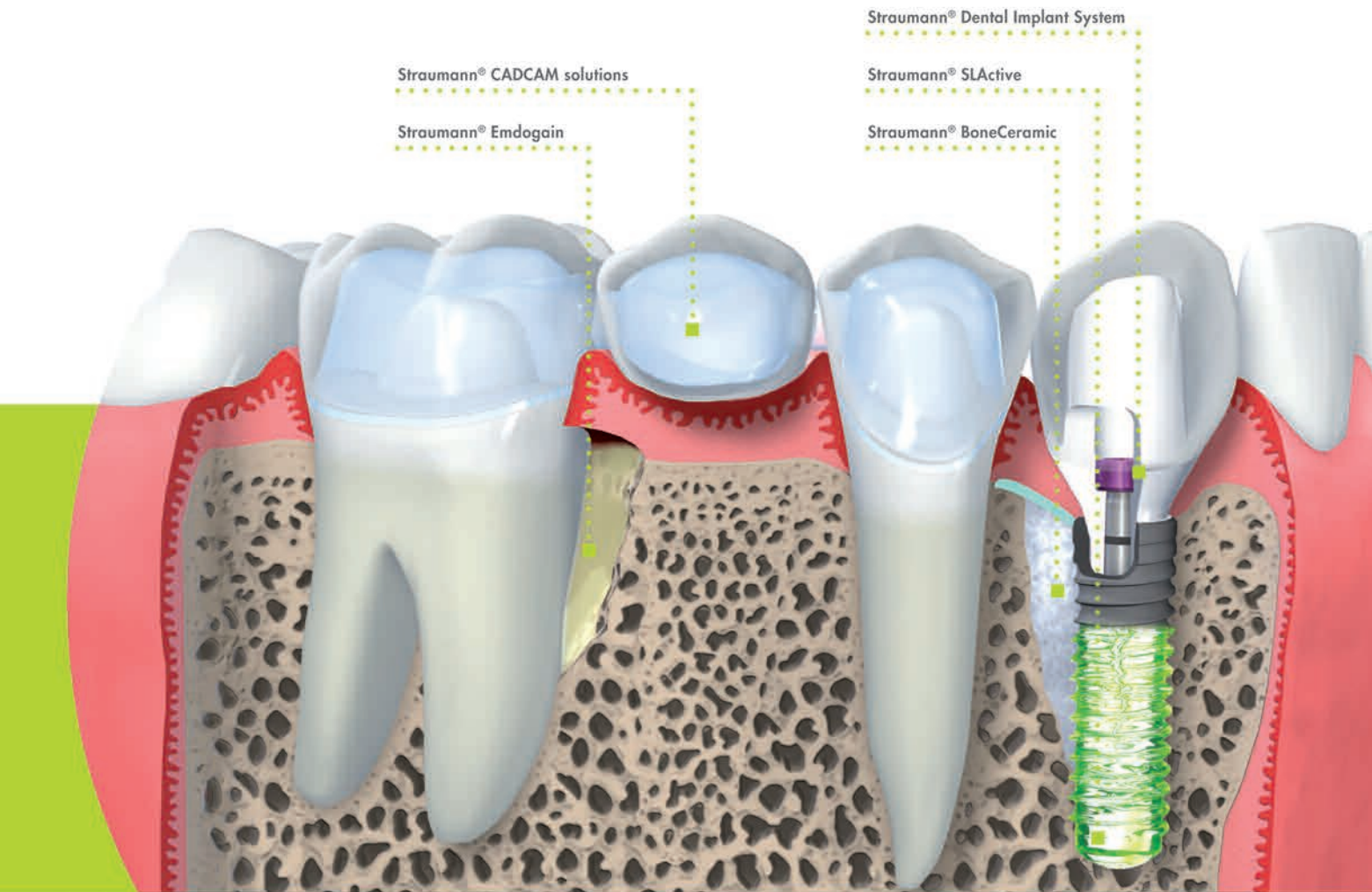
This issue of our *Journal* is spotlighting its first CAD/CAM Product Profile with the E4D system presented by Mr. Lee Culp, CDT and Dr. Lida Swann. The authors feature a *virtual workflow* involving all participants. The case study they introduce details the functions of this contemporary integrated chair-side CAD/CAM system.

Dr. Hubert Gaucher
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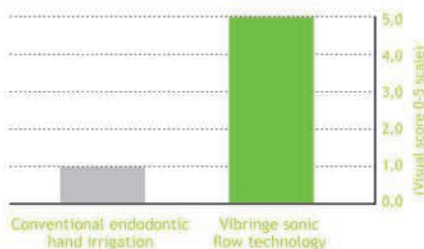


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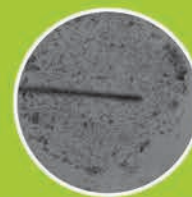


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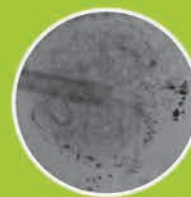


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Dentisterie informatisée :

Avantages et défis

Il y a plus de 20 ans, Siemens lançait Cerec I (Dr Mörmann, Université de Zurich) et commercialisait Fascination of dental CAD/CAM (*Fascination pour la CAO/FAO dentaire*). Peu de temps après, Le Dr François Duret de Lyon, ainsi que son oncle Bernard, également dentiste, donnaient des conférences partout dans le monde et présentaient le système innovateur de CAO/FAO dentaire Hennson. En fait, ce dernier a donné une conférence au Congrès scientifique annuel de l'ACDR en 1987 dans la ville de Québec.

Depuis les années 1985, les systèmes CAO/FAO utilisés dans les cabinets de dentistes et les laboratoires ont été florissants et se sont améliorés avec le temps. Ils continuent d'intégrer le matériel et les logiciels haut de gamme et ultra-modernes, très représentatifs de la technologie informatique actuelle. D'autres applications sur ordinateur ont grandement modifié la pratique dentaire, comme la radiographie et la photographie numérisées, les chirurgies assistées par ordinateur, le choix des teintes, la fiche parodontale, les systèmes de repérage des mouvements mandibulaires, pour n'en nommer que quelques-unes. Le but de ces applications est de mesurer objectivement les données du patient afin de confirmer et de faciliter le diagnostic et les modalités de traitement, ainsi que la prise en charge. Les termes performatifs sont *confirmer* et *faciliter*

la pratique du dentiste. L'industrie dentaire a cherché laborieusement à intégrer les composantes du matériel et du logiciel en surveillant leur mise à niveau dans le cabinet du dentiste. Par conséquent, les résultats ont amélioré l'expérience du patient chez le dentiste en réduisant la durée de plusieurs traitements et en ayant une valeur ajoutée au contrôle de la qualité du traitement.

La dentisterie informatisée a nettement facilité la dissémination de la télé-dentisterie ainsi que la formation et les interactions professionnelles sur Internet, telles que le suivi et les recommandations des patients à des spécialistes, y compris les communications entre les laboratoires dentaires et le paiement au tiers. La connectivité à large bande peut maintenant mettre en mémoire les données numérisées sur le patient et son traitement permettant une participation rapide et

facile des collègues et collaborateurs au diagnostic et au traitement. Tout cela peut se faire de manière sélective, par des transmissions sécuritaires et encodées qui peuvent être authentifiées et stockées à long terme. Cette information peut donc être communiquée aux professionnels pour améliorer les soins du patient et les décisions par rapport à la pratique.

Maintenant que nous reconnaissons certains avantages de la dentisterie informatisée, examinons les défis qu'elle représente. En général, il existe moins de résistance face aux technologies informatisées dans le cabinet du dentiste. Ceci est principalement dû aux jeunes dentistes technomanes qui croient en ces applications et se sentent à l'aise de les utiliser. Par conséquent, une telle réalité devrait pousser nos facultés de médecine dentaire à travailler étroitement avec l'industrie dentaire afin de favoriser un milieu de pratique contemporain pour les étudiants à tous les niveaux. Les formules nouvelles de financement participatif à ces dépenses importantes doivent être discutées maintenant!

Un autre défi pour les dentistes est de pouvoir maintenir leur choix de support global en matière de laboratoires dentaires. Nous avons tous eu la fâcheuse expérience d'un service informatisé à distance offert par certains manufacturiers. Le travail de laboratoire en sous-traitance au moyen de l'Internet nuira-t-elle à la

relation collaborative privilégiée entre le dentiste et le technicien dentaire? Les préceptes imposés, provenant de centres d'usage à l'autre bout du monde, remplaceront-ils le savoir et la prise en charge du dentiste lorsque les technologies CAO/FAO deviendront plus répandues? La dynamique émergente ainsi que les capacités accrues de la CAO/FAO ne peuvent plus être remises à l'arrière plan dans notre pratique quotidienne. Le défi d'intégrer des logiciels interactifs de Diagnostic et de Plan de traitement aux divers logiciels de restaurations CAO/FAO est, à mon avis, la prochaine étape logique en dentisterie informatisée.

Nous souhaitons la bienvenue aux nouveaux contributeurs à ce numéro. L'article du LCol Martin Brochu intitulé « Plein feu sur les scanners dentaires numériques : La Science à l'appui » est un article tout à fait à propos et une ressource très valable puisque nous essayons d'assimiler les caractéristiques différentes des nouveaux scanners et des scanners modernisés. Dans cet article, il explique les technologies concernant les modules de balayage pour laboratoires et intra-oraux ayant une architecture ouverte ou fermée et donne la liste des fabricants respectifs. Au fur et à mesure que nous délaissions l'âge de pierre, il est essentiel

d'obtenir plus de documentation au moyen d'essais cliniques de comparaison à répartition aléatoire avec ces différents scanners et de choisir objectivement leurs courbes d'apprentissage respectives.

Dans notre seconde série sur la gestion de la pratique, nous commençons avec le premier de trois articles rédigé par M. Jacques Marois. Le « Leadership dentaire » et ses subtilités seront systématiquement présentés pour que les compétences en leadership puissent être acquises par tous. Quatre dimensions de leadership seront exposées en faisant référence aux modèles intégrés. Cet article interpelle nos compétences introspectives et souligne les bienfaits que nous pouvons retirer en adoptant les stratégies visionnaires de l'auteur.

Le Dr Harry Rosen présente un cas clinique donnant les faits saillants d'options possibles aux procédures invasives contre-indiquées, comme les implants dentaires ou la chirurgie parodontale, chez les patients dont la santé est moins qu'optimale. L'allongement contrôlé et sélectif de couronne utilisant une technique d'empreinte de bande métallique est bien illustré et contraste avec les limites actuelles des scanners numérisés oraux.

Le deuxième article du Dr Gildo Santo sur

les matériaux dentaires de dentisterie restauratrice traite en détail d'un essai in vitro comparant la force d'adhésion nettement inférieure de systèmes adhésifs automordançants aux systèmes adhésifs à deux ou trois étapes. L'auteur donne également les ressemblances entre les systèmes adhésifs à deux ou trois étapes.

Nous inaugurons notre section de dentisterie informatisée et demandons à tous de nous faire parvenir des articles scientifiques ou des profils de produit donnant de l'information utile aux dentistes et traitant des avantages et des défis de la dentisterie informatisée.

Ce numéro de notre *Journal* met en valeur le premier profil de produit CAO/FAO avec le système E4D présenté par M. Lee Culp, TDC et Dr Lida Swann. Les auteurs présentent une *transitique virtuelle* incluant tous les participants. L'étude de cas qu'ils présentent donne les détails sur les fonctions de ce système CAO/FAO contemporain et intégré.

Dr Hubert Gaucher
Rédacteur en chef



COMMITTEE STRUCTURE AND MEMBERS STRUCTURE DES COMITÉS ET MEMBRES



The Canadian Academy of Restorative Dentistry and Prosthodontics Académie Canadienne de Dentisterie Restauratrice et de Prosthodontie

CARDP consists of many volunteers that donate a lot of their time and talents. Below is an outline of the council and committee structure of the academy.

L'ACRDP est constituée de nombreux bénévoles qui offrent leur temps et talents. Ci-bas vous lirez un sommaire de l'organigramme du comité exécutif ainsi que des autres comités

The main governing body is made up of the executive council, which consists of: The President, President Elect, Past President, Vice President, and Secretary Treasurer.

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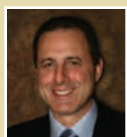
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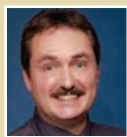
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Dr. Kim Parlett representing Ontario.
Dr. Terry Kolteck representing Manitoba and Saskatchewan.

Dr. Doug Lobb representing Alberta and the Northwest Territories

Dr. Myrna Pearce representing British Columbia and the Yukon.

Below this is the group of committee chairs and their committee members.

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2009 Joint Scientific Meeting

September 23rd - 26th, Montréal, Québec



Meeting Theme: "Tomorrow's Dentistry Today"

Meet Our Friday Speakers!

Dr. Lesley David & Dr. John Zarb

Topic: Current Concepts in Computer Guided Implant Solutions



Dr. David is an oral and maxillofacial surgeon who received her dental degree from McGill University. In addition to a private practice in Toronto, Dr. David is also a staff surgeon at the University of Toronto and an associate in the Oral and Maxillofacial Surgery Department. She is also on staff at the Mt. Sinai Hospital, the Credit Valley Hospital, and the Trillium Hospital. Dr. David is a Fellow and an examiner for the Royal College of Dentists of Canada in Oral and Maxillofacial Surgery.



Dr. Zarb earned his D.D.S. at the University of Detroit Mercy in 1995. Upon graduation, he completed a one year General Practice Residency at the VA Hospital in Ann Arbor, followed by graduate prosthodontic training at the University of Toronto, earning his M.Sc. in 2002. Dr. Zarb is a staff prosthodontist at the University of Toronto and at Mt. Sinai Hospital. He joined Barrie Prosthodontics in 2003. He is a Fellow and examiner of the Royal College of Dentists of Canada, a Fellow in the Academy of Dentistry International and an Associate Fellow of the Academy of Prosthodontics.



Dr. Paulino Castellón

Topic: The Effects of CAD-CAM and CT Guided Technology with Patient Care

Dr. Castellón received his dental degree from the University of Guadalajara, México. He obtained his Certificate in Prosthodontics from the Louisiana State University School of Dentistry where he also completed a Fellowship in Aesthetic and Implant Dentistry. His professional affiliations include the American College of Prosthodontists and the Academy of Osseointegration. Dr. Castellón is Associate Professor, Department of Prosthodontics at the LSU School of Dentistry. He has authored several publications with a focus on implant dentistry. He maintains a private practice in Metairie, Louisiana.



Dr. Izchak Barzilay

Topic: Is This Implant Integrated / Can This Implant Be Saved?

Dr. Barzilay received his D.D.S. from the University of Toronto in 1983, a Certificate in Prosthodontics from the Eastman Dental Centre in Rochester, NY in 1986, and a M.S. from the University of Rochester in 1991. He is currently Head of the Division of Prosthodontics and Restorative Dentistry, Mt. Sinai Hospital, Assistant Professor, University of Toronto, Adjunct Professor, Division of Prosthodontics of the Eastman Department of Dentistry, University of Rochester, Prosthodontic Examiner, Royal College of Dentists of Canada. He also holds fellowships in the Academy of Prosthodontics, Academy of Osseointegration, Royal College of Dental Surgeons of Canada, Pierre Fauchard Academy, and the Academy of Dentistry International.



Dr. Ashok Oommen

Topic: Health is Wealth: You're Richer Than You Think!

Dr. Oommen is an experienced family doctor and emergency specialist at McGill University Teaching Hospitals, a McGill University faculty lecturer, and the Medical Director of Cardiogenix Medical Centre. He has devoted his life to both helping patients with immediate and urgent health concerns, and to preventing healthy patients from developing life-threatening conditions. Throughout the years he has contributed his skills and expertise to several departments at major Canadian institutions: Montreal's St. Mary's Hospital, Royal Victoria Hospital, General Hospital and the Ottawa General Hospital.



Dr. Pierre Boudrias

Topic: The evolution of ceramic restorations: Zirconia

Dr. Boudrias obtained a D.M.D. in 1979 from the Université de Montréal. He went on to complete a two-year multidisciplinary residency in General Dentistry at the Jewish General Hospital in Montréal. He received a certificate in Prosthodontics and a Master of Science in Dentistry in 1985 from the University of Washington in Seattle. Dr. Boudrias maintains a private practice. He has served as examiner in Prosthodontics for the Royal College of Dentists of Canada. He is presently Director of the Department of Restorative Dentistry and Head of Fixed Prosthodontics at Université de Montréal. He is actively involved in teaching Fixed Prosthodontics and Implantology at the graduate and undergraduate levels.



Dr. Stefan Holst

Topic: Advances in Digital Dentistry with Trend-Setting Restorative Solutions and Treatment Options For All Indications

Dr. Stefan Holst studied dentistry at the Medical University of Hanover and obtained his doctorate in 2000 with the title of Dr. med. dent. From 2000 to 2001 he attended a postgraduate program in the Department of Prosthodontics at Louisiana State University, USA (Head: G. Chiche). Since 2006 Dr. Holst is appointed clinical associate professor and senior lecturer and heads the interdisciplinary histology section at the Dental Clinic, University Erlangen.

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Our Social Activities promise to be as exciting as in past years. Spend Thursday in Montréal experiencing what Nature has to offer. Golf will be available for those who wish. Also for the adventurer we will be featuring Kayaking on the Lachine River, or try the exciting sport of Zip Lining through the tree tops of Arbraska Park. Thursday Evening join us for the Welcoming Reception and meet our Sponsors for 2009. Friday evening will be a free one to reacquaint with old relationships and to make new ones. Also join us for the President's Gala and Dance the Night Away and dine on Montréal's finest cuisine.

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Dr. Leslev David & Dr. John Zarb

Sujet: Conceptualisation contemporaine de solutions implantaires assistées par ordinateur



Dr. David est chirurgienne buccale et maxillofaciale ayant obtenu son diplôme de McGill University. En plus de maintenir une pratique privée à Toronto elle oeuvre comme chirurgienne à University of Toronto et est associée dans le département de Chirurgie Buccale et Maxillofaciale. Elle fait aussi partie du personnel à l'hôpital Mt-Sinaï, l'hôpital Credit Valley ainsi que l'hôpital Trillium. Elle possède un Fellow et est

examinatrice pour le Royal College of Dentists of Canada en Chirurgie Buccale et Maxillofaciale.



Dr. Zarb a obtenu son D.D.S. à University of Detroit Mercy en 1995. Par la suite, il compléta une résidence de pratique générale d'un an à l'hôpital des vétérans à Ann Arbor, suivie d'une formation en Prosthodontie à University of Toronto lui méritant un M.Sc. en 2002. Il travaille comme prosthodontiste à University of Toronto et à l'hôpital Mt-Sinaï. Il fait partie de Barrie Prosthodontics depuis 2003. Il est Fellow et examinateur du Royal College of Dentists of Canada, Fellow de Academy of Dentistry International et Fellow associé de Academy of Prosthodontics.

Dr. Paulino Castellón

Sujet: Les effets de la CAO/FAO et de la tomographie numérique sur les soins



Dr. Castellón a obtenu son diplôme dentaire de l'Université de Guadalajara, México. Il reçut un Certificat en Prosthodontie de Louisiana State University School of Dentistry où il compléta aussi un Fellowship en dentisterie esthétique et implantaire. Ses affiliations professionnelles incluent le American College of Prosthodontists et Academy of Osseointegration. Dr Castellón est professeur agrégé au département de Prosthodontie du LSU School of Dentistry. Il est l'auteur de plusieurs publications portant surtout sur les implants dentaires. Il maintient une pratique privée à Metairie, Louisiane.

Dr. Izchak Barzilay

Sujet: Cet implant est-il ostéointégré/Peut-on le récupérer?



Dr. Barzilay a obtenu son D.D.S. de University of Toronto en 1983, un certificat en Prosthodontie du Eastman Dental Centre à Rochester, N.Y. en 1986, et un M.S. de University of Rochester en 1991. Présentement, il est directeur de la section Prosthodontie et dentisterie restauratrice à l'hôpital Mt-Sinaï, professeur adjoint à University of Toronto, professeur invité en Prosthodontie au Eastman, University of Rochester, examinateur en Prosthodontie au Royal College of Dentists of Canada. Il possède des Fellowships de Academy of Prosthodontics, Academy of Osseointegration, Royal College of Dental Surgeons of Canada, l'Académie Pierre Fauchard, ainsi que Academy of Dentistry International.

Dr. Ashok Oommen

Sujet: Santé égale richesse: vous êtes plus riche que vous ne le croyez



Dr. Oommen est un médecin de famille expérimenté et spécialiste en urgence dans les centres hospitaliers universitaires de McGill, chargé de cours, et Directeur médical de Cardiogenix Medical Centre. Il a consacré sa vie aux patients avec des problèmes urgents de santé ainsi qu'à la prévention de conditions graves chez les patients en santé. Au fil des années, il a contribué son expertise et ses aptitudes à plusieurs départements d'institutions canadiennes: St-Mary's Hospital, Royal Victoria Hospital et l'Hôpital Général à Montréal ainsi que le Ottawa General Hospital.



Dr. Pierre Boudrias

Sujet: L'évolution des restaurations toutes céramiques: le Zircon

Dr. Boudrias a obtenu un D.M.D. en 1979 de l'Université de Montréal. Par la suite, il compléta une résidence multidisciplinaire de deux ans en dentisterie générale au Jewish General Hospital de Montréal. Il a reçu un certificat en Prosthodontie ainsi qu'une Maîtrise en 1985 de University of Washington à Seattle. Il maintient une pratique privée. Il a été examinateur en Prosthodontie pour le Royal College of Dentists of Canada. Dr Boudrias est directeur du Département de Dentisterie restauratrice et chef de la Prosthodontie fixe à l'Université de Montréal. Il y enseigne la Prothèse partielle fixe et l'Implantologie aux premier et deuxième cycles.



Dr. Stefan Holst

Sujet: Progrès en dentisterie numérique offrant des solutions restauratrices d'avant-garde et des plans de traitements pour toutes situations

Dr. Holst a obtenu son D.M.D. en 2000 de l'Université médicale de Hanovre. Il a ensuite entrepris un programme de deuxième cycle d'un an en Prosthodontie à Louisiana State University. En 2006 il compléta l'équivalent d'un PhD en Réhabilitation dentaire à l'Université de Erlangen-Nuremberg. Son domaine d'expertise comprend l'esthétique dentaire portant sur l'implantologie, les prothèses parodontales ainsi que les traitements interdisciplinaires complexes. Sa recherche se penche surtout sur la dentisterie numérique, les restaurations toutes céramiques, les matériaux dentaires et la biomécanique.

Conférenciers du samedi à venir!

Traduction simultanée sur place!

Programme social

Rejoignez vos collègues et amis
Jeudi le 24 septembre 2009



Notre programme social sera toujours aussi excitant que par le passé. Le jeudi vous offre Montréal en pleine nature avec le golf pour ceux qui le désirent ou pour les plus aventureux, le kayak sur la Rivière Lachine ou encore, faites de la tyrolienne au-dessus des arbres du Parc Arbraska. Il y aura la réception de bienvenue en soirée où vous pourrez rencontrer les commanditaires de notre congrès. Le vendredi soir est libre, ce qui vous permettra de renouer avec vos amis et la ville de Montréal. N'oubliez pas de participer au Gala du Président le samedi soir pour un dîner exquis et de la danse.

Vérifier le site internet pour les mises à jour continues sur les Réunions Scientifiques!

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We at the *Canadian Journal of Restorative Dentistry and Prosthodontics* understand the sheer volume and speed of changes that today's dental professionals face. To help you keep on top of these developments within the industry, we are introducing our **Industry News section**, which will include select press releases concerning recent industry appointments and new product announcements.

Nous au *Journal canadien de dentisterie restauratrice et de prosthodontie* comprenons l'important volume et la vitesse des changements qui confrontent les professionnels dentaires. Dans le but de vous aider à demeurer bien informé au sujet de l'Industrie, nous présentons notre nouvelle Section Industrie, laquelle comprendra les communiqués de l'Industrie ainsi que les lancements de nouveaux produits.

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ProDrive Systems Appoints Richard St-Pierre as President and CEO

ProDrive Systems Ltd., announced that the board of directors has appointed Richard St-Pierre as president and CEO. Mr. St-Pierre, previously advisor to the board and a senior executive at ProDrive Systems for over three years, brings extensive management and strategic experience to the company.

"I am confident in the new leadership and strategic abilities that Richard will provide for ProDrive. Richard's experience and skills will be an invaluable resource," said Dr. Derek M.J Turner, founder and chairman of ProDrive. "Since commercially launching our product three months ago, ProDrive has shifted from intense R&D mode to bringing an overwhelmingly successful product to market. Richard plays a crucial role in managing our future and meeting our corporate objectives."

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If you have a press release you would like us to consider for Industry News, please forward them to
Scott Bryant, managing editor at:
scottqbryant@aol.com

Si vous avez un communiqué de presse à soumettre aux Nouvelles de l'Industrie, veuillez le transmettre à
Scott Bryant, Gestion de la Rédaction:
scottqbryant@aol.com



Call for Papers

Canadian Journal of Restorative Dentistry and Prosthodontics

CARDP's Executive has recently concluded a publishing Agreement with Andrew John Publishing Inc. The Academy's new Journal will have a circulation of 2,500 and be published four times a year, starting this March, followed by issues in May, August and December.

Editor – Dr. Hubert Gaucher

Associate Editors – Drs. Maureen Andrea, Emo Rajczak, and Dennis Nimchuk

The success of this Journal will depend on membership editorial contributions. Please consider submitting original articles, reviews, or participating in any of the following areas;

- I – **Articles (Original, Reviews, Case Reports):** Please visit www.cardp.ca for the "Instructions to Authors". Due dates are April 10, June 26, and September 26, 2009.
- II – **Membership News:** Please forward any news of interest to the profession.
- III – **Young Authors Awards Fund:** Financial contributions to this fund will recognize a dentist with 5 years' experience or less in practice and/or a graduate student in Canada, who will receive a \$1,000 award for the best published article of the year.
- IV – **Dental Student Award Fund:** Financial contributions to this fund will recognize a dental student in Canada, who will receive a \$500 award for the best published article of the year.
- V – **Section Editors:** Should you wish to serve as a section editor, please contact me and indicate your subject(s) of interest. It is important that a significant number of members become involved to reflect the broadest spectrum of member interests. Section editors for specific fields of interest (e.g., Dental Materials, Occlusion, Oral Biology, Microdentistry, CAD/CAM, Ceramic Restorations, Implant Dentistry) would be submitting articles and/or identifying potential Journal authors/contributors in their respective field.

If you have any comments or suggestions about submissions or would like to become more involved in the Journal, please contact me at:

hgaucher@sympatico.ca
Tel: (418) 658-9210
Fax: (418) 658-5393

Please visit www.cardp.ca for the CJRDP/JCDRP Instructions to Authors.

Demande de communications

Journal canadien de dentisterie restauratrice et de prosthodontie

Le bureau de l'Académie canadienne de dentisterie restauratrice et de prosthodontie a conclu une entente avec Andrew John Publishing Inc. La nouvelle revue de l'Académie aura un tirage de 2500 exemplaires et sera publiée quatre fois par année, soit en mars, en mai, août et décembre.

Rédacteur en chef – Dr Hubert Gaucher

Rédacteurs adjoints – Drs Maureen Andrea, Emo Rajczak, et Dennis Nimchuk

Le succès de cette revue repose sur la contribution de tous les membres. On demande aux membres de bien vouloir soumettre des articles originaux, des comptes rendus ou participer à ce qui suit :

- I – **Articles (originaux, comptes rendus, rapports de cas) :** Veuillez consulter notre site web www.cardp.ca pour les "Instructions aux auteurs" du CJRDP/JCDRP." Les dates d'échéance sont le 10 avril, le 26 juin, et le 26 septembre 2009.
- II – **Nouvelles aux membres :** Veuillez nous envoyer toute information pertinente à la profession.
- III – **Bourse pour les jeunes auteurs :** Les contributions financières à cette bourse permettront de remettre une bourse de 1000 \$ à un dentiste ayant moins de 5 ans de pratique et/ou à un(e) étudiant(e) gradué(e) au Canada pour le meilleur article publié au cours de l'année.
- IV – **Bourses pour étudiant(e)s en Médecine dentaire :** Les contributions financières à cette bourse permettront de remettre une bourse de 500 \$ à un étudiant ou une étudiante en Médecine dentaire au Canada pour le meilleur article publié au cours de l'année.
- V – **Rédacteurs d'une section :** Si vous désirez agir à titre de rédacteur d'une section, veuillez communiquer avec moi et indiquer les sujets qui vous intéressent. Il est important qu'un grand nombre de membres participent pour mieux délimiter la polyvalence des domaines d'intérêt des membres. Les rédacteurs d'une section pour divers domaines (p. ex., matériaux dentaires, occlusion, biologie orale, microdentisterie, CFAO, céramique dentaire, dentisterie implantaire), pourraient soumettre des articles et/ou identifier des auteurs ou collaborateurs dans leur domaine respectif.

Si vous avez des commentaires ou des suggestions à faire ou si vous désirez vous impliquer davantage dans la revue, veuillez communiquer avec moi :

hgaucher@sympatico.ca
Tél : (418) 658-9210
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Veuillez consulter notre site web www.cardp.ca pour les "Instructions aux auteurs" du CJRDP/JCDRP.



I - Young Authors Award Fund

Financial contributions to this fund will recognize a dentist with 5 years' experience or less in practice and/or a graduate student in Canada who will receive a \$1,000 award for the best published article of the year. Call for Papers include specific award rules and procedures for submissions to the Editor of the Canadian Journal of Restorative Dentistry and Prosthodontics (CJRDP).

Bourse pour Jeunes auteurs

Une contribution à ce fonds reconnaît un dentiste avec moins de 5 ans d'expérience pratique et/ou un étudiant de deuxième ou troisième cycle au Canada qui recevra une bourse de 1 000\$ pour le meilleur article publié de l'année. L'appel pour publications comprend des règles et procédures spécifiques pour soumission au Rédacteur en chef du Journal canadien de dentisterie restauratrice et de prosthodontie (JCGRP).

II - Dental Students Award Fund

Financial contributions to this fund will recognize a dental student in Canada who will receive a \$500 award for the best published article of the year. Call for Papers include the specific award rules and procedures for submissions to the Editor of the Canadian Journal of Restorative Dentistry and Prosthodontics (CJRDP).

Bourse d'étude en Médecine dentaire

Une contribution à ce fonds reconnaît un étudiant en Médecine dentaire au Canada qui recevra une bourse de 500\$ pour le meilleur article publié de l'année. L'appel pour publications comprend des règles et procédures spécifiques pour soumission au Rédacteur en chef du Journal canadien de dentisterie restauratrice et de prosthodontie (JCGRP).



The Canadian Academy of Restorative Dentistry and Prosthodontics
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Shear Bond Strength of Dual Resin Cement Bonded to Dentin with Simplified and Conventional Adhesive Systems

By Maria Jacinta Moreas Coelho Santos, DDS, MSc, PhD; Ivana Vilas Bôas Chagas, DDS; Elmo Castor Cerqueira dos Santos, DDS; and Gildo Coelho Santos Jr, DDS, MSc, PhD

ABSTRACT

The aim of this study was to evaluate the Shear Bond Strength (SBS) of a dual resin cement (Variolink II, Ivoclar/Vivadent) to dentin using five adhesive systems with different operative steps: (1) Adper Single Bond Plus (3M/ESPE), (2) AdheSe (Ivoclar/Vivadent), (3) Scotchbond Multi-Purpose Plus (3M/ESPE), (4) Adper Prompt (3M/ESPE), and (5) Excite DSC (Ivoclar/Vivadent). Forty intact human molars were selected and stored in 0.1% thymol solution. The teeth had their occlusal surface removed to expose the superficial dentin. All specimens were divided into 5 groups ($n = 8$). Each group was treated with a different adhesive system, according to the manufacturer's instructions. After the dentin treatment, a teflon matrix was adapted in the center of the exposed occlusal surface. The resin cement was inserted into the matrix and light cured for 40 seconds to obtain a cylinder of resin cement. The specimens were stored in 37°C distilled water for 24 hours prior to the test. All specimens were submitted to the shear bond strength (SBS) test. Data (in MPa) were analyzed by analysis of variance. ANOVA and Tukey test ($p > 0.05$) results showed the mean SBS to dentin (in MPa) was significantly higher for two- and three-step simplified adhesive systems groups 1 (10.00 ± 3.66), 3 (6.62 ± 2.56) and 5 (8.12 ± 2.80), when compared to the self-etching adhesives groups 2 (3.12 ± 2.16) and 4 (2.75 ± 0.88). Thus, self-etching adhesive systems presented SBS values to dentin that were significantly lower than the two- and three-step adhesive systems.

About the Authors

Gildo Coelho Santos Jr, is assistant professor, Division of Restorative Dentistry, University of Western Ontario, Schulich School of Medicine and Dentistry, London, ON.

Maria Jacinta Moreas Coelho Santos is adjunct professor, Division of Restorative Dentistry, University Western Ontario, Schulich School of Medicine and Dentistry, London, ON.

Ivana Vilas Bôas Chagas is in private practice in Brazil.

Elmo Castor Cerqueira dos Santos is in private practice in Brazil.

Correspondence may be directed to Gildo Coelho Santos Jr, DDS, MSc, PhD at gildo.santos@schulich.uwo.ca.



RÉSUMÉ

Le but de cette étude était d'évaluer la force d'adhésion supérieure d'une résine ciment à deux couches (Variolink II, Ivoclar/Vivadent) à la dentine en utilisant cinq systèmes adhésifs et différentes étapes d'opération : (1) Adper Single Bond Plus (3M/ESPE), (2) AdheSe (Ivoclar/Vivadent), (3) Scotchbond Multi-Purpose Plus (3M/ESPE), (4) Adper Prompt (3M/ESPE), et (5) Excite DSC (Ivoclar/Vivadent). Quarante molaires humaines intactes ont été choisies et conservées dans une solution de thymol à 0,1 %. La surface occlusale a été enlevée de façon à exposer la dentine de surface. Tous les spécimens ont été répartis en cinq groupes ($n = 8$). Chaque groupe a été traité avec un système adhésif différent, selon les directives du fabricant. Après le traitement de la dentine, une matrice de téflon a été adaptée au centre de la surface occlusale exposée. La résine ciment a été insérée dans la matrice et photopolymérisée pendant 40 secondes pour obtenir un cylindre de résine ciment. Les spécimens ont été conservés dans de l'eau distillée à 37 °C pendant 24 heures avant le test. Tous les spécimens ont été soumis au test de la force d'adhésion supérieure (SBS). Les données (en MPa) ont été analysées selon l'analyse de la variance. Les résultats de l'analyse de la variance et du test de Tukey fondé sur la variance ($p > 0,05$) ont révélé que la SBS moyenne à la dentine (en MPa) était significativement plus élevée pour le premier (10,00 + 3,66), le troisième (6,62 + 2,56) et le cinquième (8,12 + 2,80) groupes de système adhésif à deux ou trois étapes lorsqu'elle a été comparée au deuxième (3,12 + 2,16) et au quatrième (2,75 + 0,88) groupes de système adhésif auto-mordancant. Par conséquent, les systèmes adhésifs auto-mordancants ont donné des valeurs de la SBS à la dentine qui étaient significativement plus faibles que les systèmes adhésifs à deux ou trois étapes.

There is a trend to substitute the conventional adhesive systems which need cardinal steps of etching, priming, and bonding to teeth by the simplified versions, reflecting the professional desire to optimize speed and efficiency. After the introduction of single-bottle adhesives, self-etching systems were developed in order to omit the etching step. Simplified versions of both total-etch and self-etch adhesives are available to achieve bond effectively to dental substrates with or without the removal of the smear layer.^{1,2}

Although one-step adhesives permit a simplified clinical procedure, these systems are considered products of questionable clinical durability. The technological evolution used to develop them does not necessarily correspond to an improvement of the quality of these products.³

Self- or dual-curable resin composites that employ basic amines as part of the redox catalyst are incompatible with most of the simplified two-step adhesives and with all one-step self-etching adhesives due to the high concentration of acidic resin monomers.²⁻⁹ When simplified-step adhesives are used together with chemical or dual-curable resin composites, there is an interaction between the residual acidic monomers from the adhesive inhibition layer with the binary peroxide-amine catalytic components. As a result, the tertiary amines are neutralized by the acidic resin monomers and may lose their ability as reducing agents in redox reactions, thus resulting in slow or no polymerization of the resin composite, depending on the concentration of the acidic resin monomers from the adhesives.¹⁰

To solve the problem of chemical incompatibility, different co-initiators such as aryl sulphonate salts, ascorbic acid or barbituric acid salts were added on some adhesives in order to avoid the basic

tertiary amines be consumed by the acidic resin monomers from the simplified adhesive.^{2,6-8}

Apart from adverse acid-base reactions, the modifications done in the simplified adhesives formula (in order to develop a more hydrophilic and technically simple product), increased their susceptibility to the hydrophilic effects of the water, and turned them into permeable membranes after polymerization.^{1,2,4-7,8,11-13} The adhesive permeability may contribute partially for the incompatibility that was observed between the simplified-step adhesives and dual or auto-cured resin composites that utilized basic tertiary amines as catalytic components.

The permeability allows a continuous movement of dentin fluid on the bond interface, thus hindering a hermetic seal in the dentin surface. This condition interferes with the curing process of auto and dual-cured resin composites, due to the slower curing process, creating enough time for water diffusion, which will increase the hydrolytic degradation over time.^{2,4,5,11,12}

The water source used to create bubbles on the adhesive-dentin interface comes from the hydrated dentin; however, the permeability process is absent on two-step self-etching adhesives and conventional three-step ones, because they use an additional coat of more hydrophobic bonding resin, thus avoiding a direct contact between the resin composites and the acidic monomers from the primer.^{4,8}

The aim of this study was to evaluate the shear bond strength of conventional and self-etching adhesive systems when used with a dual resin cement to dentin. The hypothesis tested was that the conventional three-step adhesive system presents higher qualitative performance when compared to the simplified conventional and self-etched adhesives.

Materials and Methods

Preparation of the Specimens

Forty (40) non-carious human molars were collected after informed consent had been obtained under a protocol reviewed and approved by the institutional review board from School of Dentistry of the Federal University of Bahia, Brazil. After cleaning for both calculus deposits and soft tissue, the teeth were stored in 0.1% thymol solution. Prior to the bonding experiments, the teeth were retrieved from the disinfectant solution and stored in distilled water, with three changes of the distilled water within 6 days in order to remove the disinfectant.

The teeth were embedded in chemically cured acrylic resin (Sampl Kwick, Buehler, Lake Bluff, IL, USA). Each tooth had its occlusal enamel and superficial dentin removed, using a slow-speed saw (Isomet, Buehler Ltd, Lake Bluff, IL, USA) under water cooling. A series of SiC-papers ending with 600 grit was used on a polisher (Polimet, Buehler) to obtain a flat dentin surface at 1.5 to 2.0 mm distance from the pulp.

Bonding Procedure

Five adhesive systems (Adper Single Bond Plus-3M/ESP, AdheSe-Ivoclar/Vivadent, Scotchbond Multi-Purpose Plus-3M/ESPE, Adper Prompt-3M/ESPE, and Excite DSC-Ivoclar/Vivadent) and one resin-based luting agent (Variolink II-Ivoclar/Vivadent) were used. The compositions of the mate-

Table 1. Composition of the adhesive systems and luting cement

Adhesive/Cement	Composition
Adper Single Bond Plus	Bis-GMA, HEMA, polyalkenoic acid copolymer, ethanol, water, photoinitiator
AdheSE	Dimethacrylate, phosphonic acid acrylate, initiators, stabilizers, HEMA, dióxido de silicio
Scotchbond Multi-Purpose Plus (3M/ESPE)	Activator: ethyl alcohol, benzene sulfinic acid, sodium salt Primer: water, 2-hydroxyethyl methacrylate, polycarboxylic acid copolymer Catalyst: 2-hydroxyethyl methacrylate, bisphenol A diglycidyl ether, benzoyl peroxide
Adper Prompt	Phosphoric ester methacrylate, stabilizers, parabeno, fluoride, initiators
Excite DSC	Phosphoric acid acrylate, HEMA, ethanol, highly dispersed silicon dioxide, catalysts, stabilizers Microbrush coated with initiators
Variolink II	Base paste: Bis-GMA, UDMA and TEGDMA, fillers, pigments and stabilizers Catalyst paste: the same composition in addition to catalysts

Bis-GMA = bis-phenol A glycidylmethacrylate; HEMA = 2-hydroxyethyl methacrylate; UDMA = urethane dimethacrylate; TEGDMA = triethylenglycol dimethacrylate.

rials are listed in Table 1, and the application protocols are listed in Table 2. The teeth were randomly divided into 5 groups of 8 specimens each (Table 2). The dentin surface treatment for each group was done in agreement with the manufacturer's instructions for each product. A teflon matrix was used to obtain a cylinder of resin cement (3 mm bonding diameter and 3 mm height) on all pre-treated tooth surfaces. The dual resin cement was inserted in one increment and light-cured for 40 seconds (Gnatus Opthlight, Brazil)

(Figure 1). The intensity of the light (530 mW/cm²) was controlled by a radiometer (Optilux, Model 100, Kerr). After the removal of the matrix (Figure 2), new light activation was done for 40 seconds. The specimens were stored at 37°C in distilled water for 24 hours prior to the shear bond-strength measurement.

Shear Bond Strength Test

Each tooth was placed in an appropriate device in order to maintain stability and parallel to the base when positioned in a

Table 2. Experimental groups with their adhesive systems, classification and application procedures according to the manufacturing instructions

Groups	Adhesive Systems	Classification	Bonding Procedures
Group 1	Adper Single Bond Plus (3M/ESPE)	Conventional 2 steps	Etch with 10% phosphoric acid for 15 s. Rinse for 10 s. Blot excess of water using a mini-sponge. Apply two to three consecutive coats of adhesive for 15 s with gentle agitation using a fully saturated applicator. Gently air thin for 5 s. Light cure for 10 s.
Group 2	AdheSE (Ivoclar/Vivadent)	Self-etching. 2 steps	Apply primer for 15 s and agitate for more 15 s. Gently air thin. Apply adhesive. Gently air thin. Light cure for 10 s.
Group 3	Scotchbond Multi- Purpose Plus (3M/ESPE)	Conventional 3 steps	Etch with 10% phosphoric acid for 15 s. Rinse for 10 s. Blot excess of water using a mini-sponge. Apply activator. Gently air thin for 5 s. Apply primer. Gently air thin for 5 s. Apply catalyst. Not light cure.
Group 4	Adper Prompt (3M/ESPE)	Self-etching. 1 step	Mix one drop of each component for 5 s. Apply one layer and rub for 5 s. Gently air thin. Apply a second layer without rubbing. Gently air thin. Light cure for 10 s.
Group 5	Excite DSC (Ivoclar/Vivadent)	Conventional 2 steps	Etch with 10% phosphoric acid for 15 s. Rinse for 10 s. Blot excess of water using a mini-sponge. Apply adhesive for 10 s. Gently air thin. Not light cure.



Figure 1. Light-curing a sample.

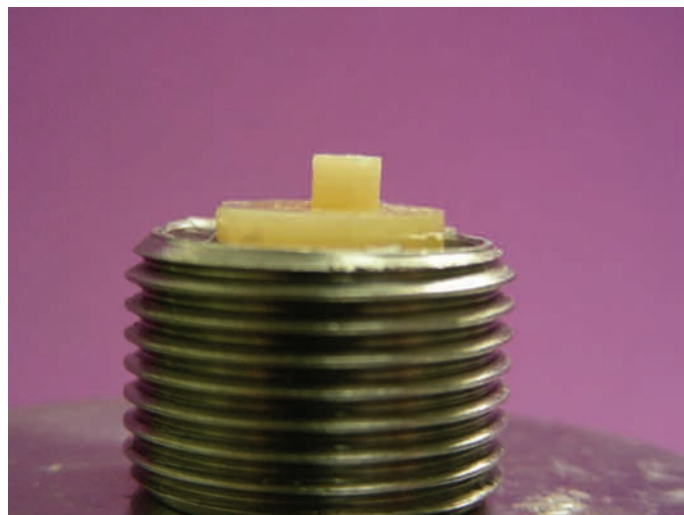


Figure 2. Sample after final polymerization showing the flat surface of tooth and the dual-cure resin cement build up.

universal testing machine (EMIC DL 2000). Shear bond strength was determined at a cross head speed of 0.5 mm/min. The test was carried with a stainless steel rod #8 attached to the device, forming a loop that involved the cylinder of resin cement, the closest possible of the interface dentin-cement. Bond strength was calculated in megapascal (MPa).

Statistical Analysis

A one-way analysis of variance (ANOVA) was performed to assess the significance of the differences in interfacial strength among five adhesive systems, followed by a Tukey test ($p > 0.05$) for post-hoc comparisons.

Results

The mean shear bond strength values and standard deviations (SDs) of the different

adhesives systems are shown in Table 3 and Figure 3. Self-etching adhesives used in groups 2 and 4 presented the smallest shear bond strength values. Groups 1 and 5, represented by the two-step simplified adhesive systems, showed the best performance presenting higher numerical values; however, no statistical difference was found among groups 1, 5 (conventional two-step adhesives) and 3 (conventional three-step system one).

Discussion

The current strategy for obtaining adhesion to the dentin substrate is divided into two techniques: one that demands a pre-

view dentin etching, which is characterized by the complexity of the clinical procedures, and the other that utilizes self-etching system that follows the current tendency of simplification.¹⁴

In the last few years a great number of simplified adhesive systems have been released in the market, although several studies have shown significant drawbacks to these new systems.^{4,5,8,9,11-13,15}

The chemical incompatibility of the simplified adhesive systems with auto- and dual-cured resin composites and the demonstration that these simplified adhesives work as permeable membranes after curing, prevent them to provide a hermetic

Table 3. Mean shear-bond strengths and standard deviation (SD) of the experimental groups

Group	Mean (MPa)	SD
1	10.00 ^A	3.66
2	3.12 ^B	2.16
3	6.62 ^{AB}	2.56
4	2.75 ^B	0.88
5	8.12 ^A	2.80

Same letters show no significant difference ($p < 0.05$)

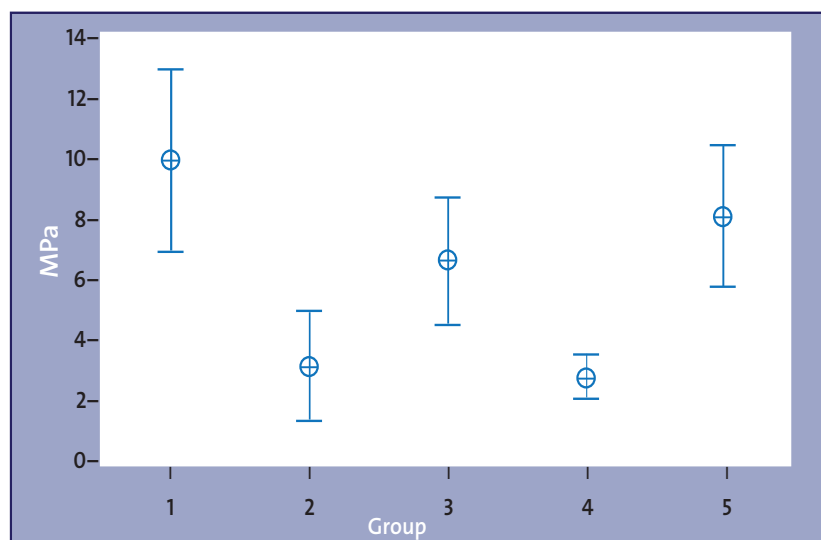


Figure 3. Mean SBS (MPa) and trust interval at 95% for all groups.

seal in dentin.²

In the present study, the simplified adhesive system, Excite DSC, presented one of the best results, due to its dual-cured adhesive that contains a chemical co-initiator which partially solves the chemical incompatibility problem with chemical and dual cure resin based products. Adper Single Bond Plus and Excite DSC presented higher numerical values; however, no significant differences were found among them and the conventional three-step adhesive Scotchbond Multi-Purpose Plus. Contrary to our results, other studies have found superior numeric results with Adper Single Bond Plus when compared to three-step adhesives.^{4,8,11,16} These differences may occur because of the type of test performed (microtensile X shear bond). Further studies should investigate the influence of the chemical incompatibility between simplified adhesives and chemical and dual cure resin based products over time, since this study does not present any difference when compared simplified adhesives to a conventional three-step, after 24 hours. Evaluation of the hydrolytic degradation over time may show the difference.

Self-etching adhesives were designed to bond to the smear layer of dentin. Frequently, high concentrations of acidic resin monomers are included in these products to turn them acidic enough to penetrate the smear layer and join the underlying intact dentin.⁷ The acidic pH level on the self-etching adhesives usually varies between 1.6 and 2.5.¹⁷ Recently, some studies have shown that one-step self-etching adhesives increase the hydrolytic degradation over time challenging the bond longevity of the resin composite materials.^{2,4,5,11,12}

In the present study, one- and two-step self-etching adhesive systems Adper Prompt and AdheSe, respectively, revealed no significant differences between them; however, a slight superior numerical difference could be found on AdheSe, most likely due to the use of an additional resin layer, presented on the two-step self-etching adhesive system. This resin layer is a non-acidic resin coating, relatively hydrophobic, and not permeable, which prevents the contact of acidic resin monomers with the basic tertiary amines.^{3,4,6,11,13,16} In the absence of a resin coating, water may migrate from an area of

low solute concentration (hydrated dentin substrate) to an area of high solute concentration (unpolymerized interface).^{2,4,6,9,11,18} The water movement across the cured adhesive layer occurs as a result of increased concentration of dissolved inorganic ions and hydrophilic groups that are retained within the oxygen inhibition layer. The high concentration of such ionic groups may establish an osmotic pressure gradient, which may generate droplets of water, which will accumulate in weak spots along the adhesive interface. As a result catastrophic failure along the adhesive-composite interfaces may be observed in those areas.^{2,4-9,12,13} Tay et al. (2002)¹² have reported some structures named “honeycomb” that are negative impressions of the water droplets that extruded out of cured adhesive interfaces as the relatively hydrophobic resin composite polymerized. The aim of this study did not examine the samples by SEM, thus, the presence or absence of these structures among the adhesives tested was not observed.

In this study the shear bond strength test was performed 24 hours after the bonding procedures. Longitudinal studies are necessary to investigate the hydrolytic degradation of the simplified adhesives along the time.

Conclusion

Within the limitation of this in-vitro study, the following conclusions may be drawn:

- The self-etching adhesive systems, AdheSe and Adper Prompt presented the lowest SBS values statistically inferior to the two- and three-step adhesive systems.
- The two-step adhesive systems, Adper Single Bond Plus and Excite DSC presented SBS values statistically similar to the three-step adhesive Scotchbond Multi-Purpose Plus.
- The hypothesis that the conventional three-step adhesive system would present a better performance was upheld when compared to the self-etching systems, but was rejected when compared to the simplified two-step adhesives.

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Disclosure

The authors declare no competing financial interests.

References

1. Hewlett ER. Resin adhesion to enamel and dentin: a review. *J Calif Dent Assoc* 2003;31(6):469–76.
2. Franco EB, Lopes LG, D'alpino PHP, et al. Evolution of compatibility between different types of adhesives and dual-cured resin cement. *J Adhes Dent* 2002;4(4):271–75.
3. Cheong C, King NM, Pashley DH, et al. Incompatibility of self-etching adhesives with chemical/dual-cured composites: two-step vs. one-step systems. *Oper Dent* 2003;28(6):747–55.
4. Tay FR, Pashley DH, Peters MC. Adhesive permeability affects composite coupling to dentin treated with a self-etching adhesive. *Oper Dent* 2003;28(5):610–21.
5. Tay FR, Pashley DH, Yiu CKY, et al. Factors contributing to the incompatibility between simplified-step adhesives and chemically cured or dual-cured composites. Part I. Single-step self-etching adhesive. *J Adhes Dent* 2003;5(1):27–40.
6. Tay FR, Suh BI, Pashley DH, et al. Factors contributing to the incompatibility between simplified-step adhesives and self-cured and dual-cured composites. Part II. Single-bottle, total-etch adhesive. *J Adhes Dent* 2003;5(2):91–105.
7. Suh BI, Freng L, Pashley DH, Tay FR. Factors contributing to the incompatibility between simplified-step adhesives and chemically-cured or dual-cured composites. Part III. Effect of acidic resin monomers. *J Adhes Dent* 2003;5(4):267–82.
8. Carvalho RM, Pegoraro TA, Tay FR, et al. Adhesive permeability affects coupling of resin cements that utilize self-etching primers to dentine. *J Dent* 2004;32:55–65.
9. Sanares AME, Itthagarun A, King NM, et al. Adverse surface interactions between one-bottle light-cure adhesives and chemical-cure composites. *Dent Mater* 2001;17:542–56.
10. Tay FR, Frankenberger R, Krejci I, et al. Single-bottle adhesives behave as permeable membranes after polymerization. I. In vivo evidence. *J Dent* 2004;32:611–21.
11. Tay FR, Pashley DH, Suh BI, et al. Single-step adhesives are permeable membranes. *J Dent* 2002;30:371–82.
12. Tay FR, Pashley DH. Have dentin adhesives become too hydrophilic? *J Can Dent Assoc* 2003;69(11):726–31.
13. Sensi LG, Lopes GC, Monteiro Júnior S, et al. Dentin bond strength of self-etching primers/adhesives. *Oper Dent*



- 2005;30(1):63-8.
14. Yesilyurt C, Bulucu B. Bond strength of total-etch and self-etch dentin adhesive systems on peripheral and central dentinal tissue: a microtensile bond strength test. *J Contemp Dent Pract* 2006;7(2):26-36.
 15. Santos MJMC, Navarro MFL, Tam L, McComb D. The effect of dentin adhesive and cure mode on film thickness and microtensile bond strength to dentin in indirect restorations. *Oper Dent* 2005;30(1):50-7.
 16. Finger WJ, Tani C. Effect of application mode on bonding performance of self-etching adhesives. *Am J Dent* 2005;18(1):41-4.
 17. Tay FR, Pashley DH, Garcia-Godoy F, Yiu CK. Single-step, self-etch adhesives behave as permeable membranes after polymerization. Part II. Silver tracer penetration evidence. *Am J Dent* 2004;17(5):315-22.

Dentiste et leader – Inspirez le dépassement!

Par Jacques Marois, MSc

Sous le thème « **Être dentiste et leader** », cette série de trois articles a pour objectif d'amener les dentistes à prendre conscience de l'importance de devenir de meilleurs leaders, des leaders plus complets, aussi bien dans leur clinique dentaire que dans leur vie.

Rares sont les dentistes qui travaillent complètement seuls. Ainsi, même les dentistes à pourcentage doivent assumer un certain leadership auprès de l'équipe qui les appuie. Ce que je constate c'est que, peu importe qu'ils soient de bons ou de moins bons leaders, la grande majorité des dentistes ne sont même pas conscients du fait qu'ils auraient beaucoup à gagner en devenant de meilleurs leaders.

C'est le leadership qui fait la différence

Les dentistes se considèrent avant tout comme des professionnels, des experts. Comme la plupart des experts, beaucoup de dentistes agissent comme si leur succès ne dépendait que de la qualité de leur expertise. **Cette croyance est fausse!** Ainsi, s'il est

vrai qu'il est très important d'être un bon dentiste pour réussir, il est démontré que, dans des domaines d'expertise comme la dentisterie, **c'est généralement le leadership et l'intelligence émotionnelle qui font toute la différence!**¹

Dans mon livre « Dentiste et leader »,² j'aborde la question du leadership sous divers angles. Dans les deux premiers articles, je vous présenterai mon modèle intégré de leadership. J'ai créé ce modèle en intégrant une approche philosophique du leadership, le « Diamant du leadership » de Koestenbaum³ à une approche que j'ai développée à partir des archétypes de l'homme mature proposés par Moore et Gillette.⁴

Selon moi, c'est plus important d'être un leader complet qu'un leader avec beaucoup de charisme ou avec beaucoup d'autorité. Un leader complet, c'est un leader compétent dans chacune des 4 dimensions du leadership présentées dans le schéma 1. Plus il sera compétent dans chacune de ces quatre dimensions du leadership, plus il sera en mesure de rallier son équipe pour l'amener à livrer des résultats remarquables. Ce qui

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est intéressant avec ces 4 dimensions, c'est que c'est tout à fait possible de s'améliorer dans chacune d'entre elles. Ainsi, même si vous n'êtes pas né leader, vous pouvez le devenir!

Avant d'examiner ce modèle de leadership, une précision s'impose. La qualité de votre leadership n'a rien à voir avec la taille de l'équipe que vous dirigez. Vous pouvez être à la tête d'une vaste organisation, avoir beaucoup de pouvoirs et être un très mauvais leader. Vous pouvez n'avoir qu'une assistante dentaire et être un excellent leader.

Ce modèle de leadership vous montre le chemin à suivre, au quotidien, pour mieux exercer votre leadership et obtenir ainsi encore plus de succès et de bonheur, dans votre clinique dentaire et dans votre vie.

Le leadership, c'est la capacité d'influencer les autres

Un leader, c'est quelqu'un qui prend la tête d'un groupe de personnes, qui les **influence** à penser et à agir dans la direction qu'il leur propose. Cette capacité d'influencer les autres est une compétence émotionnelle avancée qui s'appuie sur l'intelligence émotionnelle.

Vous avez du leadership si, au quotidien dans votre centre dentaire :

- Vous réussissez, lorsqu'un défi se présente, à amener chacun des membres de votre équipe à donner son plein potentiel.
- Vous réussissez à mobiliser votre équipe, peu importe les circonstances, pour que tous travaillent efficacement ensemble, dans la direction que vous leur proposez.
- Vous savez comment composer avec les émotions de vos patients. Vous savez quoi leur dire et quoi faire pour que la peur ne les empêche pas d'accepter les meilleurs traitements pour eux.
- Vous réussissez à établir des liens émotionnels forts qui fidéliseront à la fois les membres de votre équipe et votre clientèle.

N'oubliez jamais que, si vous êtes propriétaire de votre clinique dentaire, vous êtes forcément en position de leadership, même si, dans votre tête, vous vous sentez beaucoup plus dentiste que leader. Que vous le vouliez ou non, vous êtes donc à la fois dentiste et leader. Vos patients et votre équipe

recherchent tout autant votre expertise en dentisterie que votre leadership. Alors, donnez-leur les deux et ils vous le rendront bien!

En fait, la question à vous poser, ce n'est pas de savoir si vous êtes un leader ou non. La première bonne question à vous poser c'est : quel genre de leader suis-je auprès de mon équipe? Suis-je un leader faible qui n'affirme pas son leadership quand il le faut? Suis-je un leader manipulateur qui ne vise que ses propres intérêts? Suis-je un tyran qui ne réussit à s'imposer que par la peur? Suis-je un bon leader complet et mature?

Vous ne le savez peut-être pas, mais dites-vous que les membres de votre équipe ont probablement leur petite idée là-dessus.

L'autre question à vous poser tout au long de la lecture de cet article c'est : que pourrais-je faire pour développer mon leadership? Après avoir lu ce premier d'une série de trois articles sur votre rôle de leader de clinique dentaire, vous en saurez suffisamment pour mieux vous situer et, surtout, pour vous engager à devenir un meilleur leader auprès de votre équipe et dans votre vie.

Les quatre forces d'un leader complet

Devenir un meilleur leader, c'est bien beau, mais comment faire? Par où commencer? Je vous propose de commencer par bien comprendre quels sont les ingrédients du leadership. En comprenant ce qui caractérise les bons leaders, ce qui les distingue des autres leaders, vous serez en mesure de mieux vous situer et d'apporter les ajustements requis pour développer votre leadership.

Un leader, c'est un peu comme un joueur de hockey. Au hockey, pour être reconnu comme étant un joueur complet, il faut se distinguer dans toutes les facettes du jeu : l'offensive, la défensive, le jeu physique, les unités spéciales. C'est la même chose pour le leadership. Pour être reconnu comme un leader complet, il faut être compétent dans chacune des quatre dimensions, ou forces, suivantes : 1) vision 2) maîtrise de la réalité 3) courage 4) éthique. Ceux qui ont le meilleur impact positif sur leur environnement, ce sont les leaders complets, les leaders qui maîtrisent bien les quatre dimensions du leadership.

Après avoir fait un survol des quatre dimensions du leadership, j'approfondirai, dans ce premier article, la première des quatre dimensions du leadership : la dimension vision.

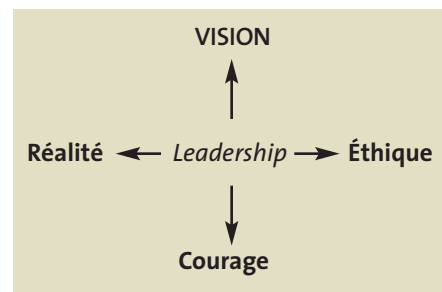


Schéma 1. Les 4 dimensions du leadership.

Dimension 1 - Vision

La première force d'un leader, c'est sa vision. Pour être un leader complet, un dentiste doit être un **leader visionnaire**. Le visionnaire est capable d'imaginer le futur, un futur meilleur qui se rapproche de son monde idéal. Le leader visionnaire ne se contente pas d'imaginer un futur meilleur. Il est, de plus, animé par le **désir de réaliser** sa vision et il réussit à **communiquer** sa vision aux autres de façon telle, qu'ils **passent à l'action** pour la réaliser. Le leader visionnaire est donc, avant tout un **idéaliste**. Il est solidement connecté à ses idéaux, à ses valeurs, à ses rêves, à sa vision de clinique dentaire idéale et **il croit** qu'il est possible de la concrétiser. Il réussit de plus à transmettre aux membres de son équipe son enthousiasme, son désir d'accomplissement. La dernière section de cet article porte sur cette importante dimension du leadership.

Dimension 2 - Maîtrise de la réalité

La deuxième force d'un leader, c'est sa maîtrise de la réalité. Cette deuxième force agit comme contrepoids à la première. Pour être un leader complet, un dentiste doit également être bien **ancré dans la réalité**. Il doit bien la comprendre et savoir faire la part des choses.

La maîtrise de la réalité, c'est une force naturelle chez les dentistes : poser le bon diagnostic, poser exactement la bonne séquence de gestes pour effectuer un traitement nécessite une excellente maîtrise de la réalité. Au plan de son leadership auprès de l'équipe et de la gestion de sa clinique, leur niveau de maîtrise de la réalité est souvent beaucoup moins élevé.

Le dentiste qui est compétent dans cette deuxième dimension du leadership ne se fait pas d'illusion, il **valide ses perceptions avant de décider**, être réaliste, c'est se dire clairement la vérité, voir les choses comme elles sont. Dans sa clinique dentaire, il est maître dans l'art de bien utiliser ses **moniteurs**.

En tant que leader d'entreprise, le dentiste réaliste est avant tout centré sur ses patients et sur son équipe. Il cherche toujours à connaître leurs besoins, leur contexte, leurs perceptions. Il veut savoir ce qui les motive. Il veut également savoir ce que ses clients et ses employés pensent de lui. Les perceptions ne sont pas des faits, mais c'est un fait que les êtres humains agissent généralement sur la base de leurs perceptions. C'est sur cette **connaissance des autres**, de leur réalité qu'il fonde ses décisions et ses actions. Cette dimension permet au leader de toujours garder les deux pieds sur terre, d'être en contact étroit avec sa clientèle et ses employés.

Le manque de réalisme va presque inévitablement conduire le leader visionnaire et son équipe à se déconnecter de la réalité, à se donner des objectifs irréalistes, ce qui ne peut conduire qu'à la désillusion, à la faillite des rêves. Par contre, s'il est trop pragmatique et pas assez visionnaire, le leader éprouvera beaucoup de difficulté à mobiliser les autres, à les motiver; il ne fera que les gérer.

La force du dentiste qui est à la fois visionnaire et réaliste, c'est d'être capable de porter simultanément ces deux pôles souvent opposés que sont les rêves et la réalité, sans se déconnecter de l'un ou de l'autre, même lorsque le chemin qui les relie est parfois très obscur. Il sait qu'avec le temps, le chemin à suivre deviendra plus clair.

Dimension 3 – Courage

Un leader peut être excellent au plan des deux premières dimensions, il peut être visionnaire et réaliste, mais s'il manque de courage, il ne réussira pas à **prendre les décisions qui s'imposent**, à **poser les gestes requis**, à **prendre les risques nécessaires** pour réaliser ses rêves. Il sera incapable de **livrer les résultats attendus**.

En toutes circonstances, le dentiste courageux **assume ses responsabilités et prend l'initiative d'agir**. Il n'attend pas après les autres. Il est aux commandes de sa vie et de sa clinique dentaire. Il prend des décisions, assume les risques et pose les gestes nécessaires pour faire avancer les choses, pour réaliser sa vision, pour défendre ses valeurs.

Le leader courageux ne se résigne pas. Il est **discipliné, persévérant et déterminé**. Il est conscient des dangers, mais il ne se laisse pas arrêter par sa peur. Quand il tombe, il se relève sans se plaindre. Il ne subit pas le changement, c'est lui qui le provoque.

Dimension 4 – Éthique

C'est cette dernière dimension du leadership qui est, à mon avis, la plus importante pour la société et pour votre équipe. C'est pourtant celle qui est le moins abordée dans les ouvrages traitant de leadership.

Être éthique, avoir un comportement éthique, ça va bien au-delà du respect des lois. « **L'éthique, c'est les autres!** » écrit Koestenbaum (3). Avoir un comportement éthique, c'est agir en conformité avec les valeurs et les règles morales des autres. L'atteinte d'un niveau élevé d'éthique survient lorsque le leader se place **authentiquement au service des autres**.

Se placer au service des autres, c'est l'inverse d'utiliser les autres pour atteindre ses fins. Pour le dentiste qui a un niveau élevé d'éthique, cela se traduit dans sa vision : **sa vision de clinique idéale traduit, avant tout, son profond désir de contribuer au mieux-être des autres, patients et employés**. Son but n'est pas de démontrer sa compétence et son talent, ni de devenir riche ou de démontrer à ses pairs dentistes qu'il est meilleur qu'eux! Il sait déjà qu'il est un bon dentiste, qu'il a un rôle important à accomplir et il n'a rien à prouver. Ce qui anime le dentiste qui a un niveau d'éthique élevé, c'est son désir de **placer son plein potentiel au service des autres, au service d'une cause plus importante que lui-même**.

Ce fort positionnement moral du dentiste qui se place authentiquement au service des autres le protège des manquements éthiques et le rend digne de la confiance que ses employés et ses patients lui accordent. Malheureusement, dans notre société, il arrive trop souvent que des leaders soient à la fois visionnaires, réalistes et courageux, mais qu'ils soient déficients au plan de l'éthique.

Un leadership en crise d'éthique

Notre société vit une véritable crise de leadership. Jusqu'à récemment, une large partie de la société respectait les leaders des grandes entreprises et leur faisait confiance. Ces leaders avaient une très haute cote. Ils étaient presque vénérés dans certains milieux.

Et puis tout s'est écroulé tel un château de cartes. Une cascade de scandales nous a amené à faire une dure prise de contact avec la réalité. Nous nous sommes sentis trahis par ceux-là même entre les mains desquels nous avions confié notre avenir. Nos leaders nous avaient menti depuis des années. Ils étaient certes des leaders puissants. Ils

avaient beaucoup de pouvoir, ils avaient même parfois beaucoup de charisme, mais ils n'étaient certainement pas de bons leaders. En fait, ils ne pensaient qu'à eux-mêmes, même s'ils affirmaient le contraire. Ces leaders technocrates (5) n'étaient pas véritablement au service de la société, ni même des organisations qu'ils dirigeaient. C'était le contraire, ils se servaient de leurs organisations et ils manipulaient ceux qui croyaient en eux afin de s'enrichir.

Le pire service à rendre à la société est de former des leaders qui n'ont pas d'éthique authentique, des leaders dont l'objectif ultime est de s'enrichir aux dépens des autres. Je ne suis pas opposé à ce qu'un dentiste s'enrichisse, loin de là. En fait je suis convaincu que cet enrichissement est, en quelque sorte, un effet secondaire généré par l'accomplissement de la mission du dentiste. C'est pourquoi, lorsque je fais du coaching avec un leader et que je découvre qu'il est faible au plan de l'éthique, le développement de son éthique devient alors une condition non négociable pour la poursuite du coaching.

Pourtant, en ces temps de grande incertitude, d'insécurité croissante où tout est en perpétuel changement, la société a, plus que jamais, un urgent besoin de leaders, de bons leaders complets qui placent leurs talents et leur pouvoir au service du mieux-être des autres.

Vous êtes dentiste et propriétaire de votre centre dentaire. Vous êtes à la tête de votre petite équipe. Que vous le vouliez ou non, pour les membres de votre équipe, vous êtes un leader. Certes, que vous soyez un bon leader, un mauvais leader ou un dentiste sans leadership, cela n'aura pas un impact aussi considérable sur la société que si vous étiez leader d'une grande entreprise. Cela en aura cependant un majeur sur les membres de votre équipe, sur vos patients et sur vos pairs.

Plus vous serez un bon leader, un leader complet, plus vous mesurerez votre succès en regardant la contribution que vous apportez aux autres. Plus il y aura de dentistes, de professionnels dans tous les domaines, de propriétaires de petites entreprises qui seront des leaders complets, compétents dans chacune des quatre dimensions du leadership, mieux se portera notre société.

Modèle intégré de leadership

À chacune des dimensions du leadership, correspond presque exactement l'un des quatre archétypes de la maturité chez les

hommes et chez les femmes. (Voir schéma 2) Un archétype, c'est une force qui anime universellement les individus. Cette force existe depuis très longtemps et elle est répandue dans toutes les cultures. Ces archétypes sont : 1) Roi/Reine, 2) Magicien/Fée, 3) Guerrier/Mère et 4) Amoureux. La compréhension de ces archétypes est très utile pour vous guider dans le développement de votre leadership. En fait, je suis convaincu que pour être un leader complet, vous devez être un individu mature. Le corollaire est aussi vrai : en apprenant à devenir un leader plus complet, vous deviendrez nécessairement une personne plus mature. Ainsi **le fait d'être en position de leadership vous procure une formidable opportunité de développement personnel!**

Il est important de souligner que les archétypes masculins et féminins sont simultanément actifs, à des degrés divers, autant chez les hommes que chez les femmes. Les archétypes masculins portent sur la *faire*, sur la dimension analytique, sur le monde extérieur, alors que les archétypes féminins portent sur l'être, sur le monde intuitif, sur le monde intérieur.

Dans la dernière section de cet article, je me concentrerai sur la dimension la plus caractéristique des leaders : la vision qui correspond aux archétypes du Roi et de la Reine. Dans mon prochain article, j'aborderai les trois autres dimensions/archétypes du leadership.

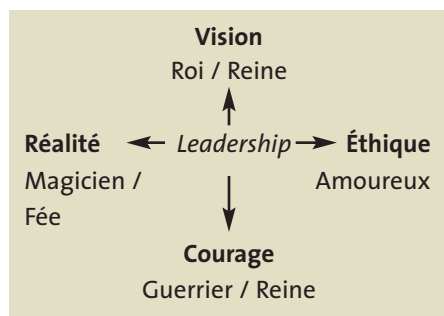


Schéma 2. Modèle intégré de leadership

Développer la dimension visionnaire : l'archétype du Roi et de la Reine

Le Roi est l'archétype central du leadership. Le Roi est à la tête de son royaume, il en gouverne la destinée. Le Roi définit les frontières et il édicte les lois qui régissent son royaume. Le but du bon Roi est de générer de la prospérité pour les membres de son

royaume. C'est le Roi qui donne la vision, la mission à accomplir et les grands objectifs à atteindre. Cette dimension du leadership est essentielle, car c'est elle qui **donne un sens à l'équipe**. Une équipe, c'est un groupe de personnes qui travaillent ensemble dans un même but. Dans votre clinique dentaire, si le but à atteindre n'est pas clair et partagé par tous, si les règles du jeu sont confuses, vous risquez gros : la dissension au sein de votre équipe et l'échec de vos rêves.

C'est l'archétype de l'**importance** : le Roi est important et il amène chacun à se sentir important en leur donnant une mission importante. Dans votre clinique dentaire, c'est vous le Roi et votre royaume, c'est votre clinique dentaire. Votre première responsabilité en tant que leader, c'est donc de définir clairement votre vision, de clarifier, pour les membres de votre équipe, la clinique idéale que vous désirez mettre en place. Le visionnaire porte également sur l'archétype de la **Reine**. C'est la Reine qui **définit les valeurs, les qualités morales, les standards à respecter**. La Reine ne se contente pas de demi-mesures et de demi-efforts. C'est cet archétype qui amène le dentiste à élever les standards à respecter dans sa clinique dentaire. C'est l'archétype de la Reine qui amène chacun à donner le meilleur de son potentiel pour accomplir la mission qui lui a été confiée.

Plus vous vous donnerez une vision, une mission et des objectifs clairs et stimulants, plus vous serez en mesure de mobiliser votre équipe pour les concrétiser. Par ailleurs, plus vos standards seront bien définis, élevés et congruents à votre vision (protocoles clairs et détaillés, qui appuient la réalisation de votre vision), plus vous serez en mesure de bien guider votre équipe dans la réalisation de sa mission. Vous voulez développer votre dimension visionnaire? J'utilise avec mes clients plusieurs stratégies pour y arriver; en voici deux qui pourraient grandement vous aider.

Stratégie 1 – Précisez ce que vous voulez!

Savoir ce que vous voulez, c'est une condition nécessaire à l'exercice efficace de votre leadership. Savez-vous vraiment ce que vous voulez? Si oui, vous n'aurez sans doute aucune difficulté à répondre aux questions suivantes. Ça vaut la peine de prendre le temps nécessaire de bien y répondre. Si vous éprouvez de la difficulté, rassurez-vous

en vous disant que vous n'êtes pas seul et choisissez de ne pas en rester là!

Votre mission

Quelle est votre mission? Que voulez-vous accomplir avec votre clinique dentaire? Quelle contribution désirez-vous apporter à vos patients, à vos employés et à la société? Pourquoi avez-vous choisi de devenir dentiste et d'avoir votre clinique dentaire? Vous contentez-vous d'avoir une mission ou êtes-vous vraiment en mission?

Vos valeurs

Quelles sont les trois ou quatre principales valeurs à respecter dans votre clinique dentaire? Comment ces valeurs s'appliquent-elles dans chacun des volets de votre clinique dentaire?

Par exemple, si vos trois principales valeurs sont : le professionnalisme, la gentillesse et le travail en équipe, comment ces valeurs se traduisent-elles pour l'accueil des nouveaux clients, les urgences, la vente de plans de traitement, etc.

Votre vision

Quelle est votre vision? Compte tenu de votre expérience et de votre contexte personnel, décrivez votre clinique idéale. Votre clinique idéale n'est pas fixe. Elle évolue dans le temps. Il serait peut être temps que vous la mettiez à jour.

Décrivez précisément votre clinique idéale telle que vous la voulez présentement. Pour y arriver, regardez votre clinique actuelle, identifiez ce qui ne correspond pas à ce que vous voulez et décrivez ce que serait la situation idéale. Plus votre vision sera précise et stimulante, meilleures seront vos chances de la concrétiser. Ne vous laissez pas arrêter par la question « Comment? ». **La question « comment? » tue la question « quoi? ».** Commencez par préciser exactement ce que vous voulez vraiment, par la suite, il sera toujours temps de trouver les « comment? » Apprenez à ne pas abdiquer de votre vision, à ne pas l'abandonner parce que vous ne savez pas encore comment la réaliser.

Vos standards

Avez-vous des protocoles détaillés qui correspondent bien à vos attentes relativement à chacun des gestes importants à poser par les membres de votre équipe? Vos protocoles sont-ils congruents avec votre vision, vos valeurs et votre mission? Vos protocoles sont-ils respectés et mis à jour régulièrement? Que faites-vous pour vous en assurer? Avez-vous des protocoles clairs relativement à la gestion des relations humaines au sein de votre équipe. Par exemple, vos

employées savent-elles exactement quoi faire pour gérer un différend ou pour régler un problème.

En précisant et en élevant le niveau de vos standards, vous amenez votre équipe à mieux utiliser son potentiel et vous maximisez vos chances d'obtenir les résultats que vous visez.

Stratégie 2 – Communiquez efficacement!

Pour être un bon leader visionnaire, il ne suffit pas que vous ayez une vision stimulante, il faut surtout réussir à la **communiquer** à votre équipe, à vos patients et à vos fournisseurs.

Les dentistes ne sont pas tous doués également au plan de la communication. Si certains sont de véritables communicateurs, plusieurs sont surtout à l'aise lorsque le contenu de leur communication porte sur des aspects techniques pertinents à leurs fonctions de dentistes, alors que d'autres sont inconfortables en tout temps.

Voici quelques idées qui devraient vous aider à mieux communiquer votre vision.

- Plus vous êtes inconfortable au plan de la communication, plus il est important de **prendre le temps d'écrire** avant de la communiquer.
- La meilleure façon de communiquer votre message, c'est d'en être le modèle, de le **transmettre par l'exemple que vous donnez**. N'oubliez pas que ce qui est important pour le leader visionnaire, ce n'est pas tellement d'avoir une vision, mais c'est bien plus **d'être en mission** pour réaliser sa

vision. En communication, on dit souvent que 80% du message se passe dans le contenu non verbal. Pour le leader visionnaire, c'est 95% du message. Alors, que vous soyez un bon communicateur ou pas, c'est peu important! Soyez un modèle pour votre équipe. Agissez toujours en harmonie avec vos valeurs et votre vision. Les membres de votre équipe vont certainement saisir votre message.

- À chacune des dimensions et des archétypes du leadership correspond un style de communication bien précis. Avant de décider, le Roi écoute. Il écoute, il réfléchit, puis il décide. Il communique de trois façons : il fait des déclarations, il fait des demandes et il décrète des lois!

C'est la même chose dans votre clinique dentaire. Tout en ayant en tête ce que vous voulez décider, passez beaucoup de temps à écouter vos employés, vos patients, vos fournisseurs. Posez des questions et écoutez les réponses, sans argumenter, en ayant en tête une seule idée : prendre la meilleure décision possible. Puis lorsque tout devient clair pour vous, vous réunissez votre équipe et vous déclarez ce que vous avez à dire, vous leur faites part de votre décision.

N'oubliez pas que le Roi n'a pas à se justifier. Il ne dit que ce qui doit être dit pour que sa décision soit bien comprise. Par exemple : « Le nombre de rendez-vous manqués est beaucoup trop élevé depuis 6 mois, j'ai décidé que nous allons revoir entièrement

notre protocole de rendez-vous, afin de réduire les rendez-vous manqués à moins de... Je vous demande de... »

- Lorsque votre vision et vos standards sont en jeu, prenez quelques minutes avant de parler pour vous préparer, pour vous centrer sur vous, sur l'importance du message que vous allez livrer. Retirez, dans votre tête, votre sarrau de dentiste, revêtez votre costume de leader et dites simplement ce que vous avez à dire.

Conclusion

Vous n'êtes pas devenu un bon dentiste du jour au lendemain. Pour y arriver, vous avez dû y mettre beaucoup de temps : du temps pour apprendre et encore plus de temps pour pratiquer. Même si le leadership n'est pas une science comme la dentisterie, le processus est le même : pour développer votre leadership, il vous faut y mettre du temps. Il vous faut avant tout avoir l'intention ferme d'y arriver.

Dans le prochain article, j'aborderai les trois autres dimensions du leadership et je vous présenterai les meilleurs styles de leadership à utiliser dans votre clinique dentaire.

References

1. Goleman D. Intelligence émotionnelle 2. Robert Laffont, Paris, 1998.
2. Marois J. Dentiste et leader. Inter Formation, Boucherville, 2008.
3. Koestenbaum P. The Inner Side of Greatness. John Wiley & Sons, San Francisco, 2002.
4. Moore R. and Gillette D. King, Warrior, Magician Lover. Harper Collins, San Francisco, 1990.



Dentist and Leader:

Be the Best You Can Be

By Mr. Jacques Marois, MSc

This series of three articles takes up the theme of “dentist and leader,” with the goal of encouraging dentists to recognize and reflect on the importance of becoming better, more well-rounded leaders in their dental clinics and in their lives.

Most, if not all dentists, including associate dentists, work with a support team. Rare are the dentists who do not have to provide leadership of some kind to a team. What is more, I have seen that whether or not they are good leaders, most dentists are frankly unaware that they would have much to gain by becoming better leaders.

Leadership Tips the Balance in Your Favour

Dentists see themselves primarily as professionals and experts. As do most experts, many dentists act as if their success depends solely on the quality of their expertise. This belief is misleading! While it is true that being a good dentist is a necessary foundation for success, it has been proven that, in fields of expertise such as dentistry, it is generally leadership and emotional intelligence that count the most for success!¹

In my book on dentists as leaders,² I address the question of leadership from various angles. In the first two of this series of articles, I will introduce my integrated model

for leadership. I created this model by marrying a philosophic view of leadership, namely Koestenbaum’s “Leadership Diamond,”³ to an approach I developed based on the archetypes of the mature male as proposed by Moore and Gillette.⁴

In my view, it is more important to be a well-rounded leader than a charismatic or authoritarian leader. A well-rounded leader is competent in all four of the dimensions shown in Diagram 1. The more competent you are in a given leadership dimension, the better able you will be to rally your team and, through them, achieve remarkable results. An interesting aspect of these four dimensions is that each of them always offers room for improvement. Therefore, even if it is not in your nature to be a leader, you can nurture your leadership!



Diagram 1. The four dimensions of leadership

Before we take a closer look at this leadership model, one point is worth making. The quality of your leadership has nothing to do with the size of the team you are directing. You may be at the head of a vast organization, have power to spare, and yet be a very poor leader. You may have only one assistant and yet be an excellent leader.

This leadership model shows you the path to follow in your day-to-day practice in order to exercise your leadership role better and achieve even greater success and happiness in your dental clinic and in your life.

Leadership: A Capacity for Influencing Others

A person who has a goal and who heads up a group of people, influencing them to think and act to achieve the goal, is a leader. This capacity for influencing others is an advanced emotional skill that relies on emotional intelligence.

In your dental clinic and practice, you are a leader if:

- When faced with a challenge, you successfully have each member of your team contribute their full potential.
- Regardless of the circumstances, you successfully mobilize your team to work effectively and efficiently together

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About the Author



in the direction that you propose to them.

- You know how to deal with your patients' emotions. You know what to say and what to do such that their fear does not prevent them from accepting the treatment that is best for them.
- You successfully establish strong emotional ties that ensure the loyalty of both your team members and your clients.

Another point to keep in mind is that if you own a dental clinic, you have been thrust into a position of leadership, even if you feel and think that you are more of a dentist than a leader. Like it or not, as owner you are both dentist and leader. Your patients and your team look to you not only for expertise in dentistry but also for leadership. Give them both and they will pay you back in spades!

In fact, don't ask yourself: "Am I a leader or not?" The most helpful question is: "What kind of leader am I with my team?" Are you weak, not asserting leadership when it is needed? Are you a manipulative leader who looks out only for personal interests? Is fear your only means for getting what you want, like a tyrant? Are you a good, well-rounded, mature leader?

You may perhaps be unaware of it, but you can be sure that the members of your team have already formed their own answers to those questions.

Another question worth keeping in mind as you read this article is: "What could I do to develop my leadership?" After reading this first of three articles on your role as leader of a dental clinic, you will know enough to determine where you stand and, especially, to take action to become a better leader with your team and in your life.

The Four Strengths of a Well-Rounded Leader

Saying you will become a better leader is one thing, making it happen is another. Where do you begin? I suggest that you begin by carefully reviewing the ingredients of leadership. By understanding the characteristics that typically set good leaders apart from less-than-good leaders, you will be better able to take stock of your situation and make any adjustments necessary for developing your leadership.

Leaders are somewhat like hockey players. To be recognized as a well-rounded player,

one must excel in all aspects of the game: offence, defence, physical play, and special teams. The same applies to leaders who, to be well-rounded, must be skilled in each of the following four dimensions or strengths: vision, reality, courage, and ethics.

Individuals who are grounded in these four dimensions are the well-rounded leaders who have the greatest positive impact on their working environment.

In this article I will first briefly describe the four dimensions of leadership, and then focus on the importance of vision.

Dimension 1: Vision

A leader's foremost strength is vision. To be a well-rounded leader, a dentist must be a visionary, someone able to imagine not only the future but a better future that approaches what is deemed to be the ideal world. But visionary leaders do not stop at imagining a better future. They are next driven by a desire to realize the vision, which obliges them to communicate it to others such that others make an active effort to fulfill it. Visionary leaders are therefore primarily idealists. They are solidly anchored to their ideals, values, dreams, and view of the ideal dental clinic. They believe that the ideal can be made a reality. What is more, they successfully transmit to their team members their enthusiasm and desire for fulfillment. We will return to this important dimension of leadership in the last part of this article.

Dimension 2: Reality

A leader's second strength is being grounded in reality. This second strength counterbalances the first one, for, to be a well-rounded leader, a dentist must also have no illusions about reality. Leaders must fully grasp their reality and know how to say what's what.

Being on top of reality comes naturally to dentists: an excellent grasp of the patient's reality is necessary for correct diagnoses and proper treatment procedures. When it comes to their team leadership and clinical management, however, their mastery of reality is often greatly reduced. Dentists skilled in this second leadership dimension have no illusions and validate their observations before making a decision. To be realistic is to tell yourself the truth plainly, to see situations as they are. In a dental clinic, being realistic calls for mastery of the art of using dashboards.

As business leaders, realistic dentists focus primarily on their patients and support teams – identifying their needs, context,

and perceptions. They want to know what motivates them and also how the clients and employees view them as dentist and leader. These perceptions are not facts, yet it is known that human beings generally act on the basis of their views. Leaders base their own decisions and actions on their knowledge of others and of their reality. It is in the reality dimension that the leader keeps both feet on the ground and maintains close contact with both clients and employees.

Any lack of realism will almost certainly disconnect the visionary leader—and the support team as well – from reality and result in unrealistic goals, with the inevitably ensuing disillusionment and ruin of dreams. However, an excess of pragmatism and a shortage of vision make it considerably more difficult for a leader to mobilize and motivate others: instead of leading, the dentist only manages.

A dentist who is both visionary and realistic has the strength to simultaneously embrace both reality and dreams, which often are polar opposites, without losing touch with either of them even when the path between them may be very obscure. Dentists with this strength know that over time the path to follow will become clearer.

Dimension 3: Courage

A leader may excel in the first two dimensions and be visionary and realistic, but if courage is lacking it will be impossible to make the necessary decisions, carry out the required actions, and assume the unavoidable risks of fulfilling the dreams. Without courage you will be unable to deliver the envisaged results.

Whatever the circumstances, a courageous dentist assumes responsibilities and takes the initiative without waiting for others. With courage you can be at the helm of your life and dental clinic, making decisions, assuming risks and carrying out the actions needed to move yourself forward, fulfill your vision, and defend your values.

A courageous leader does not give up but remains disciplined, persevering and determined. You can be mindful of the hazards without being paralyzed by fear. With courage you can fall and pick yourself back up without complaining. A courageous leader does not undergo change, but causes it.

Dimension 4: Ethics

In my view, this last dimension of leadership is the most important one for society

as a whole and for your team. Yet it is also the dimension most overlooked in discussions on leadership.

Being ethical and having ethical behaviour goes well beyond being a law-abiding citizen. "Ethics is others!" wrote Koestenbaum.³ Having ethical behaviour means acting in compliance with the values and moral dictates of others. As a leader, you excel in the area of ethics when you genuinely put yourself in the service of others.

Serving others is the opposite of using others for one's own ends. As a highly ethical dentist, your vision of an ideal clinic will be characterized by your profound desire to contribute to the betterment of others – patients and employees alike. Your goal is not to show off your skills and talent, or even to become wealthy or engage in one-upmanship with your dentist peers! You already know that you are a good dentist, that you have an important role to play, and that there is nothing to prove. The driving force of a highly ethical dentist is a personal desire to place one's full potential in the service of others, in the service of a cause greater than oneself.

One benefit of taking a strong moral position, of authentically placing oneself in the service of others, is that a dentist is protected from ethical shortcomings and earns the trust of both employees and patients.

Unfortunately, it is too often the case in our society that leaders who are visionary, realistic, and courageous prove deficient when it comes to ethics.

Showing Leadership in an Ethical Crisis

Our society is experiencing a real leadership crisis. Until recently, a broad spectrum of society respected the leaders of large corporations and trusted them. These leaders were highly rated, to the point of veneration in some settings.

But then everything collapsed like a house of cards. One scandal after another hammered us into taking a hard-hitting reality check. We felt betrayed by the very people in whose hands we had entrusted our future. Our leaders had been lying to us for years. Yes, they excelled in taking the lead, enjoying considerable power, sometimes coupled with a good dose of charisma, but they certainly were not good leaders. In fact, they thought only of themselves, even if they earnestly protested otherwise. These technocratic leaders were not genuinely serving society, let alone the organizations they directed. Rather, they were serving

themselves, using their organizations as a means, and they manipulated those who believed in them in order to acquire wealth.

Society is least served by forming leaders who lack a genuine ethic, whose ultimate objective is to make capital out of others. I am not opposed to your acquiring wealth as a dentist, far from it. Rather, I am persuaded that acquiring wealth is a sort of side effect of fulfilling your mission as dentist. For this reason, when I coach leaders and discover that they fall short in the area of ethics, I make the development of a personal ethic a non-negotiable condition for continuing the coaching program.

However, in our day of great uncertainty and growing insecurity, when all is perpetual change, society more than ever has an urgent need for leaders – good, well-rounded leaders who put their talents and their power in the service of the betterment of others.

You are a dentist and you run your own dental centre. You are at the head of a small team. Like it or not, the members of your team see you as its leader. Of course, whether you are a good or poor leader or a dentist totally lacking in leadership, your impact on society will not be as considerable as if you were the leader of a huge corporation. But your leadership will have a major impact on each member of your team, on each patient and on your peers.

The more you are a good, well-rounded leader, the more you will measure your success in terms of what you contribute to others. And the more there are dentists, professionals in other fields and small-business owners who are well-rounded individuals, skilled in each of the four leadership dimensions, the better will be our social health.

An Integrated Model for Leadership

Each of the leadership dimensions can be matched almost exactly with one of the four archetypes of maturity in men and women (Diagram 2). These archetypes symbolize the strengths that universally empower individuals. Such strengths have long been in existence throughout all cultures. These archetypes are: King–Queen, Magician–Fairy, Warrior–Mother and Lover. Understanding these archetypes can be very helpful to you, to give direction to your leadership development. In fact, I am convinced that if you are to be a well-rounded leader you must first be a mature individual.

The corollary also holds true: by learning how to become a more-well-rounded leader, you will inevitably gain maturity. In other words, the fact that you are in a position of leadership affords you an incredible opportunity for personal development!



Diagram 2. Integrated model for leadership

It is important to keep in mind that the male and female archetypes are simultaneously active, but at varying degrees, in both men and women. The male archetypes relate to *doing*, analysis and the external world, while the female archetypes relate to *being*, intuition and the internal world.

In the last section of this article, I will develop the dimension most characteristic of leaders, namely vision, which ties in with the King–Queen archetype. In my next article, I will do the same for the three remaining leadership dimensions and archetypes.

Developing Your Vision: The King–Queen Archetype

The King archetype is central to leadership. The King is at the head of his kingdom, whose destiny he steers. The King defines the boundaries and enacts the laws that govern the kingdom. The goal of a good King is to generate prosperity for his constituents. It is the King who provides the vision, the mission to be done, and the general objectives to be reached. This leadership dimension is essential, for it is what brings direction and meaning to the team, i.e., the group of people who work together to reach a shared goal. If the goal to be reached in your dental clinic is not clear to everyone or equally shared, and if the rules of the game are murky, you have much to lose: dissension will break up your team and your dreams will come to naught.

This is the archetype that determines what is important: the King is important and he leads everyone to feel important by giving them an important mission. In your dental

clinic, you are the archetypal King, and your dental clinic is your kingdom. Your primary responsibility as leader therefore is to define your vision clearly, to give your team members a clear picture of the ideal clinic that you want to set up.

The Queen archetype is vital for visionary leadership. It is the Queen who defines the values, the moral qualities and the standards to be upheld. The Queen does not condone half measures and half-hearted effort. It is the Queenly dentist who raises the standards in the dental clinic and holds them high. It is the Queen archetype that leads everyone to give the best of their potential to accomplish their mission.

The more you express your vision, mission and objectives in a way that is clear and stimulating, the more you will be able to mobilize your team to achieve them. The more your standards are well defined, held high, and consistent with your vision (i.e., you have clear and detailed protocols that give effect to your vision), the more you will be able to guide your team well as it carries out its mission.

Do you want to develop your visionary dimension? When coaching my clients I use various strategies to do so. Here are two you may find very helpful.

Strategy 1: Say What You Want!

Know what you want. If you don't know what you want, your leadership will be neither effective nor efficient. Do you really know what you want? If you do, you will probably have no difficulty answering the following questions. Take time to answer them well; you will be rewarded for your effort. If you have difficulty, take heart in knowing that you are not alone, and choose to move on from there!

Your Mission

What is your mission? What do you want to accomplish with your dental clinic? What do you want to contribute to your patients, your employees and society? Why did you choose to be a dentist and open a dental clinic? Is it enough for you to have a mission, or are you really on a mission?

Your Values

Name the three or four key values to be upheld in your dental clinic. How are these values applied in each aspect of your dental clinic?

For example, if your three main values are professionalism, kindness and teamwork, how do these values take shape at the recep-

tion desk, in emergencies, when selling treatment plans, etc?

Your Vision

What is your vision? Based on your experience and your personal context, describe your ideal clinic. Don't carve it in stone. A clinic evolves over time. Perhaps your vision needs to be updated.

Describe your ideal clinic with precision, as you envisage it now. In putting it on paper, take a look at your current clinic, identify its elements that don't match what you want, and describe what the ideal situation would be. The more specific and stimulating you make your vision, the more you improve your chances of making it a reality. Don't let the "how" question stop this process. "How?" defeats the "What?" Begin by specifying exactly what you really want; you will have ample time later to discover the "how." Learn not to renounce or abandon your vision on the grounds that you don't know how to make it reality.

Your Standards

Do you have detailed protocols or procedures adequately outlining your expectations for each important activity carried out by the members of your team? Are these protocols consistent with your vision, values, and mission? Are they followed and regularly updated? What do you do to ensure compliance? Do you have clear protocols for managing human relations within the team? For example, do your employees know exactly what to do when resolving a dispute or problem?

By being specific and by raising the level of your standards, you are leading your team to make better use of its potential and you are maximizing your chances of obtaining the results you desire.

Strategy 2: Say It Well!

It is one thing to have a stimulating vision; it's another to get it across to your team, your patients and even to your suppliers. A good visionary leader also has to communicate successfully.

Dentists are not created equal when it comes to speaking. While some are born communicators, many others are more at ease talking about the technical aspects of the dental work to be done, and some are simply uncomfortable with speaking.

Here are a few ideas you may find helpful when communicating your vision.

- The more you are uncomfortable with

speaking, the more important it is to spend time putting in writing what has to be said prior to saying it.

- The best way to communicate your message is to model it, to transmit it by the example you give. Keep in mind that, while recognizing the value of having a vision, a visionary leader puts more importance on being on a mission to realize the vision. Communication theory often tells us that 80% of a message is transmitted nonverbally. For visionary leaders, it's 95% of the message. This means that whether or not you are a good speaker is not that important! Model your message for your team. Walk the talk in harmony with your values and your vision. The members of your team will then most assuredly grasp your message.

- Each leadership dimension and archetype has a matching, distinctive communication style. Before making a decision, the King listens. He listens, he reflects, and then he decides. A King has three forms of communication: declarations, requests, and orders!

Put the King in your dental clinic. Although you already have in mind what you want to decide, spend a lot of time listening to your employees, patients, and suppliers. Ask questions and listen to the answers, without arguing, while keeping foremost in your mind the singular idea of making the best possible decision. Once all the issues have become clear for you, bring your team together and declare what you have to say; you inform them of your decision.

Keep in mind as well that the King does not have to justify himself. He says only what has to be said for his decision to be understood well. For example: "The number of missed appointments has been much too high in the last six months. I have decided that we will review our entire procedure for appointments with the goal of reducing missed appointments to fewer than ... I am asking you to..."

- When your vision and your standards themselves are the topic, take a few minutes before speaking to prepare yourself, to focus yourself on you and

on the importance of the message that you are going to deliver. In your mind, stand before your team without your dentist's smock and put on the garment of leadership, and then simply say what has to be said.

Conclusion

You did not become a good dentist overnight. You must have invested countless hours: you spent time learning and even

more time practising. Although leadership is not a science like dentistry, the process is the same: to develop your leadership, you will definitely have to give it time. And, what is more, you will have to have a firm intention to get to where you want to go. In the next article, I will discuss the other three leadership dimensions and introduce the best leadership styles for use in your dental clinic.

References

1. Goleman D. Working with Emotional Intelligence. Bantam Books. New York: 1998.
2. Marois J. Dentiste et leader. Inter Formation: Boucherville, 2008.
3. Koesternbaum P. The Inner Side of Greatness. John Wiley & Sons. San Francisco: 2002.
4. Moore R, and Gilette D. King, Warrior, Magician, Lover. Harper Collins. San Francisco: 1990.



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Noninvasive Crown Lengthening: A Case Report

By Harry Rosen, DDS, MRCD(C)

ABSTRACT

Teeth with root caries lesions that appear hopeless often can be salvaged by extending a crown restoration onto sound subgingival root dentin coronal to the junctional epithelium. This article reports the case of a 92-year-old patient who presented with a lower left first bicuspid completely undermined by recurrent root caries. The noninvasive technique described in this article permits construction of a crown that sufficiently braces the root to protect it against root fracture and caries recurrence.

RÉSUMÉ

Les dents ayant des caries du cément et qui semblent sans issue peuvent souvent être sauvées en faisant un allongement de couronne dans la dentine coronaire saine de la racine sous-gingivale à l'épithélium fonctionnel. Cet article rapporte un cas d'un patient de 92 ans qui présentait une prémolaire dans le quadrant gauche inférieur complètement rongée par une carie du cément récurrente. La technique non invasive décrite dans cet article permet la construction d'une couronne qui supporte suffisamment la racine pour la protéger contre la fracture et la récurrence de carie.

About the Author

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NONINVASIVE CROWN LENGTHENING

A 92-year-old patient presented with a lower left first bicuspid completely undermined by recurrent root caries. No teeth had been lost to date despite the patient's failure to return for recalls. In the past 10 years he had suffered a litany of medical conditions. A variety of medications were prescribed which resulted in xerostomia with some subsequent root caries in vulnerable locations that could not be maintained by the patient or were not self cleansing.¹⁻¹³

Possible choices of treatment would be extraction of the root and replacement with an implant and a crown. The patient's age, his existing medical history, and his general lack of interest in any invasive surgical procedure precluded that option. The second possible option would be clinical crown lengthening.⁴⁻⁶ Crown lengthening would be a more invasive surgical procedure than implant installation. More so the final restoration would have had to be deferred for five months while healing ensued. Crown lengthening would have also resulted in root shortening of an already compromised root which suffered significant bone loss.

An effective alternate is described in this article and illustrated in the accompanying figures. At the first appointment the quadrant was anesthetized with a mandibular block. Decay was removed just short of the cavo-surface angle without resulting in gingival bleeding. The pulp was exposed and an endodontic procedure was performed. A clamp and rubber dam could not be applied on the subgingival root stump. As with most aging patients, maintaining a dry field presented no problem once the patient was anesthetized and not apprehensive about the procedure (Figures 1 and 2).

A prefabricated serrated parallel sided post (Parapost, Whaledent International New York, NY) was installed immediately after the root canal was obturated.^{1,9} A post diameter was selected that necessitated little or no removal of root dentin while providing the most retention (Figure 3). Added retention was achieved within the pulp chamber and the space that resulted from the decay removal by creating ledges with a number 34 inverted cone long shank drill. A number .031 inch pin also was installed (Whaledent International New York, NY) in the space provided by the root canal taper.^{1,9,10} That procedure also added retention without sacrificing root dentin and without contributing to possible root fracture.

An aluminum shell was trimmed and festooned to precisely fit over the root stump. Care was taken not to cause bleeding while fitting the shell.

Decay at the cavo surface was now removed with a slow speed drill and hand instruments. At this point some bleeding is not critical. The aluminum shell was perforated at the occlusal end to allow air to escape, a mix of Adaptic composite resin was loaded into the aluminum shell and a mix of glass ionomer cement was buttered over the parapost and the retentive preparations within the chamber. The shell was plunged over the post and the exposed root. Most overflow excess material was removed from the external surface of the shell. When set the shell was split and removed (Figures 4 and 5). Some of the excess composite resin was left to be removed later at the tooth preparation stage.

A wax impression of the quadrant was made. The wax was retro-carved to simulate the shape of the first bicuspid. Using a torpedo-shaped diamond (Tri Hawk F5 or Brassler USA drill #2862) with brush-like strokes the excess core material within the gingival sulcus was removed and the preparation was extended beyond the gingival seat of the core. A feather edge finish line was established on sound root dentin close to the base of the gingival sulcus



Figure 1. Extensive loss of coronal dentin tooth #34.



Figure 2. Caries removed endodontic trial point.

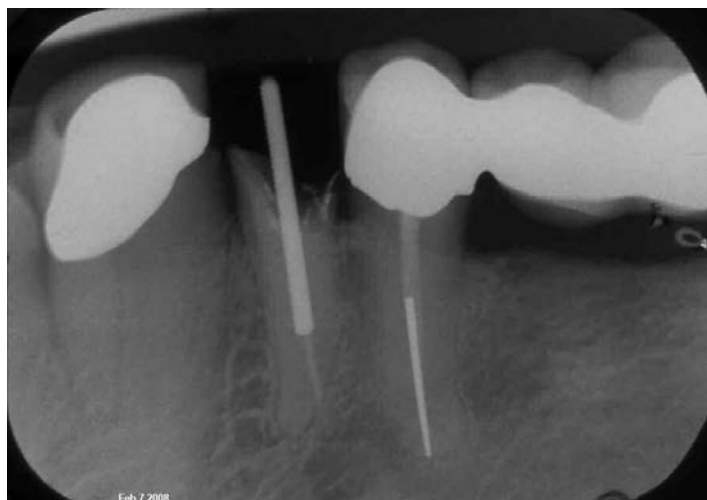


Figure 3. Parallel sided serrated post (parapost #4) .031 inch self tapping pin added for retention – not visible in radiograph.

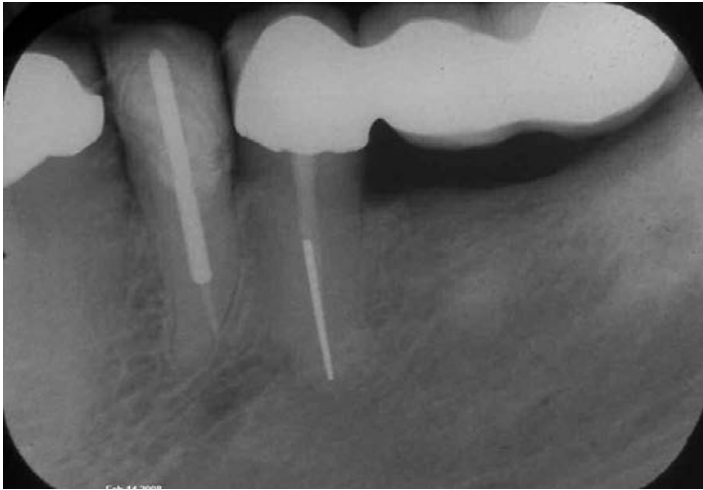


Figure 4. Composite resin buttered with glass ionomer cement core as formed by aluminum shell.



Figure 5. Composite core just after splitting and removal of aluminum shell.



Figure 6. Preparation beyond gingival seat of the core.

(Figure 6). Where no root dentin was visible beyond the gingival seat of the core some diamond point curettage was instituted. This diamond point curettage resulted in some gentle stripping of gingival tissue and the junctional epithelium to expose root dentin in areas where it could not be visualized or felt before. One to 2 mm of prepared root dentin was ultimately exposed around the entire periphery of the root without any crestal bone reduction.

A triple tray impression was made with polyvinyl impression material (3M ESPE Express Dental Products St. Paul, MN 55144-1000). The termination of the preparation could not be captured in the tray impression but was captured with relative ease using an unannealed copper band with polyvinyl putty. The band deflects tissue and fluids to enable the impression material to capture detail beyond the termination of the preparation. The band also supports and protects the impression material beyond the finish line of the preparation for more accurate pouring of the cast.¹¹

The model poured from the tray impression was used in the laboratory to achieve contact and occlusion while the model recovered from the band impression functioned as a master die which provided precise detail for the termination of the preparation (Figures 8–10).

The laboratory procedure for the construction of a PFM crown was uneventful as a finish line was clearly visible on the master die poured from the copper band impression. The crown that was cemented at a subsequent appointment fit precisely with a gingival margin that could barely be detected just coronal to the base of the gingival sulcus.

Discussion

The arbitrary 2 mm ferrule recommended in text books for anterior teeth which are long and narrow might be more than what is needed for posterior teeth which are short and wide. Margins of castings probed years later reveal the existence of some sound root structure coronal to the junctional epithelium even in isolated locations where biologic width was violated. One can conclude that the bone remodelled in those locations. The remodelling occurred only where remodelling was required.



Figure 7.



Figure 8. Crown finish line extends beyond chamfer finish where possible.



Figure 9. Ceramo-metal crown just after cementation.

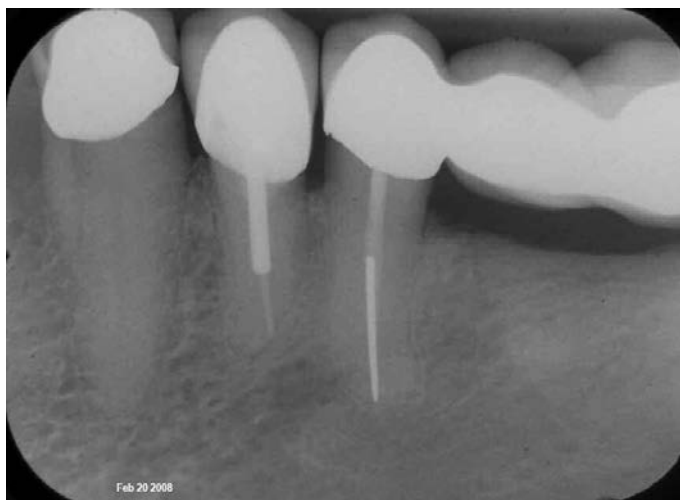


Figure 10. Radiograph after cementation, crown margin close to crestal bone.



Figure 11. Before radiograph 1983 same patient opposite side (tooth 45).



Figure 12. Endo, parapost plus added pin retention and composite core build-up.



Figure 13. Termination of restoration at base of gingival sulcus. Crestal bone has remodelled to accommodate biologic width.



Figure 14. Advanced root caries with loss of all coronal dentin. 2 mm of sound dentin can be probed with an explorer coronal to the base of the sulcus 1982.

The same patient presented with a similar problem 25 years ago March 1983 on tooth #45 (Figures 11–13). The treatment was almost identical. Note the narrow diameter of the serrated parallel sided post the added pin retention within the root canal space. In this instance sufficient dentin was available on the gingival seat of the core preparation to safely permit installation of two extra non-parallel .031 inch self tapping pins for added retention (Figures 11–13).

The steps in this predictable procedure are further illustrated with a 1982 case presentation (Figures 14–23).

Conclusion

A noninvasive alternative has been presented for ageing and or medically compromised patients for whom clinical crown lengthening is contra indicated.

This same group of patients will accept the risk of saving such a tooth rather than go the implant route which they perceive as being invasive. This approach and technique also provides a reasonable alternative for patients who present with anatomical risks that are high and access is poor for implant installation.

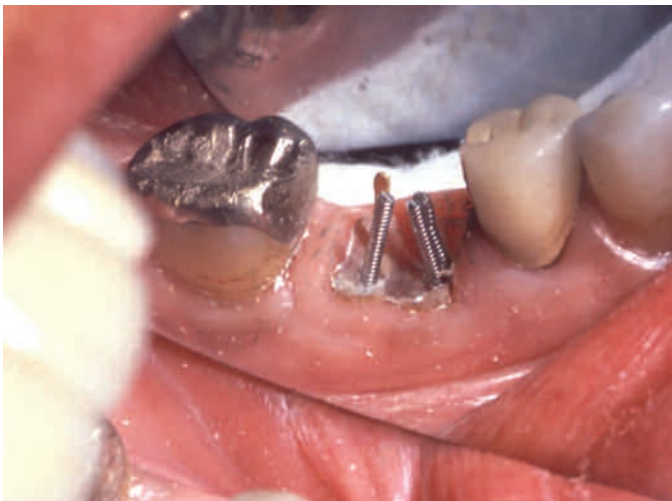


Figure 15. Caries removed from gingival seat. However, caries may not be completely removed from the cavosurface margin to avoid abrasion of the marginal gingiva. Paraposts are installed in divergent canals and a pin is added to the ovoid distal canal. Note that the field is dry and there is an absence of bleeding.



Figure 16. Typical chamfer finish preparation 2 mm beyond gingival seat of black composite core on furcation-involved mandibular molar. Note the sound root dentin prepared apical to the gingival seat and the trough created with a torpedo-shaped diamond point.

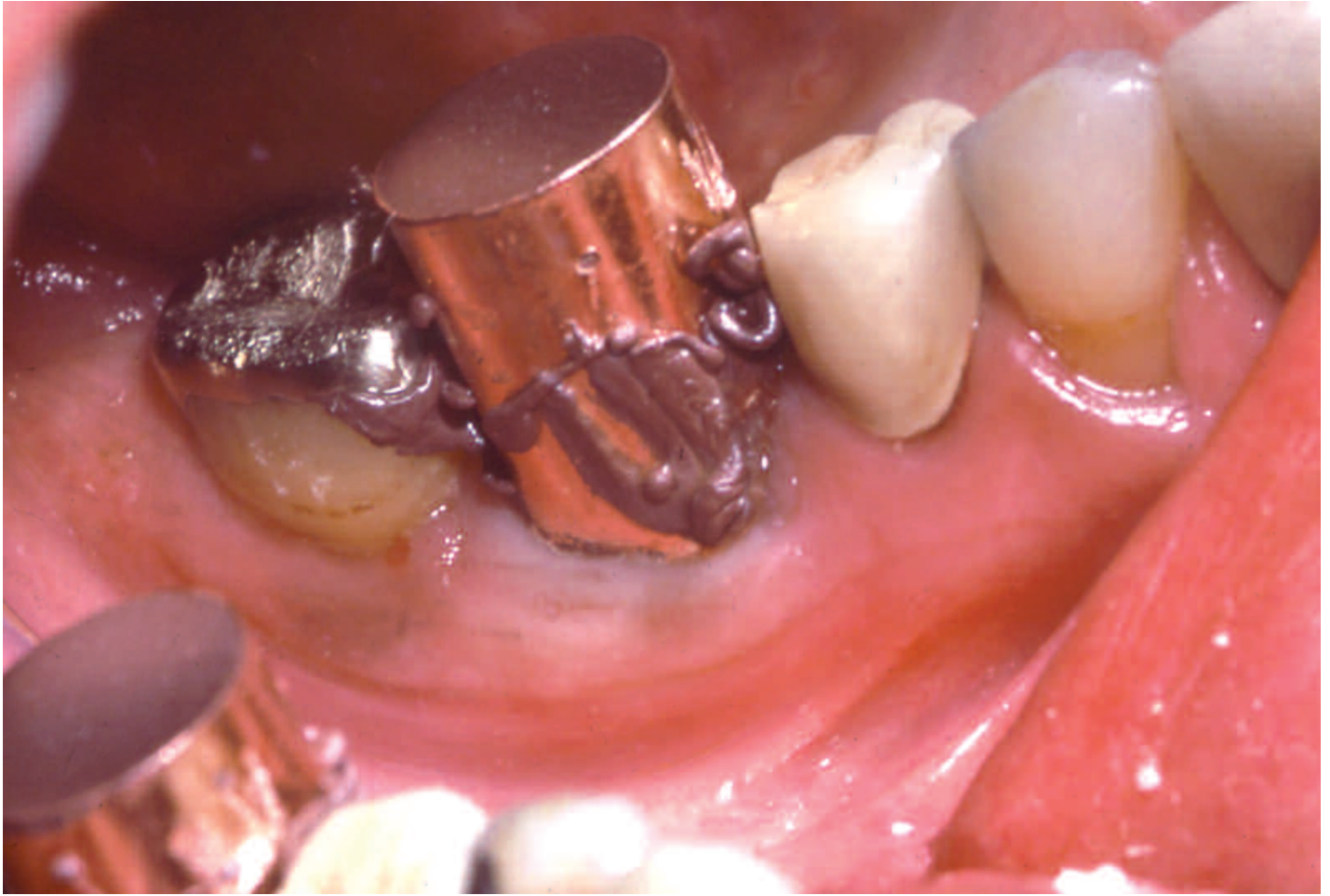


Figure 17. Trimmed and festooned unannealed copper band seated within sulcus with viscous rubber base impression material (Neo-Plex). (1982) Note the blanching and deflection of the gingiva. Viscous rubber-base impression material not available today. Polyvinyl putty is a convenient but not better alternative.



Figure 18. Impression captures chamfer finish line close to the base of the sulcus.



Figure 19. Chamfer finish line on master die and final porcelain-fused-to-metal crown.

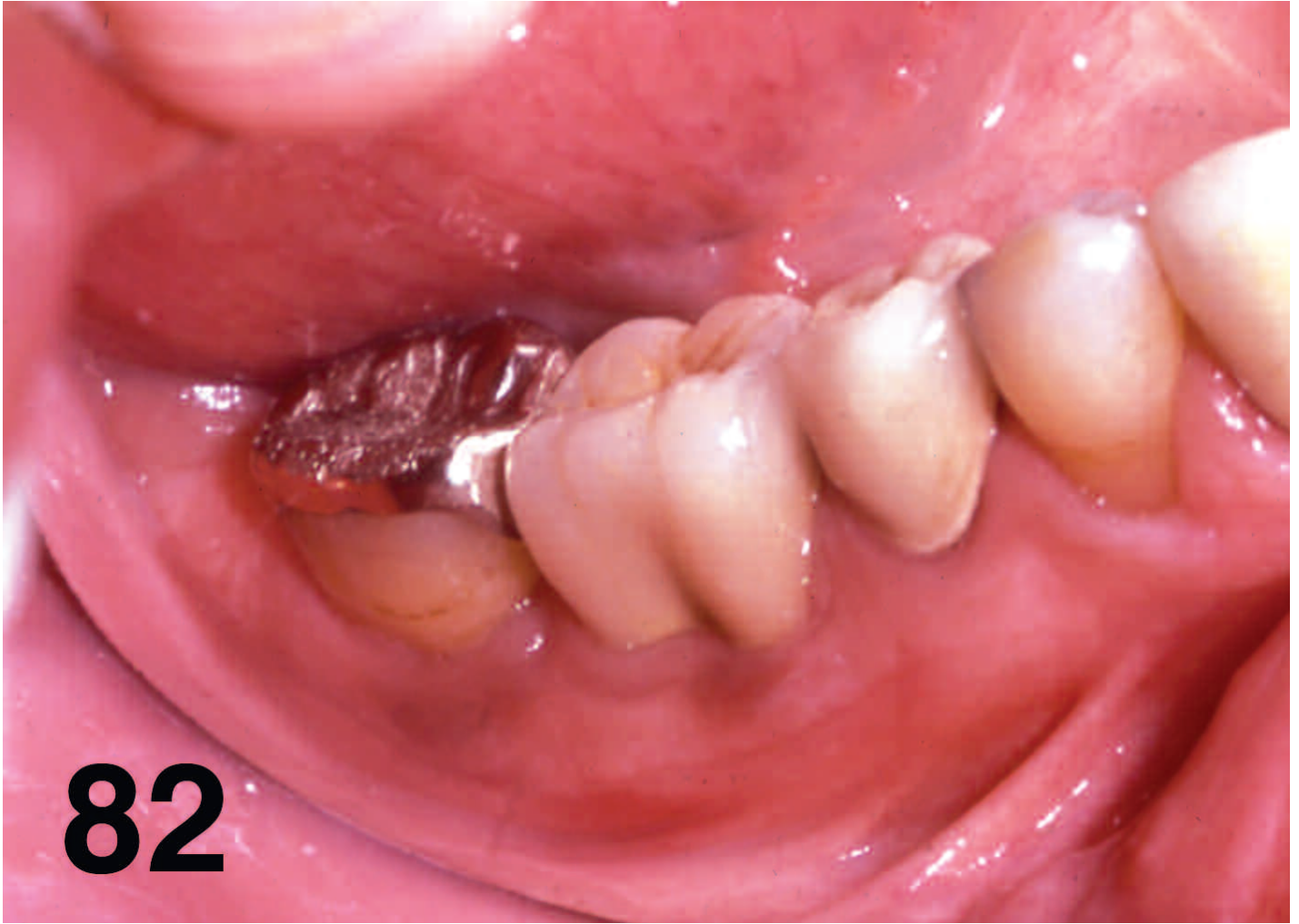


Figure 20. Porcelain-fused-to-metal crown 1 week after cementation. Metal collar is completely hidden in sulcus. Note tissue response (1982).

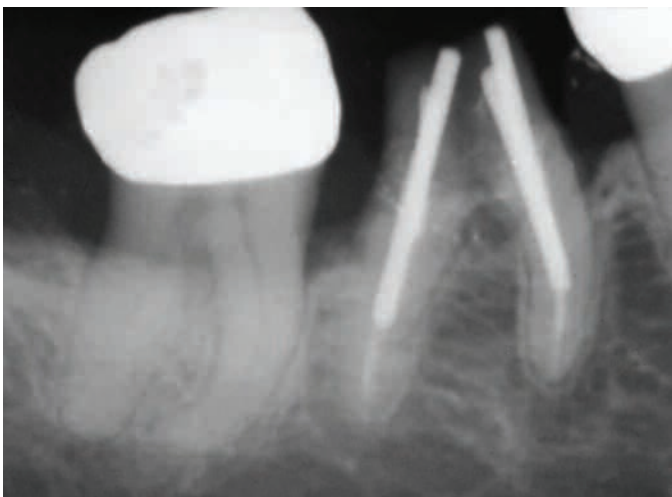


Figure 21. 1982 radiograph. Cement washout of old crown and root caries resulted in loss of all coronal dentin.



Figure 22. 1990 porcelain-fused-to-metal crown appears radiographically to extend to the level of crestal bone but actually terminates close to the base of the sulcus. Where there is no other choice and the fit is precise, such extension close to the junctional epithelium is clinically tolerated



Figure 23. Tissue response 8 years later. (1990) Some shrinkage and remodeling has occurred. Sulcus is now only 2mm deep, and some sound root dentin can be probed apical to the termination of the restoration and coronal to the base of the sulcus. The fit is precise, such extension close to the junctional epithelium is clinically tolerated.

References

1. Rosen H. Dissolution of Cement, Root Caries, Fracture and Retrofit of Post and Cores. *J Prosthet Dent* 1998;80:4:511-3.
2. Rosen H. Operative Procedures on Mutilated Endodontically Treated Teeth. *J Prosthet Dent* 1961;11:5:973-86.
3. Rosen H. Post and Core Failure – Restoration and Prevention. *The Can J Dent Technol* 1999;3:5:55-6,101.
4. Allen EP. Surgical Crown Lengthening for Function and Esthetics (review). *Dent Clin North Am* 1993;37:163-79.
5. Bragger U, Lauchenauer D, Long NP. Surgical Lengthening of the Clinical Crown. *J Clin Periodont* 1992;19:58-63.
6. Bragger U, Posquali L, Korman KS. Remodeling of Interdental Alveolar Bone after Periodontal Flap Procedures Assessed by Means of Computer-Assisted Densitometric Image Analysis (CADIA). *J Clin Periodont* 1988;15(9):558-64.
7. Fitzig S, Feder D, Marshak B, Orstein M. An Improved Copper Band Impression Technique. *Quintessence Int* 1985 Dec;16(12):851-3.
8. Reeves WG. Restorative Margin Placement and Periodontal Health (review). *J Prosthet Dent* 1991;66:733-36.
9. Rosen H. Aging and Medically Compromised Periodontal Prosthodontic Patients – Salvaging Abutment Teeth Undermined by Root Surface Caries. *J Periodont Restorative Dent* 1996;16:492-502.
10. Rosen H. Repair of Interproximal Root Surface Caries in Ageing Periodontal-Prosthodontic Patients. *J Periodont Restorative Dent* 1988;5:41-9.
11. Rosen H. Complex Impressions Simplified with Copper Bands and Warmed Rubber Base. *JCDA* 1991;57:8:644-48.
12. Rosen H. A Modified Rubber Base Impression Technique. *JCDA* 1963;29:11:703-16.
13. Ruel J, Schuessler PJ, Malament K, Mori D. Effects of Retraction Procedures on the Periodontium in Humans. *J Prosthet Dent* 1980;44(5):508-15.

Focus on Dental Digital Scanners:

The Science Behind

By Martin Brochu, DMD, ABGD

ABSTRACT

The aim of this article is to provide an overview of the different technologies and physics employed in commercially available dental scanning devices and to enable the reader to understand how digital impression works.

Digital technology applications in dentistry are developing at a very fast pace and are no longer limited to managing patients' files and booking appointments. We're living through exciting times and digitalization will certainly influence how we do dentistry from now on. Patients' request for quicker, high-tech treatment options combined with the availability of high-strength structural materials like zirconia-based ceramics for restoration cores, which can be shaped only by CAD/CAM systems, have both increased the demand for CAD/CAM produced restorations. As a result, CAD/CAM-based procedures are one of the fastest growing market segments in dentistry.

Computer Aided Design (CAD)/ Computer Aided Manufacturing (CAM) technology has been in use for the last 50 years. It originated with numerically controlled machines feeding numbers on paper tape into controllers wired to motors positioning work on machine tools. It advanced in the 1960s with the creation of early computer software that enabled the design of products in many

industries. Innovation in 3D digital scanners went along with the development of captors in optical engineering and the making of smaller lasers. The introduction of CAD/CAM concepts into dental applications was presented in 1973 by Dr. Francois Duret in his thesis entitled "Empreinte Optique" (Optical Impression). In 1989, he presented a CAD/CAM device capable of taking a virtual impression of a tooth and fabricated a crown in 4 hours. In the meantime, in 1980, Dr. Werner Mörmann and an electrical engineer, Marco Brandestini developed the concept for what was to be introduced in 1987 by Sirona (Charlotte, NC) as the first in-office CAD/CAM system for the fabrication of dental restorations: CEREC.¹

CAD/CAM systems are made of three functional components: data capture or scanning to capture and record data about the oral environment, tooth preparation, adjacent teeth and occluding tooth geometry; CAD to design the restoration to fit the preparation; and CAM to fabricate the restoration. Data capture differs remarkably between commercially available dental

CAD/CAM systems. Some systems are capable of capturing 3-D virtual images of tooth preparations directly in the mouth – a digital impression from which restorations may be fabricated directly. These intraoral scanning devices are getting very popular worldwide but it was estimated in 2008 that less than 10% of dentists were using one. On the other hand, laboratory scanning systems will capture the image of a dental model and create a virtual cast which will be used to generate a restoration. Contrary to the dentist population, almost all major dental labs today in Canada operate a digital scanner. The fundamental differences between data capture devices reside mainly on the technology involved during the scanning process.

Laboratory Scanning Devices

Most commercially available CAD/CAM systems capture data from models in laboratory, using optical digitizers of various types. Sensitive to any motion, these high-precision digitizers use technologies that prevent them from being used intra-orally.

LCol Martin Brochu is a dental officer in the Canadian Forces Dental Services and board certified by the American Board of General Dentistry.

About the Author



In the dentist office, a conventional impression is taken using impression material and sent to a dental lab where it is poured in stone. In the dental lab, a bench-top optical digitizer allows scanning of full casts, dies, wax-ups, frameworks, or implant abutments automatically. It also offers a solution for storage of casts and orthodontics treatment planning and analysis. Scanning time is highly dependable on the image resolution, number of CCD (camera) used in the device, and the technology used in a specific system. For example, it may take between 1 to 5 minutes, depending on the device, to scan a model of a three unit (FPD). Laboratory scanners provide extremely high measurement precision of the scanned object with a precision level between 3 to 20 μm .

In most cases, the scanner used to capture data is an integral part of a CAD/CAM system and operates only in combination with dedicated CAD software of the same manufacturer. All components are linked by a unique data format, precluding data from one system from being used to shape a restoration with a different system. Cercon Eye Laser Scanner (Dentsply, Burlington, NJ), Everest Scan (KaVo, Cambridge, ON), and CEREC InLab (Sirona, Charlotte, NC) are examples of closed architecture systems. Open architecture relates to the accessibility to data captured by the optical digitizer. Some manufacturers use a standard imaging file extension to save the data captured. This feature permits the exchange of files or networking between different labs because images can be read by other users working on a different CAD/CAM system. 3Shape (3Shape A/S, Copenhagen, Denmark), Hint-EL (Hint-EL GmbH, Griesheim, Germany), and ZENO Tec (Wieland Dental, Pforzheim, Germany) are examples of completely open systems.

The latest generation of laboratory scanners employs a topometric 3-D measurement process. Topometric metrologies make use of the mathematical concept of triangulation to measure the distance of an object. The measuring system is based on the principle of human stereoscopic vision: both eyes view an object at a specific distance from the same angle and the brain processes the information from the eyes into a three-dimensional picture. Another basic principle of the system is linear projection: if straight lines are projected onto an object, for example: a ball, the lines will be curved around the ball. To measure distances, the light projector, the camera and the object to be measured form the corners of the trian-

gulation triangle (Figure 1). The camera in a specific position takes a picture of the object illuminated by the light projector and evaluates the distortions of the straight lines so that a three-dimensional image coordinate can be calculated for each image point based on triangulation. By turning and tipping the object, each relevant point can be precisely recorded including overlapping locations. This allows the measurement of objects with very complex surface contours (Figure 2). Some systems require the object surface to reflect homogeneously so that the projected strip patterns can be detected by the camera with sufficient contrast. In these cases, the use of titanium dioxide powder on the surface of the cast is essential to avoid light absorption or diffraction by the surface of the scanned object.

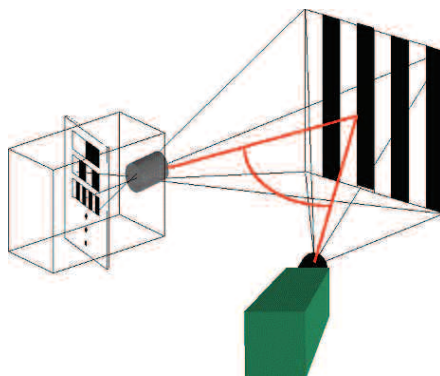


Figure 1. Triangulation: A triangle formed by a light source, a camera, and the object to be measured.



Figure 2. Projection of strip patterns on a model.

Intraoral Scanning Device

The latest developments in automation, optics, and miniaturization have enabled the capture of high quality intraoral digital dental impressions. Intraoral digital scanners have been in use in dentistry for more than 25 years and continue to be improved in order to obtain user-friendly virtual

impressions. The critical task of obtaining accurate impressions has undergone a paradigm shift. A wand positioned by the dentist or dental assistant in the patient mouth will record in 5 to 10 minutes the same data traditionally obtained by a full mouth impression and bite registration taken with elastomeric impression materials. Two dedicated stand-alone systems using open architecture and two integral digital impression systems using closed architectures are currently available in Canada. These systems are able to feed data obtained from accurate digital scans of teeth directly into milling systems capable of carving restorations out of ceramic or composite resin blocks without the primary need for a physical replica of the prepared, adjacent, and opposing teeth.

The availability on PubMed of independent research of the in-vivo accuracy of digital impression is extremely limited. On the other hand, the marginal fit and clinical performance of restorations made by CAD/CAM systems has been evaluated by several studies. Since variables from milling machines and materials used have a significant role in the marginal fit of the restoration, we cannot extrapolate from these researches. There are anecdotal reports in the literature of dentists stating that their number of retakes have dropped significantly using digital impressions versus conventional impressions. It is important to mention that proper tissue management is still required and even appeared to be more critical in order to capture high quality digital impression. For example, the pooling of blood or saliva that could block out critical anatomical features of dentition or tissue from the scanner light needs to be avoided for a period ranging for 1 to 5 minutes. An uneven powder coating or environmental changes during scanning – such as saliva, contact with scanner probe or the tongue – might further compromise the accuracy of these systems. What the scanner can't see cannot be captured.

Dedicated Digital Impression Systems

The Cadent iTero (Carlstadt, NJ) and the Lava COS from 3M ESPE (St. Paul, MN) represent the two stand-alone units using open architecture concept. Both capture intraoral digital impression and digital data are sent wirelessly from the dentist office to dental labs in order to fabricate either a CAM restoration and/or a CAM model made in acrylic.

The iTero features parallel confocal imaging, which utilizes laser and optical scanning to digitally capture the surface and contours of the tooth and gum structure (Figure 3). Confocal roughly translates as 'having the same focus' and light is collected from the same focal position by spatial filtering i.e., a pinhole. A pinhole can be used to spatially resolve light from a particular depth or plane in an object. As can be seen in Figure 4, only light (denoted by green) from the right plane passes through the pinhole. Light from the plane above the imaged plane (denoted in red) is focused above the pinhole so most of the light fails to pass through the pinhole. Conversely light from the plane below the imaged plane (denoted in yellow) focuses before the pinhole and fails to pass through the pinhole. Therefore only light from one plane is in focus to pass through the pinhole, or in other words: light is confocal. The iTero scanner captures 100,000 points of laser light in perfect focus at 300 focal depths of the tooth structure. These focal depth images are spaced approximately 50 microns apart. Parallel confocal scanning with the iTero system captures all elements and materials found in the mouth without the need for scanning powder. Because there is no tooth coating, the iTero system can operate with contact scanning techniques.²



Figure 3. iTero scanner.

The Lava Chairside Oral Scanner (COS) utilizes Active Wavefront Sampling (AWS) as the method for capturing 3-D impressions. The AWS is mainly based on the 3-D surface imaging technique known as depth-from-defocus.³ As it can be seen on Figures 5 and 6, the diameter of a target object defocus blur is directly related to that object's distance from the optical system's in-focus plane (CCD's surface). If the object is situated in the in-focus plane, the target is in perfect focus, and the defocus blur diameter is zero. As the target object moves away from the in-focus plane, however, the diameter of the defocus blur (also called circle of confusion) increases. Using geometrical optics analysis and image processing algorithms, the software determines the distance between the wand and the target

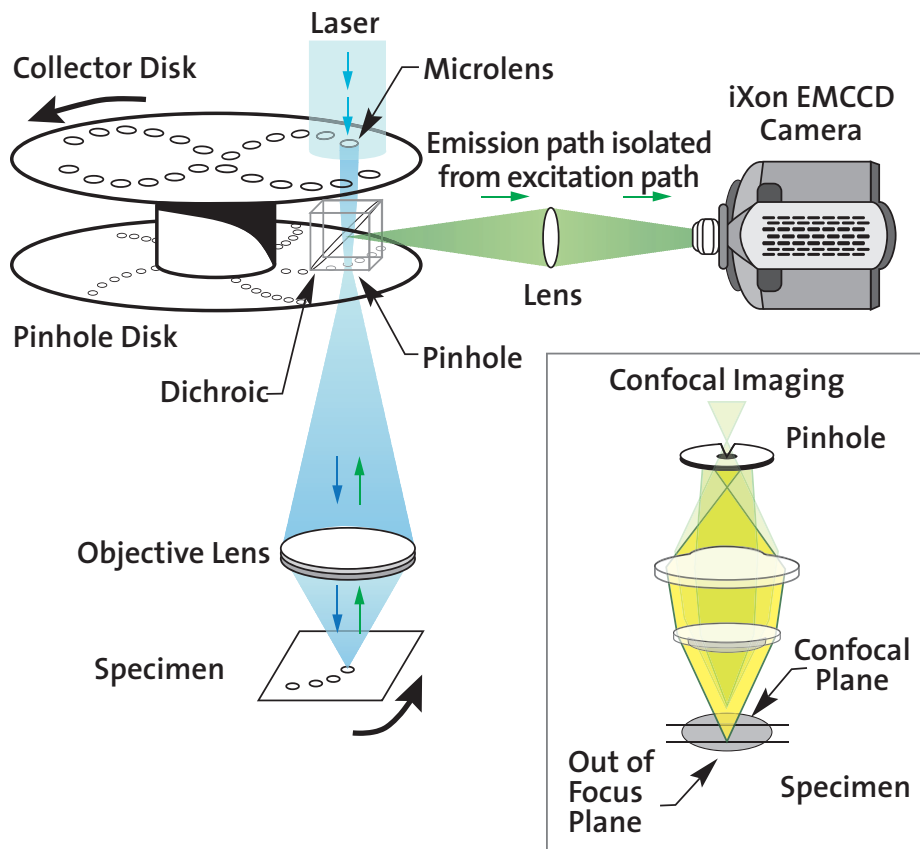


Figure 4. Parallel confocal imaging.

object by measuring the size of circles of confusion on the surface of CCDs. This technique provides real-time model reconstruction in an instantaneous video sequence in real time. The Lava COS requires very light powdering to allow the scanner to locate reference points (Figure 7).

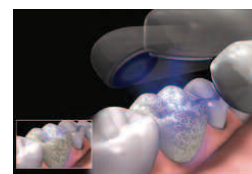


Figure 7.
3M Lava COS.

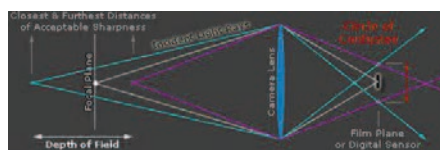


Figure 5. Depth from defocus: The position of an object related to the focal plan creates a circle of a specific diameter on the camera surface.



Figure 6. Diameter of circles of confusion increases as the object position moves away from the focal plan.

Integral Digital Impression Systems

Intraoral digital 3-D scanning device is an integral component of the CEREC AC Bluecam system (Sirona) and E4D system

(D4D, Richardson, Texas). Since these systems are new on the market, it is very difficult to find independent scientific literature regarding the specific technology involved in these intraoral devices.

Sirona has introduced in January 2009 its new intraoral optical scanner, the CEREC Bluecam (Figure 8). CEREC now uses a new optical system made of a blue LED laser rather than the commonly used red LED. The sensitivity of the CCD sensor has also been enhanced. Bluecam utilized the triangulation technique, as presented earlier, by projecting a grid of dark and light stripes onto the tooth surface. The tooth surfaces still required powdering but less than the previous versions of CEREC. According to Sirona, the shorter wavelength of blue light improves the precision of the optical impression and reduces the distortion often by the triangulation technique at peripheral

areas of curved surfaces.⁴ The scanner has an improved depth of field which makes its positioning over the tooth surface less critical.



Figure 8. CEREC Bluecam scanner.

E4D IOD (Intra Oral Digitizer) uses a single laser point reflecting off micro-mirrors oscillating at 20,000 cycles per second a complete laser pattern is captured for imaging. Rather than triangulation technique to measure a single point or a single line, the E4D IOD utilizes a Moiré technique by creating an interference pattern that reveals multiple lines used to compute a relative height map of the surface characteristics of a tooth. The advantage of this concept is the elimination of usage of powder on teeth surfaces before scanning. This technique is illustrated by a checkered plan produced by the interference of two light patterns of curvilinear lines placed at a set angle from each other (Figure 9). The CCD is configured to capture an image according to light reflected during each exposure period. Data associated

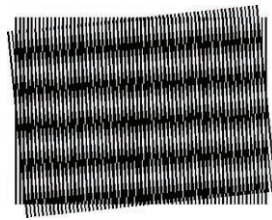


Figure 9. Moiré pattern.

with the surface characteristics are generated by capturing images of the object from various perspectives. The perspectives are mapped or combined to produce a set of data points that represent the various surfaces of the object. The data points are finally processed to generate the three-dimensional visual display of the object.

The aim of this article was to expose and familiarize dentists to the different technologies involved in dental digital scanners. Deep knowledge of the physics and mathematics involved is certainly not a prerequisite for the daily operation of these devices; but as scientists and health professionals it is important to understand the mechanisms behind the apparatus we use in our patient's mouth. The science of optics and electronics continue to progress at a very fast pace. Digital impression using wireless wand capable

of taking full arch impression in less than 1 minute would probably be a reality one day.

Disclosure

The author has no financial or commercial interest in any products described in this article.

The views expressed in this article are those of the author and do not reflect the official policy of the CFDS, nor the Department of National Defense, Canada

References

1. Birnbaum NS, Aaronson HB. Dental Impressions Using 3D Digital Scanners: Virtual Becomes Reality. *Compend Contin Educ Dent* 2008;29(8):494, 496, 498–505.
2. Henkel GL. A Comparison of Fixed Prostheses Generated from Conventional vs Digitally Scanned Dental Impressions. *Compend Contin Educ Dent* 2007;28(8):422–31.
3. Frigerio F. 3-Dimensional Surface Imaging Using Active Wavefront Sampling. Cambridge, MA: Massachusetts Institute of Technology. 2006.
4. Pieper R. Digital Impressions – Easier Than Ever. *Int J Comp Dent* 2009;12:47–52.

Focalisation sur les scanneurs dentaires numériques:

La Science a l'appui

Par Martin Brochu, DMD, ABGD

RESUME

Le but de cet article est de présenter une vue générale des différentes technologies et la physique utilisées dans la fabrication des dispositifs des scanneurs dentaires disponibles à la commercialisation pour permettre au lecteur de comprendre le fonctionnement de l'empreinte numérique.

Les applications de la technologie numérique dans la dentisterie se développent très rapidement et ne sont plus limitées à gérer les fichiers et les rendez-vous des patients. Nous vivons des moments passionnants et la numérisation va sûrement influencer la dentisterie dans l'avenir. La demande des patients pour des options de traitements rapides et high-tech combinée à la disponibilité de matériaux de structures haute résistance comme les céramiques à base de zircone pour les chappes, qui ne peuvent être mises en forme que par les systèmes CAO/FAO, ont ensemble augmenté la demande pour les restaurations produites par les systèmes CAO/FAO. De ce fait, les procédures à base de CAO/FAO est l'un des segments de la dentisterie qui enregistre une croissance très rapide sur le marché.

La technologie Conception assistée par

ordinateur (CAO)/ Fabrication assistée par ordinateur (FAO) a été utilisée durant les 50 dernières années. À l'origine, des machines contrôlées numériquement livrant des chiffres sur rubans de papier dans des contrôleurs câblés à des moteurs qui mettent en position le travail sur les machines à outils. L'avancée se fait en 1960 avec la création des premiers logiciels d'ordinateurs qui ont permis la conception de produits dans plusieurs industries. L'innovation des scanneurs numériques 3D s'est faite en parallèle avec le développement des capteurs dans l'ingénierie optique et la fabrication de plus petits lasers. L'introduction des concepts CAO/FAO dans les applications dentaires a été présentée en 1973 par le DR. François Duret dans sa thèse intitulée "Empreinte Optique". En 1989, il a présenté un dispositif CAO/FAO capable de prendre l'empreinte virtuelle d'une dent et en fabriquer une couronne 4 heures plus tard. Au même

temps, en 1980, Dr Werner Mörmann et Marco Brandestini, un ingénieur électricien, ont développé le concept de ce qui sera présenté en 1987 par Sirona (Charlotte, Caroline du Nord) comme le premier système CAO/FAO de cabinet pour la fabrication des restaurations dentaires : CEREC.¹

Les systèmes CAO/FAO sont fait de trois composants fonctionnels: saisie des données ou balayage pour saisir et enregistrer les données concernant l'environnement oral, la préparation de la dent, la dent adjacente, les dents adjacentes et la géométrie des dents d'occlusion; la CAO pour concevoir la restauration pour qu'elle corresponde à la préparation; et la FAO pour fabriquer la restauration. La saisie des données diffère de manière remarquable entre les systèmes dentaires CAO/FAO disponibles sur le marché. Certains systèmes sont capables de saisir des images virtuelles en 3-D des préparations des dents directement dans la

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bouche- une empreinte digitale à partir de laquelle les restaurations peuvent être fabriquées directement. Ces outils de balayage intra buccal sont devenus très populaires partout dans le monde mais en 2008, on a estimé que moins de 10% des dentistes les utilisent. D'autre part, les systèmes de balayage au laboratoire saisissent l'image d'un modèle dentaire et créent un modèle virtuel qui va être utilisé pour générer une restauration. Contrairement à la population des dentistes, presque tous les grands laboratoires dentaires utilisent un scanner numérique. Les différences fondamentales entre les outils de saisie des données sont principalement liées à la technologie utilisée durant le processus de balayage.

Les Outils de Balayage au Laboratoire

La majorité des systèmes CAO/FAO disponibles sur le marché saisissent les données à partir des modèles au laboratoire, en utilisant des numériseurs optiques de type varié. Sensible à tout mouvement, ces numériseurs de haute précision font recours à des technologies qui les empêchent d'être utilisés intra-oralement. Au cabinet du dentiste, une empreinte conventionnelle est prise en utilisant un matériau d'empreinte et envoyé au laboratoire et est coulé dans la pierre. Au laboratoire dentaire, un numériseur optique permet la saisie automatique de modèles complets, matrices, modèles en cire, cadres, ou implant-piliers. Ils offrent aussi une solution de stockage des modèles, des planifications et des analyses des traitements orthodontiques. Le temps de saisie dépend énormément de la résolution de l'image, le nombre de CCD (caméra) utilisé dans l'outil, et la technologie utilisée dans un système spécifique. Par exemple, il faudrait entre 1 à 5 minutes, en fonction de l'outil, pour saisir modèle de trois unités (PDF). Les scanners de laboratoires fournissent une mesure de précision extrêmement supérieure de l'objet saisi avec un niveau de précision entre 3 et 20 µm.

Dans la majorité des cas, le scanner utilisé pour saisir les données est une partie entière du système CAO/FAO et fonctionne seulement en combinaison avec un logiciel CAO spécialisé du même fabricant. Tous les composants sont liés par un format de données unique, empêchant l'utilisation des données d'un système pour configurer une restauration avec un système différent. Cercon Eye Laser Scanner (Dentsply, Burlington, NJ), Everest Scan (KaVo, Cambridge, ON), and

CEREC InLab (Sirona, Charlotte, Caroline du nord) sont des exemples de systèmes architecturaux fermés. L'architecture ouverte porte sur la question de l'accessibilité aux données saisies par le numériseur optique. Certains fabricants utilisent des extensions de fichiers d'imagerie standard pour sauvegarder les données saisies. Cette caractéristique permet l'échange de fichiers ou le réseautage entre les différents laboratoires parce que les images peuvent être déchiffrées par d'autres utilisateurs travaillant avec des systèmes CAO/FAO différents. 3Shape (3Shape A/S, Copenhagen, Danemark), Hint-EL (Hint-EL GmbH, Griesheim, Allemagne), et ZENO Tec (Wieland Dental, Pforzheim, Allemagne) sont des exemples de systèmes complètement ouverts.

La dernière génération des scanners de laboratoire emploie le processus de mesure de topométrie 3-D. les métrologies topométriques utilisent le concept mathématique de la triangulation pour mesurer la distance par rapport à un objet. Le système de mesure se base sur le principe de la vision stéréoscopique humaine : les deux yeux voient un objet à une distance spécifique à partir du même angle et le cerveau transforme l'information à partir des yeux en une image tridimensionnelle. L'autre principe de base du système est la projection linéaire: si des lignes sont projetées sur un objet, par exemple: un ballon, les lignes vont être arrondies autour du ballon. Pour mesurer les distances, le projecteur de lumière, la caméra et l'objet à mesurer forment les coins du triangle de la triangulation (Figure 1). La caméra en position spécifique prend une photo de l'objet illuminé par le projecteur de lumière et évalue les distorsions des lignes droites de façon à ce qu'une image tridimensionnelle coordonnée puisse être calculée pour chaque point de prise d'image en triangulation. En tournant et en basculant l'objet, chaque point pertinent peut être enregistré avec précision y compris les emplacements chevauchants. Ceci permet la mesure des objets avec des contours de surface très complexes (Figure 2). Certains systèmes exigent que la surface de l'objet reflète de manière homogène pour que les profils des bandes projetées puissent être détectés par la caméra avec suffisamment de contraste. Dans ces cas, l'utilisation de la poudre du dioxyde de titane sur la surface du modèle est fondamentale pour éviter l'absorption ou la diffraction de la lumière par la surface de l'objet balayé. .

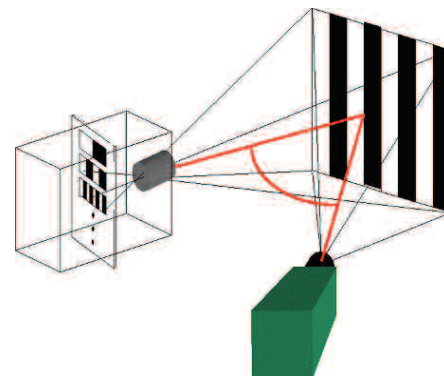


Figure 1. Triangulation: Un triangle forme par une source de lumière, une caméra, et l'objet à mesurer.



Figure 2. Projection de bandes de motifs sur un modèle.

Outil de balayage intra-buccal

Les derniers développements en automatisation, optique, et miniaturisation ont permis la saisie d'empreintes dentaires numériques intra-buccales de haute qualité. Les balayeurs numériques intra-buccaux sont utilisés en dentisterie depuis plus de 25 ans et continuent d'être améliorés pour obtenir des empreintes virtuelles conviviales. La tâche principale d'obtenir des empreintes précises est passé par un changement de paradigme. Un support dentaire posé par le dentiste or par l'assistant dans la bouche du patient va enregistrer en 5 à 10 minutes les mêmes données obtenues traditionnellement par une empreinte de la bouche au complet et l'enregistrement d'une morsure prise par des matériaux d'empreintes élastomères. Deux systèmes spécialisés autonomes utilisant l'architecture ouverte et deux systèmes d'empreintes numériques intégrales utilisant des architectures fermées sont disponibles au Canada. Ces systèmes sont capables d'alimenter des données dentaires obtenues des balayeurs numériques de dents directement dans des systèmes capable de sculpter des

restaurations à partir de céramiques ou de blocs de composite de résine sans le besoin essentiel d'une réplique physique de la dent préparée, adjacente et opposée.

La disponibilité sur PubMed de recherche indépendante concernant la précision des empreintes numériques in-vivo est extrêmement limitée. D'autre part, la correspondance marginale et la performance clinique des restaurations faites par les systèmes CAO/FAO ont été évaluées par plusieurs études. Étant donné que les machines de mouture et les matériaux utilisés jouent un rôle significatif dans la correspondance marginale de la restauration, nous ne pouvons pas extrapoler ces recherches. Des rapports anecdotiques dans la littérature des dentistes mentionnent la diminution de manière significative du nombre de reprise après utilisation des empreintes numériques versus les empreintes conventionnelles. Il est important de mentionner qu'une gestion adéquate des tissus est toujours exigée et paraît même essentielle pour saisir des empreintes numériques de qualité supérieure. Par exemple, l'accumulation du sang ou de la salive qui peut bloquer des caractéristiques anatomiques essentielles de la dentition ou du tissu des lumières du scanneur doit être évitée pour une période de 1 à 3 minutes. Une poudre d'enrobage irrégulière ou des changements environnementaux durant le balayage- comme la salive, le contact avec le scanneur ou la langue- peut compromettre l'exactitude de ces systèmes. Ce que le scanneur ne peut voir ne peut être saisi.

Systèmes numériques d'empreinte intégrals

Le Cadent iTero (Carlstadt, NJ) et le Lava COS de 3M ESPE (St. Paul, MN) représentent les deux unités autonomes utilisant le concept de l'architecture ouverte. Toutes les deux saisissent des empreintes numériques intra-buccales et les données numériques sont envoyées sans fil du cabinet du dentiste au laboratoire dentaire pour fabriquer soit une restauration CAO et/ou un modèle CAO fait d'acrylique.

Le iTero présente l'imagerie parallèle confocale, qui utilise le laser et le scanneur optique pour saisir de façon numérique la surface, les contours de la dent et la structure de la gencive (Figure 3). Le confocal se traduit comme 'ayant le même focus' et la lumière est prise de la même position focale par une filtration spatiale par exemple, un trou. Un trou peut être utilisée pour régler

spatialement la lumière à partir d'une profondeur ou d'un plan particulier sur un objet. Comme vous pouvez le voir sur la Figure 4, seule la lumière (vue en vert) du côté droit passe à travers le trou. La lumière provenant du plan en dessus du plan de l'image (vue en rouge) est focalisée au dessus du trou de manière à ce que le plus de lumière ne passe pas à travers le trou. Réciproquement, la lumière provenant du plan en dessous du plan de l'image (vue en jaune) se focalise avant le trou et ne passe pas à travers le trou. Il en résulte que seule la lumière provenant d'un plan au point est capable de passer à travers le trou, ou en d'autres mots: la lumière est confocale. Le scanneur iTero saisit 100,000 points de lumière laser parfaitement au point à une profondeur focale de la structure de la dent de 300. Ces images en profondeur focale sont espacées de 50 microns approximativement. Le balayage parallèle confocal avec le système iTero saisit tous les éléments et matériaux trouvés dans la bouche sans faire appel à la poudre pour le balayage. Du fait qu'il n'y a pas d'enduit pour les dents, le système iTero peut fonctionner avec les techniques de balayage de contact.²

Figure 3.
Scanneur
iTero.



Les scanneurs buccaux pour cabinets (SBC) Lava utilisent le prélèvement actif des surfaces d'ondes comme méthode pour saisir les empreintes 3-D. Cette méthode est essentiellement basée sur la technique de l'imagerie de surface 3-D, technique connue sous le nom de mesure de la profondeur par defocalisation.³ Comme on peut le voir sur les figures 5 et 6, le diamètre du flou de l'objet ciblé est directement lié à la distance du dit objet du plan au point du système optique (la surface de CCD). Si l'objet est situé dans le plan au point, l'objectif est dans un foyer parfait, et le diamètre du flou est zéro. Toutefois, au fur et à mesure que l'objet ciblé s'éloigne du plan du foyer, le diamètre du flou (ce qu'on appelle aussi cercle de confusion) augmente. En utilisant l'analyse optique géométrique et les algorithmes de traitement des images, le logiciel détermine la distance entre le lecteur et l'objet ciblé en

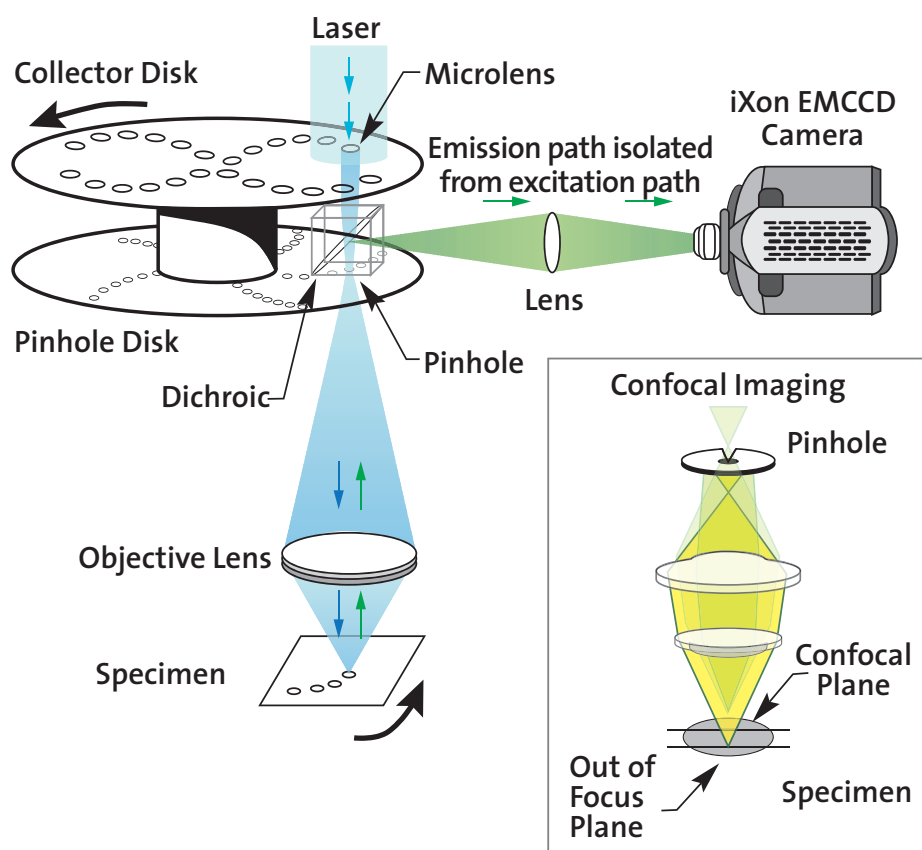


Figure 4. Imagerie confocale parallèle.

mesurant la taille des cercles de confusion de la surface des CCD. Cette technique fournit un modèle de reconstitution en temps réel de séquences vidéo instantanées en temps réel. Le CBC Lava exige un poudrage très léger pour permettre au scanneur de localiser les points de référence (Figure 7).

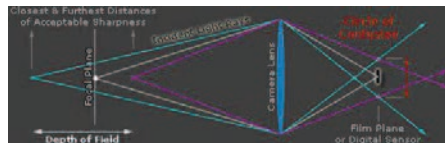


Figure 5. Mesure de la profondeur par defocalisation: La position d'un objet par rapport au plan focal crée un cercle de diamètre spécifique sur la surface de la camera.



Figure 6. Les diamètres des cercles de confusion augmentent quand l'objet s'éloigne du plan focal.

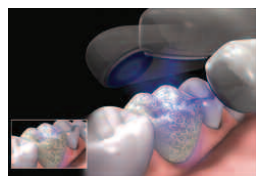


Figure 7.
Le SBC 3M Lava.

Systèmes numériques d'empreinte intégrales

L'outil de balayage intra-buccal numérique 3-D est une composante intégrale du système CEREC AC Bluecam (Sirona) et système E4D (D4D, Richardson, Texas). Étant donné que ces systèmes sont nouveaux sur le marché, il est très difficile de trouver de la littérature scientifique indépendante concernant la technologie spécifique impliquée dans ces outils intra-buccaux.

Sirona a présenté, en Janvier 2009, son nouveau scanneur optique intra-buccal, le CEREC Bluecam (Figure 8). Maintenant CEREC utilise un nouveau système optique fait de laser DEL bleu au lieu du communément utilisé DEL rouge. La sensibilité du capteur CCD a aussi été rehaussée. Bluecam a utilisé la technique de triangulation, comme présenté plutôt, en projetant une

grille de bandes sombres et claires sur la surface de la dent. Les surfaces de la dent exigent encore du poudrage mais moins que les versions précédentes de CEREC. Selon Sirona, les longueurs d'ondes courtes de la lumière bleu améliorent la précision de l'empreinte optique et réduit souvent la distorsion par la technique de triangulation aux niveaux des régions périphériques des surfaces courbées 4. Le scanneur a une profondeur de terrain améliorée ce qui rend son positionnement sur la surface de la dent moins essentiel.



Figure 8. Le scanneur CEREC Bluecam.

En utilisant un point singulier du laser réfléchissant, des micro-miroirs oscillant à 20,000 cycles par seconde, un parcours laser complet est saisi pour l'imagerie par le E4D IOD (Numériseur Intra-buccal). Au lieu de la technique de triangulation pour mesurer un point particulier ou une ligne particulière, le E4D IOD utilise la technique Moiré en créant un parcours d'interface qui révèle des lignes multiples utilisées pour calculer une carte de hauteur relative des caractéristiques de la surface de la dent. L'avantage de ce concept est l'élimination de l'usage de poudre sur les surfaces des dents avant le balayage. Cette technique est illustrée par un plan échiqueté produit par l'interface de deux parcours de lumière de lignes curvilignes placées à un angle fixe les unes des autres (Figure 9). Le CCD est configuré pour saisir une image selon la lumière réfléchie au cours de chaque période d'exposition. Des données associées aux caractéristiques de la surface sont générées par la saisie d'image de l'objet à partir de perspectives variées. Les perspectives sont portées sur la carte ou combinées pour pro-

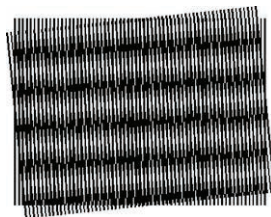


Figure 9. Le modèle Moiré.

duire un ensemble de points de données qui représente les surfaces variées de l'objet. Les points de données sont finalement développés pour générer une présentation visuelle tridimensionnelle de l'objet.

Le but de cet article est d'exposer et de familiariser les dentistes aux différentes technologies impliquées dans les scanneurs numériques dentaires. Une connaissance approfondie de la physique et des mathématiques impliquées n'est certainement pas un préalable pour les opérations quotidiennes des ces outils; mais comme scientifiques et professionnels des soins de santé, il est important de comprendre les mécanismes derrière les appareils que nous utilisons dans la bouche de nos patients. La science de l'optique et de l'électronique progressent très rapidement. L'empreinte numérique utilisant la technologie sans fil capable de prendre une empreinte complète en moins d'une minute sera, un jour, une réalité.

Divulgarion

L'auteur n'a aucun intérêt ni financier ni commercial en aucun des produits décrits dans cet article.

Les opinions exprimées dans cet article sont celles de l'auteur et ne sont ni la politique officielle du SDFC, ni celle du département national de défense, Canada

Références

1. Birnbaum NS, Aaronson HB. Dental Impressions Using 3D Digital Scanners: Virtual Becomes Reality. *Compend Contin Educ Dent* 2008;29(8):494, 496, 498-505.
2. Henkel GL. A Comparison of Fixed Prostheses Generated from Conventional vs Digitally Scanned Dental Impressions. *Compend Contin Educ Dent* 2007;28(8):422-31.
3. Frigerio F. 3-Dimensional Surface Imaging Using Active Wavefront Sampling. Cambridge, MA: Massachusetts Institute of Technology. 2006.
4. Pieper R. Digital Impressions – Easier Than Ever. *Int J Comp Dent* 2009;12:47-52.

Will Digital Impressions Eliminate the Current Problems With Conventional Impressions?

By Gordon J. Christensen, DDS, MSD, PhD

Making impressions with polyether and vinyl polysiloxane impression materials is an everyday procedure in almost every general dental practice. Manufacturers have developed and refined these materials to the level at which it is nearly impossible to blame the impression material for restoration misfits. These materials are accurate and stable.¹⁻⁵

Digital impression devices are on the dental market, and it is expected that others will be available soon. The current digital impression devices are the recently introduced Cadent iTero (Carlstadt, N.J.) and the 3M ESPE Lava Chairside Oral Scanner C.O.S. (St. Paul, Minn.).⁶ Additionally, the manufacturers of computer-directed in-office milling systems CEREC (Sirona Dental Systems, Charlotte, N.C.) and the new E4D system (D4D Technologies, Richardson, Texas) are working to provide digital impressions that can be sent to dental laboratories.

The digital impression concept is emerging rapidly on the high-tech horizon. Some optimistic proponents infer that digital impressions will solve the challenges now observed with conventional elastomer

impressions. However, there are several reasons, other than the properties of conventional impression material, for the inaccuracies that arise in conventional impressions for crowns and fixed prostheses.

I will address the several known problems observed with conventional impressions; discuss whether or not digital impressions will eliminate those problems, thus potentially improving the quality of indirectly made dental restorations; and appraise the apparent cost of making digital impressions versus that of making conventional elastomer impressions.

Soft Tissue Management

Perhaps the most significant reason for the inadequacy of some impressions made with elastomer impression materials, as observed by dental laboratory technicians, is the lack of visibility of the subgingival margins of tooth preparations (J. Shuck, vice president, sales and marketing, Glidewell Laboratories, oral communication, Jan. 9, 2008). This problem is related directly to inadequate soft-tissue management at the time the impression is made. In a previous JADA column,⁷ I have outlined the most easily

used soft-tissue management techniques. The reasons why dentists have difficulty achieving adequate soft-tissue management are not clear to me; the techniques for doing so can be quite simple. I can only guess that some practitioners do not take the time to isolate the margins of subgingival tooth preparations effectively before making conventional impressions.

In my opinion, which is based on observation of conventional impressions in many dental laboratories, proper isolation of subgingival margins is one of the most inadequately accomplished procedures in all of clinical dentistry. Will digital impressions reduce the problems related to isolation of subgingival margins? The answer is a definite "No." It is obvious to clinical dentists experienced in the digital impression technique that digital impressions require even more definitive preimpression isolation of tooth preparation margins than do conventional impressions. A digital camera cannot record tooth preparation margins if they are not visible to the naked human eye, and the computer cannot "fake" a margin any better than can a human laboratory technician. To provide an adequate digital image

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of tooth preparations, the dentist must isolate the margins of all of the tooth preparations and ensure that they are visible to the eye before making a digital impression. It appears that the profession needs an upgrade in this area.

Improper Impression Tray Selection

Most dentists use stock double-arch impression trays for their elastomer impressions of one or two units and stock trays for multiple units. Many stock trays are flexible, requiring rigid impression material to provide the stability needed. If the stock tray and the impression material inside it are not adequately rigid, the impression's accuracy will be compromised because of the flexibility of the tray and the material.⁸⁻¹⁰

Additionally, stock trays require several times the amount of impression material that custom trays do, and I have long supported the use of custom trays for crown and fixed-prosthesis impressions of three units or more.¹¹

The digital impression process does not involve impression trays, thus eliminating the problems related to improper tray selection and potentially improving the quality of impressions.

Separation of Impression Material from the Impression Tray

Problems in separating impression material from the impression tray usually are related to improper use of tray adhesive materials. Polyether and vinyl polysiloxane impression materials require adhesive agents to attach the impression material to the impression tray. Holes in trays further enhance attachment of the impression material to the tray. Impression trays are not required for digital impressions. Therefore, digital impressions can eliminate this frequently seen problem, thus potentially improving the quality of impressions.

Distortion of Conventional Impressions before Pouring

Polyether and vinyl polysiloxane impression materials are stable for a reasonable time after the impression is made,¹⁻⁵ but they can be distorted by inadequate storage or inadvertent force applied to the tray and impression during transportation or shipment to the dental laboratory.

Digital impressions do not involve impression trays, impression materials or shipment

to the dental laboratory and so eliminate the associated problems.

Storage of Conventional Impressions for Potential Remaking of Casts and Dies

Sometimes, an impression is poured improperly. It may contain bubbles. The stone used for the die material may be too thick or too thin. The impression or the poured dies may be misplaced or lost. The result of each of these problems is a need to remake the dies. When this need arises in the case of an impression made with conventional impression techniques, the impression must be repoured.

The digital impression concept allows retention of the digital information in appropriate computer storage as soon as it is received. Assuming the digital information is backed up adequately, the problems created by poorly poured, lost or misplaced impressions are eliminated by the digital impression concept, thus potentially improving impressions.

Using the cost of \$0.50 per milliliter, which is the average price of the two top-selling brands of impression materials on the market according to our measurements, and knowing that the average measured amount of impression material for stock trays is 20 cubic centimeters and for custom trays is 12 cm³,¹¹ one could estimate the current cost of elastomer impression material to be about \$40 for a stock tray and \$6 for a custom tray. One must add to the cost of the impression the variable cost of purchasing stock trays or purchasing custom light-curing tray material, as well as the costs of the dental assistant's or laboratory's time spent in making the tray. It has been estimated that a typical U.S. dentist makes about 25 impressions per month (J. Shuck, vice president, sales and marketing, Glidewell Laboratories, oral communication, Jan. 9, 2008). An iTero device costs \$23,000 (J. Gurdak, marketing coordinator, Cadent, oral communication, May 1, 2008). This means that using the above data, a dentist would need to use a digital impression device for at least a few years to break even with the cost of making conventional impressions.

Summary

Digital impressions appear to be practical, and the concept is being perfected, but the need for further research is clear.¹² Digital impressions eliminate some of the negative characteristics of conventional elastomer impressions, but proper soft-tissue manage-

ment and isolation of tooth preparation margins still is necessary. The relative cost of digital impressions to conventional elastomer impressions is related directly to the number of impressions made by specific practitioners per month, but a dentist must use a digital impression system for a significant amount of time to compensate for the cost of the device. Nevertheless, the acceptance of the digital impression concept is promising.

References

1. Clancy JM, Scandrett FR, Ettinger RL. Long-term dimensional stability of three current elastomers. *J Oral Rehabil* 1983;10(4):325-333.
2. Endo T, Finger WJ. Dimensional accuracy of a new polyether impression material. *Quintessence Int* 2006;37(1):47-51.
3. Shetty P, Rodrigues S. Accuracy of elastomeric impression materials on repeated pours. *J Indian Prosthodont Soc* 2006;6(2):68-71.
4. Hondrum SO. Changes in properties of nonaqueous elastomeric impression materials after storage of components. *J Prosthet Dent* 2001;85(1):73-81.
5. Thongthammachai S, Moore BK, Barco MT 2nd, Hovijitra S, Brown DT, Andres CJ. Dimensional accuracy of dental casts: influence of tray material, impression material, and time. *J Prosthodont* 2002;11(2):98-108.
7. Christensen GJ. The challenge to conventional impressions. *JADA* 2008;139(3):347-349.
8. Christensen GJ. The state of fixed prosthodontic impressions: room for improvement. *JADA* 2005;136(3):343-346.
8. Ceyhan JA, Johnson GH, Lepe X. The effect of tray selection, viscosity of impression material, and sequence of pour on the accuracy of dies made from dual-arch impressions (published correction appears in *J Prosthet Dent* 2007;97[1]:38). *J Prosthet Dent* 2003; 90(2):143-149.
9. Cox JR, Brandt RL, Hughes HJ. A clinical pilot study of the dimensional accuracy of double-arch and complete-arch impressions. *J Prosthet Dent* 2002;87(5):510-515.
10. Jamani KD, Harrington E, Wilson HJ. Rigidity of elastomeric impression materials. *J of Oral Rehab* 1989;16(3):241-248.
11. Christensen GJ. Now is the time to change to custom impression trays. *JADA* 1994;125(5):619-620.
12. CRA Foundation. Digital impressions challenge conventional impressions. *CRA Newsletter* 2007;31(11):3-4.

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The Expanding Role of CAD/CAM in Restorative Dentistry

By Lee Culp, CDT, and Lida Swann, DDS

ABSTRACT

The new millennium has brought with it a change in digital dentistry, as more than 30 different CAD/CAM systems have now been introduced as solutions for restorative dentistry. Dentistry has cautiously welcomed this influx of technology, which is based on technology adopted from aerospace, automotive, and even the watch-making industry. Today's CAD/CAM systems – both chair-side and laboratory based – are being used to design and manufacture metal, alumina, and zirconia frameworks, as well as all-ceramic and composite full-contour crowns, inlays, and veneers that may be stronger, fit better, and are more esthetic than restorations fabricated using traditional methods.

RÉSUMÉ

Le nouveau millénaire a apporté avec lui un changement dans la dentisterie numérisée, puisque plus de 30 systèmes différents CAO/FAO ont maintenant été introduits comme solutions pour la dentisterie restauratrice. La dentisterie a accepté avec une certaine réserve cet influx de technologie qui est basée sur l'industrie aérospatiale, automobile et même l'horlogerie. Les systèmes CAO/FAO actuels – pour le cabinet ou le laboratoire – sont utilisés pour concevoir et fabriquer des modèles en métal, en alumine et en zircone ainsi que des couronnes

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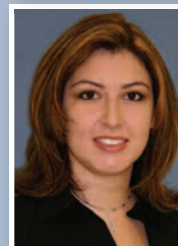
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en céramique et matériau composite, des incrustations et des facettes qui peuvent être plus résistantes, qui s'ajustent mieux et qui sont plus esthétiques que les restaurations fabriquées en utilisant les méthodes traditionnelles.

This article presents a case report of a 42-year-old male patient who presented with an amalgam restoration and a composite restoration that both showed recurrent decay. The existing restorations were removed, and all-ceramic restorations were created using accepted CAD/CAM technology. This case illustrates how CAD/CAM dentistry represents a totally new way to diagnose, treatment plan, and create functional esthetic restorations for our patients in a more productive and efficient manner.

While it took slightly longer than anticipated to integrate into the daily practice of dentistry, the new millennium seemed to be the catalyst for change in digital dentistry, as more than 30 different CAD/CAM systems have now been introduced as solutions for restorative dentistry.

Dentistry has cautiously welcomed this influx of technology that was promised so long ago. Based on technology adopted from aerospace, automotive, and even the watch-making industry, this technology is being accepted now due to its advantage of increased speed, accuracy, and efficiency without a compromise in quality. Today's CAD/CAM systems – both chair-side and laboratory-based (e.g., Procera, Nobel Biocare, Yorba Linda, CA; Lava, 3M ESPE, St. Paul, MN; Cercon, Dentsply Ceramco, Burlington, NJ; CEREC, Sirona, Charlotte, NC; E4D, D4D Technologies, Richardson, TX) – are being used to design and manufacture metal, alumina, and zirconia frameworks, as well as all-ceramic and composite full-contour crowns, inlays, and veneers that may be stronger, fit better, and are more esthetic than restorations fabricated using traditional methods.

The dentist and dental technician's primary role in indirect restorative dentistry is to perfectly copy all functional and esthetic parameters that have been defined by nature into a restorative solution. It is an architect/builder relationship. Throughout the entire restorative process, from the initial consultation through treatment planning, provisionalization (if needed), and final placement, the communication routes between the clinician and the laboratory technician require a complete transfer of information pertaining to existing, desired,

and realistic situations and expectations to and from the clinical environment.

Functional components, occlusal parameter, phonetics, and esthetic requirements are just some of the essential types of information that are necessary for the technician to complete the fabrication of successful, functional, and esthetic restorations.

The primary and conventional tools of communication between the dentist and the technician are photography, written documentation, and impressions of the patient's existing dentition, the clinical preparations and the opposing dentition. From this information models are created and mounted on an articulator, which simulates the jaw movements of the mandible.

As restorative dentistry evolves into the digital world of image capture, computer design and creation of dental restorations through robotics, our perceptions and definitions of the dental laboratory must evolve also. First, in order to fully understand this concept, we must clearly define what a laboratory is. At first thought we might say that a lab is the place that a dentist sends his or her patient's impressions which are then processed by that laboratory into restorations, which are sent back to the dentist for adjustment and delivery. This definition does seem to fit well with the traditional concept of a dentist-laboratory workflow. However, just as the Internet has forever changed the landscape of communication through related computer technology, the possibility to use CAD-CAM restoration files electronically has provided the catalyst for a significant change in the way we view and structure the dentist-lab relationship.

Let us imagine first that our laboratory is not a place, does not have walls, and exists only in the talents for the partners in the restorative process – the dentist and technician. The equipment we use to create the restoration may be located next to the chair, in an in-office laboratory area, remotely, or any or all of the above. Our "laboratory" is actually nothing more than a workflow, which is flexible to the degree that our abilities, access, and equipment will allow. The primary decision becomes where the hand-off from one partner to another should occur. Moreover, a dentist who has the ability to optically scan intraorally for impres-

sions and who often choose CAD-CAM restorations as the best treatment option for their patients, have enhanced freedom as to where we believe the hand-off to the technician partner should occur. The laboratory is no longer a place; it is to a large degree, virtual and a fluid entity.

In some instances, it makes sense for the dentist to work independently and to prepare, design and finish the restoration chairside in a single visit with the obvious advantages a clinical CAD-CAM system has to offer (Figure 1). These might include less complex restorations or fewer numbers of restoration for the same patient that do not require any special characterization other than perhaps stain and glaze or polish.

Other times, it is advantageous to engage the services of the restorative partner, a dental technician, because he or she possesses the skill and perhaps more importantly, the time, to create restorations that either demand more complex characterization or can be more efficiently created in an indirect manner.

The Digital Process

The introduction of E4D Dentist System (D4D Technologies LLC, Richardson, TX) in 2008, (Figure 2) along with its accompanying DentaLogic software and Autogenesis libraries became the first computerization model to accurately present a real 3-D virtual model and automatically take into consideration the occlusal affect of the opposing and adjacent dentition. As well as, the ability to design 16 individual full contour anatomically correct teeth at the same time. It essentially takes a complex occlusal scheme and its parameters and condenses the information, displays it in an intuitive format that allows dental professionals with basic knowledge of dental anatomy and occlusion to make modifications to the design, and then sends it through to the automated milling unit. For the dental profession, the introduction of the E4D Dentist system effectively automated some of the more mechanical and labour-intensive procedures (waxing, investing, burnout, casting, and/or pressing) involved in the conventional fabrication of a dental restoration, allowing the dentist and technician the ability to create functional dental restorations

with a consistent, precise method.

The Way It Was

In the conventional indirect restorative process, the procedure begins with the usual steps: the clinician prepares the case according to the appropriate preparation guidelines, impressions the case, and sends these and other critical communication aspects to the laboratory. After the laboratory received all the materials from the dentist, the impression was poured, the models mounted, and the dies trimmed. These models were then used to fabricate appropriate restorations – either layered, pressed, milled, cast, or in combinations.

Even though this application offers many advantages to the dentist-technician team it still required the taking of an intraoral impression using conventional techniques, sending these impressions to the laboratory for the creation of stone models, and the fabrication of traditionally created dental restorations.

In this article, we would like to go to the next phase in the evolution of the dentist-technician working relationship.

The Way It Will Be

Case Study

A 42-year-old male patient presented with an amalgam restoration in # 30 and a composite restoration in #31. Both of them showed recurrent decay that was diagnosed using radiography (Figure 3). He possessed a negative medical history and good oral hygiene with resultant periodontal health. Teeth were asymptomatic. Treatment options of a gold onlay and a porcelain fused-to-metal crown or a single-appointment CAD/CAM ceramic inlays/onlays were considered and discussed with the patient. While a gold restoration certainly is an excellent, prudent choice, properly placed CAD/CAM designed and milled onlays have been extremely successful when proper preparations and occlusal design considerations are considered, even in these areas. The patient was appointed for a single prep and seat appointment. Upon arrival, his mandibular right quadrant was anesthetized. The existing restorations were removed and both teeth were prepared for the all-ceramic restorations, following accepted CAD/CAM glass-ceramic preparation guidelines; adequate clearance, rounded internal aspects, supragingival butt joint margins.



Figure 1. The dental operator, with clinical CAD/CAM unit.

The E4D Digital Process

An individual file is created within the DentaLogic software for each patient. The operator can input the patient's name or record number. Then the appropriate tooth number(s) to be treated (up to 16 restorations can be designed and restored at the same time with the E4D Dentist system) and entered and then the type of restoration anticipated checked (full crown, veneer, inlay/onlay). Additional preferences include material choices (IPS Empress CAD, e.max CAD (Ivoclar Vivadent, Amherst NY); Paradigm MZ 100 or C (3M ESPE, St. Paul, MN) and preferred shade. System defaults that can be set ahead of time



Figure 2.
D4D System.

or changed per patient/case are preferred contact tightness, occlusal contact intensity, and the virtual die space, which defines the internal fit of the final restoration to the die/preparation (Figure 4).

Since the E4D Dentist system is the only system that can scan the tooth structure and preparations without a contrast agent, an impression (alginate included) and a stone model, the system also requires you to enter the method of scan (intraoral; mouth or extra oral; impression or model).

All of this information can be entered prior to patient treatment or changed at any time, should the actual treatment differ than the planned.

Once the preparation has been completed, the intraoral scans are then taken. In this case a static bite registration will be taken to record the shape and position of the opposing dentition. The D4D software will automatically change the impression of the bite into a 3-D representation of the opposing dentition. A static bite registration was created by injecting a blue resilient bite registration material (Virtual Bite, Ivoclar Vivadent, Amherst, NY) onto the preparations while having the patient occlude. Although this particular bite registration has metallic additives to allow for scanning without powdering even for those systems that require it, the E4D System can be used with any bite registration material. The IOD scanner was used to capture occlusal scans of the bite registration over the preparation and the occlusal surfaces of the neighbouring teeth.

Next scans from the occlusal, lingual and buccal were taken of each preparation with the IOD scanner to build the virtual model to completion. Multiple scans are taken per preparation in order to capture the full contours (and undercuts) of the neighbouring and preparations to aid in proper proximal contact and overall anatomical contours.

Once the images of the preparation, neighbours and bite registration are captured, the computer then has all the information it needs to prepare the working model—the preparation and the opposing model (from the bite registration images).

The real 3-D virtual model is then presented to you on screen and can be rotated and viewed from any perspective (Figure 5). The operator can choose to view the model in either animation (stone view) or in a real ICEverything view (ICE) which represents a wrapping of the actual images over the digital mess providing a realistic view of the



Figure 3. Preoperative condition of teeth #30 and 31.

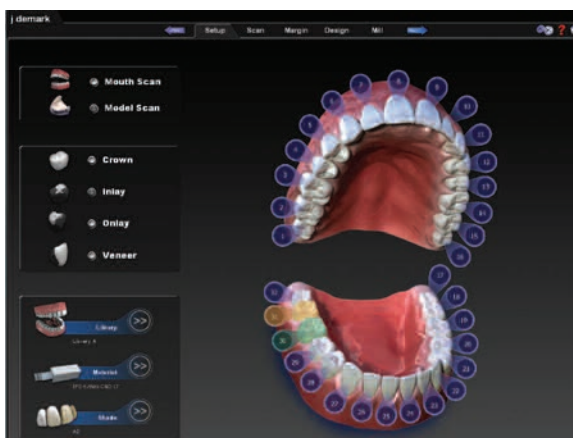


Figure 4. The data file in the D4D CAD/CAM system.

clinical conditions allowing the operator to distinguish discolourations, build-ups, soft tissue and even enamel and dentin in many areas.

The first step in designing the restoration is to virtually define the parameters and borders of the final restoration. These are defined using the bite registration information, the adjacent teeth, contact areas, and, finally, the gingival margins of the preparation.

The computer, with the aid of E4D Dentist's Autogenesis (morphing) software will place the restorations automatically in a preferred and appropriate position (based on all input and neighbouring anatomical detail), but it is now that the operator's experience, training and knowledge of form and function is needed to manually reposition and contour the restoration to the clinically ideal location if needed.

With a few simple mouse clicks, the position and rotation of the crown can be altered as desired and the software's automatic occlusion application will automati-

cally readjust each individual cusp tip, triangular ridge, and the restoration's contours, contacts, and marginal ridges based on the preferences and bite registration information and according to the newly desired position and rotation. The virtual restoration responds and adapts all parameters immediately as they relate to the new position. The position and intensity of each contact point is graphically demonstrated and color mapped immediately on the screen and can be adjusted easily pending operator and clinical preference.

Customized aspects and artistic creativity are also possible through an array of virtual carving and waxing tools. These can be used to manipulate occlusal anatomy, contours, and occlusal preferences, basically mimicking the actual laboratory methods and armamentarium. Each step is immediately updated on screen so the operator can see the effect of any changes (Figures 6–8). In addition visual representations of material thickness, X, Y, or Z slicing or a number of other variables can be checked, confirmed or changed as needed – all within the DentaLogic intuitive software.

When the final virtual restoration has been completely designed, it is simply a matter of loading the milling chamber with the predetermined shade and size of ceramic or composite block, pressing an on-screen button and, in a short time, an exact replica of the design is reproduced in ceramic.

The In-Office Laboratory Process

The ceramic restorations are then removed from the milling chamber and prepared for



Figure 5. Digital model proposal.

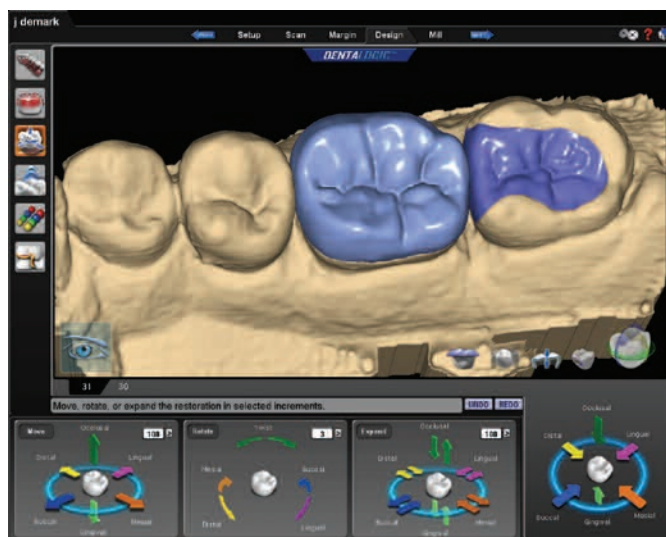


Figure 6. Digital restorative design.

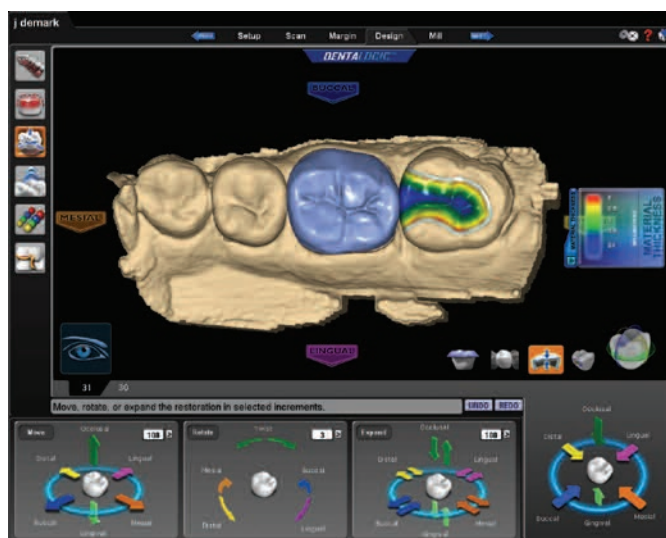


Figure 7. Material thickness indicator graphic.

final esthetic enhancements.

The “milling sprue” must be removed first, then, if desired, surface texture and occlusal anatomy are defined using diamond and carbide burs. Care should be taken not to alter occlusal or interproximal contacts, as these areas were perfected in the E4D software and accurately reproduced during milling process. After esthetic contouring, restorations are rinsed with water to remove surface ceramic debris, and dried.

Since the patient is still anesthetized and in the chair, try-in for proximal and marginal fit can be completed chair-side with assurance. Once verified and adjusted if necessary, conventional ceramic stain and glaze techniques, the restorations are further esthetically enhanced by the addition of subtle colours and glaze application. The ceramic chosen for this case was the Empress-CAD Multi-block, tooth 31 and E max Cad lithium disilicate (Ivoclar-Vivadent, Amherst, NY). These ceramic milling blocks were designed to offer optimal esthetics by offering varying degrees of color and translucency designed into the block to mimic the dentin and enamel appearance and polychromatic nature of natural dentition (Figure 9).

The dental profession currently regards CAD/CAM technology as just a machine that fabricates full contour ceramic restorations or frameworks. Digital Dentistry and the Digital Dental Team represent a totally new way to diagnose, treatment plan, and create functional esthetic restorations for our patients in a more productive and efficient manner. CAD/CAM dentistry will only further enhance the dentist/assistant/technician relationship as we move together into this new era of patient care.

Automation has been slow in coming to dentistry and although new equipment has been introduced to make our jobs easier, we still create complex dental prosthetics using techniques that are thousands of years old. And, even though the “lost wax” technique is still a tried and true method of fabrication, there will come a day in the near future when all frameworks and full anatomical crowns will be designed on computer. Only then will we truly realize the wonder and awe of dental CAD/CAM technologies that were initially introduced so long ago.

NOTE: clinical dentistry by Dr. Ed McLaren

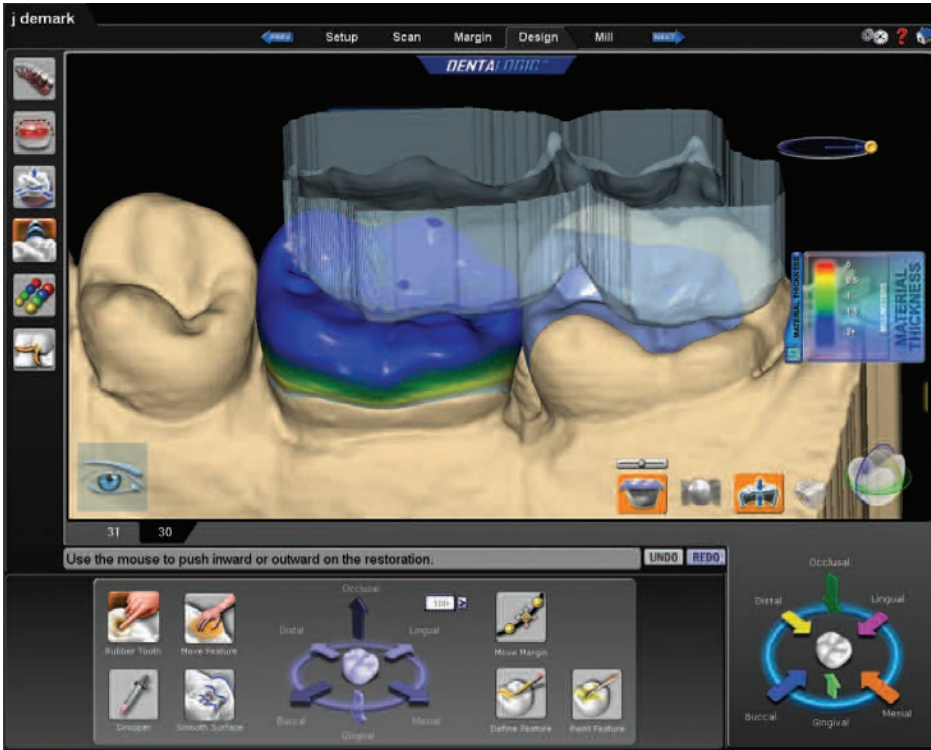


Figure 8. Interproximal-occlusal contact strength indicator.



Figure 9. Final restorations after bonding.



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- Exclusive BlueLine® layering process
- Patient-specific posterior occlusal options
- Available in all 16 A-D and 4 bleach shades

BlueLine®
Esthetic Denture Teeth

100% CUSTOMER SATISFACTION
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