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Contents

4 Editorial
“Learn or... Perish”
Ziad Noujeim

6 Meet the New Associate Editors
Sami Mosowakdié, Charles Sfeir, Tara Renton, Ah’med Feki, Tony Daher, Marcel Noujeim, Radhouane Dallel,
Pascale Hâbre Hallage, Roula Abiad, Rima Abdallah, Zoubeida Yâhosfi Al Haje

18 In Remembrance of Professor Georges Chidiac.
Ziad Noujeim

20 Georges Chidiac-in the comfort of arz el rab.
Joseph George Ghafari

22 Tribute to Jihad Abdallah.
The JLDA Editorial Staff

24 Er:YAG LASER treatment of gingival melanin hyperpigmentation: a case report.
Karim Corbani

27 The practical usefulness of “Fakhouri’s Angulator” in the management of totally edentulous patients.
Jihad Fakhouri

33 Is there a surgical risk with antiplatelet drugs?
Jean Jules El-Fata

40 Germination or fusion: a case report.
Naeda Skandri, Chirine Chammas, Dolly Roukoz

44 Socket preservation in anterior maxilla: report of two cases.
Maissa Aboul Hosn, Nabil Nader

50 Mandibular second premolar with three root canals: a case report.
Kazem F. Hosny, Roula S. Abiad

55 Differential diagnosis of multiple maxillofacial radioopacities using Cone Beam Computed
Tomography (CBCT): a case report.
Ibrahim Nasheh, Saydé Sokhn

60 Retrieval of a maxillary wisdom tooth inadvertently displaced in buccal space: a case report.
Wasfi Kanj, Rita Bou Assaf, Antoine Berberi

63 Oral intravascular papillary endothelial hyperplasia: a case report.
Wadid Chaiban, Gabriel El Hajj, Antoine Cassia

Maha Ghotmi, Fouaida Homsy, Elie Dama

75 Replacement of a missing maxillary central incisor with an Astra Tech® implant following a horizontal
ridge augmentation using a sympheseal mandibular onlay graft: a case report.
Biady Meouchy, Fady Abillamia, Elie Azar Mdaouf, Fatmé Mouchref Hamasny, Ranzi Abou Arraj

82 Guide for contributors and authors.

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Dental Industry, worldwide, has always been dynamic, but it is lately undergoing rapid change due to the explosion of information and exploitation of technologies. Thousands of scientific papers and reports are being published and digested online, thus providing us with a unique opportunity of immediate access to contemporary knowledge and innovations. But, the real danger remains in solely relying on “electronic knowledge”, regardless if peer-reviewed or not. Indeed, rehearsing a dental clinical procedure in our personal imagination is very far, and different... than carrying it out!

It is recognized that learning is a very complex process, especially that the term "knowledge" usually refers to "propositional knowledge”, within the empirical paradigm that often defines contemporary scientific thinking. Can “quality-controlled knowledge” and “empirical knowledge” reflect scientific reality? Is “procedural knowledge” experiential and embedded in activity? These are questions always dwelling in minds of practicing dentists and fresh dental graduates, but the real secret of access to knowledge is in the confrontation of clinical practice (which is mainly experiential) and codified, explicit knowledge (which is obviously evidence-based).

Being the most important foundation of health care education and health care, Evidence-Based Practice-EBP- is nowadays applied in clinical dentistry, and evidence is becoming real evidence if clinically acknowledged and shared. And since the term "knowledge" has always been associated with propositional knowledge, the latter is obviously becoming fundamental to EBP.

Evidence-based health care system has a bias towards propositional knowledge, and as weird as it may sound, clinical learning in dentistry must inevitably include propositional as well as procedural knowledge and experienced dentists usually combine personal experience and evidence-based practice in their daily clinical work and decision-making process.

Recently, the Dynamic Systems Approach-DSA- was suggested to dental educationalists in order to move forward the learning process, in terms of application of Problem-Based Learning-PBL, an educational method that was introduced during the nineties at the University of Malmö, Sweden (M. Rohlin et al., 1998), and the University of Adelaide, Australia (G. Mullins et al., 2003). Since then, PBL was implemented in dental schools and colleges, mainly in UK, USA, Canada, Ireland, and Thailand.

Is PBL better than traditional curricula, lectures, and textbook learning? the answer was always addressed as yes by most dental students who enjoyed PBL programmes that provided them with a greater ability to diagnose dental, periodontal, orofacial and craniofacial problems than do chances to learn in typical lecture-based dental and medical courses. Indeed, PBL has six main features: limited number of formal lectures, student-centred learning, prominent role for self-study, working with problems, collaborative learning, and facilitating role of the tutor. The leading
studies of H.G. Schmidt (1983) and co-workers (G.R. Norman and H.G. Schmidt, 1992), based on cognitive psychology, addressed the power of PBL to fulfill the most important principles implemented in the development of knowledge. Unfortunately, these types of clarification studies are still lacking in dentistry, and, clearly, most assessments of PBL efficacy in dentistry are extremely conflicting, and in comparison with conventional dental curricula, PBL was found to provide to dentists and dental students four modern insights on learning (upon which PBL is based), namely contextual, collaborative, constructive, and self-directed.

Each learner has his/her history of learning and is inevitably and considerably influenced by his/her prior proper experience and prior learning process. However, new insights appeared during the last two decades, moving and advancing the learning process, and DSA, as a meta-theory, has proven to work at neurobiological, psychological, social, and cultural levels, helping dentists and dental students to learn through group dynamics and interaction, brain plasticity, and self-organisation. There is no doubt that DSA sees only dynamic emergent self-organisation, and from DSA's perspective, learning is a continuously emergent property of self-organisation (S. Mennin, 2010).

Considering that an important part of PBL involves the concept of small group work, implementation of DSA to dental learning, at large, and dental education in college, should inevitably lead us to a better focus on the extreme dynamic nature of intellectual and psychological interactions that usually happen within PBL small groups of study. Indeed, it is mandatory that PBL tutorials occur prior to clinical exposure and be positively influenced by different local dynamics, in order to hope for a good educational outcome. Besides being highly plastic, our brain is an extremely dynamic system and a non-linear, emergent self-organising dissipative system. Our memory is also continuously enhanced and reinforced through a process called long-term potentiation-LTP (T.V.P. Bliss, 1993, and, G.L. Collingridge and J.C. Watkins, 1995).

Within DSA’s context, small learning groups self-organise into a new learning community, self-directed study is nowadays considered to be a neural self-organisation, neural pathways being elaborated and highly strengthened by the process of LTP, students and dentists engaged in PBL are to develop individual understandings obviously formed by new synaptic connections, students and/or dentists form small collaborative groups led by tutor (as facilitator of the learning process), learners present with a case scenario in dentistry, identify any significant information and current knowledge in order to define and analyse the clinical problem, develop consequential hypotheses and use prior experience and knowledge to construct a preliminary concept map for the clinical problem: these different steps, and others, lead learners to identify learning issues, formulate learning questions, prioritise learning issues and questions before peer and facilitator evaluation and consolidation of key learning.

In conclusion, Dynamics System Approach -DSA- is re-conceptualising dental learning, new research questions in dental education are now being framed, including the role of PBL. And if dental graduates and/or students chose to join this dynamics approach, they will surely develop critical thinking that will help them get rid of "scientific" bias and inherited "scientific" concepts and adopt evidence-based statements that will lead them to patient's welfare and satisfaction. Continuous learning is more than a duty for any dentist who should constantly strike to be a "continuous student", and learning for a contemporary dentist is a matter of survival, as a health professional. And if the world is changing, and it is, educational change should definitely be aligned with the best estimates of current and future community and societal needs.

Sami Mouwakdié is Head of Quality Management Team and Assistant Professor in the Department of Periodontology at the Lebanese University School of Dentistry in Beirut, Lebanon. Professor Mouwakdié earned the "Docteur en Chirurgie Dentaire" degree from the Saint-Joseph University Faculty of Dental Medicine, in Beirut, Lebanon, and University Diplomas (Diplômes d'Université - DU) in Clinical Periodontology (from Paris 6 University Institute of Stomatology, in France) and Oral Implantology (from Lille 2 University, in France). He also pursued a "Diplôme d'Etudes Approfondies - DEA" in Medical and Biological Engineering at the University of Paris 13 before he earned a Masters degree (MBA) that led him to a (published) research on Accreditation in Lebanon, as a tool for hospital performance.

In terms of basic research, Professor Mouwakdié has actively worked on the "Biocompatibility and corrosion of cobalt-chrome-molybdenum based alloys", within the Lille research group on biomaterials (Groupe de Recherche sur les Biomatiériaux-GRB), and under the guidance of Professor H.F. Hildebrand (INSERM Director of Research between 1996 and 1998).

Professor Mouawakdié is a very active faculty at the Lebanese University School of Dentistry where he teaches dental biomaterials and bone physiology, at undergraduate and postgraduate levels. Indeed, he designed, implemented, and updated these two courses, for years, within the undergraduate curriculum (BDS program) and the periodontology and oral surgery postgraduate programs.

Nowadays, he is considered to be a renown expert in dental biomaterials and biological engineering, and within these two fields, he published a chapter on the electrochemical evaluation of cobalt-nickel alloys at variable concentrations in: "Actualités en Biomatiériaux" (of D. Mainard, M. Merle, J.P. DeLagloutte, and J.P. Louis, in 2000), he also has published in" Implantodontie" (in France), the dental magazine of Saint-Joseph University (ACES), and the "Lebanese Dental Journal" (former title of the present JLDA).

Professor Mouawakdié maintains a private practice, in Beirut, with clinical activities limited to periodontology, implant dentistry, and oral surgery. He has extensively lectured in Lebanon, Jordan, Kuwait, and France.
Charles Sfeir works with the University of Pittsburgh, in Pennsylvania, USA, as Director of the Center for Craniofacial Regeneration, and Associate Professor at the Clinical and Translational Science Institute and the School of Dental Medicine/Departments of Oral Biology and Periodontology. He also teaches at the Carnegie Mellon University, in Pittsburgh, with the rank of Adjunct Assistant Professor in Biomedical Engineering and Materials Science and Engineering. His unique professional career combines research, clinical and didactic teaching in the fields of biomineralization, tissue engineering, molecular biology and periodontics.

His research endeavor focuses on three main themes, the role of the bone/dentin extracellular protein in cell differentiation and bone mineralization, biomimetic scaffolds development for bone tissue engineering, and integration of research activities with innovative teaching methods to enhance student learning.

Professor Sfeir graduated with a "Docteur en Chirurgie Dentaire-DCD" degree from the Louis Pasteur University Faculty of Dental Surgery, in Strasbourg, France, and an advanced certificate in Periodontics (Masters Program) from Northwestern University, in Chicago, USA, and two Ph.D. degrees, also both from Northwestern, one in Oral Biology (on the cross-cultural communication epidemic of the 21st century, passed with distinction) and the other in Molecular Biology and Biochemistry (on the phosphorylation of dentin extracellular matrix protein by protein kinases).

Meet the New Associate Editors

Oral Biology and Medicine).

Professor Sfeir is a nationally and internationally praised speaker, scientist and clinician. He has extensively lectured in USA, Canada, Switzerland, Sweden, and most Arab countries (mainly Lebanon and KSA).

Being reviewer in nine scientific journals (among them, Journal of Dental Research, Tissue Engineering, Cells Tissues Organs, Connective Tissue Research, Acta Biomaterialia, and Gene Therapy), he is now a renowned world expert in research methodology, critical thinking, tissue engineering and molecular biology.

His professional memberships include the American Academy of Periodontology, the American Association for Dental Research (AADR), the American Society for Bone and Mineralization Research, the Society for Biomaterials, Science, and the Pennsylvania Dental Association.
Tara Frances Renton is Consultant Oral and Maxillofacial Surgeon and Professor of Oral and Maxillofacial Surgery at Kings College London-KCL- Dental Institute in England, United Kingdom, where she was awarded the Oral Surgery chair in 2006. She is also a national advisor for Oral Surgery, a council member for the British Association of Oral Surgery and an elected member of the Royal College of Surgeons of England (RCS Eng.) Dental Faculty Committee.

Dr. Renton graduated with BDS degree from the University of London/Guy's Hospital Dental School and earned a Masters degree (M.D.Sc.) at the University of Melbourne, Australia, the Fellowship of the Royal Australasian College of Dental Surgeons(FRACDS) after a four year residency program in Oral and Maxillofacial Surgery at the Royal Melbourne Hospital of the University of Melbourne, and the Fellowship in Dental Surgery of the Royal College of Surgeons of England (FDS RCS Eng.). She is registered with the General Dental Council (in the UK) as specialist in Surgical Dentistry and Oral Surgery.

In 2003, Dr. Renton was awarded the Ph.D degree of the University of London after defending a thesis on the assessment of subjective and objective approaches to determine trigeminal injuries and after eight years of intensive work and research on this topic, she became an international reference in this field. Presently, she is a lead oral and maxillofacial clinician in the trigeminal nerve pain service and Head of Oral Surgery Department at KCL. She is committed to the highest standards of evidence-based teaching practice of oral surgery at undergraduate and postgraduate levels. She is also devoted to develop training pathways that better link translational research in the clinical setting with an aim to develop a translational research team of international standing. In this regard, she have enhanced her clinical expertise by working jointly with neurologists, neurosurgeons and psychiatrists on the management of patients with trigeminal neuropathic pain.

Professor Renton’s main area of research interest is trigeminal nerve injury related to third molar surgery. Indeed, she developed an objective method of assessment using electromyography to assess lingual nerve injuries and also introduced thermal quantitative assessment as a new method to apply to these injuries. Indeed, she is the first to publish the thermal evaluation, which will eventually lead to earlier repair of these injuries and to publish on evaluating these patients in order to evaluate trigeminal nerve pain pathways using functional MRI. She is currently involved in Ph.D projects evaluating pain receptor expression in the trigeminal nerve system, she's also in collaboration with KCL Neurosciences section in developing an animal model for burning mouth syndrome.


Professor Renton has extensively lectured in England and Scotland, as well as in USA, Germany, Australia, Japan, Canada, Egypt, and Lebanon.
Ah’med Feki is University Professor (PU), Hospital Dentist (PH), and Chairperson of Department of Oral Medicine and Oral Surgery at the Louis Pasteur University Faculty of Dental Surgery, in Strasbourg, France. He is a Diplomate of the European Board of Oral Surgery -EBOS- and an active member of the French College of Oral Surgery Faculty.

Dr. Feki graduated with a “Docteur en Chirurgie Dentaire” degree from Louis Pasteur University where he also earned, advanced certificates (CES) in Oral Biology, Surgical Dentistry, and Periodontology, and a “Doctorate of Odontological Sciences -DSO-” degree. He also pursued, at the Nancy 1 University, in France, the University Diploma (DU) in Head and Neck Morphology, and the University Diploma (DU) in Oral Mucosal Dermatology at the René Descartes/Paris 5 University, and he is also entitled, since 1995, to supervise basic and clinical research related to dental practice (HDR Diploma/Habilitation à Diriger des Recherches, of the Louis Pasteur University).

Besides being an exceptionally skilled surgical dentist and oral and maxillofacial surgeon, Professor Feki is a national and international expert in oral medicine, oral oncology, oral and maxillofacial anatomy, jaw tumors and lesions, oral and maxillofacial infections, orofacial genetics, oral mucosal pathology, and third molar surgery. He has authored and co-authored more than 70 papers in the fields of oral surgery, medicine, and pathology, mainly in French and European Journals and Periodicals (Journal de Biologie Buccale, Information Dentaire, Journal of Radiology, Actualités Odonto Stomatologiques -AOS-, Journal d’Odonto-Stomatologie Pédiatrique, British Dental Journal, Réalités Cliniques, Clinic, Journal of Oral and Maxillofacial Surgery, British Journal of Oral and Maxillofacial Surgery, Médecine Buccale Chirurgie Buccale, Le Chirurgien-Dentiste de France, Revue Tunisienne d’Odonto-Stomatologie, and others). He has also given more than 200 lectures in France, Spain, Switzerland, Germany, Morocco, Tunisia, Algeria, Lebanon, South Africa, Madagascar, Vietnam, and USA.

Professor Feki is the former President of the French-Speaking Society of Oral Medicine and Oral Surgery (SFMBCB), member of the examining jury of the European Board of Oral Surgery, and President of the European Federation of Oral Surgery Societies (EFOSS).
Meet the New Associate Editors

Tony Daher is Associate Professor in the Department of Restorative Dentistry of Loma Linda University -LLU- School of Dentistry, and Lecturer in the Postgraduate Prosthodontic Program of the University of California Los Angeles -UCLA-, in California, USA. He is also a Faculty Member in the Massad Group, Tulsa, Oklahoma, USA, since 2006, and the former Director of the advanced prosthodontic residency program at LLU.

Professor Daher received his "Docteur en Chirurgie Dentaire" degree from Saint-Joseph University Faculty of Dental Medicine (Beirut, Lebanon) after which he followed a complete advanced curriculum in Paris, France, earning advanced certificates (CES) in Human Biology, Fixed Prosthodontics and, Removable Prosthodontics, from the University of Paris 7. He also furthered his education and training in the US, achieving a Masters of Science degree in Education at the University of Southern California, a postgraduate certificate in Prosthodontics at UCLA, and in 1998, he became a Diplomate of the American Board of Prosthodontics (DABP).

Professor Daher has published more than 50 papers, mainly in the Compendium of Continuing Education in Dentistry, Cosmetic Tribune, Journal of the Lebanese Dental Association, General Dentistry, Journal of Prosthodontics, Journal of Prosthetic Dentistry, Arab Dental Journal, Prosthetic Dentistry Review, Dental Materials, and Loma Linda University Publications. He has extensively lectured in USA, Canada, Lebanon, Malta, and Sweden. His main research and clinical interests are implant-supported prostheses, smile design, restoration of endodontically treated teeth, implant overdenture attachments, coordination and integration of fixed and removable prosthodontics, implant esthetic zone, implant prosthodontic complications, socket preservation, occlusion controversies, implant provisionals, and implant templates.

Professor Daher is a Fellow of the International Academy for Dental Facial Esthetics, American College of Prosthodontics (FACP), and International College of Prosthodontics (FICP), and a Member in the Pierre Fauchard Academy and the Academy of Osseointegration (MAO). He maintains a private practice limited to prosthodontics and implant dentistry, in La Verne, California, USA.
Marcel Noujeim is Associate Professor and Director of the Graduate Program of Oral and Maxillofacial Radiology and Imaging at the University of Texas Health Science Center at San Antonio - UTHSCSA-, in USA.

Dr. Noujeim pursued his basic and advanced dental studies at the Lebanese University School of Dentistry, in Beirut, Lebanon, earning a BDS degree and University Diplomas in Oral Biology and Oral and Maxillofacial Radiology, and after achieving his cursus, he was appointed there as Faculty in the Department of Oral and Maxillofacial Radiology and Imaging, where he worked for seven years as Clinical Instructor, six years as Assistant Director of the Postgraduate Program, and two years as Head of Clinical Services of Oral and Maxillofacial Radiology. His educational path didn’t end here when he decided to further his training at UTHSCSA where he pursued a Residency Program and earned a Master’s degree in Oral and Maxillofacial Radiology, after which he was appointed, there, as Assistant Professor and Director of the Dental Radiology Clinic.

Professor Noujeim is a recognized expert in advanced imaging and 3D reconstruction, having extensively worked on the development and fabrication of surgical 3D models for dental implants and maxillofacial surgery. He has published a book chapter on physical evaluation in dental practice and more than 50 articles (in Dentomaxillofacial Radiology, International Journal of Oral and Maxillofacial Implants, Dental Traumatology, Journal of Periodontology, Otolaryngology and Head and Neck Surgery, Oral Surgery, Oral Medicine Oral Pathology Oral Radiology Endodontics, and other journals), mainly on CBCT, tomosynthesis method, bone changes around implants, and oral pathology. He was often an invited speaker in Lebanon, Canada, Spain, South Africa, the Netherlands, but has been lately extensively lecturing in the USA with the American Academy of Oral and Maxillofacial Radiology, the American Academy of Oral Medicine, the American Academy of Forensic Odontology, and the American Academy of Orofacial Pain.

Professor Noujeim is a reviewer for Dentomaxillofacial Radiology, Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, Endodontics, and The Journal of Implant and Advanced Clinical Dentistry, and a Fellow of the International Association of Dentomaxillofacial Radiology and the American Academy of Oral and Maxillofacial Radiology. He is the recipient of two awards, both in 2005, the Howard R. Raper award for the best promising junior faculty (awarded by the American Academy of Oral and Maxillofacial Radiology) and the best radiology young faculty/resident (awarded by the International Association of Dentomaxillofacial of Radiology).
Radhouane Dallel is University Professor (PU) and Vice Dean for Research at the University of Clermont 1/Faculty of Dental Surgery, in Clermont-Ferrand/France, Head of INSEM’s Laboratory of Neurobiology of Trigeminal Pain, Founder and Coordinator of the INSEM’s Pain Research Network, and Visiting Professor at the University of Monastir Faculty of Dental Medicine, in Monastir, Tunisia. He was also the former Co-Director (1998-2001) of the Laboratory of Oro-Facial Laboratory of Clermont 1 University, founded by Professor Alain Woda.

Dr. Dallel graduated with a "Docteur en Chirurgie Dentaire" degree from University of Clermont 1, followed a complete advanced curriculum of basic science, and worked for two years (1998-1990) as research fellow with Professor Jean-Marie Besson at the INSERM-U161, in Paris, and in 1991, he was awarded his research doctoral degree (Doctorat d'Université) from the University of Clermont 1.

In 1995, and after years of teaching and research, Professor Dallel earned the HDR diploma (Habilitation à Diriger des Recherches), the highest degree awarded in France that biomedical scientists can earn in order to be officially accredited to supervise clinical and/or basic research.

Professor Dallel has published more than 100 papers in high-quality peer-reviewed scientific journals (Pain, Brain Research, Journal of Neuroscience, Neurobiology of Disease, Molecular and Cellular Biochemistry, Molecular Pain, Journal of Comparative Neurology, European Journal of Pain, Cephalalgia, Neuroscience and Behavioural Reviews, Journal of Neurophysiology, and others). His research interests include neurophysiology and neuroanatomy of the trigeminal system, neural mechanisms and clinical correlates of sensory dysfunction in chronic cephalic pain and its control. He is a reviewer for various pain and neuroscience journals and member of the International Association for the Study of Pain (IASP), International Headache Society (IHS), French Society for the Study of Pain, and French Society for Neuroscience.

Meet the New Associate Editors

Journal of the Lebanese Dental Association

13
Pascale Habre Hallage is Assistant Professor (Maitre de Conferences) in the Department of Fixed Prosthodontics, at the Saint-Joseph University Faculty of Dental Medicine, Beirut, Lebanon. She earned (from the same university) the “Docteur en Chirurgie Dentaire” degree, and advanced certificates (CES) in Oral Biology and Prosthodontics, and a University Diploma in Surgical and Prosthetic Implantology (DUICP), all at the University of Paris 7, France.

Dr. Habre Hallage completed a full basic research curriculum, beginning with a Masters in Biological and Medical Sciences (MSBM) at the University of Paris 5, a “Diplôme d'Etudes Approfondies -DEA-” in Neuroscience at the University of Paris 6, and lately (June 2011), she graduated with a "Doctor of Biomedical Sciences" degree from the Katholieke Universiteit Leuven (KUL), in Belgium.

In October 2010, Dr. Habre Hallage won the basic research competition prize of the European Association of Osseointegration (EAO) in Glasgow, Scotland, and her study was entitled "cortical activation elicited by stimulation of periodontal mechanoreceptors during functional MRI", and the 18 finalists had been earlier selected from nearby 500 abstracts submitted to EAO scientific committee.

Roula Abiad is Assistant Dean of the Faculty of Dentistry at Beirut Arab University (BAU) in Beirut, Lebanon, she also works there as Director of Endodontic Division and Assistant Professor of Endodontics. Professor Abiad earned her Bachelor degree in Dental Surgery from BAU where she also pursued, after dental graduation, a one year program in Advanced General Dentistry and a two year advanced training program in Fixed Prosthodontics and Restorative Dentistry. And after this intensive postgraduate path, she earned a Masters degree in Endodontics (also from BAU), after which she graduated from Cairo University with a "Doctorate of Dental Sciences - D.D.Sc." degree in Endodontics.

In terms of basic research, Professor Abiad has actively worked on coronal microleakage, in-vivo LASER Doppler flowmeter measurement, surface cleaning and smear layer removal of root canal walls, bacterial eradication of endodontic canals, treatment of necrotic primary molars, and effect of sonic, passive ultrasonic, and LASER energies on root canal dentin walls. She has also published (in Lebanon and Egypt) on evaluation of teeth pulp condition, use of LASER Doppler flowmeter for detection of tooth vitality, use of CBCT in endodontics, and emergency treatment of pulp and peri-apical disease and retreatment of endodontic failure.

Besides her numerous academic and clinical responsibilities, Professor Abiad is the executive coordinator of the Lebanese Dental Association-LDA- scientific committee, and at BAU Faculty of Dentistry, she also works as member of research committee, E-learning coordinator, member of advisory committee, and member and secretary of the Faculty Council.
Rima Abdallah is a Diplomate of the American Board of Periodontology and Associate Clinical Professor in the Periodontology and Implantology Divisions of the Oral Surgical Sciences Department, at Beirut Arab University - BAU- Faculty of Dentistry in Beirut, Lebanon. Dr. Abdallah earned the Bachelor degree in Dental Surgery from BAU, a "Certificate of Advanced Graduate Studies - CAGS" in Periodontology and a "Doctorate of Sciences in Oral Biology" degree from Boston University Goldman School of Dental Medicine, in Boston, USA.

In Boston, Dr. Abdallah actively worked as Assistant Clinical Instructor and Tutor of Periodontology at the Goldman School, she also pursued an externship program in the Oral and Maxillofacial Surgery Department of Boston University. Her research career was initiated (in the same town), in 2008, where she worked, for two years, as research scholar at the Forsyth Institute Department of Periodontology and Oral Biology: her research doctoral work focused on “Periodontitis and Atherosclerosis in High-Cholesterol Fed Rabbits” and was tutored and guided by Professor Thomas Van Dyke.

In May 2008, Dr. Abdallah won the “Excellence in Periodontology” award from the Boston University Goldman School of Dental Medicine, and in 2010, and during the annual meeting of the American Association of Dental Research -AADR-, Dr. Abdallah addressed, with many colleagues and co-workers (H.Hasturk, A. Kantarci, M. Ghattas, M. Nguyen, T. Van Dyke, and others) the topic of socket preservation with a newly formulated HTR graft material.

In 2011, Dr. Abdallah and Dr. Serge Dibart published a special chapter on “Ridge splitting using piezoelectric surgery and grafting” in “Practical Osseous Surgery in Periodontics and Implant Dentistry” of Serge Dibart and Jean-Pierre Dibart (Wiley-Blackwell, UK, 2011).

Professor Abdallah has lectured in USA (Boston and NYC) and Lebanon on periodontitis and atherosclerosis, new drugs for periodontal therapy, innovative periodontal surgery techniques, endodontic-periodontal pathology, and implant site development. She maintains a private practice in Beirut, with clinical activities limited to Periodontology, Surgical Dentistry, and Implant Dentistry.
Zoubeida Yah'foufi Al Hage earned her basic dental degree (DDS) from the National and Capodistrian University of Athens, Department of Dentistry, in Athens, Greece. Immediately after graduation, she followed a special one year postgraduate program in periodontology at the University of Athens, School of Dental Medicine, Department of Periodontology, and during this didactic/clinical course, she participated in the microbiologic research laboratory work of the periodontal department and became familiar with microbiology-immunology techniques applied to periodontal disease.

Dr. Yah'foufi furthered her training and worked as research associate at the University of Berne, School of Dental Medicine, Department of Periodontology and Fixed Prosthodontics, in Berne, Switzerland: this tenure was made possible by a training grant from the swiss government, and during this period, she worked extensively with the laboratory of oral microbiology and was involved in a combined epidemiological/microbiological study on the occurrence of periodontal pathogenic disease, she also devoted herself to clinical work during which she treated periodontal patients with a high level of competence. And as a result of her academic efforts, she was awarded the title of Dr. med. dent. of the University of Berne, School of Dental Medicine, and several publications in indexed journals were generated (Microbial Ecology in Health and Disease-1994, Journal of Clinical Periodontology-1995, Arab Dental Journal-1999, and others).

In December 1993, Dr. Yah'foufi was awarded the degree of "Doctor of Dentistry" of the University of Berne, School of Dental Medicine after having submitted and defended her thesis on "The effect of plaque control in subjects with shallow pockets and high prevalence of periodontal pathogens".

Parallel to her work at the University of Berne, Dr. Yah'foufi worked in association with Lausanne University Dental polyclinic, in Switzerland, where she took an active part in the postgraduate program as Lecturer. She was also, and for several times, supervisor of clinical research projects and member of jury of several Master's thesis at Damascus University Dental School, in Damascus, Syria, and also part-time invited Lecturer in the periodontology postgraduate program at the Lebanese University School of Dentistry, Beirut, Lebanon.

In 1993, and during the annual meeting of the Swiss Society of Periodontology, in Interlaken, Switzerland, she received the first prize for the best research presentation. She is, indeed, an expert in periodontal pathogens, subgingival microflora, dental plaque control, periodontitis, peri-implantitis, and the use of antibiotics and antiseptics in periodontal disease.

Dr. Yah'foufi is member of the Swiss Society of Periodontology and was former scientific chairperson of Beirut Dentist's League. She has lectured in Lebanon, Syria, Kuwait, Bah'llain, Jordan, Greece, Switzerland, and France. She is a registered specialist in Periodontology in Lebanon and maintains (in Beirut) a private practice limited to periodontology and implant dentistry.
In Remembrance of Professor Georges Chidiac

July 12, 2011 marked the passing of Professor Georges Chidiac, one of the great dental educators in Lebanon and Arab countries. A native of Bisharreh (November 15, 1926), in Northern Lebanon, Georges Yussef Chidiac received his Diploma of "Doctor of Dental Surgery" (Diplôme de Docteur en Chirurgie Dentaire) in 1954, from the Dental School of the French Faculty of Medicine of Beirut (Ecole Dentaire de la Faculté Francaise de Médecine de Beyrouth). He graduated with distinction, earning the honor of "Lauréat de l'Ecole Dentaire de la Faculté Francaise de Médecine de Beyrouth".

After completing two years of clinical and didactic training in stomatology, prosthodontics, occlusion and temporo-mandibular disorders, at the Paris 6/Pierre and Marie Curie University Stomatology Clinic, in Paris, France, he earned the Diploma of Foreign Assistant of Paris Hospitals (Diplôme d'Assistant Etranger des Hôpitaux de Paris) and joined the Saint-Joseph University-USJ / French Faculty of Medicine where he was appointed Clinic Chief in the Department of Fixed Prosthodontics for three academic years, after which he was appointed as Academic Assistant. And after two years of hard and dedicated teaching work, he was appointed Lecturer in the same Department.

Two years after his lectureship tenure, he assumed the chairmanship of the Department of Fixed Prosthodontics and Occlusion. During his tenure, he played a leading role in the development of practical educational methods and tools that enhanced communication between Faculty and students.

Professor Chidiac's enthusiasm for Fixed Prosthodontics and Occlusion was indeed contagious, and since i was one of the fortunate students mentored by him, i had the unique opportunity to observe and acknowledge his gift for education and talent for communication. He was exceptionally detailed in his clinical observations, very meticulous and thorough in his work, and with an incredible memory and unbelievable charisma, he was meant to lead in the dental profession.

Our profession and our dental schools and teaching centers lost a talented prosthodontist and a dedicated teacher. Professor Chidiac's greatest enjoyment was teaching young and junior dental students (at the USJ) the art and science of dental morphology and the principles of prosthodontics and occlusion. And in addition to his administrative duties as Full Professor and Department Chairman, Professor Chidiac remained very active in teaching and private practice until his retirement. He was continuously honored by his students and co-workers for his tireless contributions to education as mentor, tutor, role model, and friend to students, colleagues, and the profession at large.

Professor Chidiac was greatly admired by his students and fellow colleagues who routinely gave him standing ovations during didactic courses and after clinical sessions for his outstanding help and assistance. One has only to see the list of faculty, chairpersons, and distinguished clinicians and scientists he trained—including his son, Professor José Johan Chidiac, to appreciate and evaluate his unique willingness and ability to inspire individual excellence.

Apart his academic endeavors, Professor Chidiac was an excellent speaker, capable of discussing basic and clinical aspects of dental disease, occlusion and prosthodontics. He mainly lectured nationally and in many Arab countries and was very appreciated for his outstanding courses in advanced clinical prosthodontics. He was also elected by Lebanese registered dentists
President of the Lebanese Dental Association between 1970 and 1972.

Professor Chidiac also served on many committees at the USJ Dental School and he was a very active member of the Dental School Board. His students will remember his soft-spoken and highly professional demeanor and his unique empathy. His greatest strength was the quality of care and deep concern he constantly felt for his private patients and those of the Dental School. The affection present in their doctor-patient relationship was remarkable. Many of his patients started consulting him when they were children, then parents, then grandparents. He always took to heart the life lessons learned from his parents and educators and shared, with an unprecedented generosity, that wisdom with his patients and students.

After practicing dentistry for nearly 55 years with unmatched energy, Professor Chidiac was hit by the disease that was incomprehensible and devastating.

He is survived by his wife Marie-Paule Hochmuth, and his son, José Johan, Professor at the Lebanese University School of Dentistry, in Beirut, and his two granddaughters, Sara-Marie and Reem-Marie.

A lot and more can be said about Professor Georges Chidiac, but most importantly, his passion for life, pride, correctness, ethics, and straightness are still inspiring all those who crossed his unique path. He will be greatly missed by everyone who cherished him. His death has certainly created a void in the lives of all who loved and respected him, but it is particularly comforting that he is leaving behind a legacy of outstanding students, friends, colleagues, and a wonderful family.

Ziad Noujeim,
Editor-in-Chief, JLDA
Georges Chidiac, former dental professor at the Université Saint-Joseph and President of the Lebanese Dental Association, teacher of generations of dentists, passed away on July 12, 2011. He now rests in his hometown of Bcharré in Northern Lebanon.

Georges Chidiac, another teacher of mine and numerous colleagues, exits our scene. There is a distinct resonance in the word teacher: it engenders instant respect for the almost sacred mission to educate. Many principles and feelings are coiled in the term: knowledge, uprightness, fatherhood and motherhood, brother and friend.

Yet in Georges Chidiac’s passing, more transpires from my memory screen- in a split second. I think of a patriot. He is probably the only teacher I had whom I so intimately relate to patriotism.

Not because he is from the neighborhood of my beloved cedars of Lebanon, from which rose the incense in Solomon’s biblical psalms, not to mention the biblical temples, and the Lebanese flag.

Not because a portion of his life overlapped with the life of that rebellious patriot from Bcharré, Gibran, whose thoughts and images swirl around the dreams of every being born in our land, and lifts them to near eternity.

It is simply because he loved Lebanon to prayer and to blasphemy- if one interprets some of his language the wrong way.

Of course I remember his stance during clinical demonstrations, his steady hand, confident demeanor, and his occasional incisive comments. Yet I came to “feel” his patriotism firsthand.

On one of my trips from the USA, where I lived most of my professional years, he wished to meet my late father who was praised for safeguarding land ownership in my hometown of Damour after the 1976 “displacement” to preserve the right and will of the people to return. He paid the appreciated visit in my parents’ provisional home in Broummana. My father and teacher shared momentous events of their rich lives, a dizzying panorama from French mandate to World War II, and all the Lebanon wars, with good life packed in between. In an exchange of thoughts on the future of Lebanon, now the occupied prey of both her neighbors, and on the prospects of those of us who emigrated, he addressed me in his reassuring disposition: “Joe, they shall be out. In time, the minority who stands up will become a majority. Inshalla, you and so many others will return to help the country get on its feet.” I am sure that we both believed what was a fervent wish. This is the lot of optimists. That these projections became a reality before the proud patriot left is very comforting.

During a conversation on an earlier trip when I visited my alma mater, he asked me why I was (then) learning Spanish. “It started with the preparation for a visit to former orthodontic classmates in Venezuela”, I said. I shall never forget the sparkle in the eyes of my teacher with the distinguished grey hair, and his approving smile, when I added: “as weak as my speech was, it allowed me to interact with many Lebanese Venezuelans I had met.” Lebanese connecting across this world of God, who also created arz el rab, was enough patriotism for Georges Chidiac. It kept Lebanon alive. And that was all that mattered.

As you sleep in the arms of the Holy Valley, may you smell the incense of the psalms, hear Gibran’s worship of love, and rest in the peace you wish to your country.

Joseph George Ghafari
Written in Damour, Lebanon
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Jihad Abdallah is a renowned Dental Implantologist with over thirty years of significant academic and clinical expertise. He finished his specialized course with the Italian Academy of Implant Dentistry in Milano, Italy, where he was taught and supervised by late Professor Stephano Melchiade Tramonte. He later headed to New York to continue his implant education at New York University (NYU) and Brookdale University Hospital where he was further trained under the supervision of late Professor Norman Cranin.

In 2001, Dr. Abdallah became a Fellow of the American Academy of Implant Dentistry (AAID). Established in 1951, the AAID is the only implant organization that offers implant credentials recognized by US state and federal courts as being bona fide. Its membership exceeds 4,000 dentists worldwide. According to the AAID a “Fellow Membership is a special step in validating expertise and proficiency in implant dentistry. To qualify for the Fellow examination, applicants must be Associate Fellows (which is the first step of extensive examinations) in good standing, provide both the surgical and restorative phases of implant dentistry and meet the published educational and experiential requirements. They must also meet the professional and leadership credentials requirements specified in the Requirements for Fellow Membership.” After being a Dental Implantologist for more than 5 years and qualifying for the fellowship, candidates must pass written and oral examinations to become a Fellow.

In 2004, Dr. Abdallah received the International Implant Dentist of the Year Award from the AAID. The recipient of this award would be an individual who has accomplished the most in helping the Global Committee achieve its goals. The criteria included: assisting in establishing educational programs and serving as an ambassador for the AAID.

In 2006, Dr. Abdallah was the director of the AAID MaxiCourse® in Jordan, a course cosponsored by the Jordan University of Science and Technology, with more than 90 dentists enrolled.

Dr. Abdallah continued his journey by applying for the title of Diplomate of “American Board of Oral Implantology/Implant Dentistry”. The ABOI/ID Diplomate designation symbolizes the highest level of competence in implant dentistry in the US. Certification by the ABOI/ID attests to the fact that a dentist has demonstrated knowledge, ability, and proficiency in implant dentistry through a rigorous examination process. Dr. Abdallah received that title in 2010.

In 2011, The American Academy of Implant Dentistry (AAID) named seven dentists from around the world to the coveted status of ‘Honored Fellow’ at the conclusion of its 60th Annual Meeting. The ‘Honored Fellow’ designation is awarded to those members of the AAID who, through their professional, clinical, research or academic endeavors, have distinguished themselves within implant dentistry. Dr. Abdallah was one of those 7 dentists and the only dentist residing outside the US and Canada.

Jihad Abdallah works as Head of Dental Implantology Division and Adjunct Clinical Professor in the Surgical Sciences Department at Beirut Arab University (BAU) Faculty of Dentistry, Beirut, Lebanon.

The JLDA Editorial Staff
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References:
1. Subgingival Access Efficiency Data: Internal Colgate-Palmolive Company
2. Interproximal Access Efficiency Data: Internal Colgate-Palmolive Company
Er:YAG LASER treatment of gingival melanin hyperpigmentation: a case report.

Karim Corbani*, Dr. Chir. Dent., DESS Endo., IFAACD

Abstract

Aim: The aim of this clinical report was to evaluate the effectiveness of Erbium:Yttrium-Aluminum-Garnet (Er:YAG) LASER in treatment of gingival hyperpigmentation.

Methods: Patient with a gingival hyperpigmentation was treated by ablation using an Er:YAG LASER in combination with an esthetic restorative rehabilitation.

Result: Patient was satisfied with the esthetic outcome immediately and after 6-months follow-up.

Conclusion: Treatment of gingival hyperpigmentation with an Er:YAG LASER showed effectiveness and safety. Gingival condition should be assessed carefully before selection of this technique.

INTRODUCTION

Oral hyperpigmentation is a discoloration of the gingival/oral mucosa, considered to be multifactorial and involving several physiological/pathological factors. Etiological factors are varied and include drugs, heavy metals, genetics, endocrine disturbances, and inflammatory conditions. Adverse habits such as smoking can also stimulate melanin pigmentation and the intensity of pigmentation is related to the duration of smoking and the daily number of cigarettes consumed.

Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of gingiva. It is a non–hemoglobin-derived pigment formed by cells called melanocytes, which are dendritic cells of neuroectodermal origin. Degree of pigmentation varies from one person to another and depends on variety of factors, especially the melanoblastic activity.

The first and foremost indication for depigmentation is patient’s demand for improved esthetics. Various methods of de-epithelialization of gingival hyperpigmented areas have been documented such as bur abrasion, surgical scraping, cryotherapy, electrosurgery and LASER therapy.

Different LASERs such as carbon dioxide (CO₂) LASER, Nd:YAG LASER, semiconductor diode LASER, Argon LASER, Er:YAG LASER and Er,Cr:YSGG LASER have been reported as effective and reliable methods with minimal postoperative discomfort and faster wound healing.

The Erbium:Yttrium-Aluminum-Garnet (Er:YAG) LASER, which has been widely used in dentistry, demonstrated effectiveness in depigmentation cases. Er:YAG LASER has been studied and applied effectively to periodontal soft tissue management without causing major thermal damage due to the high energy absorption by water. Er:YAG LASER irradiation results in minimal heating of tissues and surroundings, preventing scarring and enhancing wound healing.

CASE REPORT

A 50 year-old female patient complaining of hyperpigmented gums and requesting an esthetic treatment was referred to our private practice for cosmetic rehabilitation. The procedure was verbally explained to the patient and a signed informed consent was obtained. The sequenced treatment plan included: teeth preparation for ceramic laminate veneers, provisional placement, and a depigmentation procedure using the Er:YAG LASER system (AT Fidelis, Fotona, Slovenia) with set parameters.
described in Table 1. Patient and operating staff wore special protective eyeglasses. The entire depigmentation procedure was performed without any anesthetic injection because relatively low pulse energy was used.

The LASER’s device was cautiously used to avoid injury of teeth surfaces or adjacent tissues.

Immediately after depigmentation procedure and placement of ceramic laminate veneers, patient was highly satisfied (Figures 1 and 2). And after a 6-month follow-up, the described procedure showed a successful esthetic outcome (Figure 3).

DISCUSSION

Gingival hyperpigmentation is of real concern when achieving a good esthetic outcome. The use of Er:YAG LASER minimizes the damage to deep tissues and shows an effective outcome in depigmentation procedures\(^1,13\). Er:YAG LASER has a bactericidal effect and provides photobiostimulation (low-level LASER therapy)\(^20\).

The difficulty of the LASER ablation technique is in the range of ablation, as the melanin and melanocytes are located in basal and suprabasal cell layers of the epithelium; with the Er:YAG LASER, the range of ablation is limited to within the epithelium. In addition the Er:YAG wavelength matches the absorption coefficient of water, triggering water to evaporate into steam in the tissues leading to microexplosions of the tissue\(^19\). The Er:YAG wavelength has the highest water absorption and least penetration inside the tissues (1 μm). Therefore, it has the least thermal damage, and this avoids scarring and enables faster wound healing\(^22\).

Repigmentation after gingival depigmentation is a significant issue that clinicians should be aware of. Reports of repigmentation were variable ranging between 1 to 7 years\(^23,24,25\). The limitation of this case report is that the observation period should have been longer to evaluate any relapse or recurrence of pigmentation\(^11,21\).

CONCLUSION

Within the limitation of this case report, the use of Er:YAG LASER for depigmentation showed satisfactory esthetic result, safety, and effectiveness.

<table>
<thead>
<tr>
<th>LASER source</th>
<th>Er:YAG, 2940 nm</th>
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</thead>
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<tr>
<td>Pulse duration</td>
<td>VLP</td>
</tr>
<tr>
<td>Energy</td>
<td>100 mJ</td>
</tr>
<tr>
<td>Frequency</td>
<td>12 Hz</td>
</tr>
<tr>
<td>Handpiece</td>
<td>R02-Ti</td>
</tr>
</tbody>
</table>

Table 1. Set parameters of the Er:YAG LASER used for treatment of gingival hyperpigmentation.
REFERENCES

Correspond with:
Karim Corbani
karimcorbani@gmail.com
The practical usefulness of “Fakhouri’s Angulator” in the management of totally edentulous patients.


Abstract

Sagittal and frontal curves are the result of the spherical structure of dental arch. Their curvature constitute the basis of occlusal concepts, for dentulous as well as edentulous patients. However, and in what concerns dental relationships, it is necessary to quantify morphological differences caused by facial ageing in the adult who remained completely dentulous and functionally balanced. The aim of this clinical report is to help practitioners orient the occlusal plane in the edentulous, in a more rational way, taking into account the evolution of this plan with age.

Hence, a prosthodontic device was conceived for that purpose, allowing occlusal plane, priorly adjusted in parallel to Camper’s plane, to be posteriorly lowered by a 5.4° angle in young patients (under 65 years of age) and by 6.5° in those over 65 years of age.

LITERATURE REVIEW

In nowadays’ practice, and despite the fact that Camper’s plane is the reference used to determine occlusal plane (OP) in complete dentures, this theory remains quite controversial.

However, it is interesting to briefly note the principal raised hypotheses based on clinical and/or theoretical intuitions.

OP resorts to mandibular and maxillary references:

1- Maxillary and mandibular references:

According to Bowill: OP is situated halfway between antagonist crests.

According to Driscoll: OP should be inclined in a way as to exert an upward and backward force on maxillary occlusal surface and a downward and forward one on mandibular occlusal surface.

According to Dawson: OP is a virtual surface, theoretically determined by the free edge of incisors and cuspal tips.

According to Boucher: OP is an imaginary surface in anatomical relationship with the skull, theoretically tangent to the sharp edge of incisors and to the apex of occlusal surfaces of posterior teeth.

In OP’s definition, if the word “surface” is replaced by “surfaces”, the meaning shall be more objective since this plane is an average of different maxillary and mandibular curvatures.

2- Maxillary references:

According to Walker: OP must be parallel to the maxillary alveolar crest.

According to Broomel: OP is parallel to a line extending from the center of glenoïd fossa to anterior nasal spine.

According to Bonwill: OP is established in parallel to the plane of mandibular condylar movement.

According to Clapp: OP is established in parallel to a line joining the inferior edges of both external auditory meatus and nasal ala.

According to Wilson: OP is parallel to Camper’s line.

3- Mandibular references:

According to Gysi: OP is a plane crossing the free edge of the two mandibular central incisors and the distal edge of the second molars.

According to Boucher: OP is a virtual plane crossing the free edge of mandibular incisors and the apex of disto-buccal cusps of the first mandibular molars.

The terms occlusal plane, bite plane, mastication plane or masticatory plane are hence used.

Indeed, OP is not a static reference but rather one
undergoing perpetual transformation, thus it is useful to recall that it is about a «field of variable surface»

**INTRODUCTION**

**Occlusion concepts linked to occlusal plane:**

In complete dentures the four components that are the sagittal and frontal orientations of OP as well as their radii of curvature play an essential stabilizing role.

1. In intercuspidation: Occlusal forces must be perpendicularly oriented towards surfaces of support.
2. During off-center movements: The search and obtention of a balanced occlusion, a harmonious posterior and anterior guidance guarantee denture stability.

The interrelationship between different occlusion factors has been proven since 1928, known as Quint of Hannau in 1928:

\[
\frac{Tc \times Ti}{Cor \times Cs \times C} = \text{Balance}
\]

\(Tc:\) condylar trajectory  
\(Ti:\) incisor trajectory  
\(Cor:\) cord of occlusal plane  
\(Cs:\) curve of Spee  
\(C:\) cuspal height,

In a simpler equation: \(Tc = C + Cor\)

An OP strongly inclined downwards and forward favors the use of “weak” cuspids, ensuring thus posterior guidance.

An OP insufficiently inclined downwards and forward is generally manifested by an absence of posterior guidance and a premature anterior interlocking defined as the phenomenon of Christiensen. The use of “strong” cuspids may prevent such a harm.

**Ageing of occlusal plane**

The fixed referential plane is considered to be the cephalometric line Nasion (Na) - Basion (Ba) corresponding to the skull base. The point CC of Ricketts is the geometrical center of facial growth which consequently becomes the geometrical center of its ageing 1-3 (Figure 1).

In a dentulous and functionnally balanced adult, maxilla sags downwards in its whole with age. Hence, anterior and posterior poles of the alveolar line move away from the skull base (Na – Ba) during facial skeletal ageing (Figure 2). Consequently, the molars (posterior poles of occlusal plane) are obviously involved in this general sagging movement. Simultaneously, a slight mesial translation, unnoticed on first molar, influences the second one that is further
lowered' (Figure 3).

Similarly to maxillary molars crowns, those of their mandibular antagonists sag downwards, accompanied as well by a slight mesial translation of the second maxillary molar, partly nonexistent on the first (Figure 4).

As a conclusion, the occlusal level of maxillomandibular molar pillar is slightly lowered in its whole, with a more obvious sagging of second molars in ageing people (Figure 5).

Besides this sagging, we notice between young and aged dentulous adults a metric reduction of the distance separating the center of the occlusal side of first mandibular molar and mandibular interincisal point. Added to that, a flattening of the whole sagittal curve by an angle of 0.95°4 (Figure 6).

Different angular and linear variations induced by ageing are reflected upon skin. Camper’s plane is thus subject to a discrete variation of 0.6° due to sagging of the subnasal point, whereas the level of the center of tragus, corresponding to the center of the external auditory canal, remains fixed (Figure 7).

MATERIAL AND METHODS

400 cephalometric analyses of people between 20 and 40 years of age have been interpreted, allowing the evaluation of angular values between OP and the maxillary plane in a balanced dentulous adult. OP is considered as being the line joining the most posterior molar contact point and the most lingual incisal one. As to the maxillary plane, it is the line joining anterior and posterior nasal spines (Figure 8).

Fig. 4. Downward sagging of the two mandibular molars, discrete mesiogression of the second molar.

Fig. 5. Occlusal lowering of the molar pillar.

Fig. 6. Shrinking of the line C6 - C1.

Fig. 7. Flattening and facial ageing of the whole sagittal curve.

Fig. 8. Cephalometric study in edentulous adult.

<table>
<thead>
<tr>
<th>Facial form</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long and wide</td>
<td>6.0500°</td>
<td>1.480</td>
<td>0.001</td>
</tr>
<tr>
<td>Short and wide</td>
<td>7.3462°</td>
<td>3.262</td>
<td>0.004</td>
</tr>
<tr>
<td>Short and narrow</td>
<td>5.4375°</td>
<td>1.348</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Table 1: OP angle / maxillary plane

The angle between those two plans is, in average, of 6.2° (Table 1).
100 cephalometric analyses of people between 35 and 45 years of age have been interpreted, allowing the evaluation of angular values between maxillary plane and occlusion one determined in parallel to Camper’s plane (center of tragus-nasal ala) in young edentulous adult (Figure 10).

**Figure 9.** Angle between occlusal (POY) and maxillary (PMY) planes in dentulous young adult.

![Fig. 9](image)

**Table 2: OP angle parallel to Camper’s plane/maxillary plane**

<table>
<thead>
<tr>
<th>Facial form</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long and wide</td>
<td>11,400°</td>
<td>4,502</td>
<td>0.006</td>
</tr>
<tr>
<td>Short and wide</td>
<td>11,342°</td>
<td>3,154</td>
<td>0.002</td>
</tr>
<tr>
<td>Short and narrow</td>
<td>12,125°</td>
<td>5,463</td>
<td>0.005</td>
</tr>
</tbody>
</table>

The angle between those two plans is, in average, of 11.6° (Table 2).

**Figure 10.** Angle between occlusal and maxillary planes in edentulous young adult (PC=Camper plane).

![Fig. 10](image)

Statistical analysis was performed using a software program SPSS for windows version 11.0. The student test was implemented and the values were considered as statistically significant at p≤ 0.05.

**RESULTS**

Based on those two hypotheses, and after having determined the occlusion plane in parallel to Camper’s plane, OP in a young edentulous adult showed to be posteriorly lowered by 5.4° (11.6° - 6.2°).

Referring to the above-mentioned facial ageing study, maxillary plane of the aged dentulous subject remains stable, whereas OP is lowered 0.94° as of the first molar and 0.5° as of the mandibular incisor. Thus, OP is oriented at 5.7° (6.2° - 0.5°) compared to the maxillary plane (Figure 11).

Along with facial ageing, Camper’s plane (PCY) undergoes an anterior opening of 2 mm due to the sagging of the subnasal point (PCA), whereas the center of the tragus remains fixed. This plane is consequently lowered by a 0.6° angle.

As for the maxillary plane, it remains stable, whereas OP opens posterioly by 0.5°. Hence, Camper’s plane is at 12.2° (11.6° + 0.6°) compared to maxillary plane and OP in an aged edentulous adult is consequently at 6.5° (12.2° - 5.7°) compared to Camper’s plane. Hence, after having determined OP in parallel to Camper’s plane, OP in an aged edentulous adult should be lowered by 6.5° (12.2° - 5.7°) (Figure 12).

**Figure 11.** Angle between occlusal (POA) and maxillary (PMA) planes in dentulous aged adult.

![Fig. 11](image)

**Figure 12.** Angle between occlusal and maxillary planes in edentulous aged adult.
The age as of which an adult is considered aged is set by most authors at 65 years, and this on the basis of facial ageing.

THE “FAKHOURE’S ANGULATOR”
(Figs. 13 to 18)

Description of the angulator (Fig. 13):
This angulator (conceived and designed by the author) consists of:
- A plan positioned against the superior wax pad, adjusted to face width by two mobile arms.
- An adjustable helmet.
- Two vertically mobile posterior devices of Camper’s plane, one from each side, allowing its adjustment to the center of the tragus.
- An elastic device representing Camper’s plane, the male part of which interlocks from each side in the posterior device previously depicted.
- Two vertically and sagittaly mobile plates, attached to the helmet from both sides and are of two types:
  - two yellow plates used in adults over 65 years of age, marked by red and grey stripes forming a 6.5° angle.
  - two green plates used in adults under 65 years of age, marked by red and grey stripes forming a 5.4° angle.

Functioning of the angulator (Figs. 14 to 17)
The wax pad is adjusted in parallel to Camper’s plane (center of tragus – nasal ala). Hence, the angulator is worn by the patient, with the posterior device of Camper’s plane adjusted to the center of the tragus, the two plates (yellow in that case since the patient is over 65) placed against the patient’s cheeks and the elastic device, corresponding to Camper’s plane, put in place.

The plate is then adjusted from each side in a way that the elastic device corresponding to Camper’s plane is superimposed with the grey mark.

Everything is now ready to adjust OP: it consists of positioning the arm of the plane on the red mark of the plate from each side, knowing that the angular value between red and grey stripes is 6.5°.

Thus, OP is posteriorly lowered by 6.5° compared to Camper’s plane. To be mentioned that in patients under 65 years, green plates would have been used.
where the angular value between their grey and red stripes is 5.4° (Figure 18).

CONCLUSION

This clinical report attempts to quantify morphological differences caused by facial ageing and to apply them in complete dentures management during OP determination, knowing that with age, and in addition to downward sagging of maxilla and dental arches, we also notice a flattening and shrinking of OP due to a whole phenomenon of wear and tear at the level of dental crowns, as well as a sagging of the subnasal point.

It is a must, however, to recognize that such differences are minimal and we are rather optimistic regarding the harmful effects of ageing, given that the latter solely reflects the wear and tear due to age, without any added pathology.

From a clinical standpoint, we suggest that OP, priorly adjusted in parallel to Camper’s plane, be posteriorly lowered by 5.4° in young patients (under 65 years of age) and by 6.5° in patients over 65 years, with the help of “Fakhouri’s Angulator”, conceived for that purpose.

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Is there a surgical risk with antiplatelet drugs?

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Abstract

Acetylsalicylic acid has long been the only nonsteroidal anti-inflammatory drug recommended for the treatment and prevention of thromboembolic diseases. More recently, new compounds have been used in patients with vascular diseases. However, these drugs are often associated with longer bleeding times and greater operative risk.

In most surgical specialties, the question always arises as to whether antiplatelet therapy should be stopped before elective surgery. If so, for how long? If not, what are the risks? This paper reviews various antiplatelet drugs in use today, focusing on their mode of action, their effects on platelet function, and the associated operative risks. It also proposes an algorithm for decision making in this setting, based on the literature and an understanding of the mechanisms of action of this class of drugs.

Hemostasis is a process encompassing various mechanisms that stop bleeding when vascular wall is ruptured. A number of factors, including endothelial wall, platelets, and proteins of coagulation cascade and of fibrinolysis, play essential roles in this function. A congenital or acquired anomaly involving one or more of these factors predisposes a patient to hemorrhagic accidents1 (Table 1).

Hemostasis consists of a vascular phase, a platelet phase and a coagulation phase. The first 2 phases constitute primary hemostasis, in which the vessel wall, platelets and plasma proteins, including von Willebrand factor and fibrinogen, participate. Reflex vasoconstriction of blood vessel facilitates platelet adhesion and aggregation needed for formation of the hemostatic clot. The coagulation phase, also known as secondary hemostasis, allows consolidation of the platelet clot by formation of a fibrin clot. Finally, fibrinolysis rids the organism of fibrinous deposits.

Abnormal platelet aggregation plays an important role in the pathogenesis of thromboembolic diseases such as myocardial infarction, cerebral ischemia and peripheral arterial insufficiency.3 Although several antiplatelet agents have been developed in recent years, acetylsalicylic acid (ASA) is still the standard for preventing vascular diseases.4–6 Of the newer agents, ticlopidine,7 clopidogrel8 and dipyridamole9 have an effectiveness comparable to that of ASA. Each of these drugs has its own mechanism of action and pharmacokinetics (Table 2). Their effects on primary hemostasis also differ. This paper reviews the various drugs in use today, focusing on their mode of action, their effects on platelet function and the associated operative risks.

EVALUATION OF PLATELET FUNCTION

The preoperative assessment of all dental patients should include a targeted medical questionnaire aimed at identifying any personal or family history of hemostatic anomalies.

It is important to note the circumstances (traumatic v/s spontaneous), duration (few minutes v/s several hours or days), severity (whether a blood transfusion was needed) and type of bleeding reported. Platelet disorders are evidenced mainly by epistaxis, bleeding
gums or mucocutaneous bleeding in the form of ecchymoses or petechiae, whereas coagulopathies are associated more with deep bleeding and hence risk of hemarthrosis. Although the bleeding associated with vascular malformations is similar to the bleeding encountered in platelet disorders, the latter occurs more at the level of the affected vessels. A number of systemic diseases, including kidney\(^{10}\) and liver failure, myeloproliferative syndromes,\(^{11}\) collagenoses\(^{12}\) and certain neoplasias,\(^{13}\) are associated with platelet dysfunction.

Finally, it is imperative that the medication history be well known. Many drugs, natural products and foods cause various platelet dysfunctions (Table 3), which can in turn affect primary hemostasis.\(^{2,14}\)

The platelet count is the main laboratory test used in the evaluation of hemostasis (normal range 150–400 × 10\(^9\)/L). Values higher than normal indicate thrombocytosis, whereas values lower than normal indicate thrombocytopenia. Minor elective procedures are generally contraindicated if the platelet count is less than 50 × 10\(^9\)/L. Spontaneous bleeding may occur in patients whose platelet count is less than 10–20 × 10\(^9\)/L.

Bleeding Time (BT) test is also used in evaluating primary hemostasis. In 1951, O’Brien defined BT as the time between the making of a small cut on the skin and the cessation of bleeding (normally 4–8 minutes). Because of the wide variability and lack of specificity of this test, its use in the detection of blood dyscrasia is limited. Nevertheless, BT test remains useful in preoperative assessment of patients with hemostatic disorders. In addition to BT, most medical laboratories perform a platelet aggregation test. This in-vitro test evaluates platelet aggregation capacity of a blood sample in response to specific inducers such as epinephrine, adenosine diphosphate (ADP), collagen, serotonin, arachidonic acid, and ristocetin. The level of response to these various substances pinpoints the nature of the platelet dysfunction. A recently developed fast, sensitive diagnostic test, the PFA-100 (Dade-Behring, Mississauga, Ont.), is now being used to quantify platelet activation and aggregation capacity.\(^{14}\)

### ACETYLSALICYLIC ACID (ASA)

ASA is still the only nonsteroidal anti-inflammatory drug (NSAID) used in the treatment and prevention of thromboembolic diseases.\(^{15}\) ASA acts by irreversibly inactivating (for the life of the platelet) the enzyme cyclooxygenase (COX). This enzyme is responsible for the formation of prostaglandins and thromboxane A\(_2\), which are involved in platelet activation and aggregation mechanisms.\(^{16,17}\)

ASA therapy has long been associated with an increase in BT and risk of postoperative hemorrhage. For most elective surgeries, it has typically been recommended that the patient stop taking ASA 7 to 10 days before the procedure. This recommendation was based on general surgical studies, which reported an increase in intraoperative and postoperative bleeding in patients taking ASA.\(^{18-21}\) Other studies, mainly related to general and cardiovascular surgery, did not show any significant increase in blood loss or any need for postoperative transfusions.\(^{22-26}\) Several factors might explain this discrepancy, including the heterogeneity of the populations studied, improvements in surgical techniques, and use of local and systemic means to control bleeding.

Ardekian and co-workers\(^{27}\) noticed that a daily dose

### Table 1 Systemic diseases associated with hemostatic disorders

<table>
<thead>
<tr>
<th>Type of hemostatic disorder</th>
<th>Systemic diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platelet anomalies</strong></td>
<td></td>
</tr>
<tr>
<td>Quantitative</td>
<td>Hemolytic anemia</td>
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<tr>
<td></td>
<td>Megaloblastic anemia</td>
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<td></td>
<td>Hepatic cirrhosis and hypersplenism</td>
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<tr>
<td></td>
<td>Ethylysm</td>
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<td></td>
<td>Leukemias</td>
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<tr>
<td></td>
<td>Systemic lupus erythematosus</td>
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<tr>
<td></td>
<td>Idiopathic thrombocytopenic purpura</td>
</tr>
<tr>
<td></td>
<td>AIDS</td>
</tr>
<tr>
<td>Qualitative</td>
<td>Megaloblastic anemia</td>
</tr>
<tr>
<td></td>
<td>Kidney failure and uremic syndrome</td>
</tr>
<tr>
<td></td>
<td>von Willebrand’s disease</td>
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<tr>
<td></td>
<td>Bernard-Soulier syndrome</td>
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<tr>
<td></td>
<td>Chediak-Higashi syndrome</td>
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<tr>
<td></td>
<td>Hermansky-Pudlak syndrome</td>
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<tr>
<td></td>
<td>Wiskott-Aldrich syndrome</td>
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<tr>
<td></td>
<td>Glanzmann’s disease</td>
</tr>
</tbody>
</table>

| Coagulopathies             |                   |
|----------------------------|                   |
| Congenital                 | Factor VII deficiency |
|                           | Factor VIII deficiency (hemophilia A) |
|                           | Factor IX deficiency (hemophilia B) |
| Acquired                   | Hepatic cirrhosis  |
|                           | Vitamin K deficiency |
|                           | Ethylysm           |
Table 2  Pharmacological properties of and therapeutic indications for antiplatelet drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Mechanism of action</th>
<th>Duration of antiplatelet effect</th>
<th>Indications</th>
</tr>
</thead>
</table>
| ASA             | Irreversible inactivation of cyclooxygenase (COX-1 and COX-2) | 7–10 days                      | - Secondary prevention of myocardial infarction, peripheral arterial insufficiency and certain forms of CVA  
- Inflammatory and degenerative arthritis  
- Chronic moderate pain                                      |
| Nonselective NSAIDs | Reversible inactivation of cyclooxygenase (COX-1 and COX-2) | Depends on half-life of the drug | - Slight to moderate pain  
- Inflammatory and degenerative arthritis |
| Ticlopidine or clopidogrel | Blocking of ADP receptor on platelets | 7–14 days                      | - Secondary prevention of myocardial infarction and CVA  
- Secondary prevention of peripheral arterial insufficiency (clopidogrel only) |
| Dipyridamole* | Increase in concentration of cAMP        | 24 hours (half-life = 12 hours) | - Secondary prevention of CVA                                              |

ASA = acetylsalicylic acid, CVA = cerebrovascular accident, NSAID = nonsteroidal anti-inflammatory drug, ADP = adenosine diphosphate, cAMP = cyclic adenosine monophosphate.
* In combination with ASA (Aggrenox)

Table 3  Drugs, natural products and foods that may alter platelet function\textsuperscript{15,16}

Drugs
- Nonsteroidal anti-inflammatory drugs
  - ASA, ibuprofen, diclofenac, naproxen, indomethacin, diflunisal, phenylbutazone, meclofenamic acid
- Antiplatelet drugs
  - ticlopidine, dipyridamole, clopidogrel, GP IIb/IIa receptor blockers
- Anticoagulants, fibrinolytics and antifibrinolytics
  - aminoacaproic acid, heparin, protamine
- Antibiotics
  - penicillins and derivatives  
  - cephalosporins and derivatives
- Cardiovascular agents
  - diltiazem, propranolol, nitroprusside, nifedipine, nitroglycerin, quinidine, furosemide
- Psychotropic, anesthetic and narcotic agents
  - fluoxetine and other SSRIs  
  - amitriptyline, nortriptyline, promazine, chlorpromazine  
  - lidocaine  
  - heroin, cocaine
- Other
  - diphenhydramine, cyclophosphamide, chlorpheniramine

Natural products
- Ginkgo biloba, ginseng

Foods and beverages
- ginger, garlic, cumin, onion, alcohol

\textsuperscript{ASA} = acetylsalicylic acid, \textsuperscript{GP} = glycoprotein, \textsuperscript{SSRI} = selective serotonin reuptake inhibitor.

of 100 mg of ASA did not significantly increase intraoperative and postoperative bleeding during teeth extractions. Moreover, Sonksen and co-workers\textsuperscript{29} showed that the increase in BT caused by daily ASA in doses of up to 300 mg did not exceed normal limits in most patients. Thus, patients do not need to stop taking ASA before dental surgery, provided hemorrhagic risk is not greater than thromboembolic risk associated with interrupting use of the drug. When intraoperative or postoperative bleeding occurs, local hemostatic methods are generally very effective (Table 4).\textsuperscript{29}

However, a high hemorrhagic risk has been documented in patients with qualitative or quantitative platelet anomalies,\textsuperscript{39} those with congenital or acquired coagulopathies,\textsuperscript{31} those presenting with chronic kidney\textsuperscript{32,33} or liver\textsuperscript{34} failure, and alcoholic patients\textsuperscript{35,36} (Table 1). In these situations, a medical consultation should be requested and ASA should be stopped 7 days before surgery to minimize hemorrhagic complications. If interruption of ASA therapy is contraindicated, patient should receive specialized treatment in hospital.\textsuperscript{16}

OTHER NONSTERoidal ANTI-INFLAMMATory DRUGS (NSAIDs)

Unlike ASA, other NSAIDs inactivate the enzyme COX transitorily. Their effect on primary hemostasis depends on their plasma half-life.\textsuperscript{37} Long-acting NSAIDs, such as piroxicam, have a prolonged effect
that lasts for several days after the patient stops taking them.\textsuperscript{38} Conversely, short-acting NSAIDs, such as ibuprofen, lose their antiplatelet effect after few hours.

BT generally increases with NSAIDs but remains within normal limits.\textsuperscript{39} It is therefore unnecessary for the patient to stop taking NSAIDs before elective surgery. However, as with ASA, antiplatelet effect may be exaggerated in patients with hemostatic disorders (Table 1). In these cases, it is recommended that patients stop taking NSAID, 2 to 3 days before surgery in order to minimize the risk of hemorrhage.

Finally, COX-2-specific NSAIDs, such as

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**Table 4  Methods of local hemostasis**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Composition</th>
<th>Mechanism of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasoconstrictor</td>
<td>Epinephrine or levonordefrin</td>
<td>Arterial vasoconstriction</td>
</tr>
<tr>
<td>Bone wax</td>
<td>Beeswax and salicylic acid</td>
<td>Mechanical blocking of osseous bleeding</td>
</tr>
<tr>
<td>Suture</td>
<td>Various materials</td>
<td>Tissue compression</td>
</tr>
<tr>
<td>Gel foam (Pharmacia, Mississauga, Ont.)</td>
<td>Animal gelatin</td>
<td>Scaffold for formation of the platelet clot</td>
</tr>
<tr>
<td>Surgicel (Johnson &amp; Johnson, Guelph, Ont.)</td>
<td>Oxidized cellulose</td>
<td>Stabilization of the platelet clot</td>
</tr>
<tr>
<td>Collagen</td>
<td>Bovine collagen</td>
<td>Platelet activation</td>
</tr>
<tr>
<td>Fibrinous glue</td>
<td>Plasma rich in platelets and thrombin</td>
<td>Formation of fibrin clot</td>
</tr>
<tr>
<td>Thrombostat (Pfizer, Toronto, Ont.)</td>
<td>Thrombin</td>
<td>Fibrinogen activation</td>
</tr>
<tr>
<td>Electrocautery</td>
<td>Electrical current</td>
<td>Tissue coagulation</td>
</tr>
<tr>
<td>LASER</td>
<td>Ionized unipolar current</td>
<td>Tissue coagulation</td>
</tr>
</tbody>
</table>

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*Fig. 1. Algorithm for surgical preparation of patients who are taking antiplatelet drugs.*

**NSAID = nonsteroidal anti-inflammatory drug, ASA = acetylsalicylic acid.**

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36

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**Volume 48 - Nº 1 - 2013**
meiloxicam, rofecoxib and celecoxib, do not alter hemostatic factors. Therefore, it is not necessary to interrupt their use before elective dental surgery.40

ADP RECEPTOR BLOCKERS

Ticlopidine and clopidogrel are members of the thienopyridine family. This class of antiplatelet drugs acts on the ADP receptors implicated in platelet aggregation41. Both are recommended for the secondary prevention of thromboembolic diseases in ASA-resistant or ASA-intolerant patients and when a greater risk of cerebral ischemia is identified.7,8,42

Ticlopidine seems more effective than ASA in preventing cerebrovascular accidents (CVAs), but its use is associated with major side-effects such as diarrhea, anemia and neutropenia.43

Antiplatelet activity of clopidogrel is greater than that of ASA and ticlopidine. The CAPRIE study8 confirmed the superiority of clopidogrel over ASA in the secondary prevention of CVA, myocardial infarction and peripheral arterial insufficiency. Moreover, clopidogrel has fewer side-effects than ticlopidine.44 Despite its growing popularity, clopidogrel is very expensive, so it is used only selectively in patients resistant to treatment with ASA.

Antiplatelet effect of clopidogrel and ticlopidine is irreversible and lasts for the life of the platelet (7 to 10 days).41 The use of these drugs is associated with a significant increase in postoperative bleeding in patients who have undergone cardiovascular surgery.45,46 Although the risk of postoperative hemorrhage in dental surgery has not been studied, clinical experience of the present paper’s author (with specific consideration of the higher risk of hemorrhage and the irreversible effect of these drugs) suggests that patients should stop taking them 7 to 10 days before elective surgery.37 When thrombotic risk exceeds hemorrhagic risk and interruption of the drug cannot be considered, the patient should be referred to a hospital, where surgical procedure can be performed under medical supervision and where systemic measures can be taken if necessary.48,49,57

PHOSPHODIESTERASE INHIBITOR

Dipyridamole is one of the antiplatelet drugs that acts by inhibiting phosphodiesterase, an enzyme involved in the breakdown of cyclic adenosine monophosphate (cAMP). The resulting increase in cAMP inhibits platelet activation and aggregation.6 However, the antiplatelet activity of dipyridamole is less than that of ASA and the ADP receptor blockers. Moreover, its action on phosphodiesterase is wholly reversible and ceases about 24 hours after the drug is discontinued.50 According to the Second European Stroke Prevention Study,51 dipyridamole seems as effective as ASA in secondary prevention of CVA and transient cerebral ischemia (TCI). The ASA–dipyridamole combination, however, proved twice as effective as each of these 2 drugs taken alone. This combination, marketed under the name Aggrenox (Boehringer Ingelheim, Vancouver, B.C.), is used for certain patients who have had TCI or CVA.

Few studies have measured the hemorrhagic complications related to Aggrenox. Daily use of dipyridamole does not appear to increase blood loss significantly during surgical procedures.52 However, cases of uncontrollable bleeding have been reported with Aggrenox, where bleeding could only be controlled by stopping the drug.53,54 The increased hemorrhagic risk associated with Aggrenox is probably attributable to the additive effects of ASA and dipyridamole, which alter platelet function through independent mechanisms.

Because of the operative risk associated with Aggrenox, it is recommended that patients undergo a medical consultation and stop taking it before surgery. The antiplatelet activity of dipyridamole in Aggrenox is eliminated from the body within 24 hours.50 Dental procedures can then be performed, provided that proper hemostasis is ensured, as described for patients taking ASA.

CONCLUSION

All antiplatelet drugs used in the secondary prevention of thromboembolic diseases can cause intraoperative and postoperative hemorrhagic complications. However, stopping these drugs before a procedure exposes the patient to vascular problems with the potential for significant morbidity. An algorithm for decision making (Fig. 1) has been developed and it takes into account pharmacological properties of antiplatelet drugs, their effects on hemostasis, and patient’s health and welfare.
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Germination or fusion: a case report.

Nadia Skandri¹, Chirine Chammas², Dolly Roukoz³

Abstract
Fusion or germination associated with talon cusps are rare dental anomalies. These abnormalities affect both primary and permanent dentitions and can lead to aesthetic impairment, pain, caries and crowding.

We are reporting a case of an uncommon double tooth with talon cusp of left central maxillary incisor, associated with agenesis of maxillary left lateral incisor.

INTRODUCTION
Development of human dentition is a very complex process. Any aberration during different stages of tooth development can result in unique manifestations, either in primary or permanent dentition. In dental literature, terms like "joined teeth", "fused teeth", or "dental twinning" are used to describe fused or geminated teeth. Brook and Winter proposed to use a neutral term, such as "double teeth", whether a tooth is fused or germinated both of which are developmental abnormalities of teeth. Several clinical and radiographic criteria are used to distinguish fusion from germination.

Fusion is a rare developmental disorder characterized by union of two adjacent buds, either of two permanent or primary teeth or one tooth and a supernumerary one. It can be partial or total. Partial fusion occurs at crown level (enamel and dentin), causing formation of tooth with an enlarged single crown, a small groove and two separate roots: the endodontic system can be one pulp chamber with two-root canals or two independent pulp chambers and canals, while total fusion of two buds leads to a single tooth larger than the initial one.

Germination (or gemination) is characterized by division of the bud of primary or permanent teeth. It is more frequently described in primary dentition, maxillary incisors and canines are the most affected teeth and can be partial or total.

Partial (or incomplete) germination is an attempt of a single tooth bud to divide, giving rise to a large single tooth with a bifid crown and a single root canal, while total germination is a complete division of a single tooth germ resulting in two similar shape teeth called twinning teeth. Mesiodistal coronal width of each tooth is less than the controlateral one but the sum of the mesiodistal coronal width of the two twinning teeth is more than the one of the controlateral one.

Talon cusp, also known as an “eagle’s talon”, is a morphologically well-delineated accessory cusp-like structure projecting from cingulum area or cemento-enamel junction towards incisal ridge of maxillary or mandibular anterior teeth in both primary (though rarely) and permanent dentitions; this term refers to the same condition as “dens evaginatus” but talon cusp appears as the manifestation of dens evaginatus of anterior teeth. This anomalous structure is composed of normal enamel, dentin and varying extension of pulp tissue. Talon cusp may occur in isolation or with other dental anomalies such as fusion and germination; it affects mainly maxillary lateral incisor (33%), uni or bilaterally, and in some cases, central incisors, premolars, canines and molars.

Incidence of talon cusp ranges from less than 1% to 6% of population. This clinical report describes a case of palatal talon cusp on maxillary left central “double teeth” with agenesis of maxillary left lateral incisor.
CASE REPORT

A 10-year-old male consulted for an aesthetic chief complaint on maxillary right central incisor. His medical and dental histories were non contributory.

Intra-oral examination displayed mixed dentition, poor hygiene and caries on maxillary second primary molars and rotation of maxillary right central incisor. Maxillary left central incisor was larger and presented a middle vertical groove on buccal side (Fig. 1) and a palatal pyramidal evaginated structure (Fig. 2) projecting from lingual enamel-cement junction. Left lateral maxillary incisor was absent with no dental extraction history. Although, talon cusp didn’t irritate tongue during speech and mastication, but it interfered with occlusion of left lateral mandibular incisor. Molar relationship was Angle’s class I on either side. Measurement was done on a cast model with a caliper square. Mesio-distally coronal width of 11 was 10.1 mm and 13.3 mm for 21. Measures of talon cusp was 5.4 mm in incisivo-cervically axis and 3.2 mm in mesio-distally one.

Periapical radiograph (Fig. 3) of double teeth revealed a large crown with a V-shaped structure more radiopaque than dentine and enamel superimposed on the image of affected crown. Root was wide with a large pulp chamber and root system with unachieved apexogenesis.

Orthopantomogram (Fig. 4) showed normally developed permanent dentition except for missing maxillary left lateral incisor.

Based on clinical and radiographic findings, differential diagnosis was established: first, macrodontia of maxillary left central incisor associated with a palatal talon cusp and agenesis of maxillary left lateral incisor, second, complete fusion of maxillary left central and lateral incisors associated...
with a palatal talon cusp, and third, partial germination of maxillary left central incisor associated with agenesis of maxillary left lateral incisor and a palatal talon cusp. Vertical groove of the crown was laterally displaced and presence of asymmetric germination was rarely described in the literature and remains a controversial hypothesis.

It is hard to establish definitive diagnosis but the second one is the most likely, due to the presence of one large root canal.

Oral hygiene prophylaxis was implemented to improve patient’s oral microbial control. After parental consent, a periodic reduction of talon cusp, according to the protocol used by Dinesh Rao and Hedge, was carried out at 6-8 week intervals, using a diamond bur of a high-speed water-cooled handpiece. Following each grinding procedure, exposed surface was treated with sodium fluoride varnish 5% (Duraflor® Pharmascience INC, Montreal, Canada) for desensitization, and since 11 rotation adjustment was the patient’s chief complaint, an orthodontic treatment was planned, together with biannual caries prevention program and regular periapical radiographs.

DISCUSSION

Fused or germinated dentition are developmental anomalies with bizarre anatomy. These anomalies may develop during tooth bud morpho-differentiation as a result of a developmental aberration of both ectoderm and mesoderm. Several mechanisms have been proposed to explain the etiology of these anomalies including genetic predisposition, physical force producing close contact between two developing tooth buds, environmental factors such as thalidomide embryopathy, fetal alcohol exposure, or hypervitaminosis A of pregnant mother. It may also occur with several syndromes such as achondrodysplasia, chondroectodermal dysplasia, osteopetrosis, and others.

Association of talon cusp and fused or germinated teeth was rarely reported in dental literature.

Brook and Winter addressed the difficulty to distinguish between partial fusion and partial germination and suggested that these anomalies to be referred as "double teeth". Then, definite categorization of joined teeth as either germination, or fusion is often difficult.

Fusion is the incomplete attempt to two tooth buds to fuse in one, whereas germination is the incomplete attempt of one bud to divide into two. Hence, tooth count in partial germination is full, and in partial fusion is one tooth less. While in total germination, there is one more tooth and in complete fusion, there is one tooth less. However, distinguishing germination and fusion by tooth count alone is not a definitive parameter in all cases because fusion can occur between a normal and a supernumerary tooth.

Clinically, partial germination results in a bifid crown, with coronal halves appearing as mirror images, whereas fusion takes place at an angle causing a tooth with a crooked appearance. Radiographic examination reveals two separate canals in case of incomplete fusion whereas in germination, there is usually one large joint root canal. In complete fusion, root canal is usually one which was larger than the original one.

We believed the double teeth in our case to be the most likely complete fusion of maxillary left lateral and central incisors due to the larger mesiodistal coronal and radicular width and the presence of vestibular vertical groove in the distal part of the crown. Incomplete apexogenesis of the double tooth and the maxillary right left incisor and achieve apexogenesis of 11 lead to support this hypothesis.

Similar to fusion and germination, talon cups are believed to originate during morphodifferentiation stage of tooth development, as a result of an outward folding of inner enamel epithelial cells and a transient focal hyperplasia of mesenchymal dental papilla. Its exact etiology is yet to be known.

Tooth development is a complex process, in which reciprocal and sequential interactions between epithelial and mesenchymal cell regulate cell activities like proliferation, condensation, adhesion, migration, differential, and secretion which lead to the formation of a functional tooth organ. Any aberration among these will result in tooth agenesis, the most common type of craniofacial malformations. In our case, agenesis of maxillary left lateral incisor can be due to its fusion with central incisor.

Association of fusion, talon cusp, and agenesis of
a maxillary left central incisor are rarely described in dental literature. This association can be due to multiple etiological factors not well known yet.

CONCLUSION

Frequency of fusion, germination, talon cusp and agenesis is rare. Association of two or more of these developmental teeth abnormalities was exceptional and rarely described in the literature. Through this case report, we are attempting to develop a rationale in order to reach the most accurate diagnosis.

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Socket preservation in anterior maxilla: report of two cases.

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Abstract

After tooth extraction, alveolar ridge will decrease in volume and change in morphology. These changes are clinically significant and can make placement of a conventional bridge or an implant-supported crown difficult and extremely challenging.¹,²,³,⁷

Socket preservation procedures following tooth extraction will reduce the need for further ridge augmentation techniques prior to implant placement. This clinical report outlines the technical basis for socket preservation procedures and demonstrates its importance as an available treatment modality to prevent ridge atrophy and optimize anterior esthetics in maxilla.

INTRODUCTION

Tooth extraction is followed by marked osseous changes of the residual alveolar ridge including severe bone alterations both in height and width.² However, such remodeling could jeopardize subsequent implant insertion for two main reasons: first, the absence of adequate bone levels makes implant placement difficult; second, aesthetic problems in the fabrication of implant-supported restoration could be caused by serious bone resorption. Thus, it is of crucial importance that dentists know how alveolar crest changes when a single tooth is removed.

However, it is possible to minimize such problems by simply carrying out ridge preservation procedures in extraction sockets using guided bone regeneration with or without bone substitutes.¹⁴,¹⁵ The graft material serves as a scaffold to maintain hard- and soft-tissue volume as well as blood clot for initial healing.¹⁰

Many measures should be taken into consideration when conducting socket preservation surgery, including reducing extraction trauma and limiting flap elevation.¹ Factors such as trauma, temporization, infection, tissue atrophy, periapical lesion, biotype, and root fracture, can cause loss of alveolar bone.⁵⁹

Since not all extraction sites are the same, Elian and co-workers’ suggested extraction site classification schemes that were meant to be utilized in developing site-specific treatment designs based on gingival margin level as well as the presence or absence of the labial and interproximal bone surrounding the compromised tooth to be extracted.

• Type I Socket: The facial soft tissue and buccal plate of bone are of normal levels in relation to the cementoenamel junction of the pre-extracted tooth and remain intact postextraction.
• Type II Socket: Facial soft tissue is present but the buccal plate is partially missing following extraction of the tooth.
• Type III Socket: The facial soft tissue and the buccal plate of bone are both markedly reduced after tooth extraction.

A good diagnosis, based on a clinical and radiological exam and socket classification (Elian et al., 2007) is necessary to manage post-extraction alveolar socket.

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CLINICAL CASES

Case 1
A 52-year-old male with a non-contributory medical history, presented with non restorable tooth 12 (Figure 1). Patient displayed a high smile line, and clinical examination showed that 12 presented a mesio-distal vertical fracture (Figure 2). Tooth was deemed hopeless and was referred for extraction with socket preservation for future dental implant placement.

Tooth was atraumatically removed using a periotome in order not to harm its buccal bone. Since hard and soft tissues were preserved (Figure 3), the present clinical situation was classified as type 1 defect according to Elian and co-workers classification5.

Referring to parameters cited above, decision was made to fill the extraction socket with a mineralized bone allograft matrix (Figure 4) (Puros® Zimmer Dental, Carlsbad, California, USA). A dense collagen product (CollaPlug® Zimmer Dental, Carlsbad, California, USA) was placed on top of extraction socket to protect the graft substitute and preserve blood clot (Figure 5). Non resorbable silk (4/0) was used to secure the surgical site (Figure 6).

Three months later, periapical radiographs showed homogenous image of the alveolar bone revealing acceptable bone healing (Figure 7). Bone level was maintained allowing the placement of bone level tapered Screw-Vent® dental implant (Zimmer Dental, Carlsbad, California, USA).

Knowing that peri-implant bone remodeling occurs once the implant is exposed to oral environment, 11 months later, periapical radiograph revealed that crestal bone level was maintained around implant neck (Figure 8).

Case 2
A 62 year-old male presented with a mobile tooth 11 with grey discoloration. Clinical examination revealed a thin biotype with a low smile line. Tooth 11 presented a horizontal fracture (mesio-distally) (Figure 9), and its gingival level contour was 4mm higher than adjacent central incisor, indicating soft tissue loss.

A periapical radiograph revealed an advanced periodontal disease. The case was referred for periodontal treatment, and once the disease was stabilized, tooth was referred for extraction with socket preservation for future dental implant placement.

After the tooth was atraumatically extracted with forceps (Figures 11,12), extraction site was grafted with a mineralized bone allograft matrix (Puros® Zimmer Dental, Carlsbad, California, USA). An epithelial-connective tissue punch taken from the palate, with 5mm thickness, was placed on the top of the extraction socket to compensate soft tissue loss, and it was sutured to the surrounding soft tissue using 5/0 monofilament suture (Figure 13).

The crown of the tooth was used as temporary crown that was sealed on a wire to the palatal part of adjacent teeth (12-21), avoiding any contact with the grafted site to facilitate the healing process and conserve esthetics in the anterior area (Figure 14).

Four months later, surgical re-entry during implant placement showed good bony healing, allowing the placement of a bone level implant (Tapered Screw-Vent®).

24 months later, CBCT showed good preservation of the buccal plate allowing esthetic final restoration, with respect of the integrity of gingival margins and interdental papillae (Figure 17).

DISCUSSION
Tooth extraction is followed by marked osseous changes of the residual alveolar ridge. Absence of adequate bone levels makes implant placement difficult, and aesthetic problems in the fabrication of implanto-supported restoration could be caused by serious bone resorption1,2.

During a first phase, bundle bone resorbs and is replaced with woven (immature) bone leading to a great reduction in bone height, especially in the buccal aspect of the socket3, as its crestal portion consists solely of bundle bone. The second phase shows resorption from outer surfaces of both bony walls2.

Atrophy, decreased blood supply, and localized inflammation might play important roles in bone resorption. However, it is now known that bone remodeling is a complex process involving structural, functional, and physiologic factors and that surgical trauma resulting from dental extraction induces microtrauma to surrounding bone, which accelerates bone remodeling1,2,8.
Covani and co-workers found that buccal wall tends to resorb after extraction, according to a specific pattern. Thus, resorption at the midpoint represents the double of bone loss at distal and mesial points.

Schropp and co-workers concluded that two thirds of hard and soft tissue changes occur during the first 3 months: they reported 50% loss of crestal width in a 12-months period (corresponding to 6.1 mm; range 2.7 to 12.2 mm), 2/3 of which (3.8 mm; 30%) occurred during the first 12 weeks. When examining the premolar area only, a loss of alveolar ridge width of 4.9 mm (45%) was reported, of which 3.1 mm (28.4%) occurred during the first 12 weeks.

A recently published systematic review reported a greater horizontal alveolar ridge reduction (29–63%; 3.79 mm) than vertical bone loss (11–22%; 1.24 mm on the buccal, 0.84 mm on mesial, and 0.80 on distal sites) at 6 months.
Fig. 9. Hopeless tooth 11 with grey discoloration.

Fig. 10. Soft tissue loss.

Fig. 11. Immediately after tooth extraction.

Fig. 12. Immediately after tooth extraction.

Fig. 13. Punch graft.

Fig. 14. Crown sealed to the palatal aspect of adjacent teeth.

Fig. 15. Clinical view showing the healthy soft tissue.

Fig. 16. Final crown.

Fig. 17. Cone Beam CT showing preservation of buccal plate.

Figs. 18 and 19. The case 24 months later.
In early 2000, authors such as Covani and Bottecelli, suggested that immediate implant placement after tooth extraction will preserve bone from resorption but a study published by Araujo in 2006, showed that implants placed directly after extraction will not preserve dimension of the ridge, resulting in marginal bone loss.

Grafting materials used as bone “fillers” after tooth extraction are able to provide a mechanical support and prevent the collapse of both buccal and lingual bone walls, thus delaying residual ridge resorption until enough healing (new bone formation) occurs[^13].

The main determinants to achieve long-term esthetic predictability in this environment are related to understanding and managing a complex combination of clinical and biological factors, as follows[^16,17,18,19]:

1. Diagnosis and classification of extraction site in the esthetic zone.
2. The natural biological modeling and remodeling of extraction sockets.
3. The relationship of underlying bone to overlying soft-tissue profile and their stability.
4. The relationship of labial and vertical soft-tissue thickness and height around implant-supported restorations.
5. Site-specific surgical protocols that minimize negative dimensional alteration of the extraction site.
6. Restorative protocols and materials that optimize healing as well as soft-tissue stability and color[^10].

**CONCLUSION[^16,17,18,19]**

To achieve predictable esthetic success, critical clinical principles must be respected.

These clinical steps are helpful to limit the amount of buccal contour changes of the extraction site and potentially enhance the thickness of peri-implant soft tissues.

The ongoing challenge for clinicians performing anterior implants placement is no longer to achieve osseointegration. Instead, the challenge is improving protocols that allow less traumatic and highly predictable esthetic treatment outcomes in the more demanding anterior area.

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Mandibular second premolar with three root canals: a case report.

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Abstract

Introduction: Mandibular second premolars with three canals and separate foramina are very rare. A review of the literature has revealed that human mandibular premolar tooth can have an extremely complex root and root canal morphology; however, incidence of both multiple roots and multiple canals in mandibular second premolar is lower than that found in mandibular first premolar.

Aim: To report and discuss endodontic management for an unusual occurrence of three canals with three separate foramina in mandibular second premolar.

Materials and methods: Description of the root canal anatomy and management for a case of mandibular premolar with three root canals for an 18 year old African American male patient, where pulp chamber floor revealed one lingual and two buccal orifices at the same level. This report was clinically and radiographically based.

Conclusion: The complex nature of root and root canal morphology of mandibular premolars has been underestimated, which resulted in unknown endodontic failures in many clinical cases. Proper diagnosis and orientation with the root canal anatomy is mandatory for successful treatment.

INTRODUCTION

To achieve a successful root canal treatment, a thorough knowledge of root and root canal morphology as well as possible variation in anatomy of the root canal system is of utmost importance¹,². This is followed by negotiation, cleaning and shaping, and obturation of the entire canal system in three dimensions³,⁴.

Failure to recognize the presence of an additional root canal may result in unsuccessful treatment and may be the origin of acute flare ups during and after treatment⁵.

Normal root and root canal anatomy of mandibular premolars are well documented in numerous textbooks, but there is a great deal of variation in the reporting of the incidence of anomalies⁶,⁷,⁸,⁹,¹⁰,¹¹,¹²,¹³,¹⁴. Slowey³ indicated that due to the variations in canal anatomy, mandibular premolars are the most difficult teeth to treat endodontically; they have a high flare up and failure rate¹⁴.

Mandibular premolars have gained a reputation for having aberrant anatomy. Different studies have looked at the morphology of mandibular premolars over the years and reported a fairly high percentage of these teeth to have more than one canal¹,²,¹⁵.

Occurrence of three canals with three separate apices (type V, Vertucci) in mandibular premolars is very rare¹⁶.

In a classic anatomical study, Zillich and Dowson¹⁷ showed the occurrence of three canals in mandibular second premolars to be 0.4%, while Vertucci¹⁸ reported it as zero %.

Clinically reported cases showing the presence of three separate roots for the same tooth are very few and far between¹,¹⁵,¹⁹,²⁰,²¹,²²,²³.

Our report addresses a case of nonsurgical endodontic management of mandibular second premolar with three separate roots and root canals with three foramina.
MATERIALS AND METHODS

An 18 year old African American male patient was referred to the endodontic clinic in Concord, California, USA, with chief complaint of severe shooting pain related to lower left side of his face over a period of one week. Patient also complained of episodes of sensitivity to hot and cold foods in mandibular left second premolar tooth.

On clinical examination, patient’s oral hygiene was found to be fair. Deep carious lesions were observed in teeth # 19 and 20. Tooth #20 had a very deep cavity showing pulpal involvement and was tender on percussion. The crown of mandibular second premolar on contralateral side showed no unusual anatomy in terms of number of cusps and dimension suggestive of any anomaly. Electric pulp test (Sybron Endo, USA) and heat test with a gutta-percha stick gave a lingering response. There was no evidence of swelling or sinus tract.

Preoperative periapical radiograph revealed slight widening of the periodontal ligament space at the periapical area related to the mandibular second premolar and thickening of the lamina dura, with deep occluso-distal cavity reaching the pulp space area (Fig. 1).

Radiograph also showed the presence of two roots with a shadow of a third root in between the first two.

Based on clinical and radiographic evidences, a diagnosis of irreversible pulpitis was made.

Access was gained to the pulp chamber after administration of local analgesia (2% lidocaine with 1:80, 000 adrenaline) under rubber dam isolation using 557 bur and endo Z bur. To gain sufficient access to canals, conventional access opening was modified into one that was wider mesiodistally. Radiographically, the mid-root diameter appeared to be almost equal to the crown diameter. Tactile examination of the walls of major canals was implemented with a small precurved pathfinder file (Dentsply, Maillefer, USA) which was slowly pushed down each wall of the major canal, probing for a catch. A slight catch may signify the orifice of an additional canal especially in the case of the buccal and lingual walls because these are the unseen dimensions on the radiograph. Three separate orifices were located: two buccal, and one lingually. Patency was ascertained with a small size 10 K-file (Dentsply, Maillefer, USA). The working length radiograph was taken (Fig. 2). Canals were cleaned and shaped sequentially with ProTaper files (Dentsply, Maillefer, USA), irrigated using 6% sodium hypochlorite and a final rinse of saline. Canals were dried with paper points (Dentsply, Maillefer, USA), cotton was placed in pulp chamber and Cavite (3M ESPE, St. Paul, MN, USA) was used to close access cavity. At second appointment, canals were obturated with F2 ProTaper gutta-percha cones (Dentsply, Maillefer, USA) using AH Plus sealer (Dentsply, Maillefer, USA), Calamus dual (Dentsply, Tulsa denta, USA) used for vertical compaction technique with the use of Buchanan hand pluggers (Sybronendo, USA) (Fig. 3).

Fig. 1. Preoperative radiograph: the tip of the third (lingual) root was identified in between the two buccal roots.

Fig. 2. Working length.
DISCUSSION

The complex nature of the root and root canal morphology of the mandibular premolars has been underestimated.

Since 1979, Slowey reported that root canals are frequently left untreated because clinicians often fail to identify their presence, particularly in teeth that have anatomical variations or additional root canals, before root canal treatment is performed. Therefore, clinicians should be aware of the configuration of pulp space of the tooth is to be treated.

Anatomical variations of mandibular premolars are well documented in literature both in terms of anatomic studies and clinically reported cases, and reports have shown that mandibular premolars are possibly the most difficult teeth to treat endodontically due to wide variation in root canal morphology.

Failure to recognize presence of an additional root canal may result in unsuccessful treatment and may be the origin of flare ups during and after treatment.

Incidence of number of roots and number of canals reported in anatomic studies greatly varies in literature. Root morphology and canal morphology of mandibular premolars can be extremely complex and highly variable.

Factors that can contribute to differences observed in various anatomic studies have been previously reported, and these factors include ethnicity, age, gender, unintentional bias in the selection of clinical examples of patients or teeth (specialty endodontic practice v/s general dental practice), as well as study design (in vitro v/s in vivo).

Based on race, and since our patient was African American, a study by Trope and co-workers compared the number of roots and number of canals in mandibular premolars between African American and white patients: the African American group had an incidence of two or more roots in the mandibular second premolar tooth at 4.8% of the time compared with a 1.5% incidence in the white patient group. Although the incidence of multiple roots was greater in the African American patients compared to white patients in both mandibular first and second premolars, the differences were statistically significant only for mandibular first premolar.

Ethnic differences in internal canal morphology were also found in this study but were not statistically significant. The African American group had an incidence of two or more canals at 7.8% of the time, whereas the white group had an incidence of 2.8%.

However, based on gender distribution, two studies compared differences for number of roots or canals in a known population. A study by Serman and Hasselgren reported the incidence of two canals and two roots for mandibular first and second premolars: authors found gender differences with respect to the number of canals and roots in an analysis of radiographic surveys of 547 patients. The distribution of men (252 patients) and women (295 patients) was approximately equal and in their study, more men exhibited multiple roots and/or canals (29 men v/s 15 women) in the mandibular second premolar. Also, Sert and Bayirli assessed canal morphology in 100 Turkish male and 100 Turkish female patients: male (43%) exhibited two or more canals much more frequently than female patients (15%).

Incidence of mandibular premolars with more than one canal or root is likely to be greater than that reported/found because of hidden images radiographically. The Washington study assessed the results of endodontic therapy of mandibular premolars showed that the failure rate in mandibular second premolar as 4.54%. This may be due the extreme variations in root canal morphology of mandibular premolar teeth compared with the standard description of one root and one canal and therefore
poses an endodontic challenge to clinicians.

Root canal morphology of mandibular premolars can be highly variable and complex and it is often a challenging task to carry out successful endodontic therapy with such teeth. Therefore, the primary step in root canal treatment is the identification of the internal morphology of canal system as precisely as possible. Gulabivala and co-workers concluded that broad, flat roots are much more likely to contain multiple canals and intercanal ramifications. In such cases, and to obtain predictable results, high-quality pre-operative radiographs should be available at different horizontal angulations and carefully evaluated to detect the presence of extra root canal.

**CONCLUSIONS**

A thorough knowledge of root canal anatomy and its variations, careful interpretation of peri-apical radiographs, close clinical inspection of the floor of the pulp chamber and proper modification of access opening along with adequate magnification, all are essential for successful treatment outcome.

The following clues from diagnostic information and techniques might help clinicians to detect additional root(s) and canal(s):

High-quality pre-operative radiographs should be obtained at different horizontal angulations, 15° to 40°, either mesial or distal from horizontal long axis of the root, and they are necessary to accurately diagnose number of roots and canals in premolars.

Yoshioka and co-workers have indicated that sudden narrowing of the canal system on a parallel radiograph suggests canal system multiplicity.

A general guideline is that if the mid-root image diameter appears equal or greater than the crown image diameter, then the tooth most likely has a variation in root canal configuration.

Presence of additional canal should be suspected whenever an instrument demonstrates an eccentric direction on deeper penetration into the canal, termed directional control, or if the working length file appears off center in the radiograph.

Use of magnification has been demonstrated to improve the clinician's ability to visualize and access canals.

Advent of 3D imaging such as Cone Beam Computed Tomography (CBCT) and (the more recent) tuned aperture computed tomography would be very beneficial and should have been used in such rare cases for effective evaluation of root canal morphology, as this may facilitate and enhance visualization of the area of interest. However, the high cost, accessibility and availability to patient and extra radiation as compared to standard radiographic methods makes its routine use limited.

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Differential diagnosis of multiple maxillofacial radioopacities using Cone Beam Computed Tomography (CBCT): a case report.

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Abstract

Imaging plays an essential role in the evaluation of maxillofacial complex morphology, detection and differential diagnosis of pathologies, and establishment of a treatment plan.

A 60 year-old male was referred for a routine panoramic radiograph prior to dental treatment. Panoramic view displayed multiple radioopacities with different shapes and densities scattered throughout the jaws and surrounding soft tissues. In the absence of other incidence, no additional information was obtained on their exact locations, mainly in bucco-lingual dimension.

A three-dimensional image, acquired in few minutes with Cone-Beam Computed Tomography (CBCT) technique, allowed us to make an appropriate diagnosis through an anatomical three-dimensional perspective.

Images provided by Cone-Beam technology tremendously improved the accuracy of radiological evaluation of all entities revealed by panoramic radiograph.

INTRODUCTION

Since the discovery of X-rays in 1895, film has been the primary medium for capturing, displaying and storing radiographic images. It is the technology that practitioners are most familiar and comfortable with, in terms of technique and interpretation. Rapid development of computer technology, improved performance, accessibility and lower cost have opened the way to digital and advanced imaging modalities where high-performance processors are needed to handle and manipulate large amounts of data. 1,2

Dental radiographs are primarily used to survey dental structures for morphological and pathological changes of diagnostic interest. However, conventional transmission radiography projects alveolar process onto a two-dimensional (2D) film plane so that many anatomical structures may overlie lesions in trabecular bone. This means that differentiation between buccal and lingual cortices is limited, and this makes the topography and extent of lesions in bucco-lingual dimension impossible to evaluate with certainty. 1,3

Benefits of three-dimensional medical computed tomography (CT) are already well established in many dental specialties. Several studies have supported the use of CT for the diagnosis and management of maxillofacial skeleton trauma. It has also been used for patients requiring surgical facial reconstruction, orthognathic surgery, dental implants, and complicated extractions. The high-radiation dose, cost, limited availability and some difficulty in interpretation have resulted in limited use of CT imaging as a definitive diagnostic tool.

Recent cone-beam innovations in CT technology are becoming popular tools in modern dental practice. Some machines cover the entire maxillofacial area while others are used for imaging a much smaller region of interest, although usually with finer resolution. This means that much lower-powered X-ray generators can be used and that the radiation dose to the patient required for such scanners is much lower than that used in medical CT. Furthermore, and because cone beam reconstruction algorithms make it
possible to reconstruct an entire volumetric region, this region can be reformatted to show anatomical details in any imaginable plane. Views, not usually seen with conventional modes of dental radiography, can be achieved and accurate measurements can be performed, free from usual problems of magnification and distortion. CBCT is a method that produces volume imaging quicker and easier than conventional CT with considerably lower radiation exposure.1,3,4

Development and application of such concepts show that the future is not on the distant horizon but rather is developing in the present.

CASE REPORT

A 60-year-old male patient was referred to the Department of Dento-Maxillo-Facial Radiology and Imaging at the Lebanese University School of Dentistry, for a routine panoramic radiograph in order to evaluate teeth and jaws before placing a complete removable denture.

Panoramic radiograph (Fig.1) displayed multiple radioopacities of different densities spread throughout the image:
- one is superimposed over the image of upper lip,
- a second, in the molar region of left maxilla,
- a third and fourth, in premolar and molar regions of left mandible
- and the last radioopacity was superimposed over the image of left mandibular ramus.

Usually, amount of information gained from conventional plain radiographs (such as panoramic image) is limited by the fact that three-dimensional anatomy of the area being imaged is compressed into two-dimensional image. As a result of superimposition, two-dimensional radiographs reveal limited aspects of the three-dimensional anatomy requiring, in several times, combination of different conventional plain films. These problems are also easily overcome using imaging techniques that can quickly produce three-dimensional images of involved structures and surrounding tissues.

Hence, in this case, and for further investigation of the internal structure, size estimation and localization, a CBCT was acquired and it showed the overall appearance and made it much easier to locate the position of each radioopacity.

a) The radioopacity superimposed over the image of upper lip:

Sagittal images (Fig.2) revealed a well-demarcated metallic high density mass located in upper lip, at right side; and a well-circumscribed, bone-like density, irregular, heterogeneous radioopacity, located adjacent to images of C1, C2 (1st and 2nd vertebrae).

b) The second radioopacity in molar region of left maxilla:

Axial and cross sectional images showed a homogeneous ovoid shape high density image in the molar region of left maxilla; this image displayed bone density (Fig.3). This can either be a residual tooth or a dense bone (e.g. condensing osteitis).
c) The third and fourth radioopacities were located in premolar and molar regions of left mandible. Panoramic reconstruction and cross-sectional images demonstrated a well-defined high density radioopacity surrounded by a thin zone of lower density, the final diagnosis was a residual root tip or root fragment. These fragments are well-known radiographically by their shapes and their densities and they are easily identified by CBCT (Fig.4).

d) Superimposed radioopacity on left mandibular ramus: well-circumscribed, bone-like density, irregular, heterogeneous radioopacity, located adjacent to C1-C2 images (Figs.1, 5). All radiographic data lead to the diagnosis of a calcified lymph node. And to make an adequate differential diagnosis for this last calcification, we had to distinguish it from other pathological and anatomical radioopacities that variably appear contiguous to this region. Differential diagnosis included anatomic densities such as:

1. Hyoid bone (has a defined cortex and trabecular pattern).
2. Styloid process (on a panoramic radiograph, it appears projecting downward and forward between mandibular ramus and mastoid process).
3. Stylohyoid ligament (when calcified, it can be posterior to mandible, either continuously or in segmented fashion).
4. Stylomandibular ligament (when calcified, it may be seen on panoramic radiograph).
5. Thyroid cartilage (when calcified, its superior horn may be seen on a panoramic radiograph).
6. Triticeous cartilage (a small cartilage in the thyrohyoid ligament): when calcified, it appears as a radioopacity the size of a wheat grain, just below the tip of the greater cornu of hyoid bone.
7. Epiglottis (the lidlike cartilage overhanging larynx entrance, guarding it during swallowing): vertically oriented crescent-shaped soft tissue opacity
above the greater horn of the hyoid.
8. Soft palate.
10. Auricle: ear lobe.

On the other hand, differential diagnosis of pathological radioopacities included: 5-8
1. Calcified lymph nodes: cauliflower-like in shape and variable in radiodensity. They are almost always unilateral, single multiple, or in a chain.
2. Phleboliths: dystrophic calcifications found in veins, usually smaller than hilar stones, usually multiple, and frequently have concentric radiopaque and radiolucent rings (bulls-eye pattern).
3. Submandibular salivary gland sialoliths: stones located in the hilum, almost always unilateral and appear below inferior border of mandible in the third molar/ramus area. They are usually smooth in outline and diffusely calcified.
4. Loose body: a small pathologic bony outgrowth (osteofyte) that fractured off the body of a cervical vertebra.
5. Tonsillitis: multiple small radiopacities clustered together over the oropharyngeal airspace.
6. Calcified acne.

The described image in this case is very suggestive of a calcified lymph node.

DISCUSSION
Benefits of three-dimensional CBCT are already well established in many dental specialities. 4, 10, 13
* In oral surgery, CBCT is superior in identifying bucco-lingual location and proximity of impacted third molars relative to inferior alveolar nerve.
* The morphology and dimension of the alveolar ridge and the location of inferior alveolar nerve canal (if applicable) are essential information in selecting optimal sizes of dental implants.
* CBCT images have also been used to detect various oral pathological conditions such as odontogenic and non-odontogenic cysts and tumors, inflammatory and non-inflammatory lesions, primary or metastatic malignancies.
* Other dental applications of CBCT include visualization of craniofacial anomalies such as cleft palate cases, assessment of pharyngeal airway patency, and evaluation of paranasal sinuses.

* For orthodontics, one single CBCT scan can effectively generate, at a relatively equivalent radiation, all the conventional radiographic images needed for orthodontic diagnosis such as lateral cephalogram, panoramic radiograph, antero-posterior cephalogram, temporo-mandibular joint tomograms, as well as many other oblique / cross-sectional slices previously unavailable in flat planar films. 8-11

Therefore, both educational institutions and private practices should play roles in establishing standardized protocols in the use of CBCT technology by developing and participating in a variety of educational courses to better understand this relatively new technology.

CONCLUSION
More clinicians and health professionals are convinced of the significant advantages of using 3-D images, compared to conventional 2-D planar film images. It is time, now, for dentists, to embrace the new era of 3-D dental imaging with CBCT and to take next step towards integrating this technology into their daily clinical practices. 12

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Retrieval of a maxillary wisdom tooth inadvertently displaced in buccal space: a case report.


Abstract

Surgical extraction of impacted wisdom teeth is a daily routine dental practice. Still the possible complications that an oral surgeon may encounter necessitate an understanding of the involved anatomical spaces. In the present clinical report, we are addressing an inadvertent displacement of a maxillary wisdom tooth into left buccal space. We will also tackle anatomical landmarks to be respected and discuss the surgical procedure carried out.

A 25 year old male was referred to the Department of Oral and Maxillofacial Surgery Lebanese University, School of Dentistry, after accidental displacement of maxillary left third molar beneath the surgical flap, during surgical removal of aforementioned third molar, under local analgesia.

Oral examination revealed a hard moveable mass within left buccinator muscle, anterior to the coronoid process. The affected muscular area proved to be painful on palpation.

An intra-oral radiograph displayed the third molar in a parallel position to the maxillary second molar. An axial CT cut revealed a displaced third molar entrapped within left buccal space (Fig. 1).

After delivering local analgesia of left maxillary molar vestibule and tuberosity (2% lidocaine with 1/100000 epinephrine), tooth was reached and removed (Figs. 2,3).

The most challenging part of the surgical operation was the separation of fibrous connection between the tooth and the surrounding adipose tissue. After separating the tooth from adipose tissue, submucosal and mucosal tissues were sutured, using separated Vicryl® 3/0 sutures. Postoperatively, analgesics and antibiotics were prescribed for one week (Amoxicilline 500mg, 1 tablet each 6 hours for 1 week, Acetaminophen 500mg, 1 tablet each 4 hours for 2 days). Postoperatively, the patient did not experience any neural deficits or muscle weakness, or jaw stiffness, and he regained a full range of jaw movement, 5 days after surgery.

SURGICAL ANATOMY OF BUCCAL SPACE

Buccal space’s anatomical boundaries are buccinator muscle medially, superficial layer of the deep cervical fascia and muscles of facial expression laterally and anteriorly, masseter muscle, mandible, lateral and medial pterygoid muscles and the parotid gland posteriorly.

Buccinator muscle originates from external surface of the alveolar process of permanent molars of the maxilla and mandible and inserts posteriorly on anterior border of pterygo-mandibular ligament. Branches of the buccal nerve perforate buccinator muscle and ramify in the mucous membranes of the cheek. If the nerves are damaged by a displaced tooth, sensory disturbances may occur.

The greater part of the space is filled by adipose tissue (termed as buccal fat pad), which extends medially between the mandible and maxillary. The anterior portion of buccal fat pad extends anterior to
the parotid and facial vein. The superior temporal extensions of buccal fat are divided into the deep and superficial subdivisions with respect to temporal muscle.

Parotid duct courses in a transverse fashion through buccal fat pad, and it pierces buccinator muscle, opposite to second permanent maxillary molar.

Buccal fat pad assists muscular motions such those needed to open and close the mouth⁵. Thin and divergent roots of maxillary third molars are vulnerable to fractures. A small part detached from the tooth or bone that is displaced into buccal space can be easily pushed with the help of adipose tissue and muscular motion, and may travel to adjacent deep anatomical areas via anatomical communications of buccal space.

**DISCUSSION**

Various complications resulting from maxillary third molar surgical extraction have been reported in dental literature, such as alveolar osteitis, fractures, bleeding, oro-antral fistula, damage to adjacent teeth,
and displaced teeth. Regarding the latter, the most common types of accidental displacement occur in the maxillary sinus. Excessive force when using elevators and improper surgical technique are quoted as the most common causes of iatrogenic displacements. Accidental and inadvertent displacement of surgically extracted impacted third molars, either a root fragment, crown, or entire tooth, is a complication that occurs during these surgical procedures.

During surgical extraction, a maxillary third molar may be displaced into the buccal space. Incorrect use of the elevator may lead to tooth or root displacement and/or fracture of the buccal wall and/or entire maxillary tuberosity, which consists mostly of trabecular bone with a thin cortical layer, and the pushed tooth/root may easily be displaced into the buccal space. If the bone height buccal and/or distal to the molar is inadequate, this risk increases.

Displacement of teeth during removal of third molars is rarely reported, as most surgeons retrieve their displaced teeth/roots without reporting the complications. The typical management of displaced third molar teeth involves an initial, conservative attempt to remove tooth from the area in which it is believed to be displaced. Imaging is mandatory to localize the tooth in three dimensions. Imaging is recommended immediately after displacement in order to determine whether displacement of tooth may affect function of adjacent anatomical spaces.

Difficulties may be encountered when teeth are displaced into anatomical locations where they may be able to “migrate”; and this is particularly the case with underdeveloped teeth without roots. Difficult-to-access areas include buccal fat pad, infratemporal fossa, maxillary sinus, floor of mouth (for mandibular wisdom teeth), masticatory space, or other areas of loose fascial planes.

Correlation of the position of the tooth with a multiplane CT scan makes this approach reasonable for most minimally displaced teeth. However, surgical dissection and manipulation of tissues can change reference points for the operating surgeon, and further displacement of tooth can occur. Although some retrievals may be easy, others can be very difficult, with risk of hemorrhage or neurologic injury, and may even require aborting the procedure if the tooth is not located.

It should be kept in mind that removal of impacted third molars can result in severe complications. Careful attention to surgical details, including proper patient preparation, asepsis, meticulous management of hard and soft tissues, controlled force when applying surgical instruments, homeostasis, and adequate postoperative instructions may help to reduce rate of complications.

It is recommended that an open surgical procedure be performed instead of using elevators when the movement of the tooth in an unfavorable direction is recognized.

Architecture of maxillary tuberosity features a trabecular pattern that is more vulnerable to fractures, consequently, the risk of displacement into adjacent anatomical sites is more likely to occur. If access is limited or difficult, an open surgical procedure is preferable to secure retrieval of displaced tooth.

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Oral intravascular papillary endothelial hyperplasia: a case report.


Abstract

Intravascular papillary endothelial hyperplasia (IPEH) is an unusual vascular lesion of proliferating endothelial cells. It is more frequently observed in extremities, particularly fingers. Oral IPEH is rare; it has been reported in lip, tongue, buccal mucosa and in one case only, at the angle of mouth. A misdiagnosis of angiosarcoma can be made in a case of IPEH due to similar histopathologic features. In this clinical report, we address a case of a 61-year-old male with an oral IPEH at the angle of the mouth, facing an edentulous site of maxillary right first premolar (extracted 10 years earlier). The patient mentioned a biting and suction habit of this lesion. Surgical removal was performed and histopathologic examination identified IPEH. Patient’s follow-up revealed an ischemic heart stroke 5 years after and no recurrence six years after surgery.

INTRODUCTION

Intravascular papillary endothelial hyperplasia (IPEH) is a benign non-neoplastic intravascular lesion. In 1923, Pierre Masson was the first to report this lesion in hemorrhoid vessels as “vegetant intravascular hemangioendothelioma”[1-4]. Later the terms “intravenous atypical vascular proliferation”[2], “intravascular angiomatosis”[5-7], “intravascular endothelial proliferation”[4], “Masson's pseudoangiosarcoma”[2, 3, 5, 6] and “Masson's lesion”[4] were suggested. The term “intravascular papillary endothelial hyperplasia” (IPEH)⁹sounds more descriptive and less confusing and is the most frequently used in medical literature[2, 6].

Clinically, IPEH presents as firm or tender nodule or mass with slight elevation, rather sharp demarcation and slow growth with a red or blue color of the overlying skin[3, 4, 5, 8, 9]. Clearkin and Enzinger⁸ pointed out that sub cutis of fingers, head, neck and trunk are the most common locations.

IPEH is a benign non-neoplastic intravascular lesion. It presents as exuberant organization and recanalization of a thrombus and occurs either in a pure form in previously normal vessels or in a mixed form in a pre-existing vascular processes like in varices, hemorrhoids, pyogenic granulomas, and hemangiomas[5, 6, 9].

IPEH simulates angiosarcoma, a malignant tumor arising from vascular endothelial cells. Features common to both lesions are, usually, presence of papillary proliferation of endothelial cells, anastomosing vascular channels, and plump endothelial cells. IPEH is differentiated from angiosarcoma by the exclusively intravascular nature of the process, lack of necrosis, bizarre cells, atypical mitoses, and the characteristically fibrous and/or hyaline appearance of the papillary stalks in IPEH⁹.

The exact pathogenesis is unknown. Treatment is surgical removal[1, 4, 9-24].

IPEH has been rarely described in the oral region. In this clinical report, a new case is addressed.

CASE REPORT

A 61 year-old male was referred to the Oral Pathology and Diagnosis Department at the School of Dentistry of Lebanese University, for a tumor-like lesion of the right angle of the mouth. (Fig. 1).

Patient has been taking acetyl salicylic acid (A.S.A.) 100 mg/day, twice a week, for the last 6 years (to prevent ischemic vascular accidents).

Intra-oral examination displayed open teeth caries and multiple edentulous sites, in both maxilla and mandible. It also revealed the presence of a bluish painless tumor-like lesion of 1.2 cm of diameter, covered with a smooth apparently normal epithelium at

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the right angle of the mouth (commissure) (Fig. 2): this lesion faced an edentulous site of the maxillary first premolar (extracted 10 years earlier). The patient reported a biting and suction habit of this lesion, and that probably induced a firm, cartilage-like consistency. Lesion was mobile with regard of underlying connective tissue. Surrounding tissue bleached under pressure and returned to its color as soon as pressure was released. A needle aspiration from the center of the lesion (using a 0.3 mm section needle) was performed under local analgesia (2% lidocaine with 1/100000 epinephrine): no fluid could be aspirated and resulting bleeding was very limited.

Radiographic examination didn’t reveal any radiopacity even though a 70 Kvp at a low exposure time 0.05 second was used.

Differential diagnosis included (Table 1) angiosarcoma, isolated varice, mucoid cyst, fibrous hyperplasia (traumatic fibroma), hemangioma, neurofibroma, schwannoma, traumatic neuroma, Heck’s disease, pyogenic granuloma, and lymphangioma.

Surgical removal has been reported as efficient treatment modality for such lesions. Final diagnosis is obtained after histopathology examination.

Lesion was surgically removed (Figs. 4, 5) and histopathological examination revealed vascular lumina obliterated by a thrombus, recanalization in the center, all surrounded by hyalinised papillary vegetations of endothelial cells: no atypical cells were found in the specimen. Consequently, this lesion of the angle of the mouth proved to be a vegetant intra-vascular hemangioendothelioma (Masson’s tumor). (Fig. 6). The surgical wound healed normally and uneventfully (Fig. 7).
<table>
<thead>
<tr>
<th>Lesion</th>
<th>Description</th>
<th>Clinical differences</th>
<th>Histological differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiosarcoma</td>
<td>A malignant tumor arising from vascular endothelial cells characterized by papillary proliferation of endothelial cells; anastomosing vascular channels and plump endothelial cells.</td>
<td>It differs from IPEH by the lack of mobility toward surrounding tissues due to its connection and extra vascular extension.</td>
<td>It differs from IPHE by its extra vascular extension, presence of necrosis, atypical cells and mitoses.</td>
</tr>
<tr>
<td>Isolated varice</td>
<td>An abnormal dilatation of veins, bluish in color and soft in consistency but once thrombosis occurs, it can become firm and can be mobile with regard of the surrounding tissues, resembling to a buck shot beneath the epithelium.</td>
<td>Very similar if thrombosis occurs.</td>
<td>Lack of papillary proliferation of vascular endothelial cells and hyalinised papillary vegetations.</td>
</tr>
<tr>
<td>Mucoid cyst</td>
<td>A cyst of minor salivary glands or their ducts after the rupture or obstruction of these ducts. Usually, it is bluish, soft, fluctucent and gets bigger during meals due to the salivary gland activity. In the chronic phase, fibrosis can occur and it becomes firm.</td>
<td>Very similar in the chronic phase when fibrosis can occur and it becomes firm.</td>
<td>Lack of vascular endothelial cells involvement or thrombosis.</td>
</tr>
<tr>
<td>Fibrous hyperplasia (traumatic fibroma)</td>
<td>A hyperplasia due to chronic irritation, facing usually an edentulous site or occlusion gap and accompanying biting and suction habits. It is a pale, pink, firm lesion, not mobile, with regard of the underlying tissues.</td>
<td>It differs from IPHE by its connection to the underlying connective tissue, its pale pink color and its homogenous consistency.</td>
<td>Lack of vascular endothelial cells involvement or thrombosis.</td>
</tr>
<tr>
<td>Hemangioma</td>
<td>An abnormally proliferating blood vessel. Hemangioma is usually bluish but soft and bleeds excessively on aspiration.</td>
<td>It differs from IPEH by its soft consistency and the excessive bleeding.</td>
<td>Lack of calcified recanalized thrombus and hyalinised papillary vegetations of endothelial cells.</td>
</tr>
<tr>
<td>Neurofibroma and Schwannoma</td>
<td>Benign tumors of neural origins, usually firm, covered by a normal aspect endothelium. They are not mobile with regard to the surrounding tissues.</td>
<td>Differ from IPHE by the lack of displacement regarding the surrounding tissues.</td>
<td>Involvement of neural cells proliferation and lack of vascular endothelial cells hyalinised vegetation and thrombus.</td>
</tr>
<tr>
<td>Traumatic neuroma</td>
<td>Hyperplasia of neural cells after nerve trauma.</td>
<td>It differs from IPEH mainly by its painful aspect.</td>
<td>It differs from IPHE by its composition of neural cells proliferation and lack of vascular endothelial cells hyalinised vegetation and thrombus.</td>
</tr>
<tr>
<td>Heck’s disease (Facial Epithelial Hyperplasia) (Multifocal papilloma virus epithelial hyperplasia)</td>
<td>Soft, pale, sharply circumscribed and elevated, round to oval, papillar or plaque-like, and either red, pink, gray, or white lesion(s). Extremely rare among Caucasians.</td>
<td>- Smooth pearly surface - “Disappear” when stretched - May be single but often multiple and clustered - First 2 decades of life</td>
<td>- HPV 13 is detected within the lesion (HPV 32 less frequently) - Acanthotic squamous mucosa - “Mitosoid” nuclear degeneration (enlarged nuclei with clumped chromatin mimicking mitotic figures).</td>
</tr>
<tr>
<td>Pyogenic granuloma</td>
<td>- Common reactive reaction (history of prior trauma is common). - Rapidly enlarging, smooth, pedunculated, or sessile red / purple growth.</td>
<td>- Female predominance. - May become larger during puberty, pregnancy, and menopause. - Tends to bleed. - Most common sites = anterior maxillary and mandibular gingiva.</td>
<td>- Granulation tissue - Ulcerated mucosal surface. - Predominant inflammatory component. - Plump and mitotically active endothelium.</td>
</tr>
<tr>
<td>Lymphangioma</td>
<td>- Painless, nodular, vesicle-like swelling. - Color ranges from lighter than surrounding tissues to red – blue.</td>
<td>- Congenital lesion. - First 2 decades of life. - On palpation, lesion may produce a crepitant sound as lymphatic fluid is pushed from one area to another. - Tongue = most common intraoral site.</td>
<td>- Endothelium-lined lymphatic channels diffusely distributed in submucosa. - Channels contain eosinophilic lymph.</td>
</tr>
</tbody>
</table>

Table 1. The differential diagnosis of IPEH.
DISCUSSION

Pathogenesis of IPEH remains controversial: considerations included a benign neoplastic process with endothelial cell proliferation and papillary formation in the vascular lumen with degeneration and necrosis in the manner of a red infarct, a reactive process of endothelial cells induced by blood stasis and perivascular inflammation, a benign endothelial proliferation arisen from a thrombus as a variant of angiolymphoid hyperplasia with eosinophilia, and a pseudotumoral lesion caused by endothelial proliferation with papillary formation proceeded by a thrombotic material which serves as a development material\cite{5, 8, 12, 15}. IPEH is usually found in the lumen of dilated veins but it has been detected also in hemangiomas\cite{9}, hematomas\cite{13} and unexpectedly in lymphangiomas\cite{11}.

Although the exact pathogenesis of (IPEH) remains unknown, the prognosis (based on literature review) is expected to be good.

The case reported demonstrated a number of interesting features:

1. The patient was middle-aged (61 years) with long-standing bluish firm lesion of 1.2 cm of diameter at the angle of the mouth, with a history of occlusion trauma and suction. The lesion was facing a missing first maxillary right premolar.

2. When the patient noticed the lesion and stopped the trauma for one week, a remarkable regression in its volume occurred but the firm mobile mass in its center remained unchanged and perceptible (Fig. 3).

This may lead to a hypothesis that inflammation due to mechanical trauma was responsible of the variation in the lesion’s volume. Trauma involvement in the etiology of the lesion warrants further investigations.

3. We found interesting to report that the patient who has been taking (A.S.A.) 100 mg/day twice a week for the last 6 years (as a prevention of ischemic vascular accidents), had an ischemic heart stroke five years later after the excision of the (IPEH) lesion. The potential of being an early warning for ischemic vascular disorders may be as well the subject of further research.

A literature review depicted one case of IPEH at the angle of the mouth (commissure), besides our case,
among 93 cases of IPEH in the oral mucosa and lips. Mean age varied from 9 months to 61 years (average 42.1 years). This type of lesion was slightly more frequent in females (45 cases) than in males (36 cases) with a female to male ratio 1.25/1. Anatomical locations were lower lip (40 cases), tongue (19 cases), buccal mucosa (13 cases), upper lip (13 cases), mandibular vestibule (4 cases) and angle of mouth (commissure), (2 cases, including ours). Contribution of minor trauma has been estimated from 4% (in a review of 314 cases [11]) up to 10% (in a review of 152 cases [10]) and 7% (in the oral lesions [1]). The lesion has been clinically mistaken for hemangioma [1, 3, 4, 5], hematoma [12], mucocele [1, 6, 7, 12, 13], thrombosed vein [12], phlebectasia [3], lymphangioma [13], traumatic fibroma [1, 12], granuloma [4, 5, 12, 13], salivary gland tumor [4, 12, 13], and nevus [1, 12]. The pure type is more common (72 of 94 cases). The best treatment is obviously surgical excision in healthy margins. Recurrence has been cited in 1 case [4-5].

CONCLUSIONS
Diagnosis of intravascular papillary endothelial hyperplasia is easy if an operative specimen is available. However, on a small biopsy specimen, a capillary angioma or malignant hemangioendothelioma may be more difficult to rule out. The main significance of (IPHE) remains in its microscopic resemblance to angiosarcoma and possible misinterpretation as such. Surgical removal will usually allow complete healing.

The trauma involvement in the etiology of (IPHE) lesion and the relation to ischemic vascular disorders warrants further investigations and research.

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The Locator: a useful attachment for overdentures. A practical description.

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Abstract

Restoring an edentulous mandible with a conventional denture can be improved when needed by adding two implants. There is overwhelming evidence that a two-implant supported overdenture is a better choice treatment. In elderly patients, attachment systems that facilitate placement and removal of the protheses, and those that are readily hygienic, may be useful. In particular, axial attachments assure a simplification of techniques of realization, an easier management of complications, and a lower cost.

This practical paper describes characteristics, advantages, indications, and contraindications of the Locator attachment.

INTRODUCTION

Edentulous patients often experience problems with their conventional dentures resulting from pain during mastication, insufficient stability and retention of denture.

Studies reported that overdentures have been shown to enhance quality of life of edentulous patients and significantly contribute to patients’ psychological well-being. Other improvements include: a better chewing ability and an increased satisfaction with the implant-retained overdenture rather than conventional complete dentures. Overdenture requires limited clinical time and financial expenses. Multiple clinical studies have reported that overdenture prostheses for edentulous mandible have a good prognosis in terms of implant survival. In addition to improving retention and stability of denture, it has been suggested that presence of implants to support an overdenture will preserve the remaining residual bony ridge.

The removable implant-retained overdenture compared to fixed implant prostheses has several advantages: enhanced access for oral hygiene, easy modification of the prosthesis base, provision of a labial flange to improve esthetics in situations of unfavorable jaw relationship, and to compensate alveolar bone resorption.

The consensus is that 2 implants splinted by a bar or alone in the mandibular interforaminal region are sufficient to support an overdenture. The McGill consensus statement suggested that the 2-implant overdenture should be the first choice of treatment for the edentulous mandible.

Ultimately, the most suitable attachment for implant overdentures should permittraumatic and even distribution of stress to both mechanical and biologic supporting structures. However, with years of experience and prosthetic follow-up of patients who lose the manual dexterity and motivation for a rigorous hygiene, bars were abandoned to the benefit of axial attachment. This tendency is found among many clinicians who find in axial attachment a simplification of techniques of realization, management of complications easier, and a lower cost. The choice of attachment is dependent upon the retention required, jaw morphology and anatomy, function, and patient compliance for recall visits. In addition, angulation of the implants can be an important factor when choosing the attachments. The first axial attachment for implant used was the Zest® attachment, developed in 1971 by Max Zest in California, USA, within his company (Zest Anchors). Since 1994, the evolution of this attachment led to the Zaag, more sophisticated and easy maintained. O Ring and Stern Era (Sterngold) were the commonly used attachments till 2001, release date
of the third generation of attachments of the company Zest® Anchors, the Locator. The latter has been the subject of many clinical applications. This attachment is self-aligning and has dual retention in different colors with different retention values. Locator attachments are available in different vertical heights, they are resilient, retentive, durable, and have some built-in angulation compensation. In addition repair and replacement are fast and easy. It is also possible to incorporate the existing denture into the new prosthesis.

A broad systematic search of anglo-saxon dental literature was initiated. Key words or phrases included: overdenture, locator, abutment (patrix), titanium cap, copes of nylon, white block-out spacer.

Peer-reviewed articles published in English between 1998 and 2012 were identified through a Medline search, a hand search of relevant textbooks, and annual publications. Of the retrieved articles, 9 spoke about the advantages of the overdenture, 10 about the locator, 10 about the complications of the Locator attachment system, and 10 about the complications of the Locator attachment system. Additional references were included to accompany statements of facts.

The aim of this practical paper is to describe, in details the various solutions, characteristics, indications, contraindications and techniques of realization of the Locator attachment.

**INDICATIONS AND CONTRAINDICATIONS**

The most common indications for implant-supported overdentures are to restore esthetics and function, while respecting jaw anatomy, within an acceptable cost.

The only contraindication for implant-supported overdentures is advanced mandibular bone resorption.

In elderly patients, attachment systems that permit ease of prosthesis placement and removal, and those that are readily hygienic, may be preferable. The Locator implant attachment system is designed for use with overdentures or partial dentures in whole or in part by endosseous implants in mandible or maxilla. Locator is indicated when there is limited inter-arch space due to its low-profile attachment. The reduced height of the attachment component provides also easy accommodation for “not properly” aligned implants. It is not appropriate where a totally rigid connection is required. Its use on a single implant with a divergence of axis greater than 20 degrees is not recommended.

**CHARACTERISTICS**

The minimum vertical space required for the Locator attachment is 8.5 mm (from osseous level to superior surface of acrylic resin). The calculation is derived from the following measurements:

- 1.8 mm from osseous level to implant’s shoulder.
- 1.5 mm for shortest abutment including bevel, 3.2 mm for the attachment, and 2 mm of acrylic resin above the attachment (Fig. 1).

The minimum horizontal space required is 9.0 mm, as the width of the attachment is 5.0 mm and 2.0 mm of acrylic resin is required on either side for sufficient bulk and strength of the material.

Locator attachment consists of:

- An abutment (matrix) from titanium coated by titanium nitride. Compatible with multiple systems, it is screwed directly on the implant.
- Titanium Cap to stay in the resin of the prosthetic base
- Different copes of nylon: (Fig. 2)
  - Black processing male in polyethylene used for all the sequence of direct placement or for the laboratory. It does not have any resilience property.
  - Clear replacement male for strong retention 5lbs. Angulations 0 to 10°.
  - Pink nylon male for less retention 3lbs. Angulations 0 to 10°.
  - Blue nylon male for extra light retention 1.5lbs. Angulations 0 to 10°.
  - Green nylon male for angulations 20°. Strong retention
  - Red nylon male will accommodate a divergent implant up to 20° (40° between implants). Extra light retention 1.5lbs.

![Fig. 1. Minimum dimensions for Locator attachment system and Standard Plus Straumann implants.](image-url)

• Orange nylon male for light retention.
• This new LOCATOR (gray) zero (0) retention nylon replacement male is a long-term solution for reducing denture retention.

- White Block-Out Spacer is placed over the Locator Root or Implant Abutment and is used to block out the area immediately surrounding the abutment.[Fig.3]
- Locator Female Analog (4 and 5mm diameter) for the laboratory sequences. (Fig.4)
- Aluminum Housing with Black Locator LDPE Male (6.1mm height). The Locator Impression Coping is designed with minimum retention to be picked up with the impression material in a tray. (Fig.5)
- Locator core tool (Fig.6). This tool contains: The Male Removal Tool, Male Seating Tool and Gold-Plated Implant Abutment Driver. This tool is required for placement procedure of all Locator Root Attachments and Locator Implant Abutments.
  - Alignment pin
  - Angle measurement guide

ADVANTAGES OF LOCATOR:
- Compatibility with a high number of implant’s systems.
- Low profile: 3.17 mm for external hexagon implant, 2, 5 mm for internal connexion\textsuperscript{21,25}(Fig. 7).
  The transmucosal height of the abutment may vary from 1 to 4 mm, 1 to 5 mm, 1 to 6 mm, according to the implant system used. If the height is precisely chosen, biomechanical conditions become favorable, thanks to a point of force application close to the platform of the implant. Consequently, it is very important to measure the maximum height existing between implant’s platform and mucosal edge, to let emerge only 1.5 to 2 mm\textsuperscript{21}.
- Dual internal and external retention for conventional male transparent, pink and blue: externally, using an undercut against the periphery of the abutment and internal axial cavity type snap\textsuperscript{21}. A combination of inside and outside retention ensures the longest lasting performance\textsuperscript{23} (Fig. 8).
- Long lasting: in vitro insertion-desinsertion of 60000 cycles without alteration.\textsuperscript{25}
  - a non-rigid connection to the implant: the replacement male is in static contact with the abutment, while the titanium cap in the resin of the prosthetic base allows a rotational movement, absorbing then the forces (stresses) without any resulting loss of retention\textsuperscript{21,25}.
- locating design: self-locating design allows patients to easily seat their overdenture without the need for accurate alignment of the attachment components\textsuperscript{25} (Fig. 8).
  - Easy solutions for divergence up to 40º \textsuperscript{21,25} (Fig. 9).
  - One single tool with three functions to all clinical and laboratory sequences.

TECHNIQUE
Incorporation of attachment into denture can be accomplished either chairside or in laboratory.
a- Chairside technique:
The advantage of chairside “pick up” is that the attachment can be made in a passive, loaded (i.e., bite force) environment to ensure complete seating of the denture on underlying tissues. This technique is more demanding but also enables the incorporation of attachments into an existing denture25 (Fig 10-13).
- Blocking out the rings to prevent acrylic material from flowing into undercuts. Special attention must be given to block out any additional undercut areas to prevent “locking into” these areas.
- Housings are placed to verify the full seating of final prosthesis, without interference from attachments or housings.
- Final prosthesis is prepared for incorporation of the housings.
- “Vent Holes” are placed in the area of attachments to allow escape of excess material and prevent complete seating on tissues.
- Viewing of the black processing males, which are placed with acrylic by means of the patient maintaining a medium biting force in centric relation.
- Any voids around housings are filled in extraorally, and black processing males are replaced by final retentive inserts25.

b- Laboratory processing:
Laboratory attachment incorporation is less technique sensitive but does not take into account level of mucocompression necessary to ensure full seating on tissues. It is recommended with laboratory curing of the attachments that this be accomplished in the base plate prior to processing of the denture at try-in of the wax rim or the set-up appointment to evaluate full seating on the tissues and minimize distortion caused by curing of a bulk of acrylic during processing25. This will allow evaluation and correction of the attachment position prior to the delivery appointment. The most important concerns are blocking out any undercuts that acrylic may flow into, preventing removal of denture, and ensuring that prosthesis can fully seat on tissues without being held up by interference with the attachments25. The only rationale for incorporation of a metal framework or lingual reinforcing bar is to prevent potential fracture of the appliance due to minimal acrylic thickness or excessive occlusal forces25. The down side of this is the additional cost and laboratory procedures involved. In situations of high potential fracture of the appliance, such as the extreme occlusal forces seen in patients with opposing full-arch implant-supported restorations or areas of

Fig. 7. Lowest profile 3.17.25
Fig. 8. Self-alignment or dual internal retention25.
Fig. 9. Easy solution for divergence25.
Fig. 10. 2 implants in mandible with the white Block-out spacers in place.
Fig. 11. Cold cure resin added in the holes prepared in the intaglio of final prostheses.
minimal acrylic bulk, a metal frame will serve to resist flexure and potential fracture. An important consideration for the laboratory is to allow open space in the framework for incorporation of attachments25.

**DISCUSSION**

It appears that the attachment system does not influence the success rate of implants30. Other factors (quality and quantity, arch morphology) seem to play far more important roles in implant survival rates32. Sirmahan in her prospective randomized clinical study on 36 patients (from 2004 to 2009), reported that Locator system showed a higher rate of maintenance than ball attachments. There were no complications with postinsertion maintenance or implants, no problem of retention associated with the Locator system in comparison to ball and bar designs (In 23). Locator attachment was found more advantageous to ball and bar system regarding the rate of complications in clinical practice23.

Locator attachment appears to function reasonably well, but lacks long-term evaluation29. A long-term evaluation may provide useful guidelines for the clinician in selecting the type of attachment system and overdenture design9.

It has been reported that attachment adjustment is the most frequent complication in implant overdenture30.

Locator attachment provides significantly higher retention and stability of implant-supported overdentures, compared to Nobel Biocare Ball connectors31. Retentive values of the Locator attachment are significantly reduced after multiple pulls30. Abi-Nader and co-workers28 reported that while simulated mastication resulted in minor changes for ball attachment, it reduced the retention of Locator attachment to 40% of baseline values with a non-linear descending curve. The nylon capsules were strongly affected28. Kleis and co-workers29 agreed that self-aligning attachment system showed a higher rate of maintenance than ball attachment. In addition, a reduction in the retentive force has been noticed when implant angulations were increased from 0 degrees to 30 degrees27 with a premature wear of metal components and an increased maintenance27. One of the complications in ensuring resilient attachments is that denture rotation can occur. Denture rotation may cause entry of food particles under dentures and difficulty in chewing, particularly when food is chewed on anterior teeth. This could compromise patients’ quality of life with mandibular implant overdentures23. The location of denture’s mandibular anterior teeth is a major factor in rotation movement28. With every millimeter of teeth placed anteriorly, there is a 1.5 times greater likelihood that overdenture will rotate29. Kimoto28 found that a longer denture is likely to decrease the risk of overdenture rotation.

**CONCLUSION**

Patients claim to be more satisfied with implant–retained overdentures than with conventional complete dentures. Locator attachments were found to be more advantageous than ball and bar systems regarding rate of complications in clinical practice7,14,21. They are resilient, retentive, durable, and have some built-in angulation compensation. In addition, repair and replacement are fast and easy.

Locator attachments appear to function reasonably well, but long-term evaluation is warranted.

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Replacement of a missing maxillary central incisor with an Astra Tech® implant, following a horizontal ridge augmentation, using a symphseal mandibular onlay graft: a case report.

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Abstract

Background: An 18 year old female patient presented for implant placement at the site of a congenitally missing right maxillary central incisor. The clinical examination revealed an insufficient bucco-lingual width of the edentulous ridge, requiring a horizontal bone augmentation procedure prior to implant placement.

Methods: An autogenous bone block graft was harvested from mandibular symphysis, fixed on buccal aspect of edentulous crest with titanium miniscrews, covered first by autogenous bone chips and xenograft particles, and second with a resorbable barrier membrane. Four months later, an Astra Tech® implant was placed in the grafted site, surrounded by a thick buccal bony wall, demonstrating excellent primary stability and guaranteeing a better esthetic outcome. Impressions for prosthetic work were taken and final restoration cemented 3 months following implant placement.

Discussion: Autogenous bone block grafting is regarded as a predictable procedure, especially in horizontal bone augmentation from intra-oral sites. Many requirements have to be respected however in order to achieve this purpose. In addition, timing of implant placement with autogenous block grafts is a subject of controversy. Finally, implant placement in anterior maxilla has to meet guidelines proposed in the literature to avoid esthetic shortcomings.

Conclusion: This case report describes the successful replacement of an anterior missing tooth with an Astra® implant after a bucco-lingual augmentation of the edentulous ridge.

INTRODUCTION

The ability to successfully replace single or multiple missing teeth with osseointegrated dental implants has revolutionized dentistry over the past four decades. Consistent long-term results have been reported in the literature (Adell et al., 1990; Albrektsson et al., 1986; Lekholm et al., 1994). Nevertheless, dental implant therapy can be complicated by numerous local factors, namely the anatomy of the edentulous ridge. An inadequate bone volume, either in height or in width, renders the placement of implants rather difficult, especially in areas of high esthetic demands. Various bone augmentation techniques have been described in the literature in order to reconstruct deficient alveolar ridges such as particulate bone grafting, guided bone regeneration, autogenous bone block graft, ridge expansion, and alveolar distraction osteogenesis (McAllister and Haghighat, 2007; Chiapasco et al., 2006 & 2007; Esposito et al., 2006). The purpose of this clinical report is to describe a case of single implant placement in maxillary right central incisor region following horizontal bone augmentation using an autogenous block graft in a young female patient.

CASE REPORT

An 18 year old female patient was referred by the Department of Orthodontics to the Department of Periodontology (at the Lebanese University School of Dentistry) because of a missing maxillary right central incisor (Fig. 1). The patient had just completed her
orthodontic treatment and a removable maxillary retainer was fabricated to maintain the space as well as to temporarily replace the missing tooth (Fig. 2). In addition, the Department of Orthodontics and Dentofacial Orthopedics approved the initiation of surgical procedures after examining a hand wrist radiograph in order to confirm the end of growth. The questionnaire and the patient’s file revealed that this central incisor was congenitally missing. An extra-oral examination was first carried out, demonstrating a low lip line, facial symmetry and a well aligned dental midline. Then, intra-oral examination of the edentulous space showed a well managed space to symmetrically replace the missing right central incisor according to the left central incisor, a narrow alveolar crest indicating a horizontal bone loss at the site of the missing tooth (Fig. 3). A periodontal probe (Michigan probe, Hu-Friedy, IL, USA) was then used under local analgesia to assess bucco-lingual width of bone crest, after subtracting the thicknesses of buccal and lingual soft tissues from total bucco-lingual width of the ridge at top of the crest. These measurements displayed an approximate horizontal bone thickness of 3 mm. However, optimal implant placement required a buccal bone thickness of at least 1 mm to avoid esthetic shortcomings, i.e. gingival recession (Belser et al., 1998; Chiapasco et al., 1999; Buser et al., 2004). Therefore, it was decided to perform a horizontal bone augmentation procedure using an autogenous block graft prior to implant placement in a staged approach. Moreover, a peri-apical radiograph revealed a sufficient height of bone (Fig. 4).

Onlay Bone Block Grafting

Patient was instructed to perform a mouthrinse with a 0.12% solution of chlorhexidine-digluconate for 1 minute with a 10 ml solution immediately prior to surgery. Local analgesia (2% lidocaine with 1:100000 epinephrine) was administered in the area of the maxillary edentulous crest as well as in the interforaminal region of anterior mandible.

Full-thickness buccal and palatal mucoperiosteal flaps with 2 buccal vertical releasing incisions were first raised at the recipient site. The direct measurement using a periodontal probe (Michigan probe, Hu-Friedy, IL, USA) confirmed the pre-operative bucco-lingual width evaluation. Then, a template was used and adjusted at the recipient bed to assess the dimensions of the block graft to be harvested (Fig. 5).

Subsequently, a horizontal incision was made at muco-gingival junction from cuspid to cuspid at mandibular symphysis region and a full-thickness (mucoperiosteo) flap was raised (Fig. 6). Right and left mental nerves were identified and protected and the adjusted template was used to outline the cortico-cancellous block with a fissure bur used on a straight handpiece, under copious irrigation with sterile saline (Fig. 7). Following ostectomy, a 14x6x5 mm bone block was removed with fine straight chisels while preserving the lingual cortex. Further cancellous bone chips were harvested with surgical curettes and the donor site filled with haemostatic material (Cutanplast®, Milan, Italy) (Fig. 8) to minimize hematoma formation. Next, the flap was sutured back to its original position using an interlocked continuous suture technique.

At the recipient site, the block graft was adjusted to achieve better adaptability and decrease micro-movements. A round bur was used to perforate the buccal cortex of the recipient bed in order to promote bleeding and the block was fixed with 2 titanium miniscrews (Straumann®, Switzerland) after smoothening of its sharp edges (Fig. 9). Cancellous bone chips collected from donor site were mixed with xenograft bone particles (Bio-Oss®, Geistlich, Switzerland) and were used to fill the gap around the bone block (Fig. 10). Then, a resorbable membrane (Bio-Gide®, Geistlich, Switzerland) was placed in a double layer technique to cover both the block graft and bone particles (Fig. 11). Periosteal releasing incisions allowed a coronal displacement of the buccal flap enough to close the wound, using mattress and tension-free simple interrupted resorbable sutures (3/0 Vicryl®) (Fig. 12).

Antibiotic (Augmentin® 625mg TID for one week) and anti-inflammatory (Brufen® 400mg TID in case of pain) drugs were administered following surgery. Mouthrinses with a 0.12% solution of chlorhexidine-digluconate were started again 24 hours after surgery and continued for 2 weeks. The maxillary removable retainer was adjusted to avoid pressure over the grafted site and sutures were removed 10 days post-operatively.
Implant Placement

Four months later, patient returned to the Department of Periodontology for implant placement (Figs. 13 & 14).

Immediately prior to starting surgery, patient was asked to use a mouthrinse (Chlorhexidine digluconate 0.12%) for 3 minutes, and local analgesia (2% lidocaine with 1:100000 epinephrine) was administered in the grafted maxillary area. Similar to the previous procedure, crestal, intra-sulcular and vertical releasing incisions were made and full-thickness buccal and palatal mucoperiosteal flaps were raised. The grafted region demonstrated an adequate horizontal bone augmentation of approximately 7 mm with some resorption at coronal level with no considerable effect on the outcome of therapy (Fig. 15). Next, the 2 titanium miniscrews were removed, a 2mm twist drill was then used to the length of 13mm followed by verification with the direction indicator (Fig. 16). Then, the 2.5 mm Tiger drill was used to the length of 13 mm, followed by the intermediate Pilot drill, and finally the 3.2 mm Tiger drill followed by the 3.5mm cortical drill. The Direction Indicator was used at all times to guide implant positioning both mesio-distally and bucco-lingually (Fig. 17). The 3-dimensional implant placement was performed in respect to the guidelines proposed in the literature (Buser et al., 2004).

Subsequently, a 3.5 x 13 mm Astra Tech® implant was removed from its sterile container and delivered to the drilling site by first using the Delivery Cap and later the Torque Wrench until its rough surface was fully submerged in bone (Figs. 18 & 19). The implant carrier was released using the Torque Wrench in a counterclockwise direction with the Combination Wrench and a 3.5 mm cover screw placed on top of the implant. Finally, the mucoperiosteal flaps were sutured in their original position (Fig. 20).

Post-operative medications were prescribed similarly to previous surgery and sutures were removed 1 week after.

Crown Placement

Three months after implant placement, uncovering of the implant was performed and a healing screw replaced the cover screw. Three weeks later, abutment choice and impressions were made for prosthesis fabrication at the Lebanese University School of Dentistry Department of Prosthodontics. After another 3 weeks, the crown was cemented in place demonstrating an excellent immediate esthetic outcome and after a follow-up period of 1 month and 2 years (Figs 21, 22 & 23).

DISCUSSION

Insufficient width of alveolar crest has led to the application of different grafting techniques. Autogenous block grafting is a well documented procedure, either from intra-or extra-oral sites (McAllister and Haghighat 2007; Chiapasco et al., 2006). Horizontal bone augmentation, in particular, is considered a predictable approach with onlay bone grafts (Buser et al., 1996; Misch, 1997). Available intra-oral donor sites include mandibular symphysis, mandibular ramus and mandibular external oblique ridge (Proussaefs et al., 2002; Misch, 2000). Pre-requisites for the success of this therapy are the intimate contact and stabilization of the block graft to the recipient bed (de Carvalho et al., 2000; Urbani et al., 1998), and the cortical perforation with intra-marrow penetration of the defect site to increase the rate of re-vascularization and remodeling (Majzoub et al., 2000; de Carvalho, 2000). The amount of bone resorption of intra-oral (chin and mandibular ramus) onlay block grafts has been reported to vary between 5 and 10% (Chiapasco et al., 1999; Raghoebar et al., 2000; Jemt and Lekholm, 2003). However, the use of barrier membranes in combination with block grafts seems to minimize the rate of bone resorption (McAllister and Haghighat, 2007; Chiapasco et al., 2006).

The timing of implant placement in grafted sites has been a subject of controversy. Many authors24,25 advocated an immediate implant placement in conjunction with intra-oral onlay grafting procedure in order to reduce the risk of bone resorption that occurs, for the most part, shortly after graft fixation. Other authors22,23 recommended implant placement after a waiting period of 4 to 5 months of the grafting procedure to permit a better primary stability and integration of the implant in a re-vascularized bone and to avoid an implant loss due to exposure or infection of the block graft (Chiapasco et al., 2006). Therefore, in areas of esthetic concern, it would be wiser to place the implants in a delayed approach for more predictable results.
Fig. 1. Extra-oral examination showing smile line, symmetry and missing right central incisor.

Fig. 2. Maxillary retainer in place.

Fig. 3. Insufficient bucco-lingual width of the edentulous ridge.

Fig. 4. Peri-apical radiograph of the edentulous site.

Fig. 5. Adjustment of a template of the graft at the recipient site.

Fig. 6. Incision and flap at mandibular donor site.

Fig. 7. Use of the template to outline the block graft.

Fig. 8. Cancellous bone chips after block harvesting.

Fig. 9. Fixation of the block graft with 2 titanium miniscrews.

Fig. 10. Cancellous bone chips and Bio-Oss® particles filling the defects around the bone block.

Fig. 11. Placement of Bio-Gide® membrane (double layer).

Fig. 12. Horizontal mattress and simple interrupted sutures.
Fig. 13. Recipient site 4 months after bone grafting (Note that 1 of the miniscrews is showing through the alveolar mucosa).

Fig. 14. Occlusal view of the edentulous crest 4 months after bone grafting.

Fig. 15. Bone resorption at the level of the more coronal miniscrew.

Fig. 16. Direction indicator in place to verify the ideal position.

Fig. 17. Occlusal view of the Direction Indicator.

Fig. 18. Frontal view of the implant showing its corono-apical position.

Fig. 19. Occlusal view of the implant showing the presence of 2mm thickness.

Fig. 20. Flap Closure.

Fig. 21. Final cemented restoration.

Fig. 22. Peri-apical radiograph of the implant/crown connection.

Fig. 23. Peri-apical radiograph (2 years follow-up).
CONCLUSION
Lateral bone augmentation of a narrow edentulous ridge, using autogenous block grafts, has shown to be a successful technique. Furthermore, if guidelines for implant placement in anterior maxilla are respected, excellent esthetic outcomes can be achieved. This case report demonstrated the ability to replace a congenitally missing tooth using an Astra Tech® implant, 4 months following a ridge augmentation with an onlay block graft from mandibular symphysis.

Authors declare that they do not have financial arrangement or interest in Astra Tech® implant system.

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