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EDITORIAL
— from Torsten R. Oemus

Dear clinical masters,

I am delighted to introduce you to the Clinical Masters™ Network and the first issue of the Clinical Masters™ magazine for dentists who live and practice without compromise, for the true masters in a profession known for its attention to detail, quality and dedication.

If there is one thing that unites clinical masters around the world, it is their belief in the importance of continuously enhancing their skills through first-class postgraduate education and training. We have therefore made advanced clinical education and excellence the benchmark for a network of the best specialists in their respective fields.

You can become a member of the Clinical Masters™ Network and benefit from mentoring by experts around the world and patient marketing initiatives by graduating from one of our Clinical Masters™ Programs or demonstrating your expertise to our faculty by submitting clinical cases for their review.

To learn more about joining the Clinical Masters™ Network, please see pages 24–25.

The Clinical Masters™ magazine features all network activities, educational programs and social gatherings. The magazine provides insights into the treatment and work philosophy of the leaders behind this unique network, including their work tips and tricks, as well as their education centers.

I hope we will get to know one another during one of the upcoming Tribune CME programs. Please do not hesitate to share your thoughts and feedback.

Best personal regards,

Torsten R. Oemus  
President/CEO  
Dental Tribune International
CONTENTS

03 Editorial — Torsten R. Oemus

06 TRIBUNE CME
— Global knowledge, delivered by world-class faculty in prime locations

1 year Clinical Masters™ Program in
Implant Dentistry

08 Profile — Steigmann Implant Institute, Heidelberg, Germany
10 Interview — Dr. Marius Steigmann
12 Profile — Reims Implant Institute, Reims, France

14 Article — Dr. Philippe Russe
LATERAL MAXILLARY INCISOR IMPLANT
— key issues for aesthetic success

22 Interview — Dr. Gary Finelle

24 JOIN THE CLINICAL MASTERS™ NETWORK

6 months Clinical Masters™ Program in
Advanced Implant Aesthetics

28 Profile — Borg Center, Barcelona, Spain
30 Profile — Lake Como Institute, Como, Italy
32 Interview — Dr. Tiziano Testori
34 Profile — Hürzeler/Zuhr Dental Education Institute, Munich, Germany

38 FACULTY FAVORITES

1 year Clinical Masters™ Program in
Aesthetic and Restorative Dentistry

40 Profile — Geneva Smile Center, Geneva, Switzerland
42 Article — Dr. Didier Dietschi
NATURAL LAYERING CONCEPT
— a simple, reliable and effective protocol to achieve high esthetics with freehand bonding techniques

48 TESTIMONIALS

50 Article — Dr. Ed McLaren
SMILE ANALYSIS
— Photoshop smile design technique

1 year Clinical Masters™ Program in
Endodontics

58 Article — Dr. Gianluca Gambarini
INFLUENCE OF BRUSHING ACTION
— on torsional and fatigue resistance of TF Adaptive instruments

60 Article — Dr. L. Stephen Buchanan
CUTTING ENDODONTIC ACCESS CAVITIES
— for long term outcomes

Advanced Mentoring and Clinical Program in
Periodontics

66 Article — Dr. André Antonio Pelegrine
OROANTRAL FISTULA CLOSURE
— using the modified roll envelope technique

Advanced Mentoring and Clinical Program in
Laser Dentistry

72 Article — Dr. Selma Cristina Cury Camargo
THE ANTIBACTERIAL EFFECTS
— of laser in endodontics

78 REGISTRATION FORM

80 TERMS AND CONDITIONS

82 IMPRINT
— about the publisher
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- Helsinki
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The concept of the Tribune CME (continuing medical education) programs is based on a blended learning approach. Tribune CME’s mission is to deliver comprehensive, advanced hands-on training in leading-edge dentistry on a global scale through:

- Intensive face-to-face clinical educational sessions and practical training, conducted at specialized state-of-the-art training facilities of prominent faculty members, in locations across the world
- Extensive self-study opportunities via a sophisticated e-learning platform, as well as ongoing support, live mentoring sessions with experts and peers via our webinars, premium online video training on demand and the opportunity to collaborate with peers and the Tribune CME faculty.

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- Implant Dentistry
- Endodontics
- Periodontics
- Laser Dentistry

Upon successful completion, participants receive a Tribune CME certificate, which is also endorsed by the educational institutions associated with Tribune CME.

Personal branding opportunities:
all Tribune CME graduates may make use of the Clinical Masters™ Program logo to promote themselves and their practice both online and in print.

The Clinical Masters™ Programs also qualify for certification from the following associated educational institutions:
University of the Pacific in the U.S., São Leopoldo Mandic in Brazil, and Sapienza University of Rome in Italy, who acknowledge the quality and reputation of the Tribune CME programs.

Tribune CME programs are recognized by the American Dental Association® (ADA) and provide ADA CERP credits. ADA CERP is a service offered by the ADA to assist dental professionals in identifying quality providers of continuing dental education.

“World-class faculty in prime locations”

University of the Pacific
Arthur A. Dugoni School of Dentistry
San Francisco, U.S.
The Arthur A. Dugoni School of Dentistry is a nationally renowned institution of higher learning, committed to providing world-class dental education for its students. The school is highly regarded for its innovation in its dental curriculum, including comprehensive patient care, and is a pioneer in competency-based dental education—an approach that replaces the traditional system of clinical requirements with experiences that ensure graduates possess the skills, understanding and professional values needed for the independent practice of general dentistry. The institution is committed to excellence and innovation in education, research, community service and patient care.

São Leopoldo Mandic
School of Dentistry
Campinas, Brazil
São Leopoldo Mandic is currently among the top ten institutions of higher education in Brazil. It is accredited to teach undergraduate and graduate health care programs and award master’s and doctoral degrees. It also provides continuing education courses of varying lengths, presented as live clinical procedures, workshops, practical activities, seminars, online tutorials or other variations that best support mastery of the particular subject matter. The faculty carries out outstanding scientific research, achieving impressive results and continuously aiming to improve the knowledge of its students using current methods and new technologies.

Sapienza University of Rome
Faculty of Medicine and Dentistry
Rome, Italy
Sapienza University of Rome is one of the oldest universities in the world and listed among the top-performing universities in international rankings. Sapienza offers a vast array of courses, including degree programs, doctoral courses, one- to two-year professional courses, and specialization courses in many disciplines, run by 63 departments and 11 faculties. It is in every regard a research and teaching university and carries out outstanding scientific research in most disciplines, achieving impressive results both on a national and international level.
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This is to certify that Dr. John Smith has successfully passed the theoretical and practical examination of the Clinical Masters Program in Aesthetic and Restorative Dentistry, pursuant to the quality criteria of the American Dental Association ADA, the University of the Pacific, Arthur A. Dugoni School of Dentistry and Tribune CME.

Curriculum duration: 24 hours

Authenticity number: www.TribuneCME.com/id/30/768783

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Location
The Steigmann Institute is located in the popular vacation town of Neckargemünd along the Neckar river. The town has more than a thousand years of history and many of the 17th-century buildings have retained their original charm. There is a lively cultural scene with a wide range of activities, and its proximity to Germany’s famous university town of Heidelberg is a great attraction.

www.steigmann-institute.com

How to get there
Heidelberg is located one hour south of Frankfurt/Main. You can book a train ticket to Heidelberg on the national railway website: www.bahn.de

Alternatively, you could take a Lufthansa airport shuttle from Frankfurt Airport to Heidelberg. The bus route terminates at the Crowne Plaza Heidelberg City Centre hotel. Buses run every hour between 7:00 a.m. and 10:15 p.m. and can be found right across from the Frankfurt Airport meeting point in Terminal 1, Hall B, Exit B4. Seats are guaranteed if they are reserved three days prior to your arrival. The exact bus schedule and information on reservation procedures are available at: www.transcontinental-group.com

Where to stay
Both in the heart of the city and within walking distance of the old town, Heidelberg University and Heidelberg Castle are Crowne Plaza Heidelberg City Centre and the Europäische Hof Heidelberg, which overlooks the city gardens.
www.crowneplaza.com,
www.europaeischerhof.com

Another option is a vacation apartment at the Bauer winery, where you can choose from four modern apartments for two to five persons:
www.heidelberger-dachsbuckel.de

Where to eat
Recommended for German regional food is Weisser Bock. It also offers accommodation.
www.weisserbock.de

If you prefer Italian or Mediterranean cuisine, try HUGO Wine & Dine:
www.hugo-hd.de

For a taste of Spain and vegetarian fare, try Bodega Don Jamón:
www.bodega-heidelberg.de

Aubergine in Neckargemünd, offers Turkish and Eastern Mediterranean food:
www.aubergine-neckar.de
What to see and do

The ruins of the once-grand Heidelberg Castle rise up on a rocky hilltop over the city. The castle holds the largest wine barrel in the world, standing seven meters high and eight and a half meters wide, and holding 220,000 liters of wine. In the castle grounds is the Deutsches Apotheken-Museum, which recounts the history of Western pharmacology.

Heidelberg old town is filled with architectural gems. Visit the town hall, the Old University and historic buildings like the 1592 Renaissance townhouse called “Knight St. George,” and enjoy the open-air cafés dotted along the market squares. The old town is also home to a third of all the shops in Heidelberg.

Untere Straße, a narrow cobblestone street that runs parallel to the river and the main pedestrian street in the old town, is filled with great bars, coffee shops and inexpensive eateries.

The Gothic Heiliggeistkirche, Heidelberg’s famous church, was at one time used by both Catholics and Protestants. The top of its spire offers a bird’s-eye view of the town.

According to tradition, Heidelberg’s philosophers and university professors would walk and talk along the Philosophers’ Way, which runs along the side of the Heiligenberg. It passes through the forest and commands panoramic views of the castle.

The university library, built in Wilhelmian style, holds superb collections, including rare books and prints in its exhibition room.

For more information visit:
www.tourism-heidelberg.com

A boat trip down the Neckar offers a different view of the townscape:
www.weisse-flotte-heidelberg.de
INTERVIEW

with — Dr. Marius Steigmann

Q: Dr. Steigmann, you have become one of the most reputable lecturers on dental implantology and esthetic dentistry. What is the philosophy underlying your success?
A: The success is due to the vision I had many years ago regarding soft tissue. Implantology was mostly about function and the surrounding bone; hence, there was little interest in the soft-tissue outcome in terms of function and no interest in esthetics. Today, most esthetic complications in implant dentistry concern the soft-tissue outcome.

Q: According to the American Academy of Implant Dentistry, an estimated 3 million people in the U.S. alone have implants and that number is growing by 500,000 a year. What are the current concepts in implantology? In which direction is it developing?
A: Implantology was initially developed for the retention of dentures in the mandible and then for full-arch restoration. Nowadays, implants are used for patients in need of single implants too, and such cases can be predictably treated with implants. The current trend is in the direction of implants and regeneration of bone and soft tissue to resemble the natural function and aspects of natural teeth.

Q: What are the main challenges in implantology today?
A: The main challenge in implantology today is management of complications.

Q: Based on your experience, what is the future of dental implantology?
A: I think that we are seeing a phase of consolidation of the therapeutic principles. The enthusiasm is slowing down. We have predictable procedures from which patients benefit a great deal and procedures with a relative outcome. It will take some time for all therapeutic concepts to attain the same degree of predictability. The future of implantology will be continuing education.

Q: What do you think dental education today should entail? What should its main objective be?
A: Dental education today differs from country to country. In some countries, specialists are trained to place dental implants, while in other countries implants are placed by general practitioners. In implantology, the goal of education should be to have practitioners who understand the entire treatment concept placing implants. Hence, education in implant dentistry should cover surgery, bone reconstruction, mucogingival surgery for soft tissue, and prosthetic reconstruction on implants.

Q: What would you describe as the overall aim of the Clinical Masters Program in Implant Dentistry?
A: The Clinical Masters Program covers all of the aspects mentioned before, taking the participant through the journey from planning to restorations with the best trainers.

Q: What are your personal expectations of the program? What are you looking forward to in particular?
A: My expectations are that once they have completed this program participants will be able to place and restore implants at the highest level, as well as graft bone and soft tissue predictably.

Q: What do you consider the benefits of the program for both clinicians and patients?
A: Mastering the skills of clinical excellence by learning from very experienced teachers will enable participants to treat simple to complicated cases to the benefit of the patient.

Q: How does this course differ from others?
A: This course is different because it brings together the best clinicians and researchers in the field and uses modern methodology in the teaching process.

Q: One of the objectives of your course is soft-tissue management for bone augmentation. What is this concept about?
A: In bone grafting procedures, one of the greatest challenges is adequate coverage through soft-tissue augmentation. This problem can only be overcome with a graft with primary closure that remains closed, and teaching this is the aim of the course.

“The main challenge in implantology today is management of complications.”

“The future of implantology will be continuing education.”
REIMS
Implant Institute
— Reims, France

— The Reims Implant Institute, hosts the Société Internationale de Formation et de Recherche en Implantologie Orale, a scientific society founded in 1998 to train dentists who wish to begin performing or specialize in implant treatment. Located on the third floor of the Saint-Symphorien clinic, the institute, although in a 1920s building, is equipped with high-tech video equipment.

The institute is linked to the surgical wards of the clinic on the second floor. Live surgeries are recorded with a BRC-Z700 Sony camera and can be viewed on the 63-inch plasma television or via the 4,000-lumen video projector. The conference room can accommodate up to 35 attendees during lectures and 18 attendees for workshops.

The lecture room offers a beautiful view of the back of the Notre-Dame de Reims cathedral. A fully equipped kitchen allows for coffee breaks and the occasional flute of Champagne, the symbol of the region.

— Dr. Philippe Russe, graduated as a Doctor of Dental Surgery from the University of Reims Champagne-Ardenne in France in 1984. He also has a diploma in implantology, surgery and prosthetics from Université Paris Diderot, Paris 7, in France, a diploma in biomaterials and calcified tissue from the University of Angers in France, and a diploma in biomechanics in dental implantology from the University of Technology of Troyes in France.

Dr. Russe is the director of the Reims Implant Institute. He has lectured extensively in the fields of oral surgery and implantology since 1990. He is an expert to the appellate court of Reims, has earned certification as an expert in implantology by the Deutsche Gesellschaft für Orale Implantologie (German society for oral implantology), and is a member of the board of the Association française d’implantologie (French association for implantology).

Location
The Reims Implant Institute is located in Reims, a French city in the famous Champagne-Ardenne region, which is known for its Champagne production. Its impressive Gothic cathedral played a prominent role in the coronation of the French kings. The city, restored since the substantial damage it suffered during both World Wars, has beautiful cafés and boasts four Michelin-starred restaurants.

www.riir.fr
How to get there
The TGV (high-speed train) links Paris to Reims in 45 minutes and will bring you to the Gare de Reims train station, located in the heart of the city.
Alternatively, you could catch a private shuttle to Reims directly from Charles de Gaulle Airport in Paris. Reservation is essential and the price varies based on the number of travelers.
www.routair.fr

Where to stay
Indulge and stay (and/or eat) at the Château les Crayères. www.lescrayeres.com.

For more reasonably priced accommodation, you could stay at the Grand Hôtel du Nord, the Hôtel Cristal, or the Hôtel Azur, located in the centre of Reims.

Where to eat
L’Assiette Champenoise, a hotel and restaurant, is considered the best restaurant in Reims. It has been awarded three Michelin stars and five toques by the Gault&Millau guide. The restaurant’s chef, Arnaud Lallement, was voted chef of the year in 2014 by Gault&Millau. www.assiettechampenoise.com

L’Alambic, located in an authentic Champagne cellar, offers a tranquil and elegant setting where the regional gastronomy is in the spotlight, changing according to the seasonality of the produce. www.restaurant-lalambic.fr

Le Bouillon des Halles is where tradition and originality come together in a chic setting, and home to the largest Champagne bar in Reims. www.bouillondeshalles.fr

Anna-S. la table amoureuse is a traditional restaurant and offers fine cuisine prepared with fresh-in-season produce and paired with a glass of wine or Champagne chosen from the 250 wines and Champagnes selected for you by the restaurant’s sommelier. www.annas-latableamoureuse.com

What to see and do
With an important art and history background, Reims boasts three UNESCO World Heritage monuments:
The Notre-Dame de Reims cathedral, a masterpiece of Gothic art from the 13th century, is the site of 25 coronations and adorned with over 2,300 statues.
The Palace of Tau used to be the residence of the bishops and archbishops of Reims and now hosts the museum of the architectural construction of the cathedral.
The former Abbey of Saint-Rémi, a Romanesque-Gothic abbey built in the 11th century, still has its beautiful 9th century nave, in which lie the remains of Archbishop St. Rémi (440–533), who instituted the holy anointing of the kings of France.
The Musée de la Reddition is the site where the Allied Forces obtained the unconditional surrender of the Third Reich’s armed forces and the signing room is largely as it was then.
Villa Demoiselle, a blend of art nouveau and art deco, was built from 1904 to 1908. It was restored in 2004 to its former glory and is a Champagne house today.
The Halles du Boulingrin house a food market and provide a beautiful art deco backdrop for exhibitions and cultural events.
Montagne de Reims regional natural park, outside the city, is a beautiful area for cycling and hiking. It has a spectacular forest of 1,000 dwarf beech trees, the largest concentration in the world.
Half an hour south of Reims is the city of Épernay, the capital of Champagne. Its most famous street is the Avenue de Champagne, which features the leading Champagne manufacturers.

For more information visit:
www.reims-tourism.com

A visit to one of the many cellars in the region is essential: Champagne Geoffroy offers cellar visits and Champagne tasting.
www.champagne-geoffroy.com

A beautiful end to your trip could be dinner at Les Grains d’argent.
www.lesgrainsdargent.fr
LATERAL MAXILLARY INCISOR IMPLANT — key issues for aesthetic success

PART ONE — preprosthetic stages

Faced by a missing lateral incisor, practitioners often consider a wide range of issues and are also faced by numerous treatment options:

– in a young patient, faced with a unilateral or bilateral agenesis, he has to choose between an orthodontic treatment that either opens up the spaces or closes them. This decision, when taken early in the overall treatment, will affect both the patient and their caregiver for a long time (Fig. 1);
– in an adult patient, this is a consequence of bone, physiological, traumatic or infectious resorption, which will result in a decision whether or not to recommend a bone reconstruction or a gingival augmentation.

In every situation, the results will be judged by the patient and those around him. Since the lateral maxillary incisor is an integral part of the smile, aesthetic expectations are generally very high and, if the results do not meet the expectations, disappointment can be powerfully felt.

When describing the different treatment stages, a number of pitfalls and difficulties will be highlighted and advice and clinical protocols will be given, in order to ensure that the results of this implant/prosthetic treatment are predictable and as aesthetically attractive as possible. This first article is concerned with these issues as regards the preprosthetic stages; the second will consider the most important aspects of the prosthetic stages as well as aesthetic outcomes and their evolution over the long term.

Anamnesis
Once the usual contraindications for oral and implant surgery have been eliminated, particular attention should be given to the patient’s answers concerning their smoking habits. Indeed, meta-analysis give an accurate picture of the consequences of smoking, with increases of:

– peri-implantitis and bone loss;
– failure rates.

The conclusions of Snider et al. can provide recommendations for the practitioner faced with a patient who is a smoker:

– the best is to ask the patient to stop smoking…;
– if this approach is not acted on, then the patient must be warned of the increased risk of failure and of postoperative complications.

This last issue is important, as smoking can be considered a lost opportunity as far as implant treatment is concerned.

It is preferable to avoid patients that are smokers.

Clinical examination

The smile line
When replacing a tooth in an aesthetic region, understanding the location of the smile line is one of the determining issues during the clinical examination. There are two factors to consider: the exposure of
The anatomy of the lateral incisor has been the subject of various publications, including, notably, by Papathanassiou who defined average dimensions and a typical form (Fig. 3a) and also presented numerous morphological variants affecting these dimensions and also other characteristics such as the crown/root ratio and the coronal and root axes (Fig. 3b). These morphological criteria, which can now be found using 3-D imaging, have had a significant influence on the location of implants in all spatial planes in order to achieve the goal of harmony of form and dimension. Other publications, such as those by Levin and Preston make it possible to estimate the width of absent lateral incisors on the basis of the central incisors (Fig. 4).

Establish the ideal width and orientation of the planned prosthetic crown.

Implant location
A clinically significant deficit signals the need for reconstruction of hard tissue but, conversely, a site without a tooth with no loss of volume should be subjected to a three-dimensional X-ray, as thick soft tissue can hide a lack of hard tissue (Fig. 5). A thin tissue biotype or a lack of attached gingiva can be a sign that gingival augmentation surgery will be required, particularly if a bone graft needs to be performed.

Occlusion
For orthodontic treatments, the anterior guidance should be analysed carefully. It can be tempting to increase the perimeter of the maxillary arcade in order to obtain, at the least, implant corridors that are sufficiently wide at the level of 12 or 22. However, an overjet will make it very likely that the natural teeth will move in relation to the implant prosthesis with highly negative consequences for the sustainability of the cosmetic outcome.

Dental aesthetics
As regards dental aesthetics, the proportions of the proposed implant supported tooth can reflect two different scenarios:

– there is a unilateral missing tooth and the contralateral incisor has normal and aesthetically pleasing proportions. The objective will be to create a lateral incisor implant that is a mirror image;

– with the same situation but where the contralateral incisor is small; this is a situation that occurs frequently in unilateral agenesis where the incisor that is present is riziform or, if there is agenesis of both lateral incisors, the clinical examination should gather the information required to decide on the dimensions and coronal axes of the proposed lateral incisors. An analysis of the occlusion and the dimensions of the central incisors are the clinical parameters that make it possible to establish the characteristics of the planned prosthetic teeth.

Fig. 1 Agenesis of 22, opening of orthodontic space.

Fig. 2 Line of intermediate smile. The smile uncovers the papillae and reaches the collar of the incisors (12 and 22 are supported by implants).

Fig. 3a Average forms, types and dimensions of the lateral incisor according to Papathanassiou. Overall height: 21 mm, coronal height: 9 mm, radical height: 12 mm, mesio-distal cervical diameter: 5 mm, mesio-distal coronal diameter: 6.5 mm, vestibular-lingual cervical diameter: 5 mm, vestibular-lingual coronal diameter: 6.5 mm.

Fig. 3b Proximal view photographs showing 10 anatomical variants of lateral maxillary incisors described by the author.*

Fig. 4 According to Levin, following the golden ratio, the width of the lateral incisor y = 0.62x and, for Preston, it is 0.66x (images from Papathanassiou).*

Fig. 5 Evidence of bone deficit at 22 (case shown in Fig. 1)
Taking photographs at the start of the treatment will make it possible to maintain a record of the initial condition, which is always useful if there are medical/legal problems at the end of the treatment. In addition, the images often make it possible to see problems relating to width, axis or asymmetry that sometimes go unnoticed during a clinical examination.

Check anterior guidance and absence of overjet.

**Complementary tests**

2-D imaging
Panoramic X-Rays or retroalveolar radiography make it possible to check the depth of implantable bone in relation to the floor of the nasal cavity, the bone level in relation to that of adjacent teeth and the parallelism of the central incisor and canine.

3-D imaging
3-D imaging is required to check the vestibular palatal dimensions of the bone crest. There are three possibilities:

- the crest is sufficiently wide to take an implant without any bone augmentation;
- the crest is narrow, bone augmentation is required prior to siting the implant (Fig. 6);
- intermediate situations where the siting of the implant will be accompanied either by bone splitting or by guided bone regeneration.

**Orthodontic preparation**

When the adjacent teeth present apical convergence, the orthodontic preparation should create a mesio-distal dimension at the level of the root that allows the implant to pass with a margin of at least 1 mm of bone (Figs. 7 and 8). Where there is a contralateral incisor of a normal size, the rule for the orthodontist is to measure the width of that tooth carefully and to recreate the same width in the crown of the planned implant. Where the contralateral incisor is riziform, the orthodontist should plan the future face of the tooth in order to achieve two laterals with the same shape.

Diastemas around the riziform tooth make it possible to achieve a smile that, in the end, is almost symmetrical (Fig. 9).

The riziform incisor does not have to be in the centre of the space but should be positioned in such a way that the papillae and the future zenith of the tooth are optimised. The zenith should be located 0.4 mm distal from the centre of the tooth for a lateral incisor, according to Chu et al. (Figs. 10a and b). Sometimes, a zenith situated more than 1 mm from a line between the collars of the central incisor and the canine should be surgically altered by coronal lengthening as a lateral incisor that is too short can also be aesthetically unacceptable.

The orthodontist should anticipate the future prosthetic morphology of the riziform incisor.

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**Documentation**

Taking photographs at the start of the treatment will make it possible to maintain a record of the initial condition, which is always useful if there are medical/legal problems at the end of the treatment. In addition, the images often make it possible to see problems relating to width, axis or asymmetry that sometimes go unnoticed during a clinical examination.

Check anterior guidance and absence of overjet.
**Hard tissue augmentation**

Where a bone reconstruction is indicated, this should take into account one of the key factors for the overall cosmetic outcome: restoration of papillary support in order to avoid any unsightly black triangles between the lateral incisor and the adjacent teeth or any concave area above the implant crown that would create an ugly shadow.

The cortical graft, taken from the chin or the external oblique, should be formed in such a way as to provide support for the gingival papillae (Fig. 11). Gaps under and around the graft should be filled with cortical bone particles, crushed from the chin block or lateral mandibular area using a bone mill.

The attachment must be reliable. This is done using two 1.6 mm diameter osteosynthesis screws (Fig. 12). Autografts take about 5 months to heal. Ideally, the implant should be inserted between 4.5 and 5.5 months after the graft (Fig. 13).

**Insertion of implant**

**Choice of implant**

The mesio-distal dimension of the gap will determine the choice of the implant. When this is close to or less than the average size of 6.5 mm, the bone and papillary volume around standard size implants will be limited. According to Hasan et al.\(^{10}\) and Bourauel et al.,\(^{11}\) the disadvantage of small diameter implants is that they transmit higher stresses to the crestal bone than do standard implants. When replacing a lateral maxillary incisor, it is possible to arrange both the anterior guidance and the diduction in such a way as to make them largely affect the natural teeth, in the absence of any significant malpositioning, and in this way reduce the stresses applied to the implants. Under these conditions, small diameter implants have the advantage of increasing surrounding residual bone volume as well as space available for papillary healing.

In a forthcoming study of 120 Nobel Active 3 mm diameter implants, one of the conclusions confirmed the importance of these small diameter implants as regards the additional height of the papillae, resulting in an improvement in the Fürhauser pink aesthetic score\(^{12}\) (Figs. 14, 15a and b).

**Favor small diameter implants.**

**3-D positioning**

As regards replacement of a lateral maxillary incisor, the tolerances for the location of the implant are very small because of the narrow width of the implant corridor. Two recent meta-analysis\(^{13, 14}\) concerning the precision of surgical guides resulting from 3-D imagery, even if these do not apply specifically to the lateral incisor replacement, has found a deviation in the order of a millimetre at the point the implant emerges and 4 to 5 degrees as regards the drilling axis. For Van Assche et al.,\(^ {14}\) the average imprecision at the apex of the implant is 1.24 mm.

Since these measurements are incompatible with a 12 or 22 implant corridor, it is important to check the first drill hole(s) during the operation, whether the surgery is guided or being carried out freehand. If the implant clinic does not have retroalveolar X-Ray equipment, portable generators such as the Anyray 2® (Vatech) are available on the market, which allow you to produce intraoperative images (Fig. 16).

In this context the Precision Drill from the Nobel Biocare kits is particularly helpful. Its sharp point provides considerable...
precision at the point of entry and its small dimensions make it possible to correct any deviations from the ideal axis occurring during the first drilling (Fig. 17).

In the vestibular palatal plane, it is essential to prepare a prosthetic treatment plan before inserting the implant because the positioning requirements differ:

– for a screwed prosthesis, the axis of the implant is very strictly determined by the point in the cingulum where the screw emerges;
– with a cemented prosthesis, the tolerance is slightly greater as it is possible to make a correction to the axis by an abutment angled up to 15 degrees or by a Procera type individualised abutment (Fig. 18).

**Position the implant under X-Ray monitoring.**

**Soft tissue management**

Whether the soft tissue management is carried out at the time the implant is put in place or when it is exposed, the choice of surgical technique depends on an examination of the initial situation:

– horizontal deficit of soft tissue that could result in the underlying titanium being visible;
– vertical deficit in the papillae that could result in unsightly black triangles.

Different surgical techniques can be used, depending on these deficits, which are taken from three publications: the roll flap developed by Abrams\(^8\), the envelope technique of Peter Raetzke\(^9\) and Carl Misch’s split-finger:17

– if there is just a horizontal deficit, a modified rolled flap\(^4\) can be carried out, without separation of papillae and without vestibular incisions, the palatal flap being folded into an envelope flap (Figs. 19 to 25). The attraction of this technique for the patient is that a second operation site to take a graft is not required. In addition, it makes it possible to recreate a root eminence, considered already 20 years ago by Silverstein and Lefkove\(^10\) to be an important factor for the aesthetic outcome (Figs. 26 and 27a to c);
– where there is a vertical deficit, a crestal W-shaped incision as described by Carl Misch\(^17\) is indicated. This makes it possible to recreate an anatomical gingival architecture while, as a first step, creating two vestibular neo-papillae (Fig. 28). After separating the sections, the palatal tissue (finger) is divided into two to make two palatal half-papillae, joined one on one with their vestibular counterparts (Fig. 29);
– where there is a combined deficit, the same incisions are combined with a buried connective vestibular graft. Provided that there is sufficient volume, the graft is taken from the maxillary tuberosity, since this area has the advantage of providing graft tissue that is more dense, opaque and less adipose than the palate and, in addition, results in less postoperative pain. If the graft is transferred in a V or Y-shape, it can support the newly formed papillae. The shape of the palatal incision can be modified to a Y-shape to assist rotation of the palatal half papilla (Fig. 31).

If the thickness of the buccal gingival tissues has not been augmented or if collagen substitutes are used that do not have the opacity characteristics of tuberosity connective tissue, the aesthetic outcome can be compromised. If there is recession of the external table or the titanium abutment under thin connective tissue, the grey titanium colour can be seen through the gum as a grey halo above the crown collar, which is detrimental to the aesthetic appearance (Figs. 32 and 33).

**Systematically augment the thickness of buccal connective tissue.**

Editorial note: A complete list of references is available from the publisher.

This article appeared in the Éditions CdP prosthetic journal, No 167, September 2014.
The aesthetic fundamentals for an implant are in the preprosthetic surgical stages of the treatment. Any approximation in the location of the implant in such a narrow implant corridor, any lack of support for papillae or any deficiency in the thickness of hard or soft tissues, will result in aesthetic problems. The prosthetic stages allow optimisation of the result as regards the gingival context but any error in the surgical stage will often be impossible to correct during the prosthetic stages. For this reason it is vital to approach this first part of the implant treatment for a lateral incisor with thoroughness and precision.

**Conclusion**

The aesthetic fundamentals for an implant are in the preprosthetic surgical stages of the treatment. Any approximation in the location of the implant in such a narrow implant corridor, any lack of support for papillae or any deficiency in the thickness of hard or soft tissues, will result in aesthetic problems. The prosthetic stages allow optimisation of the result as regards the gingival context but any error in the surgical stage will often be impossible to correct during the prosthetic stages. For this reason it is vital to approach this first part of the implant treatment for a lateral incisor with thoroughness and precision.
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INTERVIEW
with — Dr. Gary Finelle

For the first time, Dr. Gary Finelle will be teaching the “1 Year Clinical Masters Program in Implant Dentistry” at the Reims Implant Institute in November 2015.

Dr. Finelle received his dental degree from Université Paris Diderot, Paris 7, in France in 2009. He completed his doctoral thesis on soft-tissue healing around dental implants. In 2011, he joined the Advanced Graduate Education Program in Implant Dentistry at Harvard School of Dental Medicine in Boston, Mass., U.S., as a full-time resident. Since 2013, Dr. Finelle has been based in Paris and works in a private practice limited to implant treatment and prosthodontic rehabilitation. In January 2015, he joined the biomimetic unit (Université Paris Descartes, Paris V), headed by Dr. Gil Tirlet, at Charles Foix hospital in Ivry-sur-Seine, France, as a part-time fellow.

Dr. Finelle’s major interests are the application of digital technologies to the surgical and prosthetic implant treatment workflow and patient diagnostic virtualization. He has been involved in research on digital impressions and 3-D printing technologies, computer-guided implant surgery, CAD/CAM prosthetics and implant rehabilitation. He has published in scientific peer-reviewed international journals. He has lectured nationally and internationally at various scientific meetings and is a member of a number of scientific societies, including the Academy of Osseointegration and the American Dental Club of Paris. He is currently a recognized speaker for the International Team for Implantology and a scientific opinion leader for Straumann France.

Q: Dr. Finelle, your major field of interest is the application of digital technologies in dentistry. What do you consider the main advantages of these technologies for dental implant planning and treatment?
A: The overall digital workflow in implant dentistry can be divided into four treatment phases: virtual planning, computer-guided surgery, digital impressions, and CAD/CAM rehabilitation. Although the technology available on the market today is advanced enough to implement a fully digital approach to treat patients, it does not mean that dentists have to follow a digital protocol from A to Z. I believe that the success of our treatment depends more on the decisions we make during the planning phase, rather than the procedures at execution. In fact, the main benefits of working digitally today may be found in the treatment planning process. Indeed, data from different type of scanners (CBCT, surface intra-oral impression or laboratory, and facial scanners) can be merged together in 3-D planning software to produce a comprehensive 3-D reconstruction of the clinical situation. The ultimate goal is to visualize a 3-D virtual patient and superimpose orofacial structures (such as bone volume, soft tissue, dental arches, temporomandibular joints, prosthesis projection, and facial contour) on the same 3-D image to optimize the concept of prosthetically driven implant placement. Techniques of digital smile design are also powerful treatment planning tools to prepare properly for challenging esthetic cases. By analyzing on the screen the 3-D relationship between the implant, the future prosthesis, and the smile, we can improve our understanding of the case and enhance communication between the team members and patients.

As technologies become increasingly attuned to the clinical reality—not to mention accurate and cost-efficient—we are seeing an enhanced interest in using digital tools, such as 3-D-printed guides and intra-oral cameras. However, while computers can help simplify and speed up our treatment, the advances only work effectively in the hands of skilled and knowledgeable professionals.

Q: In your opinion, how have digital technologies changed dentistry over the past decades? Do you think they will determine the global dental market in the future?
A: In the last decades, digital technologies have been utilized to a far greater extent in laboratories than in dental offices. The advancement of laboratory scanners in combination with optimized CAD/CAM production centers has provided dentists with enhanced accuracy, a wider range of abutment design options, greater flexibility in materials, and more efficient communication. However, until recently, the expertise in using the technology was concentrated in laboratories, rather than in dental offices.

Today, we are seeing a second technological move towards the clinical side. Indeed, the market offers workflows that are more integrated, higher compatibility between manufacturers, and greater competition from more affordable devices, specifically in the intra-oral scanner segment. Combined with the rapid emergence of new-generation 3-D printers, we are witnessing the democratization of chairside technological devices in the dental office. The prospects for the field of 3-D printing are highly promising, and one can envisage that the dental market will soon be built around computerized fabrication techniques. The digital dentist is on the rise.

Q: At the age of 30, you are a very young specialist. Do you think that there are differences between older dentists and professionals of your generation regarding their attitude towards digitalization in dentistry? A: As I am partnered with my father in the practice, I feel I am well placed to answer this question. Regardless of his or her generation, every clinician is aware of the current and upcoming changes in our profession. The older generation may face a steeper learning curve, but we are all aware that the era of the stone model will soon pass. Today’s dental students train in a more digitalized environment, so we can expect them to be more comfortable with computerized dentistry than clinicians utilizing conventional analog methods. Interestingly, the Division of Regenerative
and Implant Sciences at the Harvard School of Dental Medicine (Lee & Gallucci, 2012) has found that non-trained dental students are more proficient at digital impressions than are trained dentists.

When my father was my age, neither implants nor composite materials existed. Colleagues who have been practicing for decades may think that the investment of time and energy to bring oneself up to speed is not worth it. That is understandable.

The new generation of dentists is lucky to work in a period of such dramatic technological progression. There is a deluge of new procedures to appreciate and huge potential to innovate. All this should lead to an enhanced service for patients.

Q: Who can benefit most from the implementation of such technologies—general dentists or specialists? Are they tools for everyone?
A: For more than a decade, general dentists have been routinely delivering CAD/CAM-milled prosthetic restorations. This trend is inevitably increasing as digital in-office equipment (CAD software, intra-oral scanners) is continuously being implemented into general practices. Nevertheless, specialists are the first to be exposed to new cutting-edge technology, largely because they benefit the most from technological advancements. They are what we call the early adopters. Many of the technologies are interesting and profitable for everyone, but as with all such advances, it may take some time before we see universal usage.

Q: Do you think that more training in digital technologies is needed for dental professionals?
A: You probably know my answer to this question. We are at the onset of a new era of dentistry. It is important to be aware of the transition and to have a vision of where the future lies, but we do not all have to dive en masse into the latest digital technology. The vast majority of analog procedures are still relevant today.

Most of our dentist colleagues are willing to learn and see how far we can go with digital technology, but before making considerable investments, they prefer to have a better and more objective understanding of the relative benefits. While the latest developments are regularly addressed in professional meetings and congresses, there is still a lack of structured training that would provide dentists with the means to compare the different systems and to operate them through workshops.

Digital development in other industries informs the dental industry in terms of understanding and implementing the digital processes. Nevertheless, we face two main challenges specific to dentistry: (a) new companies and products are introduced continuously into the market, making it almost impossible to follow every evolution; and (b) it is difficult to maintain a solid body of evidence-based research to follow the continuous developments in digital and CAD/CAM dentistry. In other words, the speed of technological change makes it difficult to support the promises with evidence.

Q: What would you describe as the overall aim of the course? How does it differ from other courses?
A: The goal of our course is to provide participants with comprehensive information about the computer-assisted surgery workflow. We will present the technological devices and 3-D imaging acquisition system required. We will cover in detail the clinical sequence, from virtual planning to implant placement. Then we will consider clinical cases and discuss the benefits of, limits of and indications for treating patients with this type of procedure. Finally, we will introduce innovative solutions to treat fully edentulous patients with computer-guided surgery.

Q: Do you think that programs such as the Tribune CME program could help raise awareness of what these technologies have to offer?
A: Digital is everywhere today and the industry is trying hard to market products. It is important to have scientific institutions that help to disseminate proper information about digital dentistry in a controlled and scientific manner (as far as possible). In each one of its master courses, Dental Tribune International has collaborated with recognized and prestigious opinion leaders. Dental Tribune International has the credibility and resources to be an important participant in the digital field.

— Dr. Gary Finelle

„I believe that the success of our treatment depends more on the decisions we make during the planning phase, rather than the procedures at execution.“
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The Clinical Masters™ Network is a group of selected dental professionals that are world-renowned for their skills and expertise. You can also become a part of this network by successfully completing one of our programs or by providing cases that show your experience and expertise.
The BORG Center, or Barcelona Osseointegration Research Group, is focused on research in oral implantology and its various clinical applications. The center was established in early 2005 when four specialists in oral implantology developed a common protocol with good results to demonstrate that in cases in which the diameter of the pillar is smaller than the diameter of the implant bone loss is ostensibly lower. This research, titled “Benefits of an Implant Platform Modification Technique to Reduce Crestal Bone Resorption,” was published in Implant Dentistry in 2006. Since then, they have lectured worldwide and have produced and collaborated on a number of publications. We enjoy our work and are eager to share it with you.

— Dr. Xavier Vela
obtained his degree in dentistry and medicine from the University of Barcelona. He has a private practice in Barcelona dedicated to implantology and prosthetics. He is a co-founder of the BORG Center, conducts research and regularly publishes articles in leading international journals. He has lectured at prominent national and international symposiums.

— Dr. Xavier Rodríguez
obtained his degree in dentistry from the University of Santiago de Compostela. He has private practices in Madrid, Lleida and Barcelona. Since joining the Borg Center in 2008, he has lectured at prominent national and international symposiums.

— Dr. Victor Méndez
obtained his degree in dentistry from the University of Santiago de Compostela. He has private practices in Madrid, Lleida and Barcelona. Since joining the Borg Center in 2008, he has lectured at prominent national and international symposiums.

Location
The BORG Center is located in Barcelona, a city with a rich cultural heritage and known for its Catalan culture and distinctive architecture, including several UNESCO World Heritage Sites. It is a popular tourist destination and boasts one of the best beaches in the world.

www.borgbcn.com

How to get there
From Barcelona Airport: The center is an 11- to 16-minute drive from the airport by taxi.

From Viladecans: Two buses depart from the train station every 20 minutes approximately, the VB1 and the VB2. Ask the bus driver to stop at the Ángel Arañó/Dos de Mayo bus stop. The center is located two streets down from the bus stop.
Where to stay
AC Hotel Gavà Mar, located by the sea in a quiet area close to the BORG Center but a little far from the center of Barcelona.
www.marriott.com

Hilton Barcelona, located in Barcelona and 20 minutes from the center.
www3.hilton.com

Majestic Hotel & Spa, located in the center of Barcelona, near shopping areas and about 25 minutes from the center.
www.hotelmajestic.es

W Barcelona, located right on the beach, half an hour from the center.
www.w-barcelona.com

Where to eat
Barceloneta, a neighborhood, is well known for its traditional tapas bars. One such place, Can Ramonet, located in one of the oldest buildings in Barcelona, has long been associated with good food and wine.
www.grupramonet.com

An absolute must is one of the restaurants—why not all five—of Albert Adrià’s BCN 5.0. At least, check out Bodega 1900, a restaurant inspired by classic Spanish vermouth bars and the aperitif culture, all under the guiding hand of chef Adria.
www.en.bcn50.org

What to see and do
Take a stroll down La Rambla, the world-famous boulevard stretching about 1.2 kilometers all the way to the Mediterranean Sea.

Wander through the Barri Gòtic (Gothic quarter), the center of the old city.
Visit the Museu Nacional d’Art de Catalunya (Catalonia national art museum).

See Antoni Gaudi’s many masterpieces, seven of which are on the UNESCO World Heritage List, the most famous probably being the Sagrada Familia basilica and the beautiful Park Güell, demonstrating perfect harmony of nature and architecture. A UNESCO World Heritage Site, Palau de la Música Catalana is a concert hall exemplary of art nouveau architecture. Some of the most important craftsmen and artists of the time were involved in its creation.

Housed in five Catalan-Gothic palazzos dating from the 13th and 14th centuries, the Museu Picasso is a museum of the artist’s formative years.

El Paral·lel, a vibrant theater district, is your destination for all entertainment and music.

A walk up Montjuïc mountain offers spectacular views.

For a day trip, take an exhilarating hot-air balloon flight over Catalonia with panoramic views of the Pyrénées, Montserrat, Montseny and the Mediterranean Sea.

For more information visit:
www.barcelonaturisme.com
Location
The Lake Como Institute is located in the town of Como, famous for its silk manufacturers. Within what remains of its 12th century walls is a charming historical center. The town is set on the shores of Lake Como, situated in a basin surrounded by wooded mountains and said to be the most beautiful of the Italian lakes. There is plenty to see while strolling around, including stunning villas, gardens, and sites of historical and cultural significance.

www.lakecomoinstitute.com

How to get there
From Milano Malpensa Airport, located about 1 hour away by car, you can take the Malpensa Express train to Como.

www.malpensaexpress.it

From Lugano Airport in Switzerland, located about 20 minutes away by car, you can take a shuttle bus to Lugano, and then a train from Lugano station to Como S. Giovanni station.

www.trenitalia.it, or www.sbb.ch

From Milano Linate Airport, you can take a connecting bus to Milano Centrale station and catch a train to Como S. Giovanni station (trains depart hourly).

The following transport options are available via the institute:

- a private mini-van (up to five passengers) one way from Milano Malpensa Airport to Como (at a cost of €100 + 10% VAT);
- a private mini-van (up to seven passengers) one way from Milano Malpensa Airport to Como (at a cost of €120 + 10% VAT);
- a private car (up to three passengers) one way from Milano Malpensa Airport to Como (at a cost of €80 + 10% VAT);
- There is an additional cost of €30 (one way) from Il Caravaggio International Airport (Orio al Serio International Airport).
- There is an additional cost of €10 (one way) from Milano Linate Airport.

Where to stay
All hotels are located within a reasonable distance to the institute. If you would prefer to stay right on the lakefront, you might want to consider one of the following hotels:

Albergo Terminus, located right on Lake Como
www.albergoterminus.it

Palace Hotel, located next to the Albergo Terminus
www.palacehotel.it

Hotel Metropole Suisse
www.hotelmetropolesuisse.com

Not on the lakefront, but also centrally located are the following hotels:

Albergo Firenze
www.hotelfirenzecomod.com

Hotel Barchetta Excelsior
www.hotelbarchetta.it

Where to eat
Navedano, located only a few minutes from the center of Como.
www.ristorantenaivedano.it

Le Colonne, located on an old square off the main streets. It offers classic regional dishes.
www.albergodelduca.it

What to see and do

Como is a very small old town and the best way to get to know it is to walk around and discover its narrow passages, old streets, quaint markets and piazzas, stopping to enjoy a cappuccino on the terrace of one of its many cafés.

The remarkable 11th-century Romanesque Basilica di Sant’Abbondio has a beautiful fresco series inside the apse and a university occupies what was once the cloister.

Lake Como’s shores feature a varied landscape of fields, forests, imposing rocks, charming villages facing the lake and magnificent mansions with beautiful gardens, particularly from Cernobbio to Gravedona and Bellagio. The following include only some of the innumerable sights:

The middle of Lake Como, where its three branches come together, offers a spectacular view of the whole promontory of Bellagio, of the northern Grigna mountains overlooking Valsassina, and of the upper basin against the backdrop of the Alps if the skies are clear. It has the mildest climate and can be reached by boat.

www.taxiboat.it

Besides the glorious views of the Lecco branch of the lake, which turns southwards, there are natural springs, like Fiumelatte, described by Leonardo da Vinci, and the impressive Orrido di Bellano (gorge), situated not far from the Renaissance Villa Monastero at Varenna.

For more information visit:

www.comotourism.it
INTERVIEW
with —
Professor
Dr. Tiziano
Testori

Q: Immediate loading is probably one of the most important innovations in the modern era of oral implantology. In your experience, why is this approach so beneficial?
A: Immediate loading has a number of advantages for the patient compared with conventional loading: return to function in fewer visits, there is no need for a removable prosthesis, improved soft-tissue healing, and less pain and discomfort. Since it is cost-effective, a much wider section of society can afford it.

Q: What do you consider the most important aspect professionals wishing to perform this clinical procedure should bear in mind?
A: Appropriate training to apply the method is essential. Professionals should be able to obtain adequate primary stability regardless of bone quality, since this is a prerequisite for clinical success, and follow an efficient prosthetic protocol that allows them to be cost-effective.

Q: Immediate loading is probably one of the most important innovations in the modern era of oral implantology. In your experience, why is this approach so beneficial?
A: Immediate loading has a number of advantages for the patient compared with conventional loading: return to function in fewer visits, there is no need for a removable prosthesis, improved soft-tissue healing, and less pain and discomfort. Since it is cost-effective, a much wider section of society can afford it.

Q: What are the main benefits of conventional and novel techniques for sinus lift for both clinicians and patients?
A: Maxillary sinus lift surgery is evolving toward a less invasive approach, such as the crestal sinus lift, in which the flaps are less extensive and the morbidity of the procedure is lowered.

Q: What is the overall aim of the course, and how does it differ from other courses?
A: The overall aim of the course is to help participants achieve a high level of competence in diagnosing and treating patients, from the easiest to the most difficult case. The main difference is the education path, moving from theory to practice in a very cost-effective way.

Q: What are the main challenges in esthetic dentistry today?
A: The main challenge is maintaining the clinical outcome achieved in the long term. The diagnostic phase is of utmost importance and requires objective methods to classify the level of complexity, since complex cases require a multidisciplinary approach.

Q: What do you consider the most important aspect professionals wishing to perform this clinical procedure should bear in mind?
A: Appropriate training to apply the method is essential. Professionals should be able to obtain adequate primary stability regardless of bone quality, since this is a prerequisite for clinical success, and follow an efficient prosthetic protocol that allows them to be cost-effective.

Q: What are the main challenges in esthetic dentistry today?
A: The main challenge is maintaining the clinical outcome achieved in the long term. The diagnostic phase is of utmost importance and requires objective methods to classify the level of complexity, since complex cases require a multidisciplinary approach.

Q: What are the most suitable implant systems for immediate loading?
A: Any implant system that has clinical peer-reviewed documentation on its protocol can be used. Many different systems exist on the market that can meet this requirement and many different types of implants are available. I prefer using tapered implants, since it is easier to achieve good primary stability with this implant type; however, I still use cylindrical implants in dense bone.

Q: What are common complications of immediate loading, and how can they be managed effectively?
A: Even though immediate loading is a safe protocol in many clinical scenarios, there are clinical situations in which it is advisable to follow a conventional protocol. Cases requiring bone regeneration or maxillary sinus lift or very esthetically demanding cases should be evaluated with caution.

Soft-tissue management is more difficult in immediate loading, since the clinician does not have an uncovering phase during which to increase or correct the soft tissue. One of the most common complications is soft-tissue recession and this can be a problem especially in cases in which esthetics is significant. There could be an increased failure rate in some clinical indications, such as post-extraction implants in the maxillae.
“Participants of the CME program learn how to progress from theory to practice.”

— Professor Dr. Tiziano Testori
HÜRZELER/ZUHR
Dental Education Institute
— Munich, Germany

— The Hürzeler/Zuhr Dental Education Institute, founded by Professor Dr. Markus Hürzeler and Dr. Otto Zuhr out of a desire to share their knowledge with ambitious dental professionals from around the world. Their goal has been to identify and implement evidence-based approaches in daily practice for the benefit of patients. Such an approach implies that a dentist must not only have a profound knowledge of the theory, but also shape and define the definitive treatment plan based on a wealth of personal experience and knowledge, taking the wishes and expectations of the patient into account.

— Professor Dr. Markus Hürzeler received his dental degree from the University of Zurich in Switzerland, his certificate as a specialist in periodontics from the Swiss Society of Periodontology, his habilitation (associate professor) from the University of Freiburg in Germany, and his certificate in prosthodontics from the German Society of Prosthodontics. He is a clinical associate professor at the University of Freiburg, Department of Operative Dentistry and Periodontology.

Professor Dr. Hürzeler has produced more than 100 scientific publications in the fields of implantology, periodontology and tissue regeneration, and is a regular national and international lecturer. He maintains a private practice specializing in periodontics and implant dentistry in Munich.

Location
The Hürzeler/Zuhr Dental Education Institute is located in Munich, Germany’s third largest city, situated on the banks of the Isar river. The city suffered particular damage during bombings in World War II, but was completely rebuilt and today offers numerous architectural attractions. For this reason, as well as its international sports events, exhibitions, conferences and Oktoberfest, it is a major tourist destination.

Munich has a number of major educational institutions, museums and theaters, and is home to many national and international bodies.

www.huerzelerzuhr.com

How to get there
The institute is 35 kilometers from Munich Airport.

In good traffic conditions, it is only about a 30-minute ride by taxi.

A cheaper alternative is to use public transport. You can plan your journey from Munich Airport to Arabellapark station at: www.mvv-muenchen.de
Where to stay
Within walking distance, just 300 meters away, are the Sheraton München Arabellapark Hotel and the Westin Grand München. www.sheratonarabellapark.com, www.westingrandmunich.com

The institute is a 10-minute walk from Hotel Rothof, located directly across from Arabellapark.
www.hotel-rothof.de

From the institute, cross the Isar river to reach the Cortiina Hotel, a beautifully designed and highly recommended hotel in the city center.
www.cortiina.com

The Bayerischer Hof opened in 1841, at the request of King Ludwig I and has a long tradition of luxury. The Blue Spa, high above the roofs of Munich and designed by Andrée Putman, is dedicated to guests’ relaxation.
www.bayerischerhof.de

Where to eat
Brenner Grill, for wonderful grilled food and a varied menu
www.brennergrill.de

Hofbräuhaus, founded in 1589, one of Munich’s oldest breweries
www.hofbraeuhaus.de

The Grill, an excellent steakhouse in Munich
www.the-grill-munich.de

Käfer-Schänke, a store offering high-quality delicatessen, as well as a gourmet restaurant located above the store
www.feinkost-kaefer.de

Kaisergarten, Bavarian-inspired cuisine with a modern twist
www.kaisergarten.com

The Victorian House, British ambiance in Munich
www.victorianhouse.de

What to see and do
The Pinakothek Museums consist of the Alte Pinakothek, a museum of the old masters of the 14th to 18th centuries, the Neue Pinakothek, which houses art from the 19th century, and the Pinakothek der Moderne, a modern art museum of leading artists and designers in the last century.
www.pinakothek.de

BMW Welt and Museum offers a showroom of the latest BMW models, a show and concert space, and a museum, where one can learn all about BMW.
www.bmw-welt.com

Nymphenburg Palace, located around five kilometers north of the old city, was the summer residence of the royal family of Bavaria.
www.schloss-nymphenburg.de

There are many places of interest in the city center as well, including Marienplatz in the heart of the city, a pedestrian zone that used to be the city’s market place until the need arose for a larger market and it was moved to the Viktualienmarkt, and has become a favorite with gourmets. The Frauenkirche, the city’s cathedral, is one of Munich’s most famous landmarks.

The late Baroque Asamkirche was originally developed as a private chapel dedicated to St. John Nepomuk, whose life is depicted in a ceiling fresco considered among the masterpieces of the artist Cosmas Damian Asam.

An unusual way of seeing Munich is via a walk on the roof of the Olympic Stadium. Participants are hooked up to a steel cable and shown about by an experienced guide.

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Credit: MeshForm solutions Inc., www.meshformsolutions.com

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Credit: Babolat, www.babolatplay.com

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Credit: Vanmoof, www.vanmoof.com
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The dental microscope KAPS 900 offers a homogenous illuminated field of view, with excellent color rendition and high contrast.
Credit: Karl Kaps GmbH, www.kaps-optik.de

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Credit: Hürzeler/Zuhr Dental Education Institute, www.huerzelerzuhr.com

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A definite must for the Rome Marathon.
Credit: Di Renzo, New Balance Italy, www.maratonadidroma.it
The Geneva Smile Center, has a treatment philosophy that gives equal consideration to the aesthetics of patients’ smiles and to their oral health. It offers excellent care performed by leading dental specialists. The center is equipped with modern dental chairs, providing great comfort and optimal hygiene control. The clinic is equipped with fully digitalized radiology equipment and a state-of-the-art computer network. Dentists at the center perform all treatments under magnification, using either Zeiss lenses (4–5×) or high-tech operation Zeiss microscopes for specific surgical or endodontic procedures.

Dr. Didier Dietschi
received his Doctor of Dental Medicine in 1984, a Doctor of Medicine in 1989, a Ph.D. in 2003 and a habilitation qualification (postdoctoral) in 2004, all from the University of Geneva. He is currently a senior lecturer at the university and is an associate professor at Case Western Reserve University in Cleveland, Ohio, in the U.S. Dr. Dietschi is in charge of anterior adhesive restorations and periodontal and implant surgery at the Geneva Smile Center.

GENEVA SMILE CENTER — Geneva, Switzerland

Location
The Geneva Smile Center is located on Lake Geneva, Europe’s largest Alpine lake, near its landmark fountain. The main shopping area in Geneva is just a few minutes away from the center. Geneva, a trendy paradise, is in the French-speaking part of Switzerland and home to the European headquarters of the United Nations, among over 200 international organizations. It is a city of culture and art and one of the greenest cities in Europe with 20 percent of its green areas, which has earned it the name “City of Parks.” It is close to some of the best ski areas in the Alps.

How to get there
The center is located seven kilometers from Geneva International Airport. It will take about 30 minutes to reach the center by taxi in good traffic conditions. An alternative is to take the No. 10 bus to the bus stop near Genève-Cornavin railway station (the stop is called “22-Cantons”), change to the No. 9 bus and get off at Place des Eaux-Vives.

Where to stay
Hotel d’Angleterre, located right on Lake Geneva, an exquisite hotel where you can really enjoy your stay.

Restaurant Hotel du Parc des Eaux-Vives, where the rooms command a view of the lake and the surrounding mountains—the hotel only has seven rooms, so booking early is recommended.

Hotel Churchill Geneva, only 350 meters from the center and in the main shopping district.

Eastwest Hotel, a boutique hotel where significant attention has been given to detail and interior decor.
Where to eat
Windows Restaurant at Hotel d’Angleterre, exquisite cuisine matched by an extensive wine list.
Le Cigalon, the place to have dinner in Geneva if you enjoy seafood and fish. www.le-cigalon.ch
La Cantine des Commerçants, a kitchen that brings together local products with simplicity and a taste of travel. www.lacantine.ch

What to see and do
Follow the story of the Genevan humanitarian movement by visiting the International Red Cross and Red Crescent Museum.
Visit the Globe of Science and Innovation at CERN, the world’s largest laboratory for particle physics.
Climb the 157 steps of the 12th century Cathédrale Saint-Pierre for a breathtaking view of the city.
See the over 6,500 flowers and plants of the Flower Clock, a fine example of Swiss precision, in the Jardin Anglais.
Take a guided tour of the Palais des Nations, which houses the United Nations Office at Geneva. www.unog.ch
Go skiing in the Alps. Chamonix and Mont Blanc are located 80 kilometers away. Megève, 70 kilometers away, originally conceived in the 1920s as a destination for the aristocracy, is a famous and fancy ski resort. A lake tour offers a wonderful way to discover Geneva. www.keytours.ch
Explore the shops and antique dealers of Carouge, close to the city centre, by day and its trendy bars by night.
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Go on an outing to the village of Dardagny to walk among the vineyards and sample the local wines.

For more information visit: www.geneve-tourisme.ch
NATURAL LAYERING CONCEPT — a simple, reliable and effective protocol to achieve high esthetics with freehand bonding techniques

Introduction
Natural, restored or orthodontically enhanced smiles may present esthetic deficiencies that require treatment. However, the search for a perfect smile should not drive the clinician to use primarily invasive solutions such as veneers and crowns to resolve all esthetic anomalies, since such procedures will have a negative impact on the long-term tooth bio-mechanical behavior and treatment cost. The freehand option, which is more conservative and cost-effective, should then always be considered as our first choice, if feasible. In this context, composite resins represent the material of choice for young patients and less privileged people, or in any case those who require a strictly conservative approach. The natural layering concept has enabled this objective to be achieved in a predictable way, by incorporating newly acquired knowledge about natural tissue optical properties into contemporary composite systems. This advance can be regarded as a milestone in operative dentistry as it will give direct composite application a tremendous input, helping a larger number of our patients to receive both conservative and highly aesthetic restorations; this concept was described as the “bio-esthetic” approach.

The aim of this article is to illustrate the bio-esthetic philosophy and Natural Layering Concept (NLC), applied to solve two advanced aesthetic cases.
The Natural Layering Concept (NLC)

The dentin L* a* b* color measurements of teeth from the “A”, “B” and “C” VITA shade groups, have suggested that an ideal dentin replacement material should exhibit the following characteristics:

Single hue.
Single opacity.
Large chroma scale (beyond the four chroma levels of the VITA system).

Actually, the variations of a* and b* values between various VITA shades seem not to justify the use of distinct dentin colours, at least for a direct composite restorative system. Likewise, the variations of the contrast ratio (opacity-translucency) within a single shade group, do not support the use of different dentin opacities (i.e.: translucent, regular or opaque dentins). However, chroma (related to a* and b* values) proved to increase from light to dark shades (A1 to A4 or B1 to B3) and then support the concept of a large chroma scale covering all variations of natural dentins, plus some specific conditions like sclerotic dentin (as found underneath decays, fillings or cervical lesions).

As regard to enamel, differences in tissue lightness and translucency proved to vary largely among patients and with tooth age, and therefore confirmed the clinical concept of three specific enamel types:

Young enamel: white tint, natural opalescence, less translucency.
Adult enamel: neutral tint, natural opalescence and intermediary translucency.
Elderly enamel: yellow tint, natural opalescence and higher translucency.

This interpretation of human dentin and enamel colorimetric data led to this clinical approach named the “Natural Layering Concept” (NLC), which embraces more accurately the optical and anatomical characteristics of natural teeth. It actually defines the features of an optimal restorative material aimed to replace dentin and enamel, respectively. Dentins shades should be available in one single hue (close to VITA “A” shade group) with a sufficient range of chroma (covering at least the existing VITA shade range), and presenting opacity similar to natural dentin. Enamel shades should present different tints and opacity levels, tentatively replicating the major variations found in nature. The latest development of this system is the inspiro (Edelweiss DR); previous generations include for instance Miris® & Miris® 2 (Coltène/Whaledent), Ceram.X® duo (DENTSPLY), ASTERIA (Tokuyama), Aura (SDI) or ENAMEL HFO/HRI (Micerium).

Case 1
An adult female patient shows esthetically defective composite veneers; she hopes for a significant improvement although she has strict financial limitations, driving the treatment plan toward the replacement of existing restorations by a similar freehand, but improved technique (cover page figures). A new generation NLC composite system (inspiro, Edelweiss DR) was selected, due to its improved optical properties and excellent surface characteristics (easy polishability and good gloss retention), resulting from a new fller technology (homogenous nano-hybrid composite). This material has no clustered nano-particles or pre-polymerized fillers, which proved to impact negatively the esthetic performance of conventional inhomogeneous nano-hybrid composites.

A rubber dam was applied to optimize adhesive and restorative procedures; indeed, such extensive treatment using a direct technique would be less predictable without this isolation procedure, which eliminates moisture from breath completely, crevicular fluid extravasation and possibly slight gingival bleeding. Restorations were made using a bi-laminar restorative approach based on one dentin shade (Body i2 for the central and lateral incisors and Body i3 for the canines; selected masses are close to A2 and A3 VITA shades). In addition, a small amount of blue effect shade (Azur, inspiro) was placed over the dentin underlay to emulate localized opalescent halo (Fig. 1a).

Finishing and polishing was performed under rubber dam which protect soft tissues for inadvertent aggression. The primary anatomy was corrected with finishing discs of decreasing coarseness (Optidisc, Kerr). When the appropriate proximal and tooth axial profiles were considered optimal, the incisal length and profile were finished using the same instruments as well as fine finishing diamonds burs. Only three instruments were used to complete the secondary anatomy (micro-texture), starting with a flame, fine diamond (40 μm), followed by a pre-polisher rubber point (Identoflex® minipoint, Kerr) and a diamond impregnated rubber cup (Hi-Luster, Kerr). This simplified instrument sequence led to the good surface anatomy and quality shown on Figures 1b–g.

Case 2
A young male patient presents various esthetic deficiencies. An orthodontic correction previously helped to manage space excess, following congenital lateral incisor aplasia (Figs. 2a–d). The dento-facial analysis (Fig. 3) reveals a serious asymmetry between the face and smile midline,
which results from an underlying orthognathic deviation (dental arches and smile are not aligned with the face) which the patient refused to treat. A computer assisted smile analysis was performed with extra- and intra-oral photographs, manipulated and altered with PowerPoint Software (Microsoft). The remaining esthetic deficiencies following orthodontic treatment could be better identified and the resulting treatment planning was explained to the patient (Figs. 3c and d).

The following esthetic abnormalities were to be corrected:

**Tooth axis** (upper laterals and canines).

**Tooth forms** (upper centrals, canines and lower incisors).

**Tooth color** (upper canines).

**Gingival profile** (upper premolars).

It was agreed with the patient to conduct the gingival profile correction for upper first premolars at a later stage.

With the first case, all adhesive and restorative procedures were performed under rubber dam to optimize the quality and longevity of the restorations. The same composite system was used (inspiro, Edelweiss DR) following the Natural Layering Concept (NLC).

**Discussion–conclusion**

The natural layering concept has enabled patient’s aesthetic expectations to be fulfilled in a predictable way, by incorporating new knowledge about natural tissue optical properties into a new restorative approach for direct, freehand restorations. It allowed a significant simplification of clinical procedures, making this technique accessible to general practitioners as well. This advance can be regarded as a milestone in operative dentistry, giving a new input to freehand bonding and helping more patients to receive conservative and highly aesthetic restorations.
Figs. 2a–d
Preoperative extra & intra-oral status. The patient has congenitally missing upper laterals and one lower incisor. Following conventional orthodontic treatment, many esthetic problems remain, such as tooth axis, forms, proportions and overall smile configuration.

Figs. 3a–b
Computer assisted smile analysis & design: The most important lines are being drawn (facial midline, bi-pupillary plane, occlusal plane, tooth axis, etc…) and help to establish the list of major/minor esthetic deficiencies.

Figs. 3c–d
When, new tooth forms and smile configuration can be drawn and partially opacified, to show the patient the expected changes (the red lines show the potential gingival profile correction of the upper first premolars).
Chair-side bleaching using 35% hydrogen peroxide was performed, to reduce the higher chroma of canines, before continuing with bonding procedures (a = intra-operative and b = post-bleaching view).

Figs. 4c–d
Intra-oral views during direct restorative procedures; the rubber-dam secured the quality of adhesion as well as a better access to all surfaces to be additively restored. The rubber dam also protects soft tissues during finishing and polishing procedures. The Natural Layering Concept (NLC) was used to obtain a more predictable and optimal treatment outcome, using the new inspiro system (edelweiss DR).

Fig. 4e
Post-treatment view, following the corrections of tooth axis, dimensions and proportions and tooth form of the upper six front teeth (previously upper first premolars, canines and central incisors).

Figs. 5a–d
Postoperative extra & intra-oral status. A no prep restorative approach was used which fulfilled the esthetic needs of the patient, using a NLC composite system (inspiro, Edelweiss DR). The treatment outcome is made more predictable, due to the simplicity and reliability of the shading system, including the color taking.

Editorial note: A complete list of references is available from the publisher.
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SMILE ANALYSIS:  
— Photoshop smile design technique

Introduction: Smile analysis and esthetic design

Dental facial esthetics can be defined in three ways:

Traditionally, dental and facial esthetics have been defined in terms of macro- and micro-elements. Macro-esthetics encompasses the interrelationships between the face, lips, gingiva, and teeth and the perception that these relationships are pleasing. Micro-esthetics involves the esthetics of an individual tooth and the perception that the color and form are pleasing.

Historically, accepted smile design concepts and smile parameters have helped to design esthetic treatments. These specific measurements of form, color, and tooth/esthetic elements aid in transferring smile design information between the dentist, ceramist, and patient. Esthetics in dentistry can encompass a broad area—known as the esthetic zone.1

Rufenacht delineated smile analysis into facial esthetics, dentofacial esthetics, and dental esthetics, encompassing the macro- and micro-elements described in the first definition above.3 Further classification identifies five levels of esthetics: facial, orofacial, oral, dentogingival, and dental (Table 1).1, 9

Initiating smile analysis: Evaluating facial and orofacial esthetics

The smile analysis/design process begins at the macrolevel, examining the patient’s face first, progressing to an evaluation of the individual teeth, and finally moving to material selection considerations. Multiple photographic views (e.g., facial and sagittal) facilitate this analysis.

At the macrolevel, facial elements are evaluated for form and balance, with an emphasis on how they may be affected by dental treatment.4, 9 During the macro-analysis, the balance of the facial thirds is examined (Fig. 1). If something appears unbalanced in any one of those zones, the face and/or smile will appear unesthetic.

Such evaluations help determine the extent and type of treatment necessary to affect the esthetic changes desired. Depending on the complexity and uniqueness of a given case, orthodontics could be considered when restorative treatment alone would not produce the desired results (Fig. 2), such as when facial height is an issue and the lower third is affected. In other cases—but not all—restorative treatment could alter the vertical dimension of occlusion to open the bite and enhance esthetics when a patient presents with relatively even facial thirds (Fig. 3).

Evaluating oral esthetics

The dentolabial gingival relationship, which is considered oral esthetics, has traditionally been the starting point for treatment planning. This process begins by determining the ideal maxillary incisal edge placement (Fig. 4). This is accomplished by understanding the incisal edge position relative to several different landmarks. The following questions can be used to determine the ideal incisal edge position:

Where in the face should the maxillary incisal edges be placed?
What is the proper tooth display, both statically and dynamically?
What is the proper intra- and inter-tooth relationship (e.g., length and size of teeth, arch form)?
Can the ideal position be achieved with restorative dentistry alone, or is orthodontics needed?

In order to facilitate smile evaluation based on these landmarks, the rule of 4.2.2—which refers to the amount of maxillary central display when the lips are at rest, the amount of gingival tissue re-
Dentogingival esthetics

Gingival margin placement and the scalloped shape, in particular, are well discussed in the literature. As gingival heights are measured, heights relative to the central incisor, lateral incisor, and canine in an up/down/up relationship are considered esthetic (Fig. 6). However, this may create a false perception that the lateral gingival line is incisal to the central incisor. Rather, in most esthetic tooth relationships, the gingival line of the four incisors is approximately the same line (Fig. 6), with the lateral incisor perhaps being slightly incisal. The gingival line should be relatively parallel to the horizon for the central incisors and the lateral incisors and symmetric on each side of the midline. The gingival contours (i.e., gingival scallop) should follow a radiating arch similar to the incisal line. The gingival scallop shapes the teeth and should be between 4 mm and 5 mm (Fig. 7). Related to normal gingival form is midline placement. Although usually the first issue addressed in smile design, it is not as significant as tooth form, gingival form, tooth shape, or smile line. Several rules can be applied when considering modifying the midline to create an esthetic smile design:
The midline only should be moved to establish an esthetic intra- and inter-tooth relationship, with the two central incisors being most important.

The midline only should be moved restoratively up to the root of the adjacent tooth.

If the midline is within 4 mm of the center of the face, it will be esthetically pleasing.

The midline should be vertical when the head is in the postural rest position.

Evaluating dental esthetics
Part of evaluating dental esthetics for smile design is choosing tooth shapes for patients based on their facial characteristics (e.g., long and dolichocephalic, or squatish and brachycephalic). When patients present with a longer face, a more rectangular tooth within the esthetic range is appropriate. For someone with a square face, a tooth with an 80% width-to-length ratio would be more appropriate. The width-to-length ratio most often discussed in the literature is between 75% and 80%, but esthetic smiles could demonstrate ratios between 70% and 75% or between 80% and 85% (Figs. 8–10).1

The length of teeth also affects esthetics. Maxillary central incisors average between 10 mm and 11 mm in length. According to Magne, the average length of an unworn maxillary central to the cemento-enamel junction is slightly over 11 mm.2 The esthetic zone for central incisor length, according to the authors, is between 10.5 mm and 12 mm, with 11 mm being a good starting point. Lateral incisors are between 1 mm and a maximum of 2 mm shorter than the central incisors, with the canines slightly shorter than the central incisors by between 0.5 mm and 1 mm (Fig. 11). The inter-tooth relationship, or arch form, involves the golden proportion and position of tooth width. Although it is a good beginning, it does not reflect natural tooth proportions. Natural portions demonstrate a lateral incisor between 60% and 70% of the width of the central incisor, and this is larger than the golden proportion.3 However, a rule guiding proportions is that the canine and all teeth distal should be perceived to occupy less visual space (Fig. 12). Another rule to help maintain proportions throughout the arch is 1-2-3-4-5; the lateral incisor is two-thirds of the central incisor and the canine is four-fifths of the lateral incisor, with some latitude within those spaces (Fig. 13). Finally, contact areas can be moved restoratively up to the root of the adjacent tooth. Beyond that, orthodontics is required (Fig. 14).

Creating a digital smile designed in Photoshop
Although there are digital smile design services available to dentists for a fee, it is possible to use Photoshop CS5 software (Adobe Systems) to create and demonstrate for patients the proposed smile design treatments. It starts by creating tooth grids—predesigned tooth templates in different width-to-length ratios (e.g., 75% central, 80% central) that can be incorporated into a custom smile design based on patient characteristics. You can create as many different tooth grids as you like with different tooth proportions in the esthetic zone. Once completed, you will not have to do this step again, since you will save the created tooth grids and use them to create a new desired outline form for the desired teeth. Follow these recommended steps:

1. Acceptable width-to-length ratios fall between 70% and 85%, with the ideal range between 80% and 85%.
2. An acceptable starting point for central incisors is 11 mm in length, with lateral incisors 1–2 mm shorter than the central incisors, and canines 0.5–1 mm shorter than the central incisors for an esthetic smile display.
3. The canines and other teeth distally located are visually perceived as occupying less space in an esthetically pleasing smile.
4. A general rule for achieving proportionate smile design is that lateral incisors should measure two-thirds of the central incisors and canines four-fifths of the lateral incisors.
5. If feasible, the contact areas can be restoratively moved up to the root of the adjacent tooth.

The midline only should be moved to establish an esthetic intra- and inter-tooth relationship, with the two central incisors being most important.

The midline only should be moved restoratively up to the root of the adjacent tooth.

If the midline is within 4 mm of the center of the face, it will be esthetically pleasing.

The midline should be vertical when the head is in the postural rest position.

Evaluating dental esthetics
Part of evaluating dental esthetics for smile design is choosing tooth shapes for patients based on their facial characteristics (e.g., long and dolichocephalic, or squatish and brachycephalic). When patients present with a longer face, a more rectangular tooth within the esthetic range is appropriate. For someone with a square face, a tooth with an 80% width-to-length ratio would be more appropriate. The width-to-length ratio most often discussed in the literature is between 75% and 80%, but esthetic smiles could demonstrate ratios between 70% and 75% or between 80% and 85% (Figs. 8–10).1

The length of teeth also affects esthetics. Maxillary central incisors average between 10 mm and 11 mm in length. According to Magne, the average length of an unworn maxillary central to the cemento-enamel junction is slightly over 11 mm.2 The esthetic zone for central incisor length, according to the authors, is between 10.5 mm and 12 mm, with 11 mm being a good starting point. Lateral incisors are between 1 mm and a maximum of 2 mm shorter than the central incisors, with the canines slightly shorter than the central incisors by between 0.5 mm and 1 mm (Fig. 11). The inter-tooth relationship, or arch form, involves the golden proportion and position of tooth width. Although it is a good beginning, it does not reflect natural tooth proportions. Natural portions demonstrate a lateral incisor between 60% and 70% of the width of the central incisor, and this is larger than the golden proportion.3 However, a rule guiding proportions is that the canine and all teeth distal should be perceived to occupy less visual space (Fig. 12). Another rule to help maintain proportions throughout the arch is 1-2-3-4-5; the lateral incisor is two-thirds of the central incisor and the canine is four-fifths of the lateral incisor, with some latitude within those spaces (Fig. 13). Finally, contact areas can be moved restoratively up to the root of the adjacent tooth. Beyond that, orthodontics is required (Fig. 14).

Creating a digital smile designed in Photoshop
Although there are digital smile design services available to dentists for a fee, it is possible to use Photoshop CS5 software (Adobe Systems) to create and demonstrate for patients the proposed smile design treatments. It starts by creating tooth grids—predesigned tooth templates in different width-to-length ratios (e.g., 75% central, 80% central) that can be incorporated into a custom smile design based on patient characteristics. You can create as many different tooth grids as you like with different tooth proportions in the esthetic zone. Once completed, you will not have to do this step again, since you will save the created tooth grids and use them to create a new desired outline form for the desired teeth. Follow these recommended steps:

1. Acceptable width-to-length ratios fall between 70% and 85%, with the ideal range between 80% and 85%.
2. An acceptable starting point for central incisors is 11 mm in length, with lateral incisors 1–2 mm shorter than the central incisors, and canines 0.5–1 mm shorter than the central incisors for an esthetic smile display.
3. The canines and other teeth distally located are visually perceived as occupying less space in an esthetically pleasing smile.
4. A general rule for achieving proportionate smile design is that lateral incisors should measure two-thirds of the central incisors and canines four-fifths of the lateral incisors.
5. If feasible, the contact areas can be restoratively moved up to the root of the adjacent tooth.

The midline only should be moved to establish an esthetic intra- and inter-tooth relationship, with the two central incisors being most important.

The midline only should be moved restoratively up to the root of the adjacent tooth.

If the midline is within 4 mm of the center of the face, it will be esthetically pleasing.

The midline should be vertical when the head is in the postural rest position.
To begin creating a tooth grid, use a cheek-retracted image of an attractive smile as a basis (e.g., one with a 75% width-to-length ratio). Open the image in Photoshop and create a new clear transparent layer on top of the teeth (Fig. 15). This transparent layer will enable the image to be outlined without the work being embedded into the image.

Name the layer appropriately and, when prompted to identify your choice of fill, choose “no fill,” since the layer will be transparent, except for the tracing of the tooth grid.

To begin tracing the tooth grid, activate a selection tool, move to the tool palette, and select either the polygonal lasso tool or the magnetic lasso tool. In the authors’ opinion, the polygonal works best. Once activated, zoom in (Fig. 16) and trace the teeth with the lasso tool.

To create a pencil outline of the tooth, with the transparent layer active, click on the edit menu in the menu bar; in the edit drop-down menu, select “stroke”; choose black for color, and select a two-pixel stroke pencil line (Fig. 17), which will create a perfect tracing of your selection. Click “OK” to stroke the selection. Select (trace with the lasso selection tool) one tooth at a time and then stroke it (Fig. 18). Select and stroke (trace) the teeth up to the second premolar (the first molar is acceptable; Fig. 19).

The image should be sized now for easy future use in a smile design. In the authors’ experience, it is best to adjust the size of the image to a height of 720 pixels (Fig. 20) by opening up the image size menu and selecting 720 pixels for the height. The width will adjust proportionately.

At this time, the tooth grid tracing can be saved, without the image of the teeth, by double-clicking on the layer of the tooth image. A dialog box reading “new layer” will appear; click “OK.” This process unlocks the layer of the teeth so it can be removed. Drag the layer of the teeth to the trash, leaving only the layer with the tracing of the teeth (Fig. 21). In the file menu, click “save as” and choose “.png” or “.psd” (Photoshop) as the file type. This will preserve the transparency. You do not want to save it as a JPEG, since this would create a white background around the tracing. Name the file appropriately (e.g., 75% W/L central).

By tracing several patients’ teeth that have tooth size and proportion in the esthetic zone and saving them, you can create a library of tooth grids to custom design new teeth for your patients who require smile designs.

Photoshop provides an effective and inexpensive way to design a digital smile with proper patient input. To start creating custom tooth grids, open an image of an attractive smile in Photoshop and create a separate transparent layer.

The polygonal lasso tool is an effective way to select the teeth.

Click “edit > stroke,” then use a two-pixel stroke line (with color set to black) to trace your selection. Make sure the transparent layer is the active working layer.

Image of the central incisor with a two-pixel black stroke (tracing).

Image of the teeth traced up to the second premolar to create a tooth grid.

Size the image in Photoshop.

Save the grid as a .png or .psd file type and name it appropriately. Create other dimension grids using the same technique.
The Photoshop smile design technique
The Photoshop smile design (PSD) technique can be done on any image, and images can be combined to show the full face or the lower third with lips on or lips off. This article (Part 1) demonstrates how to perform the technique on the cheek-retracted view. Part 2 of this article will review more possibilities using the technique.

The first step in the PSD technique is to create a digital conversion of the actual tooth length and width, and then digitally determine the proposed new length and proportion of the teeth.

Determining digital tooth size
To determine digital tooth size, follow these steps:

1. Create a conversion factor by dividing the proposed length (developed from the smile analysis) by the existing length of the tooth.

2. The patient’s tooth can be measured in the mouth or on the cast (Fig. 22). If the length measures 8.5 mm but needs to be at 11 mm for an esthetic smile, divide 11 by 8.5. The conversion factor equals 1.29, a 29% digital increase lengthwise.

3. Open the full-arch cheek-retracted view in Photoshop, and zoom in on the central incisor.

4. Select the eyedropper palette. A new menu will appear. Select the ruler tool (Fig. 23).

5. Click and drag the ruler tool from the top to the bottom of the tooth to generate a vertical number, in this case 170 pixels (Fig. 24). Multiply the number of pixels by the conversion factor. In this case, 170 × 1.29 = 219 pixels; 219 pixels is digitally equivalent to 11 mm (Fig. 25).

6. Determine the digital tooth width using the same formula.

7. Create a new layer, leave it transparent, and mark the measurement with the pencil tool (Fig. 26).

Applying a new proposed tooth form
Next, follow these steps:

1. Select the tooth grid based on the width-to-length ratio of the planned teeth (e.g., 80/70/90 or 80/65/80). Open the image of the chosen tooth grid in Photoshop and drag the grid on to the image of teeth to be smile designed (Fig. 27).

2. If the shape or length is deemed inappropriate, press the command button (control button for PCs) and “z” to delete and select a suitable choice.

3. Depending on the original image size, the tooth grid may be proportionally too big or too small. To enlarge or shrink the tooth grid created (with the layer activated), press command (or control) and “t” to bring up the free transform function. While holding the shift key (holding the shift key allows you to transform the object proportionally), click and drag a corner left or right to expand or contract the custom tooth grid. Adjust the size of the grid so that the outlines of the central incisors have the new proposed length. Move the grid as necessary using the move tool so that the incisal edge of the tooth grid lines up with the new proposed length (Fig. 28).

4. Areas of the grid can be individually altered using the liquify tool (Fig. 29).
Digitally creating new esthetic teeth

Next, follow these suggested steps:

With the new tooth grid layer and the magic wand tool both activated, click on each tooth to select all of the teeth in the grid (Fig. 30).

Expand the selection by two pixels in the expand menu; click “select > modify > expand” (Fig. 31). Note that the selection better approximates the grid. You can expand the selection or contract as necessary using the same menu.

Activate the layer of the teeth (cheek-retracted view) by clicking on it (Fig. 32).

Next, activate the liquify filter (you will see a red mask around the shapes of the proposed teeth). The mask creates a digital limit that the teeth cannot be altered beyond. This is similar to creating a mask with tape for painting a shape (Fig. 33).

Use the forward warp tool by clicking on an area of the existing tooth and dragging to mold/shape the tooth into the shape of the new proposed outline form (Fig. 34).

Repeat this for each tooth. If you make a mistake or do not like something, click command (or control) and “z” to go back to the previous edit (Fig. 35).
Adjusting tooth brightness
The following steps are recommended next:

Select the whitening tool (dodge tool) to brighten the teeth. In the dodge tool palate, click on “midtones” and set the exposure to approximately 20%. Click on the areas of the tooth you want brightened (Figs. 36 and 37). Alternatively, with the teeth selected, you can use the brightness adjustment in the brightness/contrast menu; click “image > adjustments > brightness/contrast”.

Performing the changes on only one side of the mouth allows the patient to compare the new smile design to his/her original teeth before agreeing to treatment.

Create a copy
To save the information you have created for presentation to the patient, follow these tips:

Go to “file” and select “save as.”
When the menu appears, click on the “copy” box.
Name the file at that step.
Save it as a JPEG file type.
Designate where you want it saved.
Click “save.”

A file of the current state of the image will be created in the designated area. You can now continue working on the image and save again at any point you want.

Conclusion
Knowledge of smile design, coupled with new and innovative dental technologies, allows dentists to diagnose, plan, create, and deliver esthetically pleasing new smiles. Simultaneously, digital dentistry is enabling dentists to provide what patients demand: quick, comfortable, and predictable dental restorations that satisfy their esthetic needs.
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INFLUENCE OF BRUSHING ACTION — on torsional and fatigue resistance of TF Adaptive instruments

Nickel-titanium (NiTi) alloy was introduced in endodontics more than 20 years ago, to make shaping procedures easier, more rapid and predictable. Since 1993, manufacturers have mainly changed cross-sectional designs and geometrical traits of instruments to improve intracanal resistance to fracture. In 2007, another strategy to achieve this goal was proposed: the use of new manufacturing processes to optimize the microstructure of NiTi through innovative thermomechanical processing. NiTi instruments produced with these technologies (M-Wire, CM wire, Twisted Files, etc.) showed better properties for endodontic use, in terms of flexibility and resistance to mechanical stress, compared with the traditional NiTi alloy and processing.

More recently, a third factor (the use of reciprocating motion instead of continuous rotation) has become very important in this search for safer instrumentation techniques. Current literature data show that reciprocating motion can extend both torsional and cyclic fatigue resistance of NiTi instruments compared with continuous motion, mainly because it reduces instrumentation stress. In fact, in one movement of rotation, the instrument cuts and is engaged into the canal, while in the other (usually with a smaller angle), the instrument is disengaged and stresses are reduced. Following these concepts, new motors with specific reciprocating movements were developed, and single-file techniques were proposed for clinical use. Despite this improvement, however, the accumulation of all instrumentation stress on one single file was still felt to be dangerous; consequently, a new reciprocating motion was developed to be used according to a sequence to optimize performance and safety.

Released in 2013, TF Adaptive (TFA; Axis[SybronEndo]) uses an innovative motion, different from any other motion previously used in endodontics, that combines the advantages of both continuous rotation and reciprocation. When the TFA instrument is not (or very lightly) stressed, the movement can be described as an interrupted continuous rotation, allowing optimal cutting efficiency and removal of debris, since the cross-sectional and flute designs are meant to perform at their best in a clockwise motion. In contrast, while negotiating the canal, owing to increased instrumentation stress and metal fatigue, the motion of the TFA instrument changes into reciprocation, with specifically designed clockwise and counterclockwise angles. Moreover, these angles are not constant, but vary depending on the anatomical complexities and the intracanal stress. This adaptive motion is therefore meant to reduce the risk of intracanal failure without affecting performance, by the Elements Motor automatically selecting the best movement for each clinical situation (Fig. 1).

Other clinical factors can significantly affect the clinical resistance of NiTi instruments: the anatomical challenges, the use of torque control motors, the applied pressure, and the differences in use among various clinicians in terms of sequence, the creation of a glide path, and the amount of brushing action (for coronal flaring). All these differences are very difficult to evaluate, since they are mostly related to individual skills, sensitivity and operative choice. It would be interesting to assess the extent to which fatigue resistance is affected by different clinical usage, such as performing or not performing a brushing action. The brushing action (or circumferential filing) is meant to increase coronal flaring and, consequently, make apical progression of the next instrument in the sequence easier with less stress placed on it. Therefore, the goal of this study was to compare the torsional and cyclic fatigue resistance of TFA instruments after clinical use, in order to evaluate the clinical advantages of brushing action, if any.

Methodology
Twenty packages of TFA small (SM) files were selected for this study (Fig. 2) and randomly divided into two groups of ten each. Each instrument was used once in sequence to prepare a mandibular molar with three canals (Fig. 3). Following the manufacturer’s guidelines for the TFA SM sequence, a manual glide path up to an ISO size 15 was established using the K-file stainless-steel instruments contained in the package. According to the traffic light concept, it was decided to stop at yellow and use only the first two instruments in the sequence: the SM1 (green, #20.04) followed by the SM2 (yellow, #25.06). All instruments were used with the patented TFA Elements Motor, which automatically selects the best kinematics (continuous rotation or reciprocation) according to intracanal stress. All instruments reached working length in incremental steps (1 mm), without being forced apically and with flutes being cleaned after each 1 mm apical progression. Irrigation with sodium hypochlorite was performed with the use of each instrument.

In the first group (A), no brushing action was performed. In the second group (B, with brushing action), once the SM1 instruments had reached working length, cir-
cumferential filing for approximately 20 seconds was performed in each canal to increase coronal flaring. The brushing action was performed using the TFA motion and by disengaging the instrument 1 mm from working length to allow lateral cutting with minimal stress.

After the shaping procedures had been completed, the used TFA instruments (SM1 and SM2) were first inspected under the microscope at 20x magnification to detect any signs of torsional failure (flute elongation or deformation). All deformed instruments were discarded, while the rest were subjected to a cyclic fatigue test. The fatigue test was performed using a device validated in a number of previous studies conducted by the author.1-4 The instruments were rotated into a curved canal using TFA motion until fracture occurred. The time to failure was recorded, and the mean values and standard deviation were then calculated. In order to determine any statistical difference among the subgroups, the data were subjected to a one-way analysis of variance, with significance set at the 95% confidence level.

Results
The results of the cyclic fatigue tests of used TFA instruments showed no statistically significant differences between the SM1 instruments of both groups. The brushing action performed for 60 seconds did not negatively affect the instruments’ resistance. Group A SM1 instruments had a mean time to failure of 207 seconds, while Group B SM1 instruments had a mean time of 198 seconds.

In contrast, a statistically significant difference was found between the SM2 instruments of the two groups. The Group B SM2 instruments showed a significantly higher resistance to cyclic fatigue (a mean time of 139 seconds) compared with the Group A SM2 instruments (a mean time of 111 seconds). The reason for this is that the coronal flaring previously provided by the brushing action of the SM1 file reduced the instrumentation stress on the SM2 file.

Deformation of flutes was recorded only in Group A SM2 files. The reason for this might be that the coronal flaring due to the brushing action of the SM1 file reduced the torsional stress of the SM2 file.

Discussion
The present study shows that the clinical performance of rotary and reciprocating NiTi instruments can be related to operative techniques. It has been suggested that any NiTi instrument may be used both as a reamer while working towards the apex and with a brushing action as a Hedstrom file while exiting the canal, to improve coronal flaring and/or circumferential filing. The benefit of the brushing action is not only to enhance the extent of the canal walls touched by the file and tapered preparations, but also to provide greater coronal enlargement for safer progression of the instruments in a sequence.

The suggested brushing/cumferential filing technique is therefore needed to perform better preparation of an oval canal, as shown in the clinical case. Instruments are indeed designed to shape a round canal while progressing to working length, but a significant amount of cutting/touching of canal walls on the lateral side can be performed while instruments are exiting the canal, especially in oval canals.

The author demonstrated in a previous study that the brushing action can be performed for up to 30–60 seconds with minimal or no risk of increasing instrument fatigue. The findings of the present study, which concerns TFA instruments used with TFA motion, are consistent with previously published results.*

Moreover, in the present study, it has been demonstrated that the brushing action with an SM1 file allowed safer progression to the final working length of the next (SM2) NiTi instrument in the sequence. Group A SM2 instruments (no brushing) showed a significant reduction in resistance to cyclic fatigue, and this can be attributed to greater instrumentation stress compared with Group B (in which brushing had been performed with the previous instrument). Deformation of flutes was recorded only in Group A SM2 files. The reason for this might be that the coronal flaring due to the brushing action of the SM1 file reduced the torsional stress of the SM2 file.

Conclusion
The coronal flaring provided by the brushing action of the first instrument (SM1) reduced the instrumentation stress on the second instrument (SM2) in the TFA sequence, both in terms of torsional and flexural stress. The brushing action (cumferential filing) performed in the present study (prolonged use for 60 seconds) did not adversely affect the mechanical resistance of the instruments.

Editorial note: A complete list of references is available from the publisher.

Article Endodontics issue 1/2015 — 59
Errors accumulate during procedures. That’s the reason botching the access at the start of a RCT is so much more devastating than say, problems that come from misfitting a gutta percha cone, just before finishing the case. Miss a canal and the case is going down, regardless of how brilliant the remaining procedure is carried out. Perforate the tooth and suddenly titanium starts looking better. Cut huge access cavities and expect to see relatively huge numbers of root-fractured teeth within 5 years of treatment. Simply cheat the access procedure by beginning the instrumentation of canals before a straight, perfectly smooth path has been cut to each canal orifice and be punished every time a file, an irrigating needle, an explorer, a gutta percha point, a paper point, or a plugger is taken into each of the canals scores of times.

This is not a critique so much as an admission of the ways that teeth and their root canal systems have taught me, usually the hard way, to spend whatever time is needed to create perfect entry paths into canals, before I attempt to work in them. So why do I have to have a talk with myself before beginning every access cavity – even after doing this for 35 years - to be certain to hit the mark I know must be met, before it is safe to venture further?

Zen and the Art of Endo Access
Robert Persig, in his book “Zen and the Art of Motorcycle Maintenance,” described being deeply frustrated when a bolt stripped as he was attempting to remove the side covers to the engine of his motorcycle, before rebuilding it. The rebuild could not continue until he was able to circumvent this problem. He had expected to spend several days completing the mission, yet he was amazed at the fury he experienced when faced with this conundrum. The more he thought about it, the more mystified he became about his instinctual response, until he realized that he was tweaked because he had grossly undervalued this part of the long rebuild procedure, thinking mostly about the more dramatic routines to follow, such as cracking the cylinder case, honing the cylinder, replacing the piston, and putting it all back together afterwards. When he realized that NOTHING was going to progress until he had successfully removed the side cover, he made removing that side cover a separate and important mission, an accomplishment that would deliver satisfaction in and of itself, if it could be completed during the next several hours spent. Then he was having fun again.

So it is with endodontics. When we realize how critical the quality of our access preparations is to the remainder of the case, it feels like fingernails on a chalkboard to head into a canal, before securing an ideal path into it. Aristotle got it right, excellence is a habit, not a character trait, so what do the habits of access excellence look like in this twenty-first century?

Failing to plan is planning to fail
Atul Gawande, in his book “The Checklist Manifesto,” describes the importance of planning not just which procedure to do, but how every single aspect of that procedure must be planned in detail, from start to finish, if consistently ideal results are the goal. Does the preoperative imaging accurately describe the anatomical challenges, does the clinician have adequate magnification and light, are the cutting tools adequate and well chosen, are the locations, angles, and depths of entry determined before beginning every access cavity – even after doing this for 35 years - to be certain to hit the mark I know must be met, before it is safe to venture further?
planning and execution of an ideal access cavity preparation, the rest of the procedure becomes progressively simpler as the finish is approached.

Radiographic Imaging

We wouldnt even attempt RCT without Roentgen’s invention of the dental radiograph, so it is not much of a stretch to claim the critical necessity of ideal preoperative radiography. Ideal preoperative X-ray imaging must include a straight-on angle that splits the mesial and distal contacts perfectly—taken either as a periapical or as a bitewing X-ray image, then at least one ideal off-angle view in order to capture data from the Z-plane (bucco-lingual) of the tooth in question.

In my practice, a mesial off-angle view of anteriors and premolars works well, because it is much easier to capture than a distal angle, and in anteriors and premolars the mesial view reveals as much radicular anatomy as a distal view. In molars it is different, in molars a distal view is far preferable to a mesial off-angle view, as the mesial view superimposes the body of both roots over the distally curved root structure, while the distal view casts the apical root end sideways, where it can be more easily seen on the radiographic image.

Of course, Cone Beam CT (CBCT) imaging is the unfair endodontic imaging advantage. If told I could have either a microscope or a CT machine, but not both, I would choose 3-D imaging every time. Only CBCT imaging can capture the mesial view of root structure—the view in which we see “The Secret Life of Root Canals”—the bucco-lingual plane containing the greatest degree of anatomic complexity. One of the greatest joys of having a CT machine in practice is knowing, for sure, before the access procedure is begun, that there is only a single canal in the mesiobuccal root of an upper molar. Conversely, one of the few negative experiences to be had with this technology is when the reconstructed volume shows two or three canals, in a root that has given up only one to the clinician’s exhaustive search.

The first gift of CBCT imaging to the field of endodontics has been the gift of finding all canals in a given tooth. Its second gift is the great diminution of access size possible, because the access cavity is no longer the primary viewing port into the pulp chamber and beyond. In fact, CT imaging is the ONLY view needed into the anatomic verities of root canal spaces, allowing access cavities to be used exclusively as treatment, rather than as exploratory portals. Ultimately, RCT access procedures will be done with CT-generated drill guides, allowing molars to be treated through 3–4 1mm pea-holes, rather than the 2–4mm access cavities used today.

Outline Form

So what are the objectives we consider when planning the invasion of a root canal space? Basically, all the best access cavities are cut in a precise balance between conservation and convenience form. We cut as little tooth structure as possible, while ensuring ideal pathways into each canal. Access outline form objectives become fairly simple then; we demand convenience form, otherwise we cannot complete our task, yet we always strive to preserve the structural integrity of the tooth. This boils down to three easily remembered objectives:

1. In anteriors and premolars, conservation form is found in the mesial-to-distal dimension. Traditionally, anterior access cavity outline form has been triangular because of the mesial and distal pulp horns in these teeth - logical until we consider the structural consequences, a needless weakening of coronal tooth structure to insure these lateral pulp horns are cleaned out, when the smallest undercut with a #2 Mueller Bur or Buc-1 ultrasonic tip (Spartan) could suffice as well. Premolars have pulp chambers like the shape of a hand, which is fortunately arranged in a bucco-lingual direction, the angle of the recommended slot-like access cavity outline form is bucco-lingual as well, simultaneously combining convenience conservation form.

In anterior teeth, convenience form is harder won as the incisal edge is to be avoided, out of respect for post-endodontic esthetic objectives, thus requiring a deeper cut under the cingulum, to allow a more straight-line entry path, while minding the “no-fly zone” of the incisal edge. The most dangerous anterior access cavity error is not cutting adequately through what Dr. Schilder called the “lingual dentinal triangle” under the cingulum, and this can be accomplished with minimal structural weakening when the mesio-distal dimension is kept to 1–1.5mm width (Fig. 1).
2. In posterior teeth, premolars and molars, it is important to remember that their occlusal surfaces are not centered over the root structure, but are skewed towards the idling cusp side of the root structure. As pulp chambers are centered in the root structure, not centered under the occlusal surface, access in posterior teeth is best accomplished by cutting near working cusps, while staying 1-2mm away from idling cusps (Fig. 2).

3. In molars, conservation form is held by avoiding the distal half of the occlusal plane, as ideal file paths from the distal canals of upper and lower molars are canted severely to the mesial, so much so that distal canals of lower molars are best referenced to MB or ML cusp tips, and disto-buccal canals of upper molars are best referenced to palatal cusp tips. Convenience form is achieved by cutting the mesial wall of molar access cavities, parallel to the mesial surface of the tooth (Fig. 3).

Back from the abyss
I was taught Schilder technique at University of the Pacific by Dr. Michael Scianamblo and after grad school, by Dr. Cliff Ruddie. I understood the clinical imperative Dr. Schilder had placed on cutting an access cavity adequate to treat the entire root canal system in a predictable manner, and I enjoyed working through the large access cavities and the generous coronal canal shapes he recommended, until I was brought up short by Dr. Carl Reider, a well-known prosthodontic lecturer from Southern California. When I asked what he most wanted from the endodontists he referred his patients to, he said he wished we could “just suck the pulp out, without cutting any tooth structure.” As we talked, I came to better understand the structural imperative of saving teeth in the long term, setting me on a quest for tools and methods that would allow us to achieve the same consistently ideal endodontic outcomes through smaller access openings and coronal canal shapes. Ultimately, it was the inspiration for my invention of the Maximum Flute Diameter (MFD) limitations on GT and GTX rotary files (DENTSPLY/Tulsa Dental Specialties), the LAX (line angle extension) Guided Access Diamond Burs by SybronEndo, as well as obturation methods using flexible condensation devices, such as System-B Continuous Wave electric heat pluggers (SybronEndo) and GT/GTX Obturators (DENTSPLY/Tulsa Dental Specialties).

The Itty Bitty Access Committee
Since that initial awakening in the 80’s, it felt like being a lone voice in the wilderness until the last ten years, until a new generation of dentists and endodontists, steeped in the new reality of implant dentistry as an alternative to RCT, and have taken up the cry for longer term outcomes through improved post-treatment structural preservation, becoming a group I call The Itty Bitty Access Committee. As so often happens, somebody outside of our specialty, a general dentist named Dr. David Clark, started lecturing on the access elephant in the endodontic living room. He got my buddy Dr. John Khademir turned on by the possibilities that more conservative access cavities could offer the specialty, and one-by-one a group of young endodontists joined the game of who can do a perfect RCT through the smallest access cavity? and became the IBAC club.

The cases shown in Figures 4 through 10—mostly done by IBAC members—make me very happy and afraid at the same time. What the heck are they doing? Little, tiny entries, leaving pulp chamber roofs intact, lateral pulp horns unroofed as well, or just total RCT through previously cut restorative cavities! After getting over my initial shock at what they were accomplishing, I came to understand that the future of endo is very good in these extremely talented hands, and I saw that the procedure I was developing for endodontic surgery—CT-Guided Endodontic Surgery (CT-GES)—could be applied to conventional treatment as well (Figs. 11 and 12).

And morning breaks over the field of Endodontics.

Editorial note: A complete list of references is available from the publisher.

Fig. 4 Mandibular molar with nearly total calcification of the pulp chamber prior to RCT, accomplished through two perfectly dead-on access entry ports, leaving a .75mm high pulp chamber isthmus between. Note the definitive treatment results in the apical thirds of each canal (courtesy Dr. N. Pushpak).

Fig. 5 Postoperative radiograph of a mandibular molar treated through the mesial carious defect and a second small entry cut through the central fossa. Preserving dentin between entry points is referred to as a “truss” access configuration (courtesy Dr. John Khademi).

Fig. 6 This postoperative radiograph shows a very diminutive access cavity opening with both mesial and distal lateral pulp horns unroofed during the RCT procedure, and filled during the postendodontic restorative effort. This appearance is a matter of pride among those in the ‘IBAC’ club (courtesy Dr. Jeff Pafford).

Fig. 7 Access cavities cut in a mandibular molar requiring RCT (left). Postoperative radiograph (right) showing beautiful management of root canal shaping, cleaning, and filling—despite the minimal size of entry. Note the largely remaining pulp chamber roof (courtesy Dr. Steve Baerg).

Fig. 8 This restored access cavity design was opportunistic in the best sense of the word. This patient’s endodontic disease state was resolved with almost no tooth structure being cut and the postoperative structural integrity of a tooth with only a mesial operative restoration. No need for a full-coverage crown (courtesy Dr. Michael Truude).
This lower molar was treated through an access opening that was less than 2 mm square, cut just behind the MB triangular ridge. Note the definitive treatment of the apical thirds of all four canals, despite the narrow entry portal (courtesy Dr. Charles Maupin).

Postoperative radiograph of a mandibular molar treated through an alternative to the truss configuration—an "X-entry" access cavity—a design that minimizes removal of tooth structure in the critical trunk of the tooth (author’s case).

Virtual treatment planning for CT-Guided Endodontic Access (CT-GEA). The tooth to be treated is segmented from the CT volume, ideal access entry paths are plotted through the occlusal surface of the tooth, and a CT-GEA drill is 3-D printed (left-to-right).

Author’s root-fractured #18; that tooth set in stone model after extraction, with the printed CT-GEA drill guide mounted and the first drill in place; the two small access entry holes cut using the drill guide; and a postexercise radiograph showing cones fit in canals after they were negotiated, shaped, and cone fit (left-to-right).
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OROANTRAL FISTULA CLOSURE — using the modified roll envelope technique

Introduction
Oroantral communication is an abnormal connection between the oral cavity and the maxillary sinus, and mainly arises as a complication of exodontia of maxillary molars with roots too close to the sinus, or unsuccessful sinus lift procedures with rupture of the Schneiderian membrane. There is a relatively low risk of oroantral communication after exodontia of maxillary posterior teeth, ranging from 0.31% to 4.7%; however, an oroantral fistula (OAF) may be a source of chronic infection in the maxillary sinus and is of great discomfort to the patient. OAFs with diameters smaller than 2 mm have been reported to close spontaneously; however, the extent of the fistula may then become difficult to establish clinically. Patients with larger fistulas or those with healing impairment require surgical repair techniques.

Common techniques may be used, such as deepithelialization of the edges of the fistula and suturing, bone regeneration techniques using bone particles and membranes, the use of the Bichat’s fat pad combined with mucogingival flaps, as well as periodontal plastic surgery using pedicle flaps, all of which should be considered based on factors such as the size of the defect and duration of the infection. Surgical interventions that permit future implant rehabilitation should be considered when selecting the ideal method.

The literature highlights simplicity and predictability as being paramount in the choice of the periodontal plastic surgical technique, such as the pedicle palatal flap, which allows for ample thickness of keratinized tissue in the periimplant mucosa. Yet, the use of the modified roll envelope technique has not been reported as a treatment option for OAF repair. The purpose of this study was therefore to describe a surgical technique to repair an OAF using the modified roll envelope technique and report on its effectiveness as a possible treatment option.

Clinical case report
A 52-year-old Caucasian female patient and a smoker presented in October 2010 with three OAFs measuring 6 mm, 4 mm and 2 mm in the edentulous maxillary right premolar and molar regions, two months after curettage of the maxillary sinus, which was prescribed after an unsuccessful maxillary sinus lift for implant treatment. The OAF treatment reported in this article was only begun after the patient had signed an informed consent form.
The surgical procedures were preceded by extra- and intra-oral decontamination using 2% and 0.12% chlorhexidine diglucone, respectively. An 15c scalpel blade was used to make a supra-crestal partial incision (not touching the bone) palatally (Fig. 2). The palatal soft tissue was dissected using the trapdoor technique until the extension into the connective tissue was sufficient to cover the area of the fistulas (Fig. 3). Subsequently, two further incisions were made at the ends of the flap and one at the base of the dissected connective tissue with the blade at a right angle to the palatal bone (Fig. 4).

A full-thickness connective tissue flap was then raised and placed buccally. Using the no. 15c blade, a further straight partial incision was made buccally to allow the flap to fold under and cover the defect (Figs. 5a and b). Tetracycline diluted in saline solution (50 mg/ml) was used to irrigate and decontaminate the area (Fig. 6).

Careful suturing of the pedicle flap using biodegradable polyglactin sutures (5-0; Vicryl, Ethicon) was performed in order to stabilize the graft (Fig. 7). Finally, the openings of the fistulas were deep-ithelialized and sutured to achieve a complete seal (Figs. 8 and 9).

Six-month follow-up found complete sealing of the fistulas and the area showed considerable improvement in tissue quality, including an increase in keratinized tissue (Fig. 10).

**Discussion**

This clinical case report with a six-month follow-up presented a modification of the roll envelope technique for connective tissue grafting in a surgical model for OAF repair. Radiographic examination confirmed adequate tissue quality with complete closure of the defect and no relapse. Lesions that connect the oral cavity with the maxillary sinus usually occur after exodontia of maxillary posterior teeth whose apices are located very close to the membrane lining the maxillary sinus. The size of the tract may result in an OAF. The literature reports that lesions smaller than 2 mm in diameter may resolve spontaneously in the presence of a blood clot; however, difficult visual access to the area for inspection may create an obstacle to measuring the clinical extent of the fistula, which, when present in a patient with healing impairment, will require surgical intervention.

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**Fig. 1**
Oroantral fistulas measuring 6mm, 4mm and 2mm.

**Fig. 2**
Supra-crestal incision.

**Fig. 3**
Dissection of the flap.

**Fig. 4**
The pedicle graft dislodged.

**Fig. 5a**
Straight partial incision to release the flap for folding.

**Fig. 5b**
Positioning of the pedicle graft.

**Fig. 6**
Irrigation of the surgical bed with tetracycline.

**Fig. 7**
Flap fixation using polyglactin sutures.
Several techniques describe possible ways to repair an OAF, leaving the surgeon to decide on the most appropriate method for each case, taking into consideration factors such as the size of the fistula and the duration of the infection. Alongside the development of periodontal plastic surgery, new techniques have been reported in the literature for the closure of OAFs using a cutaneous flap from the angular artery, grafting of polyurethane foam-based biodegradable materials and resorbable root analogs.10 The buccal pedicle flap technique combined with the Bichat's fat pad has shown good functional results; however, it causes loss of buccal sulcus depth, which may interfere with future prosthetic rehabilitation.

Among the periodontal plastic surgeries that aim to increase tissue volume in the edentulous alveolar ridge is the roll envelope flap described by Abrams et al. This procedure entails the preparation of a pedicle flap on the palatal aspect of the ridge with the same dimensions as the defect to be corrected. The epithelium is removed and the pedicle flap is tucked into the pocket created between the connective tissue and the periosteum of the buccal region, which is then stabilized with sutures. Considering the need to preserve the donor site, which is left exposed, Scharf et al. described a modification of this technique that preserves the epithelium of the donor site via dissection of the palatal flap. This allows tissue coaptation and suturing of the donor site after flap tucking. This modification reduces the morbidity associated with the original technique and improves postoperative masticatory capacity.

It is, however, important to highlight that in order to achieve a good postoperative outcome, surgical techniques involving pedicle flaps are strictly dependent upon the skills and dexterity of the surgeon, who must be meticulous during tissue manipulation. Therefore, the use of this modified roll envelope technique may be regarded as a feasible approach that allows for a less morbid postoperative recovery owing to flap coaptation without areas of exposed connective tissue. Reduced graft healing time is another factor that improves the quality of the grafted area, with reduced risk of loss of buccal sulcus depth, which in the present case report led to adequate implant-supported prosthetic rehabilitation.

Conclusion
The clinical analysis confirmed adequate tissue quality with complete closure of the OAF, with no relapse and no loss of sulcus depth or keratinized tissue.

Editorial note: A complete list of references is available from the publisher.
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THE ANTIBACTERIAL EFFECTS — of lasers in endodontics

Endodontic infection

Endodontic treatment can attain success rates of between 85 and 97%.
Adequate treatment protocols, knowledge and infection control are essential to achieving such rates (Fig. 1).
It is well known that apical periodontitis is caused by the communication of root-canal micro-organisms and their by-products to the surrounding periodontal structures. Exposure of dental pulp directly to the oral cavity or via accessory canals, open dentinal tubules or periodontal pockets is the most probable route of the endodontic infection.

Clinically, apical periodontitis is not evident as long as the necrotic tissue is not infected with micro-organisms. There are up to 40 isolated species of bacteria present in the root canal. Cocci, rods, filaments, spirochaetes, anaerobic and facultative anaerobic are frequently identified in primary infection. Fungus can also be isolated.
Endodontic microbiota can be found suspended in the main root canal, attached to the canal walls and deep in the dentinal tubules at a depth of up to 300 μm (Fig. 2). The absence of cementum dramatically increases bacterial penetration into dentinal tubules.

It has been shown that bacteria can also been found outside the root-canal system, located at the apical cementum and as an external biofilm on the apex. Following conventional endodontic treatment, to 20% of non-vital teeth with apical periodontitis fail. The presence of bacteria after the decontamination phase or the inability to seal root canals after treatment are reasons for failure. The remaining contamination in endodontically treated teeth continues the infectious disease process in the periapical tissue.

Retreatments are the first choice for failed root canals. The microbiota found in persistent infections differ from that in primary infection (Fig. 3). Facultative anaerobic Gram-positive (G+) and -negative (G-) micro-organisms and fungi are common. Special attention is given to Enterococcus faecalis, a resistant facultative anaerobic G+ cocci, identified in a much higher incidence in failed root canals.
The importance of bacterial control plays a significant role in endodontic success. Adequate and effective disinfection of the root-canal system is necessary.

Endodontic therapy

The bacterial flora of the root canal must be actively eliminated through a combination of debridement and antimicrobial chemical treatment. Mechanical instrumentation eliminates more than 90% of the microbial amount. An important point to note is the adequate shaping of the root canal. Evaluating the antibacterial efficacy of mechanical preparation itself, Dalton et al. conclude that instrumentation to an apical size of #25 resulted in 20% of canals free of cultivable bacteria. When shaped to a size of #35, 60% showed negative results.

Irrigating solution has been used with mechanical instrumentation to facilitate an instrument’s cutting efficiency, remove debris and the smear layer, dissolve organic matter, clean inaccessible areas and act against micro-organisms. Sodium hypochlorite is the most common irrigant used in endodontics. It has an excellent cleansing ability, dissolves necrotic tissue, has a potential antibacterial effect and, depending on the concentration, is well tolerated by biological tissues. When accompanied by mechanical instrumentation, it reduces the number of infected canals by 40 to 50%. Other irrigating solutions are also used during endodontic preparation. EDTA, a chelating agent used primarily to remove the smear layer and facilitate the removal of debris from the canal, has no antibacterial effect. Chlorhexidine gluconate has a strong antibacterial effect on an extensive number of bacterial species, even the resistant E. faecalis, but it does not break down proteins and necrotic tissue as sodium hypochlorite does.

As mechanical instrumentation and irrigating solutions are not able to eliminate bacteria from the canal system totally—a requirement for root-canal filling—additional substances and medicaments have been tested in order to address the gap in standard endodontic protocols. The principal goal of dressing the root canal between appointments is to ensure safe antibacterial action with long-lasting effects. A great number of medicaments have been used as dressing material, such as formocresol, camphorated para-chlorophenol, eugenol, iodine-potassium iodide, antibiotics, calcium hydroxide and chlorhexidine.

Calcium hydroxide has been used in endodontic therapy since 1920. With a high pH at saturation (pH above 11), it induces mineralization, reduces bacteria and dissolves tissue. For extended antibacterial effectiveness, the pH must be kept high in the canal and in the dentine as well. Sustaining the pH depends on the diffusion through dentinal tubules.
Although most micro-organisms are destroyed at pH of 9.5, a few can survive a pH of 11 or higher, such as *E. faecalis* and *Candida*. Because of the resistance of some micro-organisms to conventional treatment protocols—and the direct relation between the presence of viable bacteria in the canal system and the reduced rate of treatment success—additional effort has to be made to control canal system infection.

**Lasers in endodontics**

Lasers were introduced to endodontics as a complementary therapy to conventional antibacterial treatment. The antibacterial action of Nd:YAG, diodes, Er:YAG and photo-activated disinfection (PAD) have been explored by a number of investigators. In the following section, each laser is evaluated with the aim of selecting an adequate protocol with a high probability of success in teeth with apical periodontitis.

**Nd:YAG laser**

The Nd:YAG laser was one of the first lasers tested in endodontics. It is a solid-state laser. The active medium is usually yttrium aluminium garnet (Y₃Al₅O₁₂), where some Y³⁺ ions are replaced by Nd³⁺ ions. It is a four-level energy system operating in a continuous wave or pulsed mode. It emits a 1,064 nm infra-red wavelength. Thus, this laser needs a guide light for clinical application. Flexible fibers with a diameter between 200 and 400 μm are used as delivery systems. The laser can be used on intra-canal surfaces, in contact mode (Figs. 4a and b).

The typical morphology of root-canal walls treated with the Nd:YAG laser shows melted dentine with a globular and glassy appearance, and few areas are covered by a smear layer. Some areas show dentinal tubules sealed by fusion of the dentine and deposits of mineral components. This morphological modification reduces dentine permeability significantly. However, because the emission of the laser beam from the optical fibre is directed along the root canal, not laterally, not all root-canal walls are irradiated, which gives more effective action at the apical areas of the root. Undesirable morphological changes, such as carbonization and cracks, are seen only when high energy parameters are used.
One of the major problems regarding intra-canal laser irradiation is the temperature increase at the external surface of the root. Laser light exerts a thermal effect when it reaches tissue. The heat is directly associated with the energy used, time and irradiation mode. An increase in temperature levels above 10°C per minute can cause damage to periodontal tissues, such as necrosis and anchylosis.

Lan evaluated in vitro the temperature increase on the external surface of the root after irradiation with a Nd:YAG laser under the following energy parameters: 50, 80 and 100 mJ at 10, 20 and 30 pulses per second. The increase of temperature was less than 10°C. The same results were obtained by Bachman et al., Kimura et al. and Gutknecht et al. In contrast to the external surface, the intra-canal temperature rises dramatically at the apical area, promoting effective action against bacterial contamination. For the Nd:YAG laser, 1.5 W and 15 Hz, are safe energy parameters for temperature and morphological changes.

The primary use of the Nd:YAG laser in endodontics is focused on elimination of micro-organisms in the root-canal system. Rooney et al. evaluated the antibacterial effect of Nd:YAG lasers in vitro. Bacterial reduction was obtained considering energy parameters. The researchers developed different in vitro models simulating the organisms expected in non-vital, contaminated teeth. Nd:YAG irradiation was effective for Bacillus stearothermophilus, Streptococcus faecalis, Escherichia coli, Streptococcus mutans, Streptococcus sanguis, Prevotella intermedia, and a specific micro-organism resistant to conventional endodontic treatment, E. faecalis. Nd:YAG has an antibacterial effect in dentine at a depth of 1,000 μm (Fig. 5).

Histological models were also developed in order to evaluate periapical tissue response after intra-canal Nd:YAG laser irradiation. Suda et al. demonstrated in dog models that Nd:YAG irradiation at 100 mJ/30 pulses per second for 30 seconds was safe to surrounding root tissues. Maresca et al. using human teeth indicated for apical surgery, corroborated Suda et al.’s and Ianamoto et al.’s results. Koba et al. analyzed histopathological inflammatory response after Nd:YAG irradiation in dogs at 1 and 2 W. Results showed significant inflammatory reduction at four and eight weeks compared with the non-irradiated group.

Clinical reports published in the literature confirm the benefits of intra-canal Nd:YAG irradiation. In 1993, Eduardo et al. published a successful clinical case that combined conventional endodontic treatment with Nd:YAG irradiation for retreatment, apical periodontitis, acute abscess and perforation. Clinical and radiographic follow-up showed complete healing after six months.

Similar results were shown by Camargo et al. Gutknecht et al. reported a significant improvement in healing of laser-treated infected canals, when compared with non-irradiated cases.

Camargo et al. compared in vivo the antibacterial effects of conventional endodontic treatment and the conventional protocol associated with the Nd:YAG laser. Asymptomatic teeth with apical radiolucency and necrotic pulps were selected and divided into two groups: conventional treatment and laser irradiated. Microbiological samples were taken before canal instrumentation, after canal preparation and/or laser irradiation and one week after treatment.

The results showed a significant antibacterial effect in the laser group compared with conventional treatment. When no other bactericidal agent was used, it was assumed that the Nd:YAG laser played a specific role in bacterial reduction for endodontic treatment in patients.

Diodes
The diode laser is a solid-state semiconductor laser that uses a combination of gallium, arsenide, aluminium and/or indium as the active medium. The available wavelength for dental use ranges between 800 and 1,064 nm and emits in continuous wave and gated pulsed mode using an optical fibre as the delivery system (Figs. 6a and b). Diode lasers have gained increasing importance in dentistry owing to their compactness and affordable cost. A combination of smear layer removal, bacterial
reduction and reduced apical leakage are advantages of this laser and make it viable for endodontic treatment. The principal laser action is photo-thermal.

The thermal effect on tissue depends on the irradiation mode and settings. Wang et al. irradiated root canals in vitro and demonstrated a maximum temperature increase of 8.1°C using 5W for seven seconds. Similar results were obtained by Da Costa Ribeiro. Gutknecht et al. evaluated intra-canal diode irradiation with an output of 1.5W and observed a temperature increase of 7°C in the external surface of the root using a 980 nm diode laser at a power setting of 2.5W at a continuous and chopped mode, and found that the temperature increase never exceeded 47°C, which is considered safe for periodontal structures.

Clean intra-canal dentinal surfaces with sealed dentinal tubules, indicating melting and recrystallization, were morphological changes observed at the apical portion of the root after intra-canal diode irradiation. In general, near infra-red wavelengths, such as 1,064 and 980 nm, promote fusion and recrystallization on the dentinal surface, sealing dentinal tubules.

The apparent consensus is that diode laser irradiation has a potential antibacterial effect. In most cases, the effect is directly related to the amount of energy delivered. In a comparative study by Gutknecht et al., an 810 nm diode was able to reduce bacterial contamination by up to 88.38% with a distal output of 0.6W in continuous wave mode. A 980 nm diode laser has an efficient antibacterial effect of an average of between 77 to 97% in root canals contaminated with E. faecalis. Energy outputs of 1.7, 2.3 and 2.8W were tested. Efficiency was directly related to the amount of energy and dentine thickness.

Er:YAG laser
Er:YAG lasers are solid-state lasers with a lasing medium of erbium-doped yttrium aluminium garnet (Er:Y₃Al₅O₁₂). Er:YAG lasers typically emit light with a wavelength of 2,940nm, which is infra-red light. Unlike Nd:YAG lasers, the output of an Er:YAG laser is strongly absorbed by water because of atomic resonances. The Er:YAG wavelength is well absorbed by hard dental tissue. This laser was approved for dental procedures in 1997. Smear layer removal, canal preparation and apicectomy are indications for endodontic use.

The morphology of a dentinal surface irradiated with an Er:YAG laser is characterized by clean areas showing open dentinal tubules, free of a smear layer, in a globular surface. Bacterial reduction using the Er:YAG was observed by Moritz et al.

Stabholz et al. described a new endodontic tip that can be used with an Er:YAG laser system. The tip allows lateral emission of the radiation rather than direct emission through a single opening at the far end. It emits through a spiral tip located along the length of the tip. In examining the efficacy of the spiral tip in removing the smear layer, Stabholz et al. found clean intra-canal dentinal walls free of a smear layer and debris under SEM evaluation.

Photoactivated disinfection
PAD is another method of disinfection in endodontics and is based on the principle that photo-activated substances, which are activated by light of a particular wavelength, bind to target cells. Free radicals are formed, producing a toxic effect to bacteria. Toluidine blue and methylene blue are examples of photo-activated substances. Toluidine blue is able to kill most oral bacteria. In in vitro studies, PAD has an effective action against photosensitive bacteria such as E. faecalis, Fusobacterium nucleatum, P. Intermedia, Peptostreptococcus micros and Actinomycetemcomitans. On the other hand, Souza et al., evaluating PAD antibacterial effects as a supplement to instrumentation/irrigation of canals infected with E. faecalis, did not
prove a significant effect regarding intra-canal disinfection. Further adjustments to the PAD protocols and comparative research models may be required before recommendations can be made regarding clinical usage.

**Discussion and conclusion**

There are good reasons to focus the treatment of non-vital contaminated teeth on the destruction of bacteria in the root canal. The possibility of a favorable treatment outcome is significantly higher if the canal is free from bacteria when it is obturated. If, on the other hand, bacteria persist at the time of root filling, there is a higher risk of treatment failure. Therefore, the prime objective of treatment is to achieve complete elimination of all bacteria from the root-canal system.2, 31

Today, the potential antibacterial effect of laser irradiation associated with the bio-stimulation action and accelerated healing process is well known. Research has supported the improvement of endodontic protocol. Laser therapy in endodontic treatment offers benefits to conventional treatment, such as minimal apical leakage, effective action against resistant microorganisms and external apical biofilm, and an increase in periapical tissue repair. For this reason, laser procedures have been incorporated into conventional therapeutic concepts to improve endodontic therapy (Fig. 8).

Clinical studies have proven the benefits of an endodontic laser protocol in apical periodontitis treatment. For endodontic treatment, the protocol entails standard treatment strategies for cleaning and shaping the root canal to a minimum of #35, irrigating solutions with antibacterial properties and intra-canal laser irradiation using controlled energy parameters. Ideal sealing of the root canal and adequate coronal restoration are needed for an optimal result.

In practice, little additional time is required for laser treatment. Irradiation is simple when flexible optical fibers of 200 μm in diameter are used. The fibre can easily reach the apical third of the root canal, even in curved molars (Fig. 9). The released laser energy has an effect in dentine layers and beyond the apex in the periapical region. The laser’s effect extends to inaccessible areas, such as external biofilm at the root apex.

The irradiation technique must adhere to the following basic principles. A humid root canal is required and rotary movements from the coronal portion to the apex should be carried out, as well as scanning the root canal walls in contact mode (Figs. 10a–c). The power settings and irradiation mode depend on one’s choice of a specific wavelength.

Nd:YAG, diodes of different wavelengths, Er:YAG, and low-power lasers can be used for different procedures with acceptable results. Laser technology in dentistry is a reality. The development of specific delivery systems and the evolution of lasers combined with a better understanding of laser-tissue interaction increase the opportunities and indications in the endodontic field.
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- The full name of any other person traveling with the participant as it appears on his/her passport
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- The number of days for which the participant will be in the destination country, as well as the dates
- The complete address and contact information of the national embassy to which the letter of request for a visa must be sent

Payment and cancellation policy

- Installment payment options are available to participants upon request.
- The initial deposit is non-refundable.
- Installment payments are non-refundable for the immediate upcoming session.
- In the event that a session is cancelled or postponed, the organizer will offer a similar alternative or a refund will be granted to participants if no alternative is available.
In parallel to the works of the congress, the following will take place:

- One-day conference on orthodontics
- One-day conference on dental laboratory technology
- Live Cases on patients
- Hands-on Seminars

An exhibition of items used in dentistry and dental laboratory technology will be held during the congress at a space of 5,000 sq.m. Entrance to the exhibition will be free.

ATHENS, GREECE
May 22-24 2015

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