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cosmetic dentistry _ beauty & science

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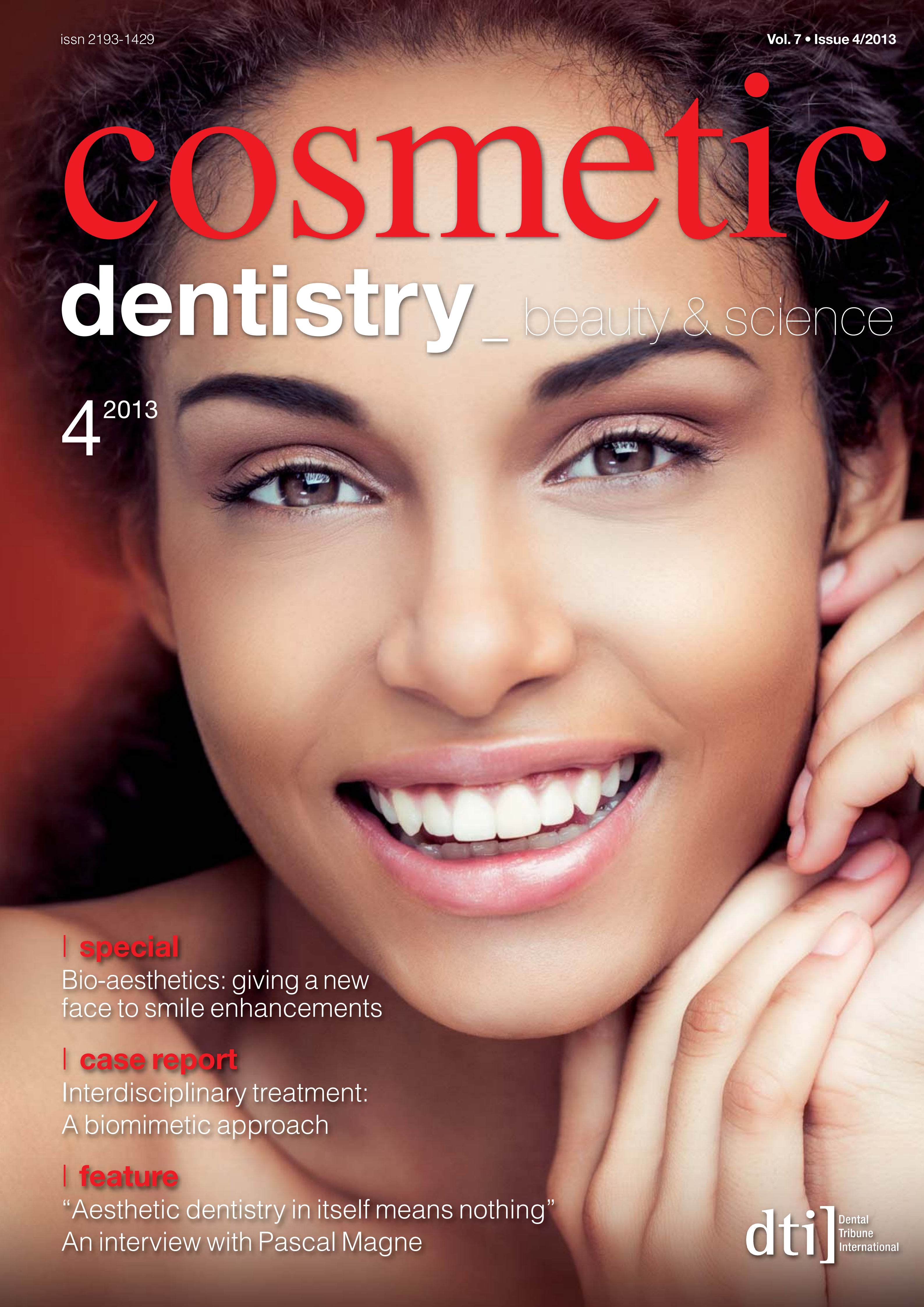

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| feature
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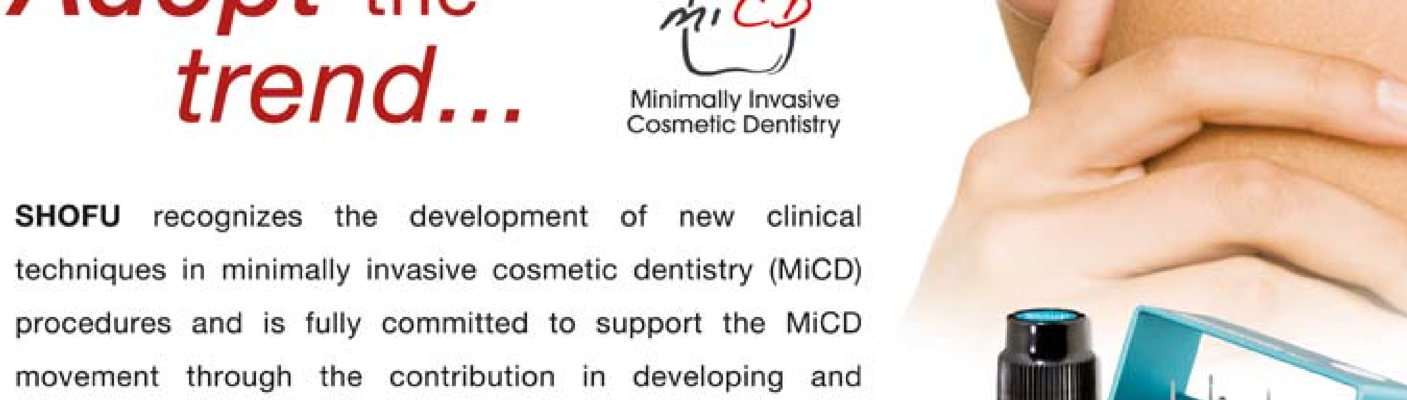

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Dear Reader,

Dr So Ran Kwon
Co-Editor-in-Chief

_**Modern science and technology** are making tremendous advances and changes in all aspects of dentistry. The rapid integration of technology has dramatically improved the way we collect and acquire information, and has greatly facilitated successful diagnosis and treatment planning.

Since beauty is subjective, successful cosmetic dentistry requires skills beyond the ability to diagnose and treat functional or pathological irregularities. Besides entailing attention to function and pathology, cosmetic treatment requires mastery of the art of understanding different types of personalities with different expectations for treatment. Proper communication appropriate to each type will not only enhance the doctor–patient relationship, but also provide greater acceptance of treatment planning.

According to Chu and colleagues, patient expectations fall into three categories: Hollywood, "Alfred E. Neuman" and the naturalist. The first type desires very white and straight restorations, and is generally very concerned and vocal. The second type tends to rely on the clinician's expertise and follow his or her recommendations. The naturalist is often the most difficult to treat because of the expectation that all the restorations should look natural and blend in perfectly with rest of the dentition.

In this issue of cosmetic **dentistry**, we have included beautifully illustrated and documented articles that provide the solutions to improving aesthetics in CAD/CAM dentistry and present the concept of bio-aesthetics, giving a new face to smile enhancement. Emphasis has also been placed on interdisciplinary treatment planning using a biomimetic approach. I hope you will enjoy this edition and apply your new knowledge to your daily practice successfully.

Yours faithfully,

Dr So Ran Kwon
Co-Editor-in-Chief
President, Korean Bleaching Society
Seoul, Korea

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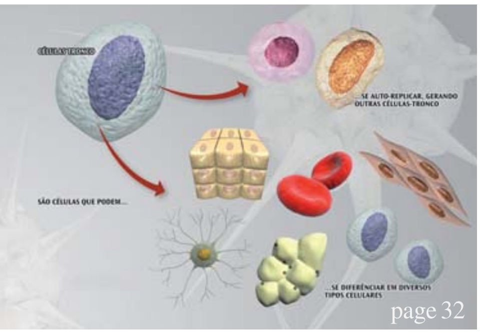

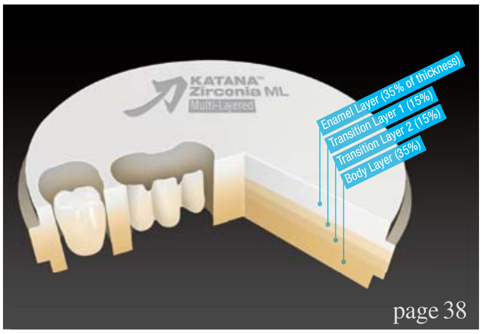

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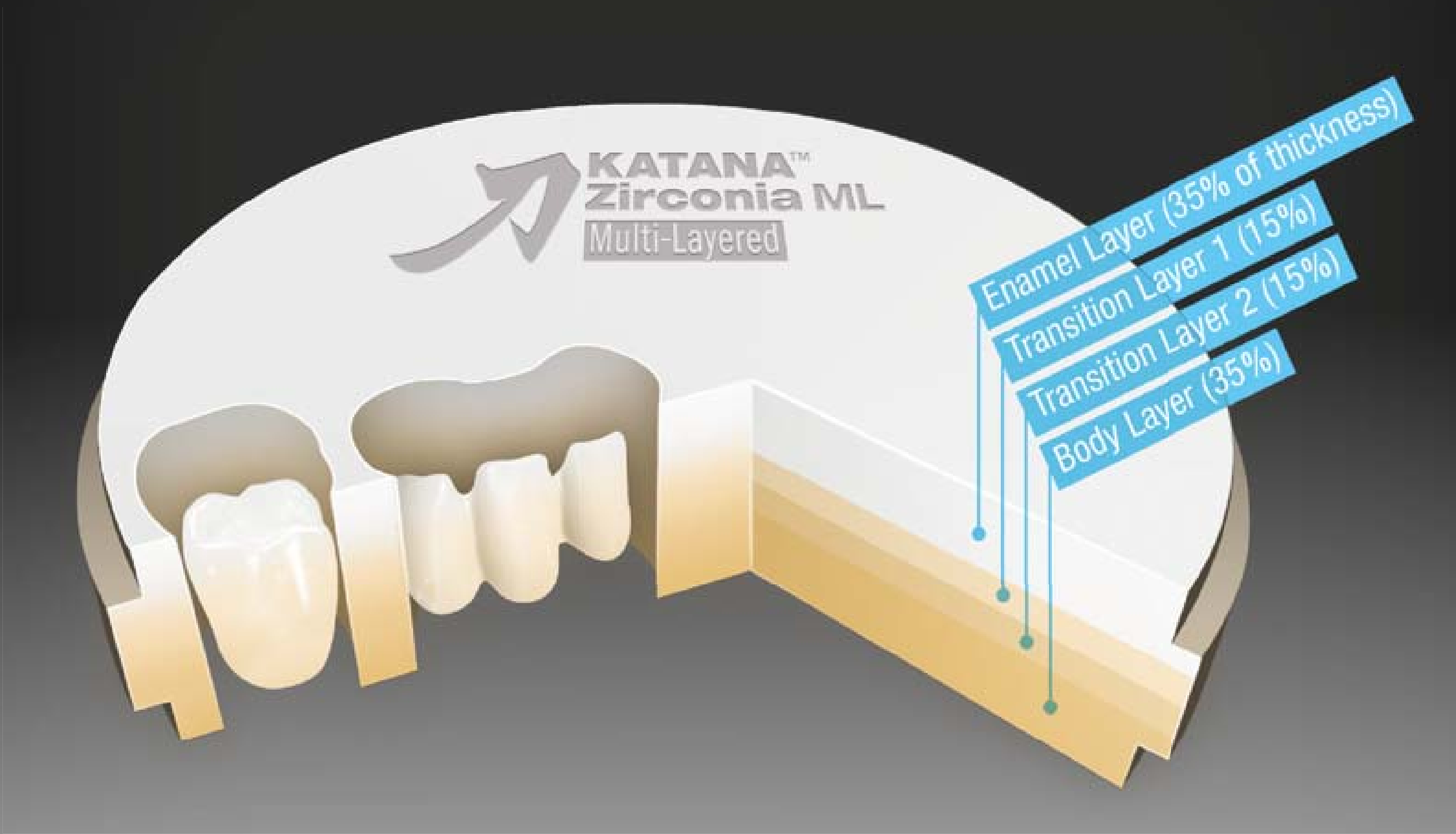

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Bio-aesthetics:
giving a new face to smile enhancements

Author _ Dr Didier Dietschi, Switzerland

Bio-aesthetics is the quintessence of biology, biomechanics and aesthetics and aims to more conservative, ethical solutions to a myriad of aesthetic deficiencies.

_Introduction

A more attractive smile, improved dental aesthetics and durable results have been for long intimately linked to ceramic restorations such as veneers and crowns and remain strongly anchored in patients and dental professional minds. Modern composite resin technology has however challenged this assumption because they offer excellent aesthetic potential and acceptable longevity, with a much lower cost than equivalent ceramic restorations for the treatment of both anterior and posterior teeth.[1–3] Moreover, composite restorations allow for minimally invasive preparations or no preparation at all when modifying existing tooth anatomy or assuming the replacement of decayed tissues; this constitutes an unparalleled advantage of "free-hand bonding" also due to its relative simplicity. This rationale has been the foundation of a new concept named "bio-aesthetics", giving priority to additive, minimally or microinvasive procedures to preserve tooth biology and biomechanics.

While resin composites are universally considered the "standard of care" material for the filling of small to medium class III, IV and V cavities, they can be used today in many more indications such as the correction of small to moderate aesthetic and functional deficiencies.[2,3…+] Recent developments in composite optical properties and physical properties have also significantly contributed to simplifying their application and improving treatment outcome and predictability.[4–6] The aim of this short article is then to demonstrate the potential and multiple applications of composite as a modern aesthetic restorative material in the context of bio-aesthetic treatment approach.

Fig. 1a Fig. 1b Fig. 1c Fig. 1d

_Revisiting smile rehabilitation concepts: Bio-aesthetics

Choosing the right restorative approach (direct or indirect, composite or ceramics) has been debated over decades and finally, the decision largely depends on the practitioner's own education background and experience with each of the aforementioned options. Only "extreme"

This rationale has been the foundation of a new concept named "bio-aesthetics", giving priority to additive, minimally or microinvasive procedures to preserve tooth biology and biomechanics.

Fig. 1e

Figs. 1a & b_Pre-operative views of a young patient presenting relatively large diastemas distally to lateral incisors. The case is complicated by improper occlusal relationship with lower canines which reduce the space available for restorations.
Figs. 1c–e_Post-operative views showing an improved smile configuration using "no-prep" direct composite restoration (inspiro, Edelweiss DR). This treatment illustrates the "bio-aesthetic" philosophy which truly represents a breakthrough in modern restorative dentistry.


Fig. 2a


Fig. 2b


Fig. 2c


Fig. 2d

Figs. 2a & b_Pre-operative smile of a young patient presenting post-orthodontic enamel hypocalcifications and asymmetrical shorter, incisors.
Fig. 2c_A free-hand mock-up was made to assess the ideal length for an optimal smile configuration.
Fig. 2d_Post-treatment view showing better smile balance and harmony, following micro-abrasion (to remove white spots) and direct bonding (inspire).

Parameters	Direct option	Indirect option veneer to crown
age of the patient	younger	older
size of the decay	smaller	larger
tooth vitality	vital	non-vital
tooth colour	normal	non-treatable discolouration*
facial anatomy	normal	altered
number of restoration	unrelated	unrelated

*using chemical treatments (vital & non-vital bleaching or microabrasion)

Tab. I

Types of procedures	Typical procedures
Non restorative	_Aesthetic chemical treatments (bleaching, micro-abrasion) _Direct bonding
Minimally invasive	_Direct bonding _Ultra-thin Veneers _Modern inlay and onlay techniques
Micro-invasive	_Classical veneers, inlay and onlay
Macro-invasive	_Crowns and bridges

Tab. II

Table I_Treatment decision process.
Table II_Modern progressive treatment concept and various types of procedures.

conditions such as minor aesthetic form and colour corrections or extensive decays in non-vital teeth, lead to evident solutions (direct and respectively indirect restorations), while the majority of other cases lie in a "gray zone" which actually makes a pertinent choice more intricate. A simple yet effective approach to this dilemma relies on a sound bio-mechanical analysis of the teeth potentially involved in the treatment status, combined to the usual functional and aesthetic analysis. Then, having as a prime objective the respect of tooth biology and conservation guides clinician to a logical decisional tree, such as presented in table I.


Fig. 3a

The "Bio-aesthetic" philosophy actually give priority to chemical color improvements (vital bleaching, non-vital bleaching, micro-abrasion), associated to direct composite restorations and bonded ceramic restorations for more extensive decays, limiting the use of traditional full crowns to existing restoration replacement and a few conditions of extreme tooth "fragilization" (weakening). The progressive treatment concept presented in table II then summarizes the modern vision of aesthetic restorative dentistry.

Fig. 3a_Pre-operative views of a young patient showing enamel hypocalcifications and asymmetrical tooth forms.


Fig. 3b


Fig. 3c

Figs. 3b & c_Shade selection is performed using a special dual-laminate shade guide which grants colour predictability (inspiro).
Figs. 3d & e_A partial mock-up (teeth #11 and #12) is made to assess the impact of planned restorations on the smile configuration.


Fig. 3d


Fig. 3e


Fig. 3f


Fig. 3g


Fig. 3h


Fig. 3i


Fig. 3j


Fig. 3k

Figs. 3f & g_Rubber dam is placed to provide an optimal working environment. The full smile (premolar to premolar) is visible to facilitate procedures and especially to keep control of the smile line configuration.

Fig. 3h_A conservative preparation of the white spots is made to provide a minimum space for color correction (1–1.5 mm).

Fig. 3i_A first layer of dentin shade is placed to cover residual discoloured area and provide a correct chroma (body i2, inspiro).

Fig. 3j_The second layer is placed with an achromatic enamel providing proper translucency and opalescence (skin white, inspiro).

Fig. 3k_Further form correction are made with the same enamel shade (no dentin is needed as layers are not thicker than 1–1.25 mm).


Fig. 3l

Fig. 3l_Detailed view of the corrected central and lateral incisors, using minimally invasive approach with direct composite.

Fig. 3m_Post-operative view showing a more harmonious smile configuration and uniform tooth colour.

Fig. 3n_Two years view showing no alteration of these partial composite restorations.

Figs. 3o & p_Anatomical details of the restoration micro-morphology and surface smoothness which proved stable over 2 years of clinical function (inspiro, Edelweiss DR).


Fig. 3m


Fig. 3n


Fig. 3o


Fig. 3p

So far, the over-simplification (mono-incremental) as well as over-complexity (multi-incremental) of shading systems has tremendously limited the benefit of direct composite restorations.

_New shading approach: the natural layering concept

To achieve perfect direct restorations has been for long and hypothetical aim due to the imperfect optical properties of many composite resins systems. So far, the over-simplification (mono-incremental) as well as over-complexity (multi-incremental) of shading systems has tremendously limited the benefit of direct composite restorations. Even today, the complexity of some systems is often associated to shading concepts mimicking ceramic systems (which are applied in totally different layer thicknesses) or the influence of over-meticulous clinicians who compensated deficient composite optical properties with intricate layering concepts. The use of the natural tooth as a model and the identification of respective dentine and enamel optical characteristics (tristimulus L*a*b* colour measurements and contrast ratio) has then been a landmark in developing better direct tooth coloured materials.[4,7–8] The 'natural layering concept' is then a simple and effective approach to creating highly aesthetic direct restorations which has become a reference in the field of composite restorations.[9–12]_

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_about the author

cosmetic dentistry

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"Aesthetic dentistry in itself means nothing"

An interview with Dr Pascal Magne, USA

Dr Pascal Magne

_**Success in aesthetic dentistry** depends on biology, function and mechanics; aesthetic dentistry cannot exist independently. cosmetic **dentistry** had the opportunity to speak with Dr Pascal Magne, a specialist in aesthetic dentistry, lecturer, author of many clinical and research articles and the well-known book *Bonded Porcelain Restorations*, and associate professor at the University of Southern California in Los Angeles, where he holds the Don and Sybil Harrington Foundation Chair in Esthetic Dentistry, about the latest trends in modern restorative dentistry at the 12th Annual Scientific Conference of the Polish Academy of Esthetic Dentistry and Art Oral, which was held in June 2013 in Sopot, Poland.

_cosmetic **dentistry:** *Dr Magne, you created an impressive training programme on aesthetic restorative dentistry and have become one of the most reputable lecturers on this topic. What is the philosophy underlying your success?*

Dr Pascal Magne: I believe that success needs to be defined first. Success at work, success in life, personal success? Often, professional success has been obtained by sacrifice of a personal nature. Can it then still be considered success? I strongly believe in what I call "balanced success", meaning that the most important values, such as spirituality and family, are preserved. I also believe in mentorship.

My advice to young colleagues is to choose one mentor (or several), a kind of dental parent. I know it is not easy to find such a person but it is worth the search. I have been blessed in my career to have three mentors, my clinical mentor, Prof. Urs Belser (University of Geneva); my research mentor, Prof. William Douglas (University of Minnesota); and my dental technique mentor, my brother Michel (university of „life").

Of course, none of this would have been possible without my mentor above all, my Lord Jesus, and I pray to receive his inspiration every day. One of my favourite quotes is Proverbs 16:9: "In his heart a man plans his course, but the Lord determines his steps."

_*What are current concepts in aesthetic restorative dentistry? In which direction is aesthetic dentistry developing?*

Aesthetic dentistry in itself means nothing; it is contingent on biology, function and mechanics. Aesthetic dentistry is the cherry on the cake for those who follow sound biomimetic concepts in restorative dentistry. Above all, as described by Rev. W. John Murray in his book The Realm of Reality, "the aesthetic is itself nothing more than a beautiful symbol of the spiritual, without which spiritual, the aesthetic is a shadow without substance".[1]

I like to remind my patients that they can always have internal beauty, the beauty of the heart, which surpasses physical aesthetics. That said, if we look at your question from a more technical perspective, the answer lies in the biomimetic approach to restorative sciences, which in turn is dependent on adhesive dentistry and minimally invasive approaches—no post, no crown dentistry.

Restorative dentistry is likely to evolve in a manner similar to technological advancements in general. If you have a smartphone, you know what I mean. CAD/CAM and technology will be used increasingly, and I hope for the best, meaning just as an additional tool in our armamentarium and not as an excuse to treat more patients.

I believe we will stop using posts, crowns and metal alloys, and stop performing intentional endodontics eventually—this has already happened for many of us who believe in the biomimetic approach.

My hope is that technology will make better treatment accessible to more patients, with a reduced need for root-canal treatment and crown lengthening. I see an increase in the diagnosis of diet-related problems and improved differential diagnosis between wear- and erosion-related lesions. Such cases will force us to strive for the solution that will preserve as much of the tooth as possible (keep the pulp alive using non-retentive preparation) that is no-post no-crown restorative dentistry. In summary I would say for the future less is more (minimally invasive). We will learn to think differently, think biomimetically, think bonding.

Technically, good bonding implies some cardinal rules: good isolation (very important; ideally a rubber dam) and knowledge of your materials, products, and procedures. A checklist is the best aid—this is similar to pilots going through a checklist before flying an airplane!

Dentists need to have a look at sound, unbiased literature before choosing products. Manufacturers do not always sell the best product but rather the most convenient one. Many new products today have been developed in response to the pressure of the market; for example, one company starts a new trend and then all the other companies follow with competing products even if this trend does not yield the best performance. It is business driven. It happens a lot.

I would say that dentists need to undergo training and gain as much experience as possible because we know that the operator factor is even more critical than the choice of product and technique. This is why as an academic I want my students to have as much experience as possible with the materials and techniques that are going to represent their daily bread when they start their practice. Today, we can no longer ignore that adhesive dentistry is this daily bread.

_Is it possible to reproduce the original stiffness of a tooth? How can this be achieved?

Absolutely! Much research, starting in the early 1980s, has demonstrated that adhesive forces obtained solely on enamel can restore the original stiffness of a tooth. Various degrees of stiffness are obtained with a combination of dental adhesives, composite resins and ceramics that simulate dentine and enamel, respectively.

Fig. 1_Partial bonded restorations teeth 13 to 23 (porcelain by Michel Magne, Oral Design Beverly Hills, on teeth 12–22). (Image courtesy of *European Journal of Esthetic Dentistry*)

_One of the objectives of your courses is to explain a new biomimetic approach to restorative dentistry. What is this concept about?

I can respond in two words: mimicking nature. As said earlier, it implies first respecting biological parameters, such as pulp vitality—once lost, the pulp will not come back and we know that a non-vital tooth has a poor prognosis—then emulating mechanical function as intended by nature. This will ultimately form an aesthetic and pleasing whole with the tooth because dental materials that are able to simulate the mechanical properties of dentine and enamel are also available in tooth colours.

This is the fundamental difference between a filling (old alloy restorations) that only fills a cavity like an obturator and one that rehabilitates the biomechanics of the tooth.

Biomimetic research is changing dentistry using apparently weak materials synergistically to simulate enamel and dentine. After all, enamel is extremely brittle (more brittle than glass) and dentine absolutely not wear resistant; yet, together (bonded) they can make a tooth that can withstand stress and function for a lifetime. How do you explain that? That is synergy! What I call the "dental trinity" (enamel, dentine and dentino-enamel junction) should be the model and we can realistically approach this model today with the structured use of porcelain/ceramics, composite resin, and enamel and dentine bonding agents. Adhesive dentistry is the cornerstone of this process. Even endodontically treated teeth can benefit from this approach because the remaining enamel and dentine can be preserved.

Adhesive dentistry today is capable of producing continuity between the ceramic/polymer and the tooth, and above all allows us to save a great deal of intact tooth structure (adhesion replacing retention and resistance form). It would be foolish to ignore bonding techniques today and remove precious enamel and dentine instead. In summary, it is not about aesthetics but about tooth-conserving dentistry.

Fig. 2_Partial bonded restorations teeth 13 to 23 (porcelain by Michel Magne, Oral Design Beverly Hills, on teeth 12-22) in black and white. (Image courtesy of *European Journal of Esthetic Dentistry*)

I believe biomimetic research will allow us to develop better solutions for tooth replacement. Currently, dental implants are not biomimetic per se because of the lack of periodontal ligament, extreme stiffness, etc. (they are only indirectly biomimetic because they do not require the neighbouring teeth to be altered). We are looking at ways to make them more biomimetic through the use of materials that are more compliant[2] and even adhesive techniques—bonding to implant abutments can be very useful.[3]

_What is your view of the role of CAD/CAM techniques in modern aesthetic restorative dentistry? Is this the future or just a temporary trend?

It is a growing trend, and it will grow not only as a restorative tool but also as a diagnostic tool through the inclusion of various modules, such as wear/erosion monitoring, caries detection, etc. I strongly believe in CAD/CAM but only as a tool, not a philosophy of work. That means that the operator still needs to have his or her own core values, treatment planning strategies, etc. that are totally independent of the tools that are used to reach the treatment objective.

_You have lectured all over the world. What do you think dental education today should entail? What should its main objective be?

I believe that an effective educator should be imbued with passion and knowledge, and must infect others with this passion and knowledge. His or her teaching must be based not only on science, but also on common sense and experience. The educator must not hide anything, especially not his or her failures.

When listening to such a teacher, dentists taking the course should feel empowered with new abilities to provide their patients with durable treatments that are better adapted and more conservative.

Ideally, this kind of teacher should be a model in his or her personal life too. This is the difference between just having success and being a successful human being. I am not saying that I am a successful human being but I strive to be. Albert Einstein once said, "I want to know God's thoughts; the rest are details."

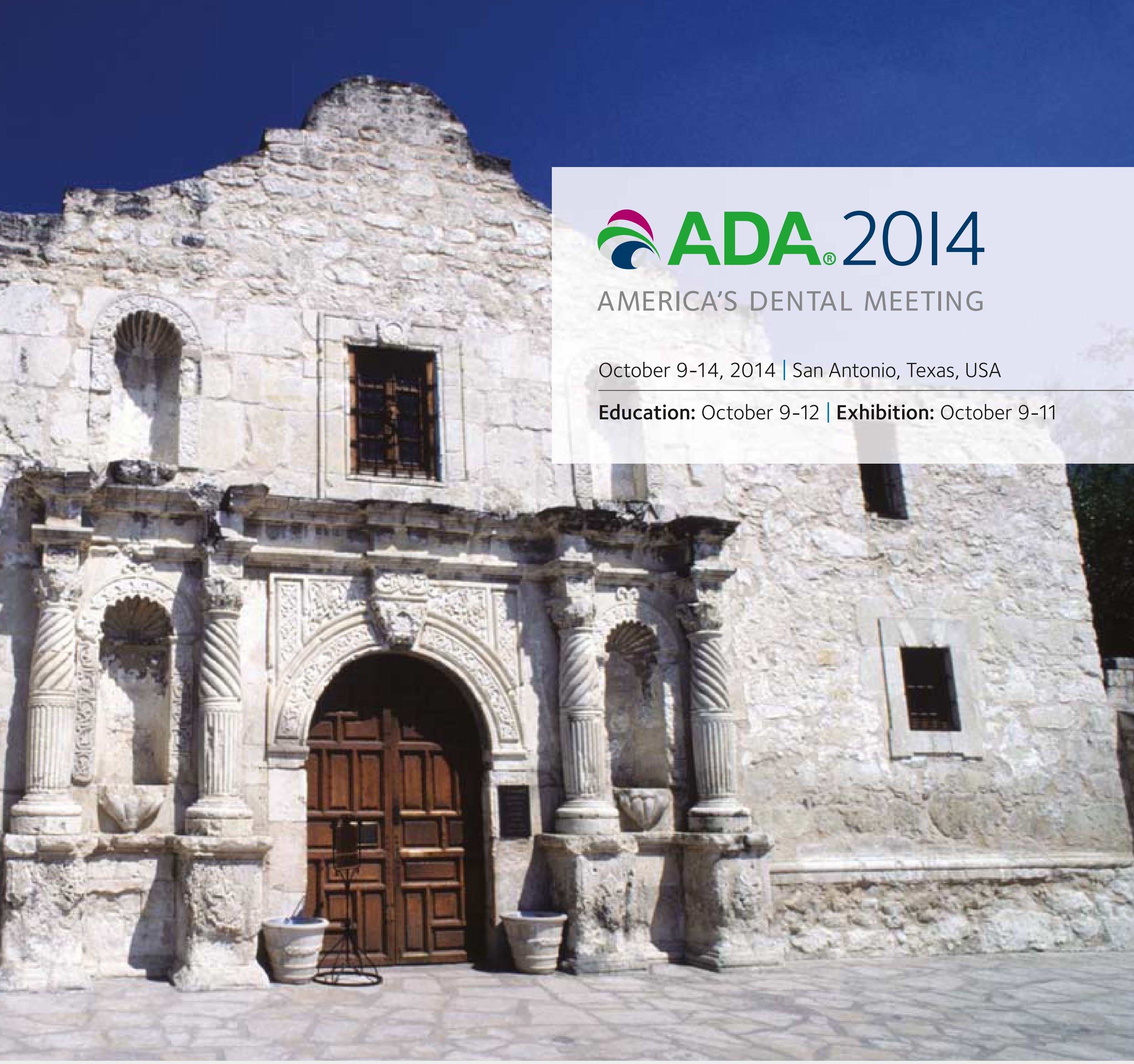
The main objective of dental education should be to establish very strong core values; values that will not age, that will be timeless. We know that ten years from now, most of the materials and tools that we use today will have been supplanted by new ones.

So I always ask my colleagues, "What is it that you would like to be remembered for when you retire?". This question usually calls for a deep reflection about one's values.

Deep respect for God's creation, including teeth, and trying to emulate it—this is the kind of value that I want to pursue.

_Thank you very much for the interview; it was very inspiring.

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



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Improving aesthetics in CAD/CAM dentistry – anatomic shell technique (AST)

Authors_ Dr Paulo Kano, Brazil, Dr Eric Van Dooren, Belgium, Dr Cristiano Xavier, Brazil, Dr Jonathan L. Ferencz, USA, Emerson Lacerda, Brazil & Dr Nelson RFA Silva, Brazil

_Abstract

Challenges in aesthetic dentistry frequently involve achieving natural and lifelike surface textures and ensuring the predictability of the final aesthetic results.

This article presents the anatomic shell technique (AST), which uses flowable composite resin shells as temporary veneers to guide the fabrication of the final restorations and to predict the aesthetic and morphological outcomes using CAD/CAM technology.

_Introduction

Lack of predictability regarding the final aesthetic outcome of CAD/CAM restorations is one of the major concerns among dental professionals, particularly in complex cases involving reconstruction using multiple units. Unfortunately, there is limited literature available on this topic. This article presents a technique in which light-cured flowable composite resin shells are used as temporary veneers prior to the final restoration to predict and preview the aesthetic and morphological outcomes using CAD/CAM technology. A clinical case is used to describe and illustrate the clinical steps.[1]

One of the challenges in aesthetic dentistry is achieving natural and lifelike surface textures.[2] Surface texture directly influences the colour, value and saturation and the zones of light reflection and absorption. An anterior restoration that does not exhibit a surface texture and lustre that is comparable to the adjacent natural teeth will immediately appear to be out of place, particularly when the surface of the surrounding dentition is complex or heavily textured. The natural tooth surface is composed of horizontal and vertical concavities

Figs. 1a–d_The images show the frontal view of the clinical situation. Note the inadequate restoration on tooth 21 and the dark aspect of both tooth 11 and tooth 21 (a & b). Frontal view before and after the temporary restoration was fabricated for tooth 21 (c & d). The temporary crown was made with a lighter shade to create a more suitable substrate for the aesthetic evaluation after composite resin shells had been placed. Note the dark substrate of tooth 11.


Fig. 2a


Fig. 2b

and convexities that vary in complexity and intensity from tooth to tooth. The ability to observe and replicate the surface texture and lustre to create an anterior restoration that is indistinguishable from adjacent natural teeth typically requires a highly skilled laboratory technician. However, if one could mimic the surface texture of adjacent natural tooth surfaces and use a milling machine to reproduce it, one could provide a very good aesthetic restoration without the need for a highly skilled laboratory technician. The goal of this article is to describe a novel approach that attempts to reproduce the complexities and nuances observed in the surface texture and lustre of natural teeth utilising the AST technique for CAD/CAM restorations.

At this point, it was decided to address the patient's aesthetic goals with porcelain veneers. To achieve a rapid aesthetic transformation, the treatment plan involved using digital dental technology together with a novel concept in which composite resin temporary veneers (composite resin shells) were utilised prior to the placement of the final restorations to predict the final aesthetic outcome and to provide lifelike texture.

_Materials

IPS Empress CAD Multi (leucite-reinforced glass-ceramic blocks; Ivoclar Vivadent) in shade A2 was selected for the final restorations. No impressions

Figs. 2a & b_Image of the Hajto model showing the surface texture of the anterior teeth (a).
Image of composite shells under polarised light. Note the opalescence of the composite shells when the photograph was taken under polarised light (b).

Figs. 3a–f_Anatomic resin shell being positioned (a), polished (b) and luted (c) without etching and utilising a flowable composite. The texture obtained mimics the original texture of the Hajto model shown in Figure 2 (d–f).

_Case description

The treatment described involved a 43-year-old patient seen at the clinic with the chief complaint of dark staining of his teeth from antibiotic therapy (particularly tooth 21; Figs. 1a–d). The patient stated that his appearance affected his ability to socialise and smile. The patient expressed an interest in having his teeth treated to improve both his appearance and his occlusion.

The clinical examination revealed a very dark root due to endodontic treatment, with compromised remaining coronal structure. The endodontic treatment was accepted and a fibre post was cemented using a dual-cure resin cement (Multilink Automix, Ivoclar Vivadent) according to the manufacturer's instructions, followed by temporisation. Tooth 11 also exhibited an abfraction lesion.


Fig. 3a Fig. 3b Fig. 3c Fig. 3d Fig. 3e Fig. 3f

Fig. 4

Fig. 5

Fig. 4_Initial photographs with composite shells temporarily cemented in place. The shade difference of tooth 11 is due to the dark substrate showing through the composite veneer.

Fig. 5_CEREC Optispray powder was applied in the patient's mouth to coat the teeth fitted with the polished anatomic composite resin shells.

Figs. 6a–e_A digital impression was taken after tooth preparation. The image shows the procedure for tooth 22 (a). The digital image acquired after preparation was

or diagnostic casts were used during the treatment planning and clinical procedures. The entire aesthetic treatment plan relied upon imaging (including photographs), prefabricated Hajto models[3] and dental digital technology (CEREC AC with Bluecam, Sirona—CEREC Software 4.0).

_Description of the anatomic shell technique

The digital smile design protocol[4–8] was used to determine the aesthetic needs of the patient. The patient, with the dentist's assistance, selected the shapes of the teeth that best suited him using digital photographs of natural smiles from a computer smile library.

After determining the ideal shapes and sizes from the digital smile design database, Hajto models[3] were selected based on the previously determined tooth dimensions of the patient. Hajto models are replicas of the ideal natural anterior dentition of males and females, with examples of different tooth shapes, sizes and surface textures. Subsequently, a silicone index (Virtual, Ivoclar Vivadent) was produced from the labial surface of the anterior teeth of the Hajto model that best matched the patient (Figs. 2a & b).

_Composite resin shells

A light-cured flowable composite resin (Tetric EvoFlow Ivoclar Vivadent) was then carefully placed into the index to produce very thin composite shells that duplicated the shape of the model teeth. After complete polymerisation, the composite shells were gently placed intra-orally on the labial surfaces of the teeth and adjusted to obtain the best possible fit (Fig. 3a).

Once the best anatomic resin shell position was obtained, the shells were polished and luted without acid etching using flowable composite (Tetric EvoFlow, Ivoclar Vivadent) (Fig. 3d–f).

The clinician together with the patient evaluated the aesthetic outcome with the polished composite shells in place (Fig. 3d–f). Digital photographs were taken to analyse the symmetry between the teeth and the patient's face. Following the digital imaging analyses, small adjustments were performed at the interproximal embrasures. After completion of the aesthetic modifications and polishing steps, the patient approved the aesthetic design (Fig. 4).

_Digital imaging

In order to facilitate the digital image capturing process, CEREC Optispray powder (Sirona; Fig. 5) was applied in the patient's mouth to coat the teeth restored with the composite resin shells. An intraoral scanner (CEREC Bluecam) was then used to create a 3-D digital model of the full mouth with the temporary composite resin shells.

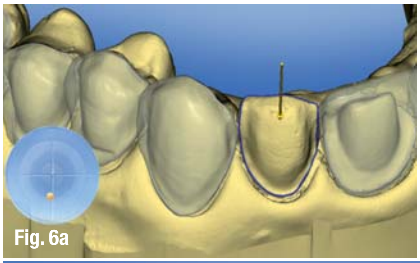

Fig. 6a

Fig. 6b

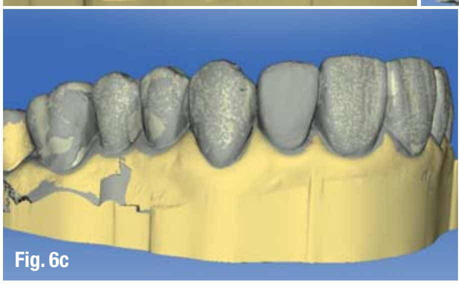

Fig. 6c

Fig. 6d

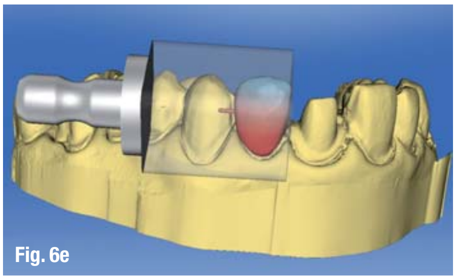

Fig. 6e

Fig. 7a Fig. 7b Fig. 7c

In this procedure, the composite shells help to predict the shape and the final aesthetic outcome of the milling process. They also serve as a guide to establish the amount of reduction necessary during tooth preparation. After the scanning process, the teeth were prepared using the composite resin shells as a reference to determine the amount of tooth reduction.

A digital impression was taken (CEREC Bluecam) after the preparations had been completed. The digital image acquired after preparation was merged and correlated with the digital image taken with the anatomic composite shell in place to generate the proper shape of the permanent veneers to be fabricated (Figs. 6a–e). The milling process was then initiated using a CEREC III milling unit equipped with CEREC Software 4.0.

After the milling process, the veneers were removed from the milling unit and visually inspected for potential flaws. The veneers were then tried-in, polished with 0.6 µ diamond paste and subsequently placed with Variolink Veneer Medium Value 0 (Ivoclar Vivadent) using the adhesive technique according to the manufacturer's instructions (Figs. 7a–c). In order to mask the dark shade of the tooth substrate, a staining agent (IPS Empress Universal Stains, Ivoclar Vivadent) was applied internally to each veneer prior to cementation.

_Conclusion

The concept of chairside CAD/CAM restoration differs from conventional dentistry in that the restoration is typically luted or bonded in place on the same day, whereas conventional dental prostheses of larger size, such as crowns, involve the placement of temporaries for several weeks while a dental laboratory produces the restoration.[1] As the CAD/CAM restoration is bonded on the same day, the principles applied in predicting the final outcomes present unique challenges compared with conventional clinical procedures for any aesthetic treatment. The clinical case described here presented some limitations, as can be seen in the slight bulkiness of the final restorations and the straighter incisal edges of the two central incisors (Figs. 7a–c) compared with the composite shells (Figs. 3d–f). These differences were attributed to a software limitation, as no other anatomical/morphological modification was performed after the milling process had been completed. However, the final outcome using monochromatic blocks was acceptable and the clinical sequence presented here using AST shows a very simple and innovative way to predict the final outcome of an aesthetic treatment and suggests that CAD/CAM technology is a very attractive concept when one understands the materials science, machine capability and the limitations involved._

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

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merged and correlated with the digital image taken with the anatomic composite shell (b) in place to generate the proper shape (c & d) of the permanent veneers to be fabricated (e).

Figs. 7a–c_Photograph of the completed clinical case (a). The final texture produced by the milling machine (b & c) and the quality of the aesthetic result are satisfactory despite the use of a monochromatic ceramic block. The texture matches that of the buccal surface of the Hajto model (Fig. 2a) that was selected for this clinical case.

Interdisciplinary treatment of a patient with 11 missing permanent teeth: A biomimetic approach

Author_ Drs Magdalena Jaszczak-Małkowska, Joanna Witanowska & Małgorzata Zadurska, Poland


Fig. 1a


Fig. 1b


Fig. 2

Figs. 1a & b_Situation before orthodontic treatment.
Fig. 2_A pre-op panoramic radiograph.

_The current level of technology and specialisation in all areas of life allow us to assess correctly our capabilities and limitations in the treatment of our patients. We are no longer trying to improve nature, but we are doing everything to imitate it as perfectly as possible, drawing from its best solutions. This is the essence of biomimetics. It has already been applied in many fields of science


Fig. 3a


Fig. 3b


Fig. 3c


Fig. 4a


Fig. 4b

Figs. 3a–c_Teeth contacts before treatment.
Figs. 4a & b_The maxillary and mandibular arches before treatment.

and technology, including medicine and dentistry. By applying the biomimetic approach to the treatment of our patients, we can achieve satisfying results aesthetically and functionally. The aim of the biomimetic approach is to respect nature and effect as little irreversible change as possible. It is very important for young adult patients, whose entire lives lie before them, and has a great influence on their treatment planning, especially in patients with multiple agenesis Undoubtedly, this is a therapeutic challenge and requires extensive knowledge, experience and close collaboration between different specialists in dentistry.

_Case description

A 19-year-old female sought treatment at the Department of Orthodontics at the Medical University of Warsaw because of her congenitally missing permanent teeth (Figs. 1a & b). During an interview, she reported that her brother and mother also had several missing teeth. Clinical examination revealed a persistent primary maxillary right second molar, the absence of all maxillary premolars, two mandibular second premolars and one mandibular incisor. A panoramic radiograph confirmed the absence of the seven permanent teeth above and all third molars (Fig. 2).

_Occlusal analysis

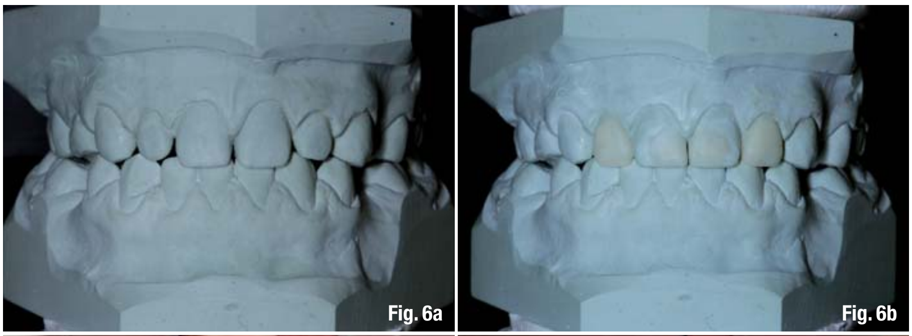
The midline of the maxillary arch did not coincide with the facial midline. The midline of the mandibular arch could not be assessed owing to the presence of three mandibular incisors. The lateral crossbite on the right side was present

Figs. 5a–d_Occlusal contacts after orthodontic treatment, showing the rounded shape of the maxillary incisors.

Figs. 6a & b_Plaster models without (a) and with the diagnostic wax-up (b).

Fig. 7_A panoramic radiograph after implantation.

Figs. 8a–c_Delayed implantation of the implant in region 14.



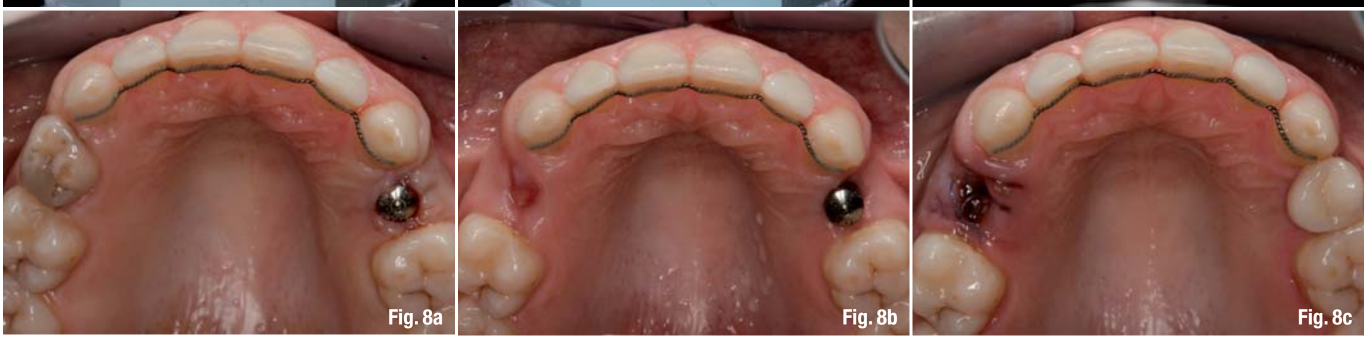



Fig. 9a


Fig. 9b

Figs. 9a & b_Reshaping of the two maxillary central incisors (before and after).

from the lateral incisor to the last tooth in the arch. Transverse and vertical relationships were normal (Figs. 3a–c, 4a & b). During lateral excursions, there


Fig. 10

Fig. 10_The prepared feldspathic veneers for the two maxillary lateral incisors.

was no canine guidance on both sides and traumatic occlusion was present at the second molars. During protrusion, the incisal guidance was maintained.

The incisal edges of the maxillary lateral incisors were rounded, and midline diastemas were present in the maxillary and mandibular arches.

_Treatment plan

Combined orthodontic, prosthodontic, and implant treatment was planned, aimed at restoring aesthetics and function with the maximum preservation of hard tissue, while replacing the missing teeth and reshaping the maxillary lateral incisors. It was planned to close the diastemas between the teeth, restore the midline in both arches and canine guidance, and gain the space necessary for one premolar on each side of the maxilla and the second premolars in the mandible. The missing teeth were to be replaced with crowns supported by implants, while the shape of incisors was to be changed with veneers and direct composite.

_Orthodontic treatment

The first stage of treatment included the orthodontic treatment to correct the lateral crossbite, close spaces in the anterior segment and restore coincidence between the midline of the maxillary arch and the facial midline. The treatment plan also included restoring the coincidence between the maxillary midline and the line between two mandibular incisors on the left side. Therefore, two incisors were left on the right side, whereas on the left side the canine was moved to the position of

Figs. 11a & b_The maxillary lateral incisors before and immediately after placing the veneers, with visible gingival irritation.

Figs. 12a & b_The veneers one week after cementation, showing perfect gingival integration.


Fig. 11a


Fig. 11b


Fig. 12a

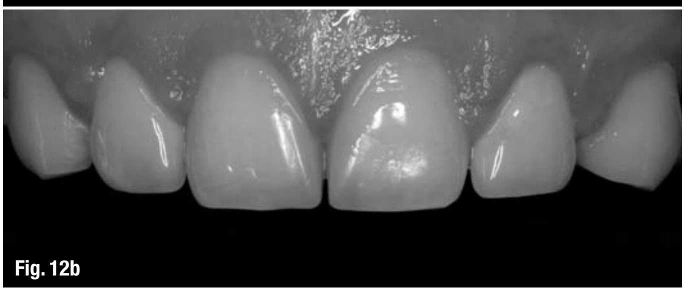
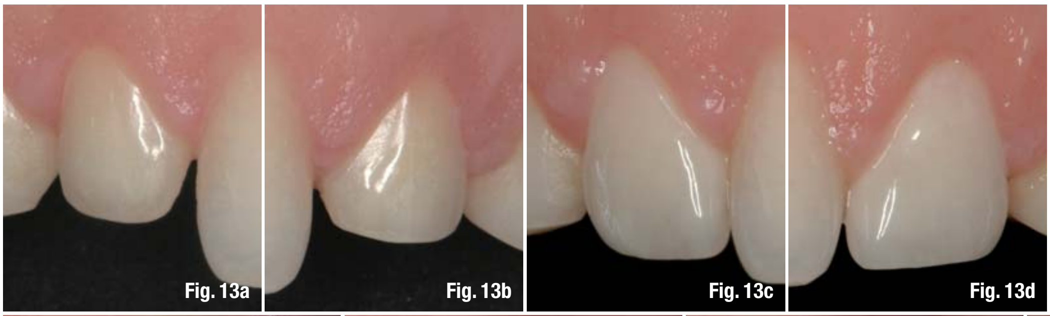


Fig. 12b



Figs. 13a–d_The maxillary lateral incisors without and with veneers, showing perfect white and red aesthetics.

Figs. 14a–d_Gingival shaping with the healing screw and temporary crown (a & b), zirconia abutment and final restoration (c & d).

the missing lateral incisor. Normal intercuspation and canine guidance were achieved on both sides. In the mandibular arch on the left side, the left canine assumed the function of the lateral incisor and the left premolar that of the canine. During orthodontic treatment, the persistent primary tooth was retained, to provide additional anchorage and to maintain the width of the alveolar process.

_Implant-prosthodontic treatment

After orthodontic treatment had been completed, a new occlusal analysis was performed to evaluate the aesthetics and to establish the implant-prosthodontic rehabilitation necessary. Photographs were taken at different angles and diagnostic casts were mounted in an Artex partially adjustable articulator (AmannGirrbach) using the facebow registration and the centric relation registration techniques by Dawson.

_Analysis of occlusion and articulation

Normal occlusion was present, and incisal and canine guidance was restored (disclusion of posterior teeth during protrusion and laterotrusion). Normal occlusal contacts and intercuspation were present. In centric relation, no premature contacts and traumatic occlusion were seen in articulation (centric relation = maximum intercuspation). No subjective or objective temporomandibular joint problems were registered. Spaces were closed and tooth contacts were restored in the maxillary and mandibular anterior segments. The space necessary to restore missing teeth 24, 25 and 45 was established by orthodontic treatment. In order to restore missing tooth 14, the space was maintained by retaining the persistent primary molar (Figs. 5a–d).

_White and red aesthetics

About 1 mm of the incisal edges was visible with lips in the rest position. During smiling, normal exposure of the maxillary teeth was present and the incisal line did not follow the curvature of the lower lip. In order to maintain the canine guidance, elongation of the maxillary incisors was not possible. The anterior gingival margin line was normal.

_Treatment plan re-evaluation

In order to establish the treatment plan and to analyse aesthetics in the anterior segment, the diagnostic wax-up and mock-up were created, which enable an assessment of the proportions

Figs. 15a–c_Teeth contacts after prosthodontic treatment.


Fig. 16a


Fig. 16b


Fig. 17a


Fig. 17b


Fig. 18


Fig. 19a


Fig. 19b

Figs. 16a & b_The maxillary and mandibular arches after prosthodontic treatment.
Figs. 17a & b_The modified zirconia crown on a standard abutment—the visible subgingival part of the crown was not covered with the ceramic.
Fig. 18_The modified crown screwed on to implant 14.
Figs. 19a & b_Post-op situation.

and appearance of the final restoration in the patient's mouth (Figs. 6 a & b). It was decided to recontour the mesial angles of the maxillary central incisors with composite and to apply two ceramic feldspathic veneers sintered on a refractory mass to the lateral incisors. Because the patient did not agree to the recontouring of the maxillary canines, it was decided not to close the gaps between the maxillary lateral incisors and canines to maintain the normal proportions between the central and lateral incisors. The patient is still using permanent and removable retainers The persistent primary tooth 55 was scheduled for extraction. Restoration of all the missing premolars was planned using implant-supported ceramic crowns.

_Implant treatment

CBCT was performed to evaluate the anatomical and surgical conditions, and to plan the surgical treatment. Owing to sufficient height and width of the alveolar process at the implant sites, guided bone regeneration was not required. TSIII implants (OSSTEM; 4 mm × 10 mm S, 3.5 mm × 10 mm M) were used in regions 14 and 24, and TSII implants (OSSTEM; 3.5 mm × 10 mm M, 3.5 mm × 10 mm M) were used in regions 35 and 45. However, delayed implantation in region 14 was performed four weeks after the extraction of tooth 55 (Figs. 7 & 8a–c).

_Prosthodontic treatment

Recontouring of the central incisors was performed using the direct method with GRADIA DIRECT composite (GC Europe) and a two-component adhesive system, CLEARFIL SE BOND (Kuraray Noritake). Mesial angles were recontoured using the standard Hawe celluloid matrix system (Kerr). The composite surface was prepared and polished using Sof-Lex discs (3M ESPE; Figs. 9a & b). The contours of the veneers for teeth 12 and 22 were checked again using a mock-up, and then minor adjustments were performed. Using a specially trimmed silicone mock-up, the amount of space for the planned ceramic reconstructions was determined and the prepa-


Fig. 20

Fig. 20_Harmonous smile after treatment.

Fig. 21a Fig. 21b Fig. 21c Fig. 21d

Fig. 22a Fig. 22b

ration of teeth was abandoned. After cleaning the teeth with pumice and introducing Ultrapak #00 retraction cord (Ultradent) into the gingival sulcus, two-layer single-phase impressions were taken using polyvinyl siloxane impression material (Bisico).

Once the final restorations had been received from the laboratory (Fig. 10), their integrity, match to the abutments and colour were checked using a Variolink Try-in paste (Ivoclar Vivadent). The abutment surfaces were isolated with a rubber dam and cleaned with pumice, then rinsed thoroughly with water and etched with 37 % phosphoric acid for 45 seconds. They were then rinsed with water for the same period. Subsequently, Variolink Veneer light-curing adhesive composite was applied. Meanwhile, the inner surfaces of the veneers were etched with 7 % hydrofluoric acid for 1 minute, rinsed with water and then the veneers were placed in the ultrasonic bath for 2 minutes. Silane (Monobond Plus, Ivoclar Vivadent) was applied to the etched surface of the veneers, which were then dried, and the bonding agent (Heliobond, Ivoclar Vivadent) was applied. Variolink Veneer in shade HV+1 was applied to the veneers' surface and the veneers were placed on the abutments. Excess material was initially removed and precured for 10 seconds. The restoration edges were smeared with glycerine

Figs. 21a–d_Upper incisors after finishing prosthodontic treatment and the two years follow-up.

Figs. 22a & b_Bite after finishing treatment and after two years, stable functional and aesthetic result.

Figs. 23a–d_Bite after finishing treatment and after two years, stable functional and aesthetic result.

Fig. 23a Fig. 23b Fig. 23c Fig. 23d

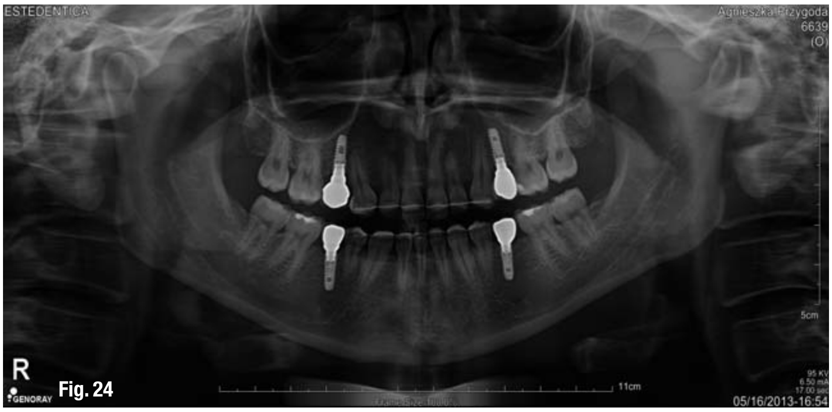


Fig. 24_Pantomographic X-ray two years after implants loading, perfect bone stability.

gel to prevent oxygen access and the formation of an oxygen inhibition layer on the composite bond. Curing was continued with an 800 mW/cm² polymerisation lamp for 60 seconds on each surface. Excess composite was removed with a #12 scalpel blade, and the veneers were polished with strips and rubber polishing burs for composites. Finally, the veneers were checked during occlusion and articulation using 14 µm articulating paper. Corrections were made using a 45 µm smooth diamond-coated bur on a 1:5 speed-increasing handpiece on a micromotor. The final polishing was performed using rubber burs for composites (Figs. 11a & b). After a week, gingival integration with the veneers had been achieved (Figs. 12a & b, 13 a–d).

After a period of healing, the emergence profile of the implant restorations was reshaped using crowns on temporary abutments (Figs. 14a & b). After obtaining a satisfactory effect for implants 24, 35 and 45, permanent zirconia crowns on standard zirconia abutments were fabricated (Figs. 14c & d, 15a–c, 16a & b). Owing to the thick layer of soft tissue, a modified screw-retained zirconia crown on a zirconia abutment was placed on implant 14 (Figs. 17a & b). The emergence profile was reshaped using a crown bonded to the standard zirconia abutment and the crown was veneered with feldspathic ceramics only at the supragingival zone, owing to the unavailability of individually shaped zirconia abutments for the OSSTEM system (Fig. 18).

_Conclusion

Working with patients missing so many permanent teeth is extremely difficult and sometimes marked with compromise. Achieving a satisfactory result both functionally and aesthetically is possible only through the close co-operation of specialists from various fields of dentistry and meticulous planning from the commencement of treatment to the final aesthetic stage (Figs. 19a & b, 20). As I mentioned at the beginning, apart from other crucial issues, it is important to preserve the patient's own tissue as far as possible, which translates into the longevity and stability of the restorations. The case presented demonstrates that. We achieved satisfactory long-term aesthetic and functional results with minimum intervention.

After two years, there is perfect bone stability around the implants (Fig. 21a–d) and excellent gingival integration with the prostheses on both the implants and the natural teeth (Figs. 22a & b, 23a–d, 24)._

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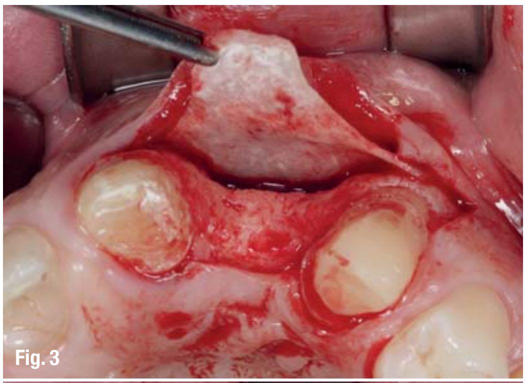
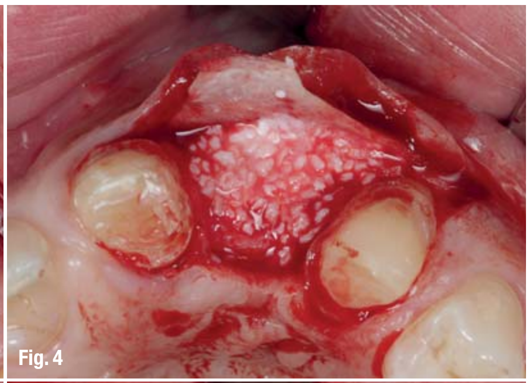
Reconstruction of a horizontal ridge defect using the bone lamina technique

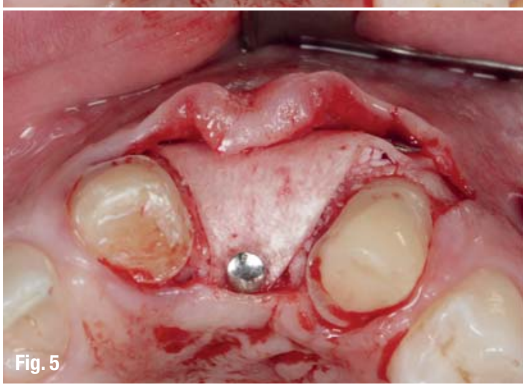
Author_ Dr Arndt Happe, Germany

Fig. 1_Localised horizontal ridge defect. The treatment plan was to place a single implant to replace the lateral incisor.
Fig. 2_A CBCT scan of the defect. The residual ridge width was 5.6 mm.

_In the case presented, the treatment plan was to place a single implant in the aesthetically demanding anterior maxillary region in the place of the left lateral incisor. A moderate horizontal ridge defect was present and the residual bone width was 5.6 mm. A staged approach employing a guided bone regeneration technique with a porcine partially demineralised cortical lamina (OsteoBiol Soft Cortical Lamina, Tecnoss Dental) was chosen. A porcine bone substitute (OsteoBiol mp3, Tecnoss Dental) was used as a filler material.







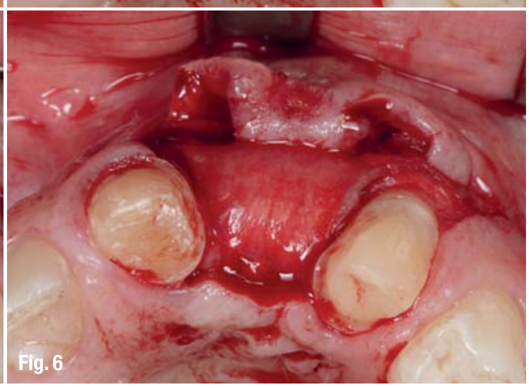
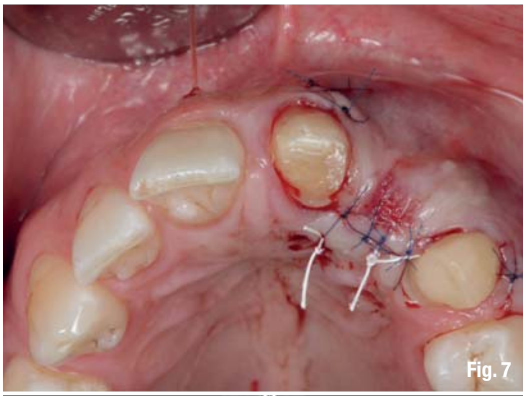
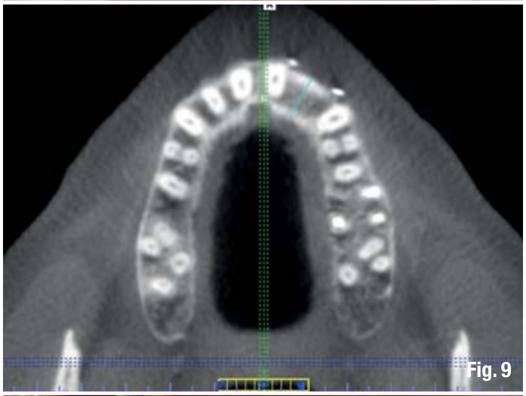
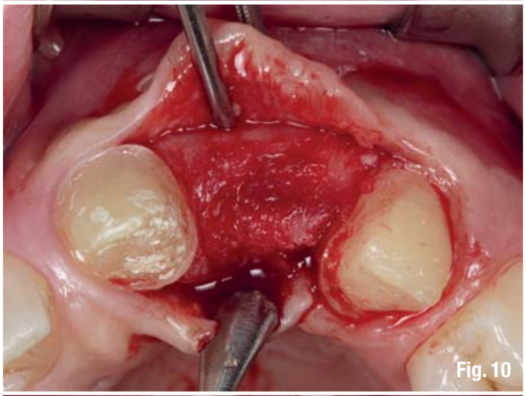


Fig. 3_Once a full thickness flap had been reflected, the buccal plate was reconstructed using OsteoBiol Soft Cortical Lamina. The lamina was secured using titanium pins.
Fig. 4_The defect was filled with OsteoBiol mp3.
Fig. 5_The lamina was shaped such that it could be folded over the coronal aspect of the filler material. A titanium pin was used to secure the lamina here too.
Fig. 6_The lamina itself was covered with a collagen membrane to allow for rapid soft-tissue integration.







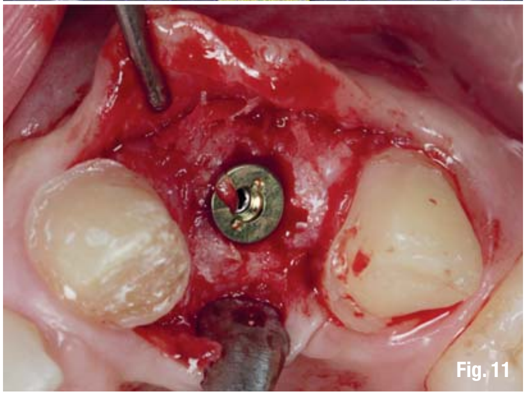


Fig. 7_Meticulous, tension-free soft-tissue closure is crucial for successful regeneration.
Fig. 8_The clinical situation after six months of healing.
Fig. 9_A CBCT scan showing the regenerated area. The ridge width was increased to 10.3 mm. A new cortical plate and cancellous compartment are visible.
Fig. 10_Upon reflection of a full thickness flap, the regenerated tissue is visible. The tissue has a good blood supply and remnants of the lamina are present.
Fig. 11_It was possible to place an implant of 3.8 mm in diameter in the correct 3-D position as planned.
Fig. 12_The regenerated ridge before restorative treatment.

After the augmentation procedure, the lamina was covered with a collagen membrane to allow for rapid soft-tissue integration. The augmentation surgery was completed with meticulous flap closure using microsurgical techniques.

After a healing period of six months, an implant of 3.8 mm in diameter and 11 mm in length was placed according to the restorative planning.

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Finally, an all-ceramic crown was seated on the zirconia abutment.

The images of the final result demonstrate clearly that an aesthetically pleasing outcome was achieved by employing the bone augmentation technique described._

Fig. 13_The final situation six months after seating the all-ceramic restoration.
Fig. 14_A periapical radiograph six months after restorative treatment.

Stem cells in implant dentistry

Author_ Dr André Antonio Pelegrine, Brazil

Fig. 1_A stem cell following either self-replication or a differentiation pathway.

Fig. 2_Different tissues originated from mesenchymal stem cells.

Fig. 3_The diversity of cell types present in the bone marrow.

Fig. 4a_Point of needle puncture for access to the bone marrow space in the iliac bone.

Fig. 4b_The needle inside the bone marrow.

Fig. 5a_A bone graft being harvested from the chin (mentum).

Fig. 5b_A bone graft being harvested from the angle of the mandible (ramus).

Fig. 5c_A bone graft being harvested from the angle of the skull (calvaria).

Fig. 5d_A bone graft being harvested from the angle of the leg (tibia or fibula).

Fig. 5e_A bone graft from the pelvic bone (iliac).

Fig. 6_A critical bony defect created in the skull (calvaria) of a rabbit.

Fig. 7_A primary culture of adult mesenchymal stem cells from the bone marrow after 21 days of culture.

Fig. 8a_A CT image of a rabbit's skull after bone-sparing grafting without stem cells (blue arrow). Note that the bony defect remains.

Fig. 8b_A CT image of a rabbit's skull after bone-sparing grafting with stem cells. Note that the bony defect has almost been resolved.

Fig. 9_A bone block from a musculoskeletal tissue bank

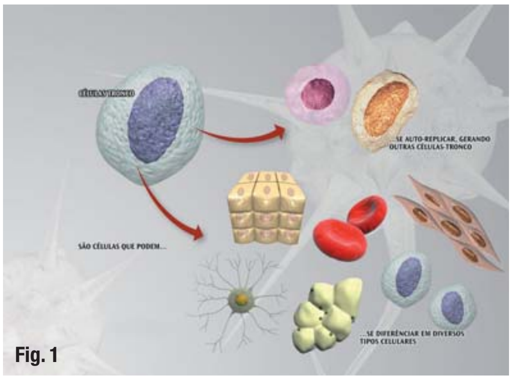


Fig. 1

_**The human body contains** over 200 different types of cells, which are organised into tissues and organs that perform all the tasks required to maintain the viability of the system, including reproduction. In healthy adult tissues, the cell population size is the result of a fine balance between cell proliferation, differentiation, and death. Following tissue injury, cell proliferation begins to repair the damage. In order to achieve this, quiescent cells (dormant cells) in the tissue become proliferative, or stem cells are activated and differentiate into the appropriate cell type needed to repair the damaged tissue. Research into stem cells seeks to understand tissue maintenance and repair in adulthood and the derivation of the significant number of cell types from human embryos.

It has long been observed that tissues can differentiate into a wide variety of cells, and in the case of blood, skin and the gastric lining the differentiated cells possess a short half-life and are incapable of renewing themselves. This has led to the idea that some tissues may be maintained by stem cells, which are defined as cells with enormous renewal capacity (self-replication) and the ability to generate daughter cells with the capacity of differentiation. Such cells, also known as adult stem cells, will only produce the appropriate cell lines for the tissues in which they reside (Fig. 1).

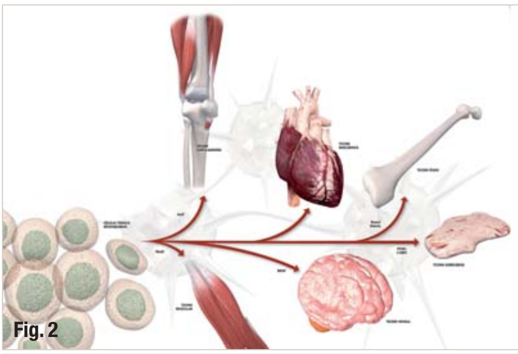


Fig. 2

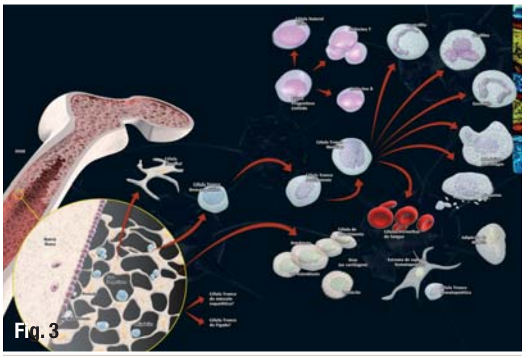


Fig. 3

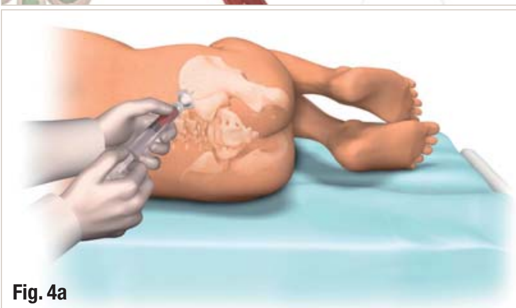


Fig. 4a

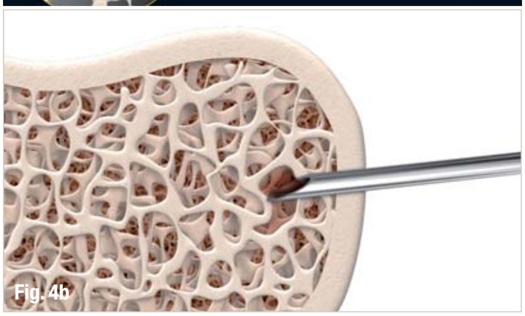


Fig. 4b

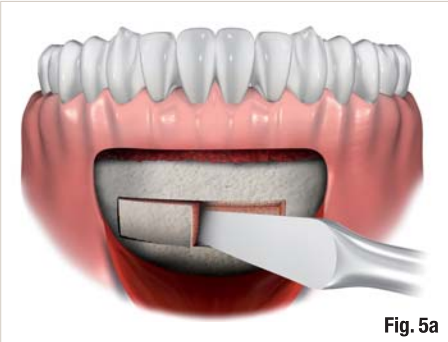


Fig. 5a

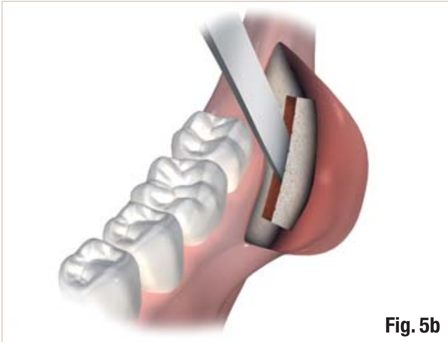


Fig. 5b

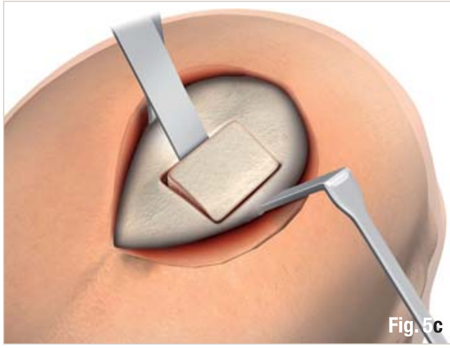


Fig. 5c

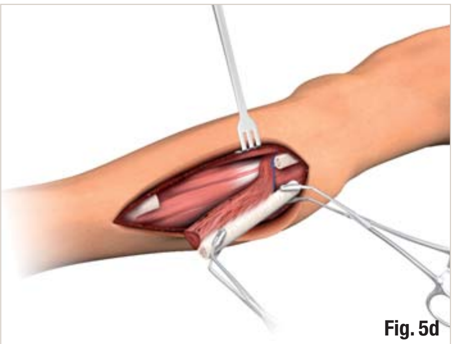


Fig. 5d

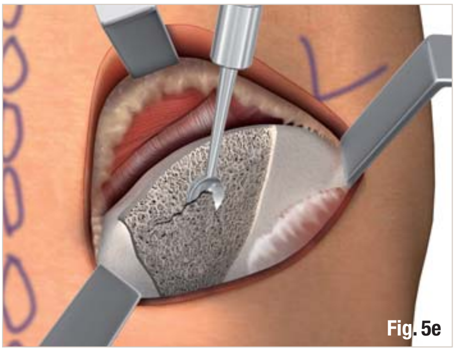


Fig. 5e

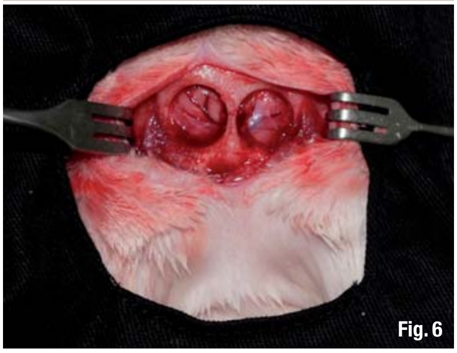


Fig. 6

Not only can stem cells be isolated from both adult and embryo tissues; they can also be kept in cultures as undifferentiated cells. Embryo stem cells have the ability to produce all the differentiated cells of an adult. Their potential can therefore be extended beyond the conventional mesodermal lineage to include differentiation into liver, kidney, muscle, skin, cardiac, and nerve cells (Fig. 2).

The recognition of stem cell potential unearthed a new age in medicine: the age of regenerative medicine. It has made it possible to consider the regeneration of damaged tissue or an organ that would otherwise be lost. Because the use of embryo stem cells raises ethical issues for obvious reasons, most scientific studies focus on the applications of adult stem cells. Adult stem cells are not considered as versatile as embryo stem cells because they are widely regarded as multipotent, that is, capable of giving rise to certain types of specific cells/tissues only, whereas the embryo stem cells can differentiate into any types of cells/tissues. Advances in scientific research have determined that some tissues have greater diffi-

combined with a bone marrow concentrate.

Fig. 10a_A histological image of the site grafted with bank bone combined with bone marrow. Note the presence of considerable amounts of mineralised tissue.

Fig. 10b_A histological image of the site grafted with bank bone not combined with bone marrow. Note the presence of low amounts of mineralised tissue.

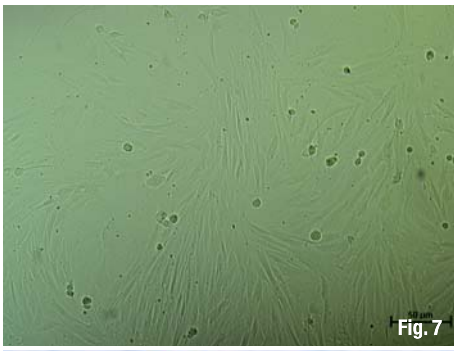


Fig. 7


Fig. 8a


Fig. 8b

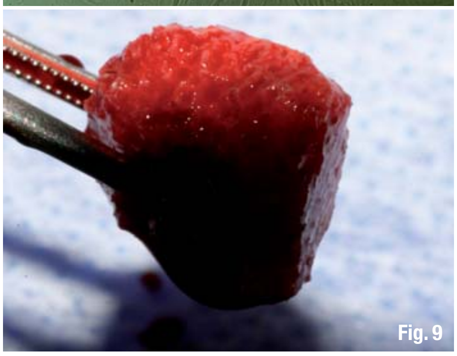


Fig. 9

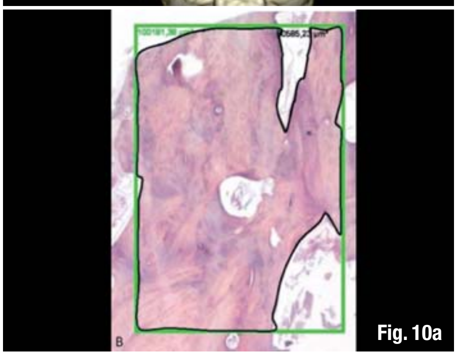


Fig. 10a

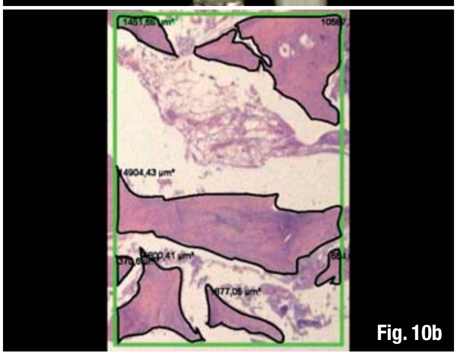
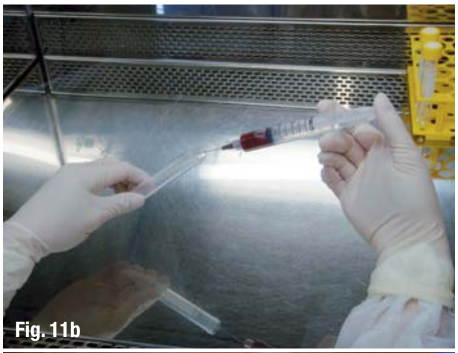
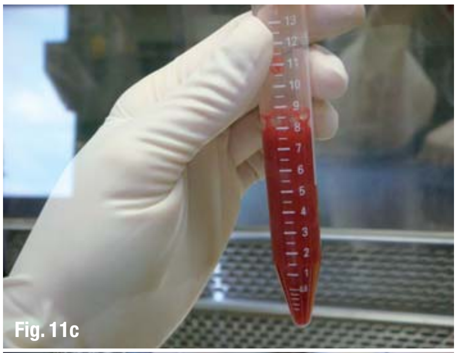


Fig. 10b

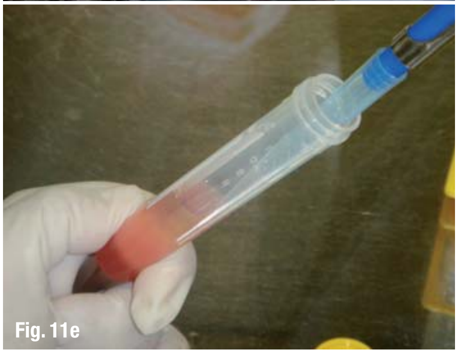



Fig. 11a_Bone marrow.
Fig. 11b_Bone marrow transfer into a conic tube in a sterile environment (laminar flow).
Fig. 11c_Bone marrow homogenisation in a buffer solution (laminar flow).
Fig. 11d_Bone marrow combined with Ficoll (to aid cell separation).
Fig. 11e_Pipette collection of the interface containing the mononuclear cells (where the stem cells are present).
Fig. 11f_Second centrifuge spin.

culty regenerating, such as the nervous tissue, whereas bone and blood, for instance, are considered more suitable for stem cell therapy.

In dentistry, pulp from primary teeth has been thoroughly investigated as a potential source of stem cells with promising results. However, the regeneration of an entire tooth, known as third dentition, is a highly complex process, which despite some promising results with animals remains very far from clinical applicability. The opposite has been observed in the area of jawbone regeneration, where there is a higher level of scientific evidence for its clinical applications. Currently, adult stem cells have been harvested from bone marrow and fat, among other tissues.

Bone marrow is haematopoietic, that is, capable of producing all the blood cells. Since the 1950s, when Nobel Prize winner Dr E. Donnall Thomas demonstrated the viability of bone marrow transplants in patients with leukaemia, many lives have been saved using this approach for a variety of immunological and haematopoietic illnesses. However, the bone marrow contains more than just haematopoietic stem cells (which give rise to red and white blood cells, as well as platelets, for example); it is also home to mesenchymal stem cells (which will become bone, muscle and fat tissues, for instance; Fig. 3).

Bone marrow harvesting is carried out under local anaesthesia using an aspiration needle through the iliac (pelvic) bone. Other than requiring a competent doctor to perform such a task, it is not regarded as an excessively invasive or complex procedure. It is also not associated with high levels of discomfort either intra or post-operatively (Figs. 4a & b).

Bone reconstruction is a challenge in dentistry (also in orthopaedics and oncology) because rebuilding bony defects caused by trauma, infections, tumours or dental extractions requires bone grafting. The lack of bone in the jaws may impede the placement of dental implants, thus adversely affecting patients' quality of life. In order to remedy bone scarcity, a bone graft is conventionally harvested from the chin region or the angle of the mandible. If the amount required is too large, bone from the skull, legs or pelvis may be used. Unlike the process for harvesting bone marrow, the process involved in obtaining larger bone grafts is often associated with high levels of discomfort and, occasionally, inevitable post-operative sequelae (Figs. 5a–e).

The problems related to bone grafting have encouraged the use of bone substitutes (synthetic materials and bone from human or bovine donors, for example). However, such materials show inferior results compared with autologous bone grafts (from the patient himself/herself), since they lack autologous proteins. Therefore, in critical bony defects, that is, those requiring specific therapy to recover their original contour, a novel concept to avoid autologous grafting, involving the use of bone-sparing material combined with stem cells from the same patient, has been gaining ground as a more modern philosophy of treatment. Con-

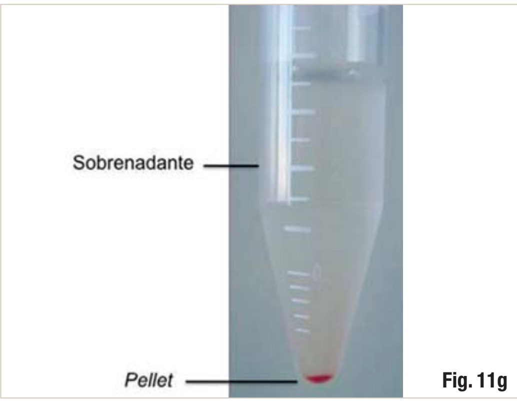


Fig. 11g


Fig. 11h

Fig. 11g_The pellet containing the bone marrow mononuclear cells after the second centrifuge spin.
Fig. 11h_A bovine bone graft combined with a bone marrow stem cell concentrate.
All images courtesy of Células Tronco em Implantodontia.[2]

sequently, to the detriment of traditional bone grafting (with all its inherent problems), this novel method of combining stem cells with mineralised materials uses a viable graft with cells from the patient himself/herself without the need for surgical bone harvesting.

Until recently, no studies had compared the different methods available for using bone marrow stem cells for bone reconstruction. In the following paragraphs, I shall summarise a study conducted by our research team, which entailed the creation of critical bony defects in rabbits and subsequently applying each of the four main stem cell methods used globally in order to compare their effectiveness in terms of bone healing:[1]

_fresh bone marrow (without any kind of processing);
_a bone marrow stem cell concentrate;
_a bone marrow stem cell culture; and
_a fat stem cell culture (Figs. 6 & 7).

In a fifth group of animals, no cell therapy method (control group) was used. The best bone regeneration results were found in the groups in which a bone marrow stem cell concentrate and a bone marrow stem cell culture were used, and the control group showed the worst results. Consequently, it was suggested that stem cells from bone marrow would be more suitable than those from fat tissue for bone reconstruction and that a simple stem cell concentrate method (which takes a few hours) would achieve similar results to those obtained using complex cell culture procedures (which take on average three to four weeks; Figs. 8a & b).

Similar studies performed in humans have corroborated the finding that bone marrow stem cells improve the repair of bony defects caused by trauma, dental extractions or tumours. The histological images below illustrate the potential of bone-sparing materials combined with stem cells for bone reconstruction (Fig. 9). It is clear that the level of mineralised tissue is significantly higher in those areas where stem cells were applied (Figs. 10a & b).

Evidently, although bone marrow stem cell techniques for bone reconstruction are very close to routine clinical use, much caution must be exercised before indicating such a procedure. This procedure requires an appropriately trained surgical and laboratory team, as well as the availability of the necessary resources (Figs. 11a–h, taken during laboratory manipulation of marrow stem cells at São Leopoldo Mandic dental school in Brazil)._

[1] *André Antonio Pelegrine, Antonio Carlos Aloise, Allan Zimmermann et al., Repair of critical-size bone defects using bone marrow stromal cells: A histomorphometric study in rabbit calvaria. Part I: Use of fresh bone marrow or bone marrow mononuclear fraction,* Clinical Oral Implants Research, *00 (2013): 1–6.*
[2] *André Antonio Pelegrine, Antonio Carlos Aloise & Carlos Eduardo Sorgi da Costa,* Células Tronco em Implantodontia *(São Paulo: Napoleão, 2013).*

_about the author

cosmetic dentistry

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Dublin conference discussed future concepts in dental implant rehabilitation

_**Dental rehabilitation using implants** has seen significant advancements in the last decade. Trends for the future of the specialty were discussed when the Convention Centre Dublin opened its doors last October for the 22nd Annual Scientific Meeting of the European Association for Osseointegration (EAO).

According to the organiser, over 2,000 dental professionals participated the three-day event, which was held in the Irish capital for the second time. In addition to current issues in the field, like peri-implantitis and the challenges linked to the treatment of an increasing elderly population, the congress reflected on new developments and methods, such as computer-assisted implant rehabilitation and tissue regeneration.

Moreover, a number of sessions focused on risk factors, treatment planning and the possibilities of virtual learning techniques.

Up to 70 experts from Europe and around the globe were speaking at the meeting. The latest research were presented in the form of short oral

sessions and poster presentations took place between the scientific sessions.

New products for treatment outcomes that are more predictable and an improved workflow in dental practices and laboratories were presented at the industry exhibition, which was supported by 87 sponsors this year. Among others, MIS and Henry Schein presented their latest tools for a complete digital workflow. Furthermore, Danish dental solutions provider 3Shape had its recently launched TRIOS intra-oral scanning system on display. New and improved implant systems were presented by Implant Direct and a number of other companies.

In 1995, the EAO held one of its earliest meetings in Dublin. Since then, the prestigious event has taken place at 17 locations in 15 countries throughout Europe. Last year's anniversary meeting in Copenhagen saw more than 2,500 professionals participating, the number expected for the 2013 edition in Ireland. In addition to the Royal College of Surgeons in Ireland and the Oral Surgery Society of Ireland, the meeting has received support from the Irish Society of Periodontology and the Prosthodontic Society of Ireland.

"In 1995, implant treatment was provided by a fairly small number of specialists and access for patients was limited," commented Dr Brian O'Connell, congress chairman and Professor of Restorative Dentistry at Trinity College Dublin's dental school and hospital.

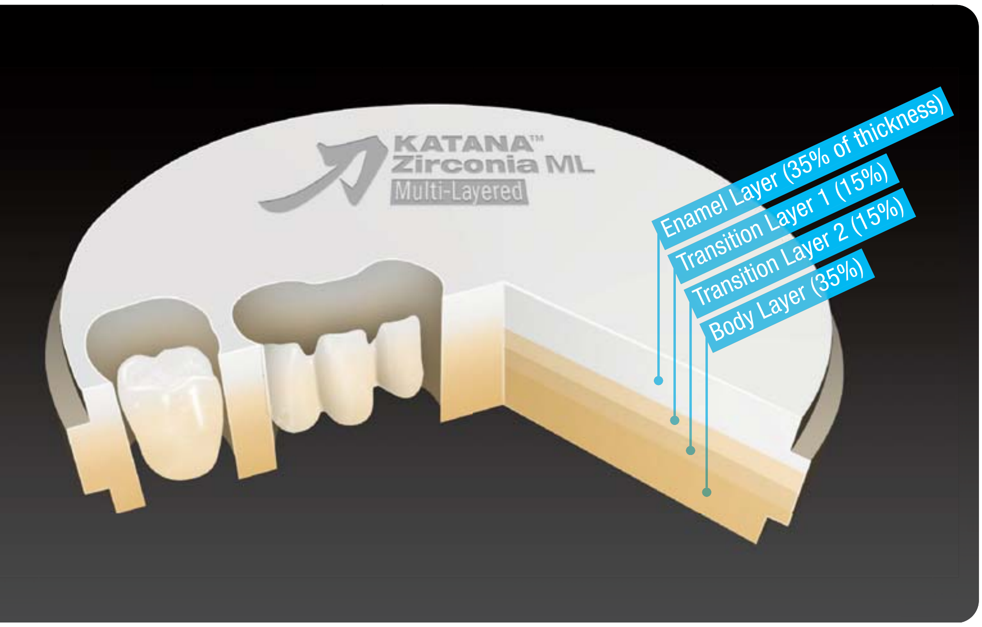
"Now implant treatment is available in every part of the country and is provided by a wide range of practitioners. As a result, awareness has really grown among the population. (...)Europe has a generally ageing population, who may have the greatest demand and need for dental implant treatment in the future. Evidence suggests that the majority remain healthy and active for much longer than we may have believed. We need to learn much more about the specific requirements of the older population and be aware of the risks as well. Often assumptions about older people are inaccurate. Although they may less demanding about their needs, they frequently respond well to implant treatment."

Next year's EAO annual congress will be held from 16 to 19 October in Rome. For details please visit EAO website._

All photos courtesy of EAO.

KATANA Zirconia ML Disc

High-performance zirconia with integrated colour shift



_KATANA Zirconia ML Discs are the world's first polychrome zirconia with integrated colour shift

KATANA Zirconia ML Discs are high-performance zirconia blanks manufactured on an industrial scale and with consistently high quality. They can be used easily in everyday milling process for laboratories with milling machines. A natural-looking restoration can be achieved immediately in one step, yielding a remarkable result with a natural gradient. The shortened manufacturing process makes the discs economical and avoids possible complaints.

The KATANA range is completed by the white KATANA Zirconia HT (High Translucent) Disc, which offers additional possibilities for individual staining and veneering.

_The KATANA Zirconia ML (Multi-Layered) Disc consists of four pre-coloured layers showing smooth enamel, dentine and cervical colour shifts. They represent natural tooth colours and allow dentists to achieve a natural-looking restoration.

_KATANA Zirconia ML yields impressive results immediately

The sintering process can be started immediately after milling without the usual working steps like dipping or painting and drying, significantly reducing the steps in the production process. After polishing or glazing, impressive restorations can be achieved under standard conditions.

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Technical details:
_Pre-sintered disc with collar
_Flexural strength: 1,050–1,100 MPa
_Fracture toughness: 5 MPa√m
Diameter: 98.5 mm

[1] *B.D. Flinn et al., Accelerated aging characteristics of three yttria-stabilized tetragonal zirconia polycrystalline dental materials,* Journal of Prosthetic Dentistry, *108/4 (2012): 223–30.*

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www.sser.ro

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Monaco. Photo: Matej Kastelic

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www.apdentalcongress.org

IACA 2014 Annual Meeting
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www.theiaca.com

AAED 39th Annual Meeting
5–8 August 2014
Santa Barbara, CA, USA
www.estheticacademy.org

FDI Annual World Dental Congress
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www.fdi2014.org.in

ESCD 11th Annual Meeting
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www.escdonline.eu

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