ce article
Essential communication: The use of technology for virtual patient records

case report
Immediate implant placement and loading—a digital chairside workflow

cone beam supplement
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Dear Reader,

The use of computed tomography (CT) in dentistry dates back more than 30 years. The ability to assess a patient’s individual anatomy in three dimensions proved to be an invaluable diagnostic tool for dental implant and oral surgery procedures. However, it did not catch on right away. There were many barriers for both doctor and patients because these large and expensive imaging devices were located in hospitals or radiology centers, and the cost of obtaining a scan on film was prohibitive. Of course, there were also issues with patient exposure to increased radiation dosage.

Fast forward to about 17 years ago, with the advent of cone beam computed tomography (CBCT). These devices had a smaller footprint, lower cost, and could be placed in a dental office for a single practitioner or group practice. The reduced radiation was a real breakthrough, and this combination became a new catalyst for the use of 3-D imaging in dentistry: improving the diagnostic capabilities for a wide variety of procedures including, but not limited to, dental implants, oral surgery, bone grafting, TMD treatment, endodontic therapy, orthodontics, and airway analysis.

With certain barriers removed, CBCT has become an essential tool that has been utilised to improve accuracy in the diagnostic and treatment planning phase while helping to reduce complications with associated procedures. However, even today in 2017, many practitioners still rely solely on periapical and panoramic radiology, which is why further education continues to be a focus of this and other publications. Fortunately, we have new catalysts for which CBCT is an important foundational step—moving from the diagnostic phase to the desired treatment outcome with important links to CAD/CAM and 3-D printing technologies. As CBCT was the initial catalyst, the ability to export the DICOM data and send it to either an expensive industrial or an in-office low-cost 3-D printer to produce a mandible or maxilla that clinicians can hold in their hand to touch, examine, and plan, has provided the dental industry with a new and exciting catalyst to enhance the acceptance of using these technologies.

We look forward to bringing our readers current techniques, innovative treatment modalities, clinical case presentations, and much more within the pages of our publications, in the hopes that it will have a positive impact on the manner in which we deliver patient care.

Respectfully,

Dr Scott D. Ganz
Editor in Chief
Dear Reader
Dr Scott D. Ganz

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Chris Barrow

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The MGUIDE system features user-friendly software to ensure accurate planning and an open design template that allows for a greater field-of-view and irrigation for easier implant placement. Learn more about the MGUIDE and MIS at: www.mis-implants.com
In an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention. These prophetic lines were shared by Nobel laureate and social scientist Dr. Herbert Simon in 1971. It seems incredible to think that his words predate the Internet by 20 years. Simon lived in a world in which advertisers tried to gain our attention with billboards, newspaper advertisements and television commercials. At the same time, the local ma-and-pa business prospered through convenience and human interest.

The connected economy and growth in population have created statistics that are beyond our comprehension. There were 60 trillion websites at the last count and every year the Internet grows by eight million new songs, two million new books, 16,000 new films, 30 billion blog posts and 182 billion tweets. Google handles 35 billion e-mails every day alone, and 1.8 billion photographs are uploaded to the Cloud from everywhere around the globe. I speculate as to how many of those photographs are of happy, smiling faces.

IBM tells us that we are “a world awash in data”, 80 per cent of which is currently invisible to our computers; however, with the IBM Watson project,
The MGUIDE system features user friendly software to ensure accurate planning and an open design template that allows for a greater field-of-view and irrigation for easier implant placement. Learn more about the MGUIDE and MIS at: www.mis-implants.com
the company intends to use cognitive computing to bring that data into a usable domain. With global health care data expected to grow by 99 per cent in the next 12 months, the search is on to find a new unified theory that will bring all of this information to the fingertips of government, business and individuals.

The question is, can we cope with this? In his book *Homo Deus: A Brief History of Tomorrow*, Israeli author Prof. Yuval Noah Harari visualises a completely connected world in which “Data-ism” dominates. There he writes: “Sapiens evolved in the savannah thousands of years ago and their algorithms are not built to handle 21st Century data flows. We might try to upgrade the human data-processing system, but this may not be enough. The Internet-of-all-Things may create such huge and rapid data flows that even upgraded human algorithms won’t handle it. When cars replaced the horse-drawn carriage, we didn’t upgrade horses—we retired them. Perhaps it is time to do the same with Homo Sapiens.”

A rather grim and ominous suggestion perhaps, but by jolting our sensibilities, Harari makes us pause for thought. Let us narrow our field of vision from these impossible numbers and facts. Pundits suggest that you and I are interrupted by advertising and brand exposures 5,000 times in an average day and mentally register around 350 of these. We note 150, think briefly about 80 and pause at 12 to think about whether they are relevant to us at this time. Thus, the challenge facing the dental marketer is how to become one of 12 out of 5,000 at the right time, on the right day, for the right person.

Big business has a simple solution to this problem; it is called big money. Whether it is a Super Bowl television commercial, a giant billboard on a motorway or, nowadays, massive expenditure on Internet visibility via paid media, those with the deepest pockets offering the best products and services are the winners in the race to attract that poverty of attention first mentioned in 1971. So where does this place the independently owned dental practice? You are a mouse, wandering between the legs of a herd of bull elephants, all trumpeting their mating call. No matter how loudly you squeak, at best your sound will be drowned out and at worst you may be trampled in the rush.

I have watched the world of digital marketing in dentistry very carefully over the last five years and have reached some conclusions that are likely to land me in trouble with traditional digital marketers. However, I did not get where I am today without stepping on the fenced-off grass every now and then, running along the side of the swimming pool.
Restoring with the natural tooth in mind

Teeth are as diverse and individual as fingerprints. To mimic nature when replacing a missing tooth, you will need an equally unique, individualized restorative solution.

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and tearing up the rule book. So, here is my recommended list of actions to be taken by the independent dental practice in order to gain attention:

1. Use good search engine optimisation (SEO) to optimise your position in Google’s organic search. SEO is a technical skill that has to be delivered by experts. Google changes its own goalposts regularly and the savvy SEO guru will know that and take appropriate action quickly.

2. Massively encourage the collection of Google reviews, user reviews via Facebook and critic reviews via proprietorial sites like WhatClinic.com, NHS Choices and Comparethetreatment.com in the UK. In September 2016, Google changed the rules twice, first by including external reviews alongside its own in searches and second by altering its own search criteria to favour businesses with in excess of 100 Google reviews. It is necessary that your marketing activity be adjusted to reflect such changes.

3. Connect to your patients through a well-maintained social media channel like Facebook or Twitter (and deliver daily human interest content). Remember that those 1.8 billion photograph uploads per day include the inevitable selfies. Many of my clients now take a patient selfie at the end of a course of aesthetic dental treatment. To quote again from Harari’s new book: “If you experience something—record it. If you record something—upload it. If you upload something—share it.”

4. Build a website that engages the visitor through video and visual testimonials. Your most powerful marketing collateral is the stories that your patients can tell about the difference that you have made to their lives.

5. Collect visitors’ e-mail addresses and consent (to e-mail) via white paper marketing. A coffee shop, hotel or airport exchanges free Wi-Fi access for an e-mail address and permission to keep one informed. You can do the same by exchanging useful information (free guides).

6. Nurture long-term relationships with patients and prospects by publishing a monthly human interest e-mail newsletter.

7. Deal with initial enquiries directed through the Internet, by telephone or in person in a polished manner.

8. Create a memorable new patient experience from initial consultation all the way through to treatment delivery.

9. Employ a strict end-of-treatment protocol to capture reviews, testimonials and social connections (as well as plan membership).

I have given you nine marketing actions designed especially for the smaller business. Actions that should be avoided by the independent dental practice are seeking to gain attention by paying through the nose for Google or Facebook advertising, broadcasting non-human interest material or selling services on price, discount or special offer. This is because every week I hear from dentists and their marketing teams that advertising to strangers,

“The challenge is for the mouse to gain attention without competing with the bull elephants.”

using jargon and cutting prices at best attract nobody and at worst attract bargain-hunters, price-shoppers and messers.

“A wealth of information creates a poverty of attention.” We end where we began. The challenge is for the mouse to gain attention without competing with the bull elephants. You can only do that by stepping away from the herd of elephants and delivering your story in a different way and a different place. For me, that means human interest, personal service and recommendation, and so when I am working with clients on their marketing plans, we focus on and mobilise their most valuable asset: the goodwill of their existing patients._

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contact

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Restoring with the natural tooth in mind

Teeth are as diverse and individual as fingerprints. To mimic nature when replacing a missing tooth, you will need an equally unique, individualized restorative solution.

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Aesthetic rehabilitation and tissue preservation in the anterior region

Authors: Dr Jan-Frederik Güth & Hans-Jürgen Stecher, Germany

While there are often several adequate prosthetic treatment options to choose from for one single case, there are some cases where none of the proven solutions seems to be perfectly suitable. The prosthodontist and his team have to balance the pros and cons for each available option—they have to decide which treatment is best suited to fulfil the needs of the specific patient. This was the case with a 16-year-old female patient who presented at the Department of Prosthodontics of the Ludwig-Maximilians University of Munich, Germany, in 2015. An orthodontic treatment had just been completed and a further prosthetic rehabilitation was required.

Background

At the age of 10, the patient had suffered an anterior tooth trauma with avulsion and replantation of the maxillary central incisors (teeth 11 and 21, FDI notation). Despite all efforts, it had not been possible to preserve tooth 21. The former dentist had replaced it with a four-unit metal-ceramic adhesive bridge (Maryland bridge) (Figs. 1 & 2).

Unfortunately, the dismal prognosis for tooth 11 was confirmed in the course of treatment: it had to be extracted during orthodontic therapy. In order to replace both central incisors for the duration of this therapy, a provisional bridge with artificial gingiva was manufactured and attached to the fixed orthodontic appliances (Fig. 3).

Prosthetic treatment plant

At the patient’s first visit in the private dental office of the LMU Munich, the lateral incisors had large composite restorations not only on the vestibular surfaces, but—due to the previous rehabilitation with an adhesive bridge—also on the palatal surfaces (Fig. 4).

Fig. 1: Situation prior to the orthodontic treatment with an adhesive bridge used to replace tooth 21.
Fig. 2: The adhesive bridge shows a compromised fit after repeated removal and placement.
Fig. 3: Snapshot during orthodontic treatment with temporarily replaced central incisors. (Image 1–3 courtesy of Prof. A. Wichelhaus)
Fig. 4: Situation at the first visit of the young female patient at the LMU Munich private dental office.
Fig. 5: Patient with interim prosthesis after removal of the orthodontic appliances, replacement of the fillings and palatal tooth preparation.
Fig. 6: Computer-aided framework design starting from the anatomical tooth shapes using the Zfx CAD Software.
Tooth 22 had received an endodontic treatment. This fact significantly limited the prosthetic options and had a negative effect on the prognosis of this tooth. The developmental stage of the cervical vertebrae assessed by the orthodontist using lateral cephalometric radiographs revealed that only minimal transversal and horizontal growth was still to be expected for this patient. Due to this fact and the unfavourable prosthetic value of the abutment teeth, the prosthodontic team—in consultation with the patient—decided to place an all-ceramic adhesive bridge with two wings bonded to teeth 12 and 22. The aim of this treatment was to postpone the placement of implants as long as possible in order to ensure that the patient was fully grown when this intervention was carried out. By use of a fixed restoration, the team strived for the best possible support and preservation of the surrounding soft and hard tissues.

First steps

After removal of the fixed orthodontic appliances, the direct restorations of the maxillary lateral incisors were replaced by new composite restorations. Tooth preparation had already been carried out on these teeth to place the former metal-ceramic bridge. Hence, it was not necessary to remove large amounts of additional tooth structure, however, the existing palatal preparations required refinement. Subsequently, gingiva management was carried out with retraction paste. An impression was taken with the 3M True Definition Scanner and uploaded to the 3M Connection Center. The patient received a removable interim prosthesis (Fig. 5).

Laboratory procedure

In the dental laboratory, the digital impression file was downloaded, a physical model ordered and the data set imported into the Zfx CAD Software for the design of the adhesive bridge framework. The bridge was designed in full contour. The recommended parameters (minimum wall thickness, connector strength etc.) for the selected material—3M Lava Plus High-Translucency Zirconia—were entered into the software. Then, the bridge was automatically reduced to the framework (Fig. 6).

This procedure is beneficial in that it provides for a uniform strength and optimal support of the veneering porcelain. The framework was milled, thinned out at the margins using a fine diamond rubber polisher, individualised with dyeing liquids, and sintered. The precise fit of the wings to the palatal tooth surfaces was confirmed on the model before the porcelain layering was performed (Fig. 7). Figure 8 shows the situation at the biscuit-bake try-in.

Finally, the adhesive bridge was finished and glazed. On the model, a highly accurate fit was obtained (Fig. 9), and the restoration showed a natural appearance (Fig. 10). This is in part due to the high translucency of the framework material (Fig. 11).

Clinical procedure

With the use of a GC Fit Checker Advanced Blue (GC Europe), the precise fit observed on the model was confirmed intraorally (Fig. 12).
As the patient was also satisfied with the aesthetic result, the adhesive bridge could be placed immediately. For this purpose, the working field was isolated with rubber dam and a 37% phosphoric acid etching gel applied to the palatal enamel surfaces of both lateral incisors for 30 seconds and to the dentine surfaces for 15 seconds before being rinsed off. The inner surfaces of the wings were conditioned to increase the surface roughness. After thorough cleaning of the surfaces, an adhesive (3M Scotch-bond Universal Adhesive) was applied, rubbed in, air-dried and light-cured according to the manufacturer’s instructions.

Then, 3M RelyX Ultimate Adhesive Resin Cement was applied and the bridge placed. The excess cement was removed immediately with a sponge pellet. To prevent a reaction of the uncured cement with oxygen and lay the foundation for a good marginal integrity, the exposed margins were covered with glycerine gel (Fig. 13) and polymerised. Figure 14 shows the situation immediately after curing.

Result

The aesthetic appearance was already satisfactory, although the harmony was impaired by black triangles between the teeth. Due to the favourable characteristics of the ceramic, however, the soft tissue recovered quickly and closed the gaps. Figures 15 and 16 show the results eight weeks after the restorative procedure.

Discussion

As an alternative to the selected treatment option, it would have been possible to place a removable partial denture or two two-unit adhesive bridges with one wing each. The former, however, is regarded as functionally less effective and not capable of supporting the preservation of soft and hard tissues. The two-unit adhesive bridges would have required stabilisation with a retainer. The main reason to opt against this alternative was the compromised value of the abutment tooth 22. As the root surfaces of the maxillary lateral incisors are small, it also seems questionable if this design would have offered sufficient stability to ensure the desired result.

With regard to the restoration that was produced, the invasive preparation is surely a matter of debate. However, the existing preparation for the metal-ceramic bridge and the large composite restorations limited the amount of sound tooth structure that needed to be sacrificed at this point of the treatment to a minimum, so that the plan became acceptable. In general, the maximum preservation of tooth structure should always be given highest priority when a dental restoration is planned. Important criteria guiding the amount of hard tissue removal are the available intermaxillary space and the minimum wall thickness of the selected material.

Due to the material selection in the present case, it is not necessary to remove the restoration as long as it serves its purpose. Thus, the planned long-term temporary might even become a definitive restoration over time. This, of course, is only possible with continuous monitoring and good compliance of the patient.

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In the last years, new technologies have been introduced to implant dentistry. For example, cone beam computed tomography (CBCT) and computer-assisted implant surgery systems are used to determine the best position for an implant. By superimposition with computer-aided design data of the planned prosthetic restoration, a result-oriented plan can be developed. It is finally implemented by use of a drill guide.

**Accuracy of guided surgery**

In order to measure the accuracy of this workflow, numerous studies have been conducted. Most of them focus on a workflow that involves the production of a conventional working model based on an impression and its digitisation with a laboratory scanner. The accuracy measurements are usually carried out by comparison of the initial CBCT scan, including the planned implant position with a CBCT scan that shows the actual implant position.

A systematic review of the literature reveals that the highest accuracy is obtained with the use of tooth-supported drill guides and a fully guided approach with implant insertion through the guide.

**Integration of intraoral scanners**

With the idea that it might be possible to optimise the process by use of an intraoral scanner, a new procedure was developed at the Academic Center for Dentistry Amsterdam. In this workflow, the initial impression is taken with the 3M True Definition Scanner. The device offers the benefit of capturing the soft tissue without difficulties due to the use of scan powder. The generated STL file is superimposed with the CBCT scan, the implant position planned, and the implant placed. Then, the intraoral scanner comes into play again: a scanbody is placed and the situation scanned to compare the planned and the final implant position, and to produce the prosthetic restoration. In this way, a second CBCT scan can be avoided.

**Clinical trial**

A clinical trial was conducted to evaluate the accuracy of this procedure: 148 implants were placed in a total of 70 patients using a fully guided protocol based on an intraoral and a CBCT scan. According to preliminary results, the implants were placed with higher accuracy in this study than in earlier investigations reviewed. The accuracy of the prosthetic procedure was assessed as well. For this purpose, the patients were split into two groups. In one group, a scanbody was placed and an impression was taken with the 3M True Definition Scanner. In the other group, a polyether impression was taken. Based on the impressions, monolithic crowns and bridges were produced. Without information about the previous process, the dental practitioner received
and placed the restorations and evaluated the result by measuring the time needed for adjustments etc. The results showed that the intraoral scanner workflow was at least as accurate as the one starting with a conventional impression.

**New chairside workflow**

Against the background of increased patient comfort, a simplified workflow and higher efficiency related to the completely digital approach, I decided to implement the new workflow in the dental office Tandartspraktijk Rijnzigt in Arnhem. It is described using the following patient case.

Due to an internal resorption of the maxillary right lateral incisor (Figs. 1 & 2), the tooth fragment had to be removed in an emergency treatment (Fig. 3). Using resin composite, the fragment was bonded to the adjacent teeth and served as a bridge, while the root remained in place (Fig. 4). In the same session, a digital impression was taken using the 3M True Definition Scanner and a CBCT scan was carried out. Figure 5 shows the STL file of the intraoral scan.

**Superimposition of scans**

Subsequently, the two files of the computer-aided design and CBCT scan were superimposed in the planning software coDiagnostiX (Dental Wings) using the teeth as a reference for matching. The ideal implant position was determined based on the patient’s anatomy and the future prosthetic plan (Fig. 6).

The selected implant was a Straumann Bone Level Tapered Implant with a diameter of 3.3 mm and a length of 12 mm. When the planning phase was completed, a drill guide was designed with the coDiagnostiX software (Fig. 7). The drill guide was immediately produced in the dental office using the DWX-4 dental milling system (Roland DG). This machine is capable of milling transparent PMMA material suitable for guide production and has a small footprint so that it can be easily integrated into every practice.

**Crown design**

The information about the future implant position was exported to the laboratory design software.
Based on this position, the design was created and the emergence profile optimised (Fig. 8). This step is optional prior to implant placement, but offers the advantage of a time-saving workflow when the temporary crown is milled for immediate restoration while the patient is still in the chair. Due to the anatomical shape of the patient’s bone, the restoration had to be designed with an incisal screw access hole.

Implant placement

The implant was placed six weeks after the emergency treatment and immediately after atraumatic extraction of the root (Figs. 9 & 10) using the prepared guided surgery protocol (Fig. 11).

Since slight inaccuracies cannot be avoided in this guided implant surgery process, it was decided to take into account the final implant position for the production of the temporary crown: An intraoral scan was carried out immediately after implant placement. For this purpose, a Straumann CARES Mono Scanbody was fixed on the implant (Fig. 12) and some powder applied to it and to the adjacent teeth.

Temporisation

Finally, the new scan file was imported into the DWOS software (Fig. 13). The predesigned crown was adjusted in a way that it matched the final implant position exactly (Figs. 14 & 15). Thanks to the presurgical design step, this procedure took just a few minutes. The temporary crown was milled in the dental office using a hybrid material with tooth-like properties (Fig. 16), luted to a titanium-alloy bonding base (Straumann CARES Variobase Abutment), polished and screwed onto the implant in the same appointment for immediate restoration (Fig. 17). The provisional crown was placed slightly out of occlusion (without functional loading) to provide for favourable healing conditions. The incisal screw access hole was closed with 3M ESPE Filtek Supreme XTE Universal Restorative (Figs. 18 & 19). The definitive restoration will be cement-retained to avoid the aesthetic limitations associated with the visibility of the screw hole.

Conclusion

The present patient case shows that the described combination of digital technologies leads to very good clinical results. The dental practitioner is able to improve the accuracy of implant placement using a guided approach and the precisely fitting temporary restoration is ready to be placed within an hour after completing the surgical procedure. And last, but not least, the patient benefits from increased comfort due to the use of an intraoral scanner and a reduction in the number of required appointments. The procedure is currently used for single tooth replacement on a regular basis in our dental office, while we are currently focusing on the development of a workflow for multi-unit restorations as well. The final restorations are always produced in a dental laboratory.

References

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Reversing a failing dentition with new technology

Author: Dr Ara Nazarian, USA

Having the ability to take a patient from start to finish in a fewer amount of appointments within your practice allows you to position yourself as a provider that can fulfill your patient's surgical and restorative needs. With the proper training, a dental provider may provide extraction, grafting and implant placement within one appointment at one location. Not only does this allow you to reduce the amount of visits for the patient, but this type of service also helps maintain the cost to the patient since they are not seeing multiple dental providers. Most importantly, this enables the dental provider full control of the surgical and prosthetic outcome. Depending on the patient's desires, the clinical conditions of the oral environment present and the skills of the provider, a dentist may choose to extract teeth, level bone, and graft with guided dental implant placement within his/her dental practice.

A patient presented to my practice for a consultation wanting to restore her smile (Fig. 1). She complained of generalised discomfort in her entire dentition; probably due to the rampant caries and infection that was already present (Figs. 2–5). Having already visited multiple providers for an evaluation, she was very frustrated with conflicting treatment options offered. Either the suggested treatment would require multiple surgical and restorative visits that would extend for a very long time or dental treatment would require a team approach where little coordination by dentist and specialist was communicated to the patient. Since many of these options did not appeal to her, the patient decided to have me provide comprehensive treatment that would include extractions, bone leveling, grafting, dental implant placement, immediate provisionalisation and prosthetic rehabilitation within my own practice.

When presenting cases like this to my patients, I will always use the Dine Digital Solution camera (Lester A. Dine). Not only is this camera small, light...
and waterproof, it also is very effective and clear in taking close-up photos as well as full face shots. Additionally, I will always offer my patients a third party payment option like the Lending Club (San Francisco, CA) for their treatment. Lending Club Patient Solutions provides patients great funding flexibility with very low rates and high approvals. Most of all, the support from their staff has been very professional.

**Planning**

A CBCT scan was taken to accurately treatment plan this case to make certain that no complications would arise from doing all the procedures (extract, graft and implant placement) within one visit. Since her entire dentition had rampant caries present, her treatment would require extracting teeth #2–15 and #18–31, as well as the impacted third molars (teeth #1, 16, 17, 32) to avoid any further complications in the future.

To further develop a treatment plan, diagnostic models were forwarded to the dental lab and mounted on the articulator for further analysis in order to meet the patient’s aesthetic and functional needs. Instructions for a virtual wax-up were prescribed for increasing the patient’s vertical dimension due to a collapse in her bite from the severe wear in her dentition.

As a result of the information gathered from merging the CBCT information with the STML files of the virtual wax-up, it was determined that aesthetics and function could be enhanced by restoring the patient’s entire maxillary and mandibular arches with implant supported restorations. All risks, benefits and alternatives of various treatment options were reviewed with the patient including dentures, over dentures and fixed restorations. Her treatment plan of choice would consist of screw retained fixed zirconia restorations in the upper and lower arches supported by six implants each.

With the combination of their corkscrew thread, built-in platform switching and apical design, the ET III SA (Hiossen) implant system was utilised in this particular case. According to the manufacturer, the enhanced SA (sand blasted and acid etched) surface of this implant has shown a substantial quickening of gene expression, cell differentiation and proliferation that are essential to osseointegration meaning faster bone healing and earlier loading times. Other dental implant systems in the market with high initial stability may include but are not limited to; Biomedical Engage (OCO), Nobel Active (Nobel Biocare), Seven (MIS), I5 (AB Dental USA), Conus 12 (Blue Sky Bio) and Any-Ridge (Megagen).

Not only was the type and size of the implant selected because of CBCT planning, but also its relationship to the planned restoration and its proximity to vital structures determined before performing the surgery. Guided bone leveling, as well as immediate implant placement, would be accomplished at the surgical appointment by using CT-based bone leveling and implant drilling guides. Additionally, prefabricated screw-retained fixed provisional restorations would be directly picked up with acrylic over dental implants in the maxilla and mandible in the key implant positions if adequate fixation was acquired.

When performing this many procedures in one visit, I will utilise IV sedation to make the procedure more efficient and comfortable for the patient as well as...
Case Report: Full Mouth Restoration

Since the patient is sedated, a mouth prop, Logibloc (Common Sense Dental Products), is used to keep her mouth open. Logibloc’s unique design stabilises and comfortably supports the jaw while allowing unrestricted visual and physical access to the working area for the provider.

Once the patient was completely sedated and anaesthetised, the teeth were extracted in a systematic manner, working in sections at a time starting from the anterior maxillary teeth. Acting like a modified class I lever, the Physics Forceps (Golden Dental Solutions) were used toatraumatically extract the teeth with the goal of trying not to disturb the underlying bone. The beak of the forceps was placed on the lingual cervical portion of each tooth, where the soft bumper portion was placed on the buccal alveolar ridge at the approximate location of the mucogingival junction. During the extraction process, the beak grasps the tooth and the bumper acts as the fulcrum. Extractions were accomplished with only slight wrist action in a buccal direction taking about 40 to 60 seconds each depending on the tooth morphology and density of bone.

Once all the maxillary teeth were extracted, the alveolar crest was leveled 2–3 mm apically following the parameters set by the bone leveling guide with the AEU-7000 surgical motor/handpiece (Aseptico), so that the patient’s transition line from the ridge to the prosthesis would not be visible when the patient smiled. Once completed, the surgical drilling guide was inserted and the sites for the implants were initiated with the Hiossen-Osstem Guided kit (Fig. 6).

In the upper arch, six 4.0 mm diameter ET III SA dental implants were placed in the areas of teeth #4, 6, 8, 9, 11 and 13 to support an All on Six restoration. The most distal implants were angled in order to avoid the maxillary sinus cavities and any augmentation in that area. In the lower arch, several different widths (3.5, 4.5 and 5.0 mm) of the ET III SA dental implants were used due to various widths of bone available in the remaining ridge. Here, the tooth areas that would have dental implant placement included #19, 22, 23, 25, 27 and 30.

A baseline ISQ reading was taken of these implants utilising the Ostell ISQ unit. Since the initial readings were all above 65 and the quality of bone after leveling was good, temporary Cylinders (Hiossen) were placed on the multiunit abutments (Hiossen) for immediate provisionalisation. Any residual areas around the implants or in the sockets were grafted with a putty blend of cortical mineralised and demineralised bone grafting material to optimise the area for regeneration. Primary closure was achieved by suturing the tissue with resorbable sutures.

The immediate provisional restoration was tried in to insure a passive fit over the temporary abutments (Fig. 7). Once confirmed, block-out material was placed to avoid the restoration from locking on and chairside hard denture reline material (Rebase II, Tokuyama) placed within recesses around the temporary abutments to pick up the restoration. After the material completely set, the immediate provisional restoration was removed and any access material trimmed and polished with the Torque Plus (Aseptico) lab handpiece and acrylic bur (Komet). A similar series of steps was utilised for the mandibular arch. In fact, the ISQ values were even higher due to the type and quality of bone present in the patient’s mandible.

At this point, a Panorex was taken to confirm the placement and position of the dental implants with...
their corresponding multi-unit abutments and temporary cylinders.

Seven days postoperatively the patient returned with very little discomfort, swelling, or bruising. She was very pleased with her fixed provisional restorations (Fig. 8). Now that the patient was no longer anaesthetised, the occlusion was checked again to confirm there were no interferences in lateral and protrusive movements. The next step in her treatment would consist of impressions for the definitive upper and lower restorations approximately 4 to 5 months postoperatively.

Approximately 16 weeks after implant placement, the patient returned for the prosthetic phase of her treatment. The gingival tissue around the implants looked healthy, so the healing caps were removed and the implants evaluated. Each implant was tested with the Osstell ISQ (Osstell, Linthicum, Md.) implant stability meter. Since the ISQ readings were all very high (above 75), impression posts (Hiossen) were inserted on the multi-unit abutments.

Since all the dental implants were well integrated, impressions were taken for the definitive restorations. For both arches, impressions were taken using Instant Custom C&B Trays (Goodfit) with a heavy and light body vinylpolysiloxane impression material (Take 1 Advanced, Kerr).

Bite relations was accomplished by picking up clear duplicates of the provisional restorations (Fig. 9). Instructions for size shape and color for the definitive restorations was forwarded to the dental laboratory and any changes indicated easily communicated to the dental laboratory technician.

A FP3 prosthesis would be fabricated for the patient’s upper and lower restorations. The pink gingival areas of this prosthesis type were needed to reconstitute the maxillary and mandibular tissue contours, as substantial bone leveling was required to even out the patient’s smile.

With improvements in materials and advancements in CAD/CAM technology (Fig. 10), full-arch prostheses can now be precisely milled from monolithic zirconia, offering aesthetics and functionality with the added benefit of long-term durability. Exhibiting exceptional fracture toughness and flexural strength, Zenostar zirconia has the ability to withstand the functional stresses that full-arch implant restorations are subject to over time.

Unlike hybrid dentures, the entire body of the Zenostar Implant Prosthesis (Arrowhead Dental Lab) including the gingival and tooth areas is constructed from the same robust material. The strength and durability offered by Zenostar is complemented by lifelike aesthetics and excellent translucency. The teeth of the prosthesis exhibit colour that is very similar to natural dentition, and advanced staining techniques are used to establish gingival areas that blend well with the patient’s soft tissue.

Within three weeks, the definitive maxillary and mandibular restorations were delivered from the dental lab (Fig. 11). Utilising a right angle prosthetic driver, both provisionals were removed and the definitive restorations inserted (Figs. 12 & 13). Care was given to torque the retention screws according to the manufacturer’s recommendations. A Panorex X-ray was taken to verify the restorations were completely seated. Once confirmed, a piece of Teflon tape was placed followed by composite material (Figs. 14 & 15).

The occlusion was checked and verified with the T-Scan (Tekscan) to make sure that all the proper points of contact were in their ideal positions to ensure longevity of the reconstruction. The patient no longer experienced pain and was very pleased with her new enhanced ‘whiter’ smile (Fig. 16).

**Conclusion**

Computer generated 3-D virtual treatment plans allow the dental provider or team to accurately place dental implants efficiently and effectively. With a variety of different software and associated surgical instrumentation available, dental implant diagnosis and treatment has become more simplified. This development has created an interdisciplinary environment in which better communication and precise execution leads to better patient care and outcomes.

**contact**

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Digital complete dentures
First clinical and technical experiences with the Digital Denture System

**Authors:** Dr Piero Venezia & Pasquale Lacasella, Italy

**Fig. 1a–c:** An edentulous patient requiring prompt and cost-effective rehabilitation of her maxilla and mandible.

**Fig. 2a & b:** Intra-oral view: resorbed alveolar ridges and a clinical situation similar to combination syndrome.

**Fig. 3:** Double-mix impression of the maxilla and mandible.

Only a few years ago, the idea of using CAD/CAM to fabricate removable dentures seemed scarcely realistic even though such technologies had already become an indispensable component of the workflow for fixed superstructures on natural teeth and implants. Recently, digital tools that help to provide rapid and predictable treatment of edentulous patients have become available. This report describes a digital system (Digital Denture System, Wieland Dental) that allows complete dentures to be produced in only three appointments.

A 70-year-old female patient wearing a complete maxillary denture had suffered an avulsion of the anterior mandibular teeth four weeks prior to her first visit. Lack of support in the posterior mandibular region and continued pressure in the anterior maxillary region had led to severe atrophy. The clinical situation was therefore akin to the dental condition described as combination syndrome (Figs. 1a–c, 2a&b). Since the patient wanted a rapid and cost-effective rehabilitation with removable dentures, we opted for the Digital Denture System protocol.

**First appointment**

For the preliminary impression, a prefabricated impression tray was coated with a tray adhesive (Virtual Tray Adhesive, Ivoclar Vivadent) and the impression material was mixed with the catalyst (Virtual Putty Regular Set, Ivoclar Vivadent). After
the primary impression had been taken, the areas where excessive compression was present were slightly reduced with the help of a micromotor handpiece. Next, the secondary impression was taken with a low-viscosity silicone (Virtual Light Body Regular Set, Ivoclar Vivadent; Fig. 3).

In order to determine the preliminary maxillomandibular relation and occlusal plane, two reference points, one on the chin and one on the nose, were marked and the distance between the two points was measured. The vertical dimension of occlusion was determined by subtracting approximately 2 to 3 mm from the soft interocclusal rest position, which corresponds to the freeway space.

A Centric Tray (Ivoclar Vivadent) was used to record the maxillomandibular relation. Consisting of an acrylic arch with a retention rail, this device was loaded with impression material (Virtual Putty Regular Set). We asked the patient to slowly close the jaws to the preliminary vertical height. After the impression material had set completely, a UTS CAD device (Wieland Dental) was attached to the handle to establish the occlusal plane. This registration device measures the angle of the occlusal plane in relation to Camper’s plane (CP) and the bipupillary plane (BP).

Once measured, the angles were transferred to the CAD software to reproduce the virtual position of the occlusal plane for the design of the 3-D bite plate (Digital Denture Professional add-on software module, Wieland Dental) and the denture. The Centric Tray was attached to the adapter of the UTS CAD and then the lateral braces of the bow were aligned to CP (Fig. 4). Next, the front part of the basic bow was aligned to the BP and the BP screw was fastened to secure the registration joint. The angle values of the patient were recorded on the order form, and then the form, impression and Centric Tray record were forwarded to the laboratory.

In the laboratory, the impressions and the Centric Tray record (preliminary bite registration) were scanned using the Digital Denture Professional add-on—based on the Denture Digital Design software (3Shape)—and the ScanIt Impression (3Shape) add-on. CP and BP angle modifications can be implemented with the latter add-on. The programme brings the two scans together and produces two virtual models of the edentulous jaws, which are aligned according to the clinical situation (Figs. 5a & b).

The dental technician created a 3-D bite plate for the functional impression and the needlepoint tracing appliance (Gnathometer CAD) into account. Next, the dimension of the bite rims had to be established (Fig. 6). The 3-D bite plate design allows for insertion of both the bite rim supports for functional impression-taking and the registration plates of the Gnathometer CAD device (Wieland Dental) for needlepoint tracing. The CAD datasets of the 3-D bite plates were sent to a Zenotec select ion milling unit (Wieland Dental) for machining (Fig. 7).
Second appointment

Before taking of the functional impression, the bite rim supports were inserted into the 3-D bite plates. For the registration, they were simply replaced with the registration plates. A polyvinyl siloxane material (Virtual Monophase, Ivoclar Vivadent) was used for functional border moulding. For this purpose, the material was applied to the margins of the maxillary plate. Once the plate had been seated in the oral cavity, the muscles were activated.

In order to determine the maxillomandibular relation, a Gnathometer CAD was used. This appliance is designed for taking needlepoint tracing records in edentulous patients. The bite rim supports were removed and the Gnathometer CAD mounted. Colouring material (crayon, felt tip pen) was applied to the lower registration plate and the patient was asked to perform retrusive, protrusive and lateral movements. The coloured registration plate showed the typical gothic arch tracing record produced by the tracing stylus. The perforation of the fixing plate was aligned with the arrow head of the arch (centric relation) and secured in position.

The patient was asked to occlude. This allowed us to check that the centric relation had been established correctly (Fig. 9). The 3-D maxilla-mandibular record can be immobilised with a suitable material (e.g. CADbite, Ivoclar Vivadent). Finally, the patient’s aesthetic lines (midline, canine–canine line, smile line, lip closure line) were marked on the record. The immobilised record was then forwarded to the laboratory, together with information about the tooth selection and CP and BP values.

In the laboratory, both sides of the record were digitised in their exact position using the denture scan holder (3Shape; Fig. 10). The digitised jaw models were aligned with each other on the basis of the registered relations, and the occlusal plane was established using the data captured with the UTS CAD.
The dental technician defined the extension of the denture and selected an appropriate tooth mould from a software library of denture teeth (Fig. 11).

The Digital Denture Professional add-on contains several examples of functional set-ups for select Ivoclar Vivadent and CANDULOR denture teeth, saving considerable time. The functional parameters and mandibular dynamics can be verified in a virtual articulator similar to the Stratos 300 (Ivoclar Vivadent) and possible interferences can be identified.

**Third appointment**

A third appointment is purely optional. In this case, a prototype was tried in on the patient to check the aesthetics, phonetics and function of the prospective final dentures (Fig. 12). Fine adjustments, such as corrections to the midline and reduction of the vertical dimension, were communicated to the laboratory. There, the denture design was approved for CNC production. A transfer template was computed automatically to facilitate the correct placement of the denture teeth. The CNC milling machine then finished the denture bases. The dentures were removed from the disc and polished (Fig. 13).

**Fourth appointment**

Intra-oral evaluation of the complete dentures and subsequent modifications were carried out in the same way as the procedures for conventional dentures. Hardly any alterations were necessary in this case. The dentures provided a secure and reliable fit and harmoniously integrated into the patient’s overall facial appearance (Fig. 14).

**Conclusion**

Scanning technologies, combined with CAD/CAM processes, substantially reduce the workload associated with the fabrication of complete dentures. Virtual set-up and design facilities (CAD) and denture milling procedures (CAM) eliminate the lengthy processes involved in model articulation and flasking. As polymerisation shrinkage does not occur, the dentures exhibit a high accuracy of fit. The system described in this report meets the demographic and economic requirements for the production of straightforward, fast, cost-effective and high-quality dentures for edentulous patients._

**contact**

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Evaluating the fit of removable dentures with magnification systems

Authors: Dr Gualtiero Mandelli & Carlo Borromeo, Italy

Nowadays, implant-supported prostheses are used more and more in people’s daily routines and removable prostheses in case of large rehabilitation offer aesthetic and functional advantages especially when support of the soft tissues is necessary.

In this article, much attention will be given to the analysis and the design of the prosthesis in order to achieve predictable and repeatable results. During the construction of the structure and superstructure the microscope will be critical to achieve the maximum precision.

Introduction

Removable prostheses are increasingly being used in everyday practice; in many cases you can achieve excellent functional aesthetic results even in the presence of a reduced number of implants, mostly when the patient wishes a stable total rehabilitation without the insertion of many implants. After the construction of a total temporary prosthesis in
the lower jaw and the evaluation of all the problems and expectations of the patient, it is planned to produce a full denture anchored to a bar screwed on four implants (Fig. 1).

**Step by step procedure**

In the first phase, after the implant surgery guided by a replica of the temporary restoration, the definitive impression was taken with a set-up created to restore aesthetics and function (Fig. 2). During the try-in, the template that was prepared in the laboratory over the master model was also checked (Fig. 3) in order to verify that there was agreement between the implants and the wax-up. The template was screwed on the implants, and blocked with the resin where it was separated; doing this we can be sure of the implants’ position. The template was returned to the laboratory to check the accuracy of the wax-up’s position and their passivity against the master

**Fig. 6:** With the resin jig the correspondence between the position of the wax-up and the implants located in the oral cavity is searched; after that the teeth set-up, the model and the implants position were scanned.

**Fig. 7:** After making the teeth set-up translucent, the design of the structure was begun, considering the available space and the position of the teeth and of the implants. It is also evaluated the masticatory plane in relation to the main plane of the structure.

**Fig. 8:** The project of the bar continues, verifying all the details before sending the file, even the choice of the kind of anchor should be carefully evaluated according to the type of structure and the available spaces.

**Fig. 9:** After sending the file, the structure was produced by the milling centre, and the first check to be carried out is the precision and passivity test, which was performed on the verification model built with the help of resin jig.

**Fig. 10:** Detail of the structure positioned with the silicone gums, checking the areas around the implants and adjacent to the bar to locate the correct positioning.

**Fig. 11:** After the bar was complete, the silicone of the set-up is positioned and the available spaces are checked.

**Fig. 12:** The possibility of screwing and unscrewing the retentive attachments gives not only the advantage to change them in case of wearing over time but also to change them at any time during the design of the superstructure.

**Fig. 13:** After carrying out all the necessary checks, the structure is finely polished before building the superstructure.
industry report use of the magnification systems

Fig. 14: After polishing, the hygiene maintenance is checked towards the whole bar extension.

Fig. 15: Once polished, the structure was built directly onto the superstructure with pattern resin and preformed castable pieces, and everything is controlled with the palatal silicone key.

Fig. 16: The sprued superstructure with main and accessory pins and the stabilising bar.

model (Figs. 4 & 5). At this point, after checking the set-up and the correct positioning of the wax-up, the model, the scan abutment, and the teeth set-up (Fig. 6) were scanned.

With the teeth set-up in light transparency, the design of the bar began, taking into consideration the available spaces, and keeping in mind the kind of prosthesis to create (Fig. 7). The design of the bar has to be accurate in all its details, including the surfaces facing the gums that should enable the patient to clean their teeth daily. Only at this stage is it possible to identify what kind of attachments to use and where to put them in order to allow a good retention and a proper function (Fig. 8).

Once the design was finished, the file was sent to the milling centre, where it was milled in chrome-cobalt and returned to the laboratory where the first verification of its passivity and precision with the measuring gauge was performed (Fig. 9). After obtaining the evidence of its passivity on the master model, another test was done mainly on the area around the implants (Fig. 10). Sitting the lingual silicone key on the model the available space for the construction of the superstructure and the prosthesis was also checked; at this stage it is still possible to intervene modifying the project.

The structures were sent to the dentist for tests in the oral cavity (Fig. 11). During the design, the
correct areas where to locate the attachments were carefully evaluated and the milling centre was asked to produce the threads inside the bar in order to screw the attachments directly into it after polishing and finishing; the most suitable attachments were then screwed to reach the retentiveness that was planned beforehand (Fig. 12). Once polished, the bar superstructure can be produced (Fig. 13). A crucial step is to refine and perfectly polish the areas around the implants and the soft tissues, because the superstructure did not have to compress any area (Fig. 14). The superstructure may be made with an indirect technique duplicating the model, or with CAD, or directly on the structure with resin, as presented in this case report. Once done and before the casting, a further control with the silicone keys of the volumes and spaces available (Fig. 15) was made. After the checks, the superstructure was sprued with injection pins and with a stabiliser bar in the rear area (Fig. 16).

Immediately after the cast, the superstructure was controlled in all its parts to verify the quality of the alloy, and checked it fit over the bar with a marker spray and with minimal pressure (Figs. 17 & 18). With magnifier systems, every area of friction or incorrect pressure, both on the bar and in the superstructure, was searched; this allows the maximal function of the implant system.

As shown in the Fig. 23: After checking the good friction of the superstructure, all the retentive laboratory caps were placed, the bar and attachments sprayed anew with the marking spray and the correct sitting is checked.

Figs. 24 & 25: After removing the superstructure, the retentive areas of the attachments are searched with the microscope; the wrong areas of contact on the attachments show how they do not work properly. This because there are some points on the structure that have to be discarded as they will interfere with the bar insertion.

Fig. 26: After correcting of those points that interfere with the proper function of the attachments, the superstructure sits correctly over the bar and this is showed by the correct contact areas on the attachments.

Fig. 27: After all these functional tests between the structure and superstructure, the available spaces are checked with the lingual silicone key. Fig. 28: Using the vestibular silicone key, the teeth were repositioned. Fig. 29: Having built the structure and the superstructure with the silicone keys, the teeth repositioning is easily done, having all the necessary space and without affecting the teeth. Fig. 30: Detail of the modeling of the soft tissues after the replacement of the teeth.
the structure and of the retentive systems to be checked (Figs. 19 & 20). These magnifying devices, such as microscopes, allow for a better identification of the areas to be eliminated, and to distinguish those only to be polished, as metal abrasions must be eliminated (Fig. 21). As soon as all these points are correctly managed, the result will be a good fitting of the superstructure with a smooth friction, with the location of the attachments perfectly in the centre of the housings (Fig. 22). Only at this point were the black lab caps inserted, and the superstructure was inserted on the bar after being sprayed with marking spray; this allows you to check how the attachments act during the insertion (Fig. 23). Once the superstructure was extracted, the attachments were checked using the microscope and it was detected that some areas were wrongly involved; indeed when the lacquer was removed (Figs. 24 & 25) around the attachments, incorrect contacts could be seen. As a consequence, the caps will not work in the retentive areas of the spheres, this is because some points of the bar will hinder the superstructure’s insertion. Once those points of friction were removed at a second test, the structure sat better over the attachments (Fig. 26).
Years of research, opinions and wishes of users as well as mutual cooperation have led to the creation of the efficient CAD/CAM solutions. Simple application, excellent technology and fine materials are backed by professional support, which is available throughout the process, i.e. from your desire and idea of a purchase to the training and fast solutions to any problems you may encounter during use.

Zr DISCS
- CC Disk Zr
- CC Disk Zr coloured
- CC Disk Zr HT
- CC Disk Zr HT coloured
- CC Disk Zr Smile
- CC Disk Multicolour

CoCr DISCS
- For all metal ceramics
- CTE 13.9 - 14.0 × 10⁻⁶K⁻¹
- Contains very little oxides

Ti DISCS
- Ti2; for crowns, bridges and simple implant substructures.
- Ti5; for crowns, bigger bridges and complex implant substructures.

PMMA DISCS
- CC Disk PMMA
- CC Disk PMMA Transparent
- CC Disk PMMA Pink
- CC Disk PMMA X-ray Opaque
At this stage, the prosthesis could be finalised using the silicone to control the spaces and to relocate the teeth (Figs. 27 & 28). The importance of using the silicone keys throughout the design and final is visible in Figure 29, where the available space for the repositioning of the teeth is clearly visible. Without damaging the individual teeth, the set-up is reproduced in a practical and quick way, keeping all the features of the initial project (Fig. 30).

After repositioning and the new waxing was completed, the model with the denture was inserted in the injection flask, and attached with a silicone base (Fig. 31). When the wax was removed and the model cleaned and isolated; the teeth were repositioned in the silicone key, the superstructure sandblasted, treated with primer, opaque and cured and put back on the model (Fig. 32). The flask was injected with resin and after its curing, the prosthesis is finished, rechecked in the articulator and polished (Figs. 33 & 34). Even the inner side was refined and polished, and only after this final steps, the retentive caps were inserted inside the prosthesis. These caps have the retention that the patient desires and the project necessitates (Fig. 35). After the structure was polished, it was delivered to the clinician; polishing is a crucial part of the process to avoid plaque adherence (Fig. 36).

During the final test after the bar is screwed in the mouth, it is good to double check the surrounding areas of the implants and the correct spaces for daily hygiene (Fig. 37). After its insertion, the prosthesis is re-checked and eventually discarded or remodeled; after a few days the patient was reviewed with great satisfaction of the work done and had a smile on his face (Figs. 38–40).

**Conclusion**

As pointed out in this article, the importance of using magnification systems is evident, including removable prosthesis, as they provide the possibility to check the good sitting of the superstructure on the bar and the proper function of the retentive systems; this eliminates the negative internal tensions of the whole system that can be transmitted to the implants, thus extending the life of attachments and of the whole system.

**Dr Gualtiero Mandelli**

graduated in Medicine and Surgery from University of Study of Milan in 1985. After graduating, he achieved three post-graduate specialisms in: Orthodontics, Stomatology and Pediatrics in the same University. He was Visiting Professor in Orthodontics at University of Parma from 2003 to 2010 and from 2011 he has been Visiting Professor at Specialisation School in Orthodontics at University of Brescia. His private practice is in Lombardia. He has been a member of SIDO from 1995. Dr Mandelli is also an author of various scientific works and has given talks and presentations at numerous courses and congresses.

**Carlo Borromeo**

founded Dental Laboratory Borromeo in Italy in 1988, specialising in the construction of prosthesis for implants using CAD/CAM. He collaborates with Nobel Biocare Procera, Dental Wings, Rhein’83 and other companies to improve his expertise with their materials. He is a highly published industry author and presents and participates in many dental lab courses and conferences.
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The synthesis of aesthetics, health and structural stability
The advantages of using the Angulated Screw Channel (ASC) abutment system

**Author:** Dr Chandur Wadhwani, USA

There are many reasons why cement-retained implant restorations gained popularity over the last few years, which can be attributed to aesthetics, ease of use and familiarity with cementation techniques. However, Pauletto, Gapski and others reported that cement excess was problematic; then Wilson’s study established a positive relationship between excess residual cement and peri-implantitis.

Surveys on cements used for implant restorations indicated a diversity in material selection, application technique and volume. This suggested a lack of conformity and understanding of cement usage within the dental profession. To overcome the cement problem, it became evident that improved understanding was required for cement material selection, abutment design and the determination of cement margin depths. Even with the very best intentions, however, residual excess cement can lead to disease, affecting the health of the implant/tissue interface and remains a dominant risk factor.

The association of residual excess cement and peri-implantitis has resulted in the need to re-examine alternatives such as the screw-retained implant crown. For many implant systems, the ability to use a screw-retained implant restoration is limited to regions where the screw access channel emerges in an aesthetically ‘safe’ site.

Usually the anterior maxilla and mandible present the greatest challenges, as the long axis of the implant often projects through the proposed incisal edge or even facial to the final restoration (Fig. 2a). Occasionally, when the surgeon places the implant in a compromised site—or the implant is inappropriately placed—the traditional screw-retained implant restoration may seem to provide more of a challenge than a solution (Fig. 2b).

**Angulated Screw Channel saves the day**

An innovative solution to the off-axial implant is the Angulated Screw Channel (ASC) abutment system developed by Nobel Biocare (Fig. 3). With the ability to alter the screw access channel up to 25 degrees, it eliminates the need for cementation in the vast majority of cases like these.
The ASC provides for an active synthesis of health, aesthetics, and excellent structural and mechanical abutment joint stability.

Health

With use of the ASC abutment system, cement extrusion into the fragile peri-implant soft tissues is eliminated. The ASC puts an end to the onslaught of cement fluid pressure and unset chemicals from the cement material. It also gets rid of the potential for foreign bodies being pushed around the implant site, which can jeopardise implant health (Fig. 4).

In addition, the use of zirconia abutment superstructures in combination with titanium bases provides optimised materials for biocompatibility and health.

Aesthetics

With the ASC, the screw access channel can be projected away from high-aesthetic-risk areas and placed appropriately at a variety of different angles. CAD/CAM design enables the restorations to be efficiently designed and quickly manufactured at Nobel Biocare’s production facilities (Fig. 5).

Milled zirconia is highly aesthetic, thus especially useful at the soft tissue emergence site.

Mechanical stability

CAD/CAM utilisation (Fig. 6a–c) allows for optimised screw access site planning, and the machining of components provides a precise, dedicated connection, optimised for the implant-abutment joint.

As with all implant-to-abutment connections, the optimised passive fit results when these surfaces are in intimate contact and forces are distributed universally. Casting abutments cannot always provide an even connection with joint contact, as they are often inadvertently damaged through cleaning and polishing, which alters the consequent fit (Fig. 7). When this occurs, the joint connection may fail, with screw loosening or even failure of the implants as a result.

Structural components

Titanium alloy abutment bases provide the most accurate fit with machining tolerances readily controlled. Abrasive wear, i.e. the release of titanium metal into the peri-implant tissues from the inside of the implant, is not an issue. The zirconia abutment, with its well-designed circumferential wall strength, is held through the abutment screw, optimising the ceramic’s ability to withstand forces that have been seen to fracture non-titanium base abutments.

Conclusion

The benefits of the ASC abutment system are numerous, reflecting a multiple symbiosis of engineering ingenuity and biocompatible materials, and allowing for the combination of good aesthetics and excellent health.

Attending IDS? Learn more about NobelProcera ASC solutions at the Nobel Biocare booth in Hall 10.1.

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Editorial note: For the complete references to this article please visit: nobelbiocare.com/news.

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is a prosthodontist in private practice in Bellevue, Washington, USA. An adjunct assistant professor at Loma Linda University’s School of Dentistry, he is also affiliate faculty at the University of Washington School of Dentistry in Seattle. He has written the first evidence-based textbook dedicated solely to implant cementation. Here, he describes some of the advantages of working with the NobelProcera ASC (Angulated Screw Channel) abutment system.
Essential communication:
The use of technology for virtual patient records

**Authors:** Dr Les Kalman & Mariana Capretz, Canada

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**Introduction**

Records are an essential and integral component of diagnosis and treatment planning.\(^1\) Moreover, the acquisition of records allows the required communication between the clinician, laboratory, patient, and other third party stakeholders.\(^2\) This is critical in all aspects of dentistry, but holds immense value in implant dentistry. Unfortunately, there is a growing epidemic in which clinicians are utilising the minimal amount of records.\(^2\) This becomes a paramount issue in the delivery of predictable and successful dental prosthetics.

Records may take many forms, but they tend to originate from two different groups: concrete and virtual. Concrete records include impressions and models, while virtual records encompass modalities such as cone bone computed tomography (CBCT) and intraoral scans. Each group has their own strengths and weaknesses, yet the literature seems to suggest that CBCT provides an abundance of information, especially for implant dentistry.\(^3\)

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**Computed tomography**

Computed tomography (CT) has revolutionised diagnostic radiology.\(^4\) Since its inception in the 1970s, its use has increased rapidly, with the annual number of CT scans, in the United States alone, now being over 70 million.\(^4,5\) By its nature, a CT unit involves larger radiation doses than the conventional X-ray imaging procedures. Consequently, a typical CT series results in radiation doses that are associated with a small, yet statistically significant increase in lifetime cancer risks.\(^4-7\) The quantity most relevant for assessing the risk of developing cancer from a CT procedure is the ‘effective dose’.\(^8\) A diagnostic CT procedure produces an effective dose in the range of 1 to 10 mSv, with a dose of 10 mSv possibly being associated with an increase in the likelihood of cancer of approximately 1 in 2000.\(^8\) The risk of radiation-induced cancer is much smaller than the natural risk of cancer; however, this small increase in risk for an individual becomes a public health concern if large numbers of people undergo increased numbers of CT screening procedures unnecessarily.\(^4,9\) There is strong evidence suggesting too many CT studies are being performed in the United States and it has been speculated that one third could be replaced by alternative approaches, or not performed at all.\(^4\)

Furthermore, in the dental office setting, the large size, high cost of the equipment and logistics makes it improbable for the clinician. Likewise, with a cost per scan ranging in the hundreds to thousands, the procedure can be challenging for patients.\(^10\) Thus, although CT has numerous beneficial aspects, there are barriers to the technology from both the clinician’s and patient’s perspective. Subsequently,

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Fig. 1: The 3M True Definition Intra-Oral Scanner.
other records acquisition techniques have gained increasing popularity.

**Cone beam computed tomography**

Cone beam computed tomography (CBCT) is a variation of the traditional computed tomography (CT) system. With CBCT, an X-ray beam, in the shape of a cone, rotates around the patient to produce a 3-D reconstruction of the craniofacial area. Dental CBCT was developed so that dentists could have a small, less expensive machine still capable of producing 3-D images. The equipment is used for various clinical applications, including dental implant planning, visualization of abnormal teeth, evaluation of the jaws and face, cleft palate assessment, diagnosis of dental caries, endodontic assessment and diagnosis of dental trauma. Thus, CBCT provides a fast, non-invasive method of addressing a number of clinical questions. This eliminates the time and cost associated with impressions, model fabrication, potential for material distortion and the issue of patient discomfort. In addition, the 3M True Definition Scanner digital files can be used with any system that accepts STL files, a common file format used for saving three-dimensional objects. Dentists can easily share files and work with laboratories and other open source technologies to design and fabricate prostheses and deliver quality treatment to the patient. However, there are limitations to the technology. Like any new technology, there is the period of skill acquisition for the clinician and, although the unit is mobile, it does require space (note: a compact, tablet-based unit has been recently released). Additionally, while the True Definition Scanner captures the dentition, there is a lack of reference to the patient. Once the scans have been compiled into an image, the image has the ability for rotation in three dimensions (Fig. 2). Figure 3 depicts the same clinical image but oriented in different positions. The incisal edges of the laterals have been demarcated. Determining which orientation is the ideal one becomes difficult without reference points. Figure 4 illustrates required reference planes of interest for the rehabilitation of complex cases that require facial form as a reference for the predictable and successful fabrication of aesthetic prostheses.

**3M True Definition Scanner**

Launched in the USA in October 2012, the 3M True Definition Scanner (Fig. 1) is a relatively new digital intraoral scanner. Its 3-D video capture technology allows the dentist to digitally capture images of the patient’s dentition (Fig. 2). The scanner’s technology instantaneously stitches the images together to generate an accurate replica of the patient’s oral anatomy. Patients can therefore have a better understanding of their oral situation and the treatment procedures. Furthermore, the preciseness of the data provides the clinician the required records to design and fabricate prostheses, such as orthodontic appliances, crowns and bridges, all without the need for impressions or models. This eliminates the time and cost associated with impressions, model fabrication, potential for material distortion and the issue of patient discomfort. In addition, the 3M True Definition Scanner digital files can be used with any system that accepts STL files, a common file format used for saving three-dimensional objects. Dentists can easily share files and work with laboratories and other open source technologies to design and fabricate prostheses and deliver quality treatment to the patient. However, there are limitations to the technology. Like any new technology, there is the period of skill acquisition for the clinician and, although the unit is mobile, it does require space (note: a compact, tablet-based unit has been recently released). Additionally, while the True Definition Scanner captures the dentition, there is a lack of reference to the patient. Once the scans have been compiled into an image, the image has the ability for rotation in three dimensions (Fig. 2). Figure 3 depicts the same clinical image but oriented in different positions. The incisal edges of the laterals have been demarcated. Determining which orientation is the ideal one becomes difficult without reference points. Figure 4 illustrates required reference planes of interest for the rehabilitation of complex cases that require facial form as a reference for the predictable and successful fabrication of aesthetic prostheses.

**MaxAlign**

Given that it accurately and efficiently captures and documents important patient information for the laboratory, third party insurance, and patients,
MaxAlign (Fig. 5) is a tablet-based technology that serves as a communication tool for clinicians.18, 19 The program is a modified virtual facebow application that, unlike conventional facebows, enables the accurate mounting of casts alongside a patient’s image.18 Thus, MaxAlign presents a novel approach to the virtual acquisition of records and communication. In three steps, the dentist can capture a photograph of the patient’s teeth, document the width of the centrals (Fig. 6), and record the occlusion.20 The accurately mounted casts provide information that can be used for diagnoses and treatment planning and offers an easy reference for the mounting of models.18, 19 Using MaxAlign with a LabStand, the lab can easily use photographic overlays to mount the models, anatomically referenced on the patient.20 Ultimately, the increased accuracy and accessibility in patient data reduces lab guesswork on cases and delivers predictable results efficiently.20 As MaxAlign is a mobile, tablet-based technology, many barriers to utilisation are eliminated. For instance, as the technology is mobile, it does not require any office space consideration. It is also cost-effective, possesses negligible radiation concerns for the patient and has a gentle learning curve for the clinician and staff.

**Merging virtual technologies**

Recent research has investigated a new application utilising MaxAlign with the True Definition Scanner...
by merging and correlating the intraoral images (Fig. 7). MaxAlign provides the reference and frames the 3-D intraoral digital impression with the landmarks of the patient’s face, providing crucial information to the lab in anterior aesthetic and complex prosthodontic cases. Additionally, early investigation has also merged images from digitised wax-up scans with the referenced patient image from MaxAlign (Fig. 7). By applying the transparency control on MaxAlign, the patient and other third parties, can now have the ability to immediately ‘try-in’ the proposed restorations and view a before and after effect within the context of the patient’s face. This can aid in patient communication and understanding of planned treatment.

Conclusion

Records will continue to have a significant requirement in the diagnoses, treatment planning and delivery of predictable and successful prostheses. With the growing pressures on the dental profession, including economics, office space limitations, patient concerns and skill acquisition, it is crucial to develop accurate and informative technologies to maximise patient information acquisition and communication. Although CBCT and virtual planning remain the ‘gold standard’, there are real patient and clinician limitations to the technologies. The utilisation of low-radiation, mobile, tablet-based technologies to merge patient information, has become an exciting avenue that will continue to have an increasingly important role in implantology and dentistry...

References


contact

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“Machines will never replace the human hand...”

An interview with Dr Stavros Pelekanos, assistant professor at the School of Dentistry of the University of Athens, Greece, and faculty member of the Global Institute for Dental Education, Los Angeles, USA

What is the role of aesthetics in dental implantology today?
Dr Stavros Pelekanos: Implantology in the 1980s and 1990s was bone-driven. The Albrektsson criteria for a successful implantation back in 1986 did not even refer to aesthetics and were followed for many years to come. Nowadays, prosthodontists start the treatment and perform backwards planning, always keeping in mind the correct positioning of the tooth or teeth to be replaced.

Patients’ expectations regarding aesthetic results are growing with the emergence of new technologies and materials. However, have these innovations truly arrived in every dental office?
Well, in continuation of my response to your first question, there are two major problems that the dental community has been facing in recent years, incorrect implant positioning and peri-implantitis both being difficult to resolve. As patients become more aware of these complications, they expect and demand more aesthetic and predictable results. New technologies such as high-resolution CBCT, CAD/CAM abutment manufacture, abutments produced using new zirconia technologies, and digital planning are already widely in use in everyday dentistry, minimising risks, as well as enhancing aesthetics and treatment workflow.

Have digital solutions changed the way dental restorations and full-mouth rehabilitations in particular have been performed over the past several years?
Digital planning, intraoral digital impressions and CAD/CAM technologies have really changed implantology today. First of all, preoperative planning is a helpful tool for ensuring correct implant placement, for both novice and experienced surgeons. Furthermore, more conservative (sometimes flapless) surgical approaches result in much less postoperative swelling, facilitating greater patient acceptance. The digital workflow in prosthodontics facilitates milled abutment constructions or even same-day teeth when immediate loading or provisionalisation is chosen in the treatment planning. CAD/CAM laboratory procedures reduce human error, providing more robust and accurate frameworks and final reconstructions.

In your experience, what is the best way to achieve a natural-looking implant crown?
Irrespective of the digital revolution, the hand skills of a talented dental technician are indispensable, especially in the case of a single implant crown next to natural teeth. Machines will never replace the human hand, as individual perception of every case, the knowledge of biology and anatomy are of the greatest importance. The factors that determine the success and natural appearance of an implant crown are accurate implant positioning, meticulous bone- and soft-tissue handling, and a skilled dental technician.

The number of implants placed worldwide is expected to double over the next five to six years.
Consequently, education efforts have to double too in order to ensure that dentists are adequately trained in implant placement. Do you agree with this statement?

Of course; however, and I say this although I am a faculty member of the School of Dentistry of the University of Athens, which provides education at the highest level, students are still unfortunately not adequately trained in implants. Postgraduate studies in a university environment or very well-organised implant master programs are necessary for a dentist to be able to place or restore implants.

We have seen quite a few different concepts emerging over the last several years in aesthetic dentistry, such as bio-emulation and smile design. Which concepts will have the most impact in the future and change the way aesthetic dentistry is performed?

Well, as a prosthodontist, I have to say there is nothing new in these concepts. Basic aesthetic rules are to be applied in every prosthodontic case, such as tooth positioning, proportion, occlusion, colour and design. However, digital technology is a very helpful tool, especially for the novice dentist, for implementing these rules and simplifying the treatment workflow. The same applies to bio-emulation. Biological concepts, improved materials and techniques are always there to simplify clinical dentistry and reduce potential errors and complications.

What is the position of aesthetic dentistry in the development of dental specialties in your opinion?

Aesthetic dentistry is not a recognised specialty generally, falling mainly under prosthodontics. I do not think aesthetic dentistry should be a stand-alone specialty. Being trained in a periodontic-prosthodontic environment (University of Freiburg, Germany, under Prof. J.R. Strub), I believe that a modern restorative dentist should be adequately trained in more than one main area. Periodontics, prosthodontics and restorative dentistry all constitute what is considered aesthetic dentistry.

**About**

Dr Stavros Pelekanos received his DDS in 1991 and his doctoral degree in 1993. He runs a private practice in Athens specialising in prosthodontics, implantology and aesthetic dentistry. He is an assistant professor at the School of Dentistry of the University of Athens, Greece, and a faculty member of the Global Institute for Dental Education, Los Angeles, CA, USA. Dr Pelekanos lectures internationally and gives hands-on courses on implants, aesthetics and restorative procedures. To date, he has published over 20 articles in peer-reviewed journals and two chapters in books.
The use of CBCT and CAD/CAM techniques in complex implant-supported rehabilitation of maxilla—Part I

Author: Dr Tomasz Śmigiel, Poland

Introduction

Patients who visit our clinic and wish to receive prosthetic treatment are frequently unaware of the possibilities that modern medicine has to offer. Neither are they aware of the fact that implantological treatment is not a 'one-day' treatment and that the integration of implants with bone tissues takes some time. That time can range from several weeks to several months. What they are also unaware of is the fact that after some time from the moment the teeth have been extracted, the bone will atrophy and hence it is often necessary to perform augmentation procedures first before dental implants can be placed.

Therefore, a complete treatment may last from several months to up to a year. As a result, the temporary prosthetic restoration, which the patient will have to use till the end of the treatment, is recom-
mended. It is important to notify the patient that following augmentation procedures, using bone blocks and biomaterial, it is inadvisable to use a functionally unstable prosthesis as it may damage the augmentation material and damage the prognosis connected with the graft’s integration. As a result, in such cases one may apply a temporary prosthesis based on telescopic crowns as the whole load will be transferred onto teeth or implants, not the mucosa. Telescopic prostheses are a type of prostheses that are not functionally unstable, unlike ordinary acrylic prostheses or some other skeletal types.

Case report

A 62-year-old patient with residual dentition used an ordinary acrylic prosthesis. The main reason why the patient wished to change the prosthesis was discomfort due to the fact that the palate was covered up while the prosthesis was movable. In order to obtain maximally precise diagnostics, a demonstrative panoramic photograph was taken as well as CBCT.

During the process of treatment planning, a few proposals for prosthetic solutions were presented, including permanent and temporary restorations, based on existing teeth as well as implants of various combinations. After analysing CBCT scans (Figs. 3–6) it could be concluded that implantological treatment may be performed at the front maxilla without any additional procedures, however, due to significant atrophy in the lateral part and a low-lying fundus of the left and right maxillary sinus, it appeared necessary to perform augmentation procedures (sinus lift), in order to make implantation possible.

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**Fig. 3**: Analysis of implantation possibility based on CBCT of the frontal region: vertical dimension 16.1 mm, horizontal dimension 5.4 mm.

**Fig. 4**: Analysis of implantation possibility based on CBCT of the left frontal region: vertical dimension 17.2 mm, horizontal dimension 4.2 mm.

**Fig. 5**: Analysis of implantation possibility based on CBCT of the right-side maxillary sinus region: vertical dimension 5.6 mm, horizontal dimension 10.4 mm.

**Fig. 6**: Analysis of implantation possibility based on CBCT at right-side maxillary sinus region: vertical dimension 4.7 mm, horizontal dimension 6.4 mm.

**Fig. 7**: Preparation for taking impressions. Closed tray impression copings mounted onto the implants.

**Fig. 8**: An impression taken on an individual tray—Impregum. Implant analogues together with impression copings placed within the impression.
It became clear that treatment in this case would require more time and hence in the period between procedures, from the moment treatment began till the time the final prosthesis was accepted, the patient should be provided with a convenient temporary restoration. Being fully aware of advantages and disadvantages of different solutions, the patient decided on a restoration based on eight implants with a combined mounting and the use of screw-based abutments and telescopic crowns of implants. Application of telescopic crowns at the front of the maxilla allowed us to make a very convenient temporary restoration, partial prosthesis based on four telescopes.

Each treatment should start with a well-prepared plan. For most patients appearance after treatment will always be very important that is why an intraoral analysis must be made in order to assess the static structure of the mouth, as well as an analysis of the lips’ dynamics along with teeth exposure during speaking and smiling (Figs. 1 & 2).

We analysed the aesthetic aspects in a way that enables us to reach an optimal balance between white (teeth) and pink (gums) aesthetics. Of course, in toothless patients, one should take note of the fact that teeth setup as well as reconstruction of atrophied tissues will constitute a support for the lips. Such an analysis may be made on the basis of a restoration that the patient uses. In this case, first sanitation of the maxilla had to be performed, next a temporary acrylic prosthesis was made.

In the next phase, implants were inserted. In compliance with the results of the CBCT study, a sinus lift procedure was performed with a simultaneous implantation in the region of lateral teeth. Eight Ankylos implants were introduced, raising both maxillary sinuses at the same time. After six weeks, the implant exposure procedure was performed. Because of the fact that implants were partially
anchored into the bone at the lateral section, partially within the augmentation material while primary stability was achieved, we decided to expose implants at lateral sections without occlusal load so as to perform the so-called bone training with a view to improving the condition of the bone being regenerated. An impression was taken (Figs. 7 & 8) for the positional model and for the preparation of the temporary prosthesis based on telescopes.

Fig. 9: Scanned abutments at the frontal section for the sake of designing telescopic crowns.

Fig. 10: A design of primary telescopic crowns from zirconium oxide.

Fig. 11: Transparency on to make the thickness of the walls of the crowns visible along with the position of the abutments.

Fig. 12: Secondary telescopic crowns made from acetal resin prior to being glued into the construction.

Fig. 13: Primary telescopic crowns made from zirconia, packed and designated.

Fig. 14: Transfer of abutments from the model to the mouth by means of pattern resin.

Fig. 15: Tightened abutments prior to the mounting of primary telescopic crowns.

Fig. 16: Temporary telescopic prosthesis, of skeletal type.

Fig. 17: Temporary telescopic prosthesis of skeletal type: inside of the denture.

Fig. 18: Mounted primary telescopic crowns made from zirconia, on abutments.

Fig. 19: Test of secondary telescopic crowns made from acetal resin.

Fig. 20: Primary zirconia crowns in situ (right-hand side).

Fig. 21: Primary zirconia crowns in situ (left-hand side) together with a secondary crown made from acetal resin as a try.

Fig. 22: A set of telescopic crowns (palatal view) prior to being installed into the skeletal prosthesis.
The model was scanned while the abutments were made ready in such a way that they could serve as telescopic crowns, also in the final stage (Fig. 9). Primary and secondary telescopic crowns were designed on the abutments (Figs. 10 & 11) on the assumption that secondary crowns had been made ready twice, that is, for the sake of temporary prosthesis and at the same time for gluing it into the final construction (Figs. 12 & 13). Abutments were mounted on implants by means of Pattern Resin (Figs. 14 & 15) in such a way that the position does not change during mounting.

A temporary skeletal prosthesis, based on four telescopes, shall be placed on such a foundation (Figs. 16 & 17). Primary telescopic crowns were glued last (Fig. 18).

Secondary telescopic crowns, made from acetal by means of the CAD/CAM virtual designing method, were tried on primary crowns (Fig. 19). Figures from 20 to 22 present a macroscopic view of zirconia primary crowns testing and acetal secondary crowns. At that stage, our patient received a temporary prosthesis, while lateral implants remained unloaded (Figs. 23 & 24).

In the second part of the article, we will present the designing process (Figs. 25 and 26) along with the process of manufacture of the final construction made from TRINIA material with glued zirconia crowns as well as veneering by means of pink composite material._

Work completed in cooperation with Inter-Dent laboratory in Warsaw, Poland.

Editorial note: This article is the first one from the two parts series. Part II will appear in CAD/CAM 2/2017.

contact

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There is mounting evidence in the literature in regards to the diagnostic superiority of 3-D imaging versus 2-D. As a result, many clinicians today are using 3-D imaging either by referring their patients to a CBCT-scanning centre or having mobile units visiting them, and the only benefit of this method is that there is no initial capital outlay to buy the machine. In contrast, the benefits of having your own in-house CBCT machine are many, including the total convenience of an on-demand service at any time (pre-op or during and after if needed), learning one software and fully utilising it rather than having to learn different software for different machines (manufacturers), thus not utilising it to its fully intended use.

Additionally, patient appreciation that they do not have to travel to another location and that fact that you care enough to have a machine installed in your clinic for their convenience and yours.

Our X-Mind Trium CBCT unit from ACTEON is rather young in our practice, and we have yet to fully utilise it. Every day we find new uses and ways to benefit our patients by using 3-D imaging where applicable.

Following the latest evidence from experts in the utilisation of 3-D imaging can help a lot in deciding where and when to use it, consequently minimising dosage and improving diagnostics and planning.

We owe our patients the lowest possible dose with the corresponding acceptable diagnostic value, and sometime a 2-D image is just not enough to give satisfactory diagnostic value. A lot of guesswork is often involved with 2-D imaging that could affect our decision-making and treatment planning.

Judging every case individually is important in order for the benefits of using a CBCT scan to outweigh the potential risks involved with the use of any type of X-ray unit. A modern CBCT machine should allow for different fields of view (FoV) to be utilised, in order to minimise the dose to the patient.

Despite the choice of four different FOV settings on the X-Mind Trium, and other settings that reduce...
the radiation significantly, individual assessment of every case is still very important to get the most of the 3-D image without exposing the patient to extra radiation.

In many cases, a small FoV that is enough for one to several teeth could be equal to a few periapical radiographs but with a much higher diagnostic value.

In order to show how a CBCT scanning machine can affect the day-to-day dentistry in a small family practice, it would be beneficial to share a week’s diary, bearing in mind each practice's needs are different, but one thing should be common above all, and that is to assess every case individually and never take 3-D scans routinely, even despite their clear benefits.

When a 3-D image is necessary, patients appreciate the information and education they get by discussing the case with them while pointing to vital structures and solutions in 3-D versus an old fashioned 2-D image that did not make sense to the untrained eye in most cases.

So here are a small selection from a week’s diary utilising the X-Mind Trium 3D CBCT scan in the clinic. More CBCT scans were probably obtained on any one day depending on the cases on that day, however, due to space limitations in this article, only one to two cases per day were selected.

Day 1

The patient had all his lower teeth extracted many months ago, due to mobility and infections and preferred to have a fixed solution through implant therapy. Patient currently is wearing a well-fitted temporary lower denture. Initially the idea was to take a scan of the existing denture with radiopaque markers (gutta-percha in 6–8 holes made in the denture) to plan for the placement stage. However, a decision was made to duplicate the existing denture using a Lang duplication flask in order to fabricate a clear acrylic radiographic guide (Figs. 1 & 2).

A 3-D scan was obtained using the X-Mind Trium 3D CBCT scanner to be utilised as an invaluable resource in the treatment planning of the case. Through the scan, the type and position of the implants in relation to the density of the surrounding bone were checked.

The AIS 3-D Software that comes with the device, includes a library of most current implants on the market, allowing to place the right implant in the right angulation plus abutments and crowns in order to maximise the predictability of positioning the implants, thus improving its success.

For clinicians who use more than one implant system, to change the implant model that was inserted from the library, we simply click in the middle of the implant and the implant library is opened again and it is possible to choose another implant model, the software will keep the same insertion point and direction of the previous one. In addition, the software will easily evaluate the bone density around the implant. The aim is to show, both through colour maps and numerically (Figs. 3 & 4) the values before commencing surgery (green if the values are acceptable and high and red if the values are low—Fig. 5), allowing the clinician to make the right decision. This can also be a very good educational tool to show patients how their bone density potentially is around the implants.

In our experience, patients like this feature once shown what they mean.

Day 2

An implant is planned to replace a missing lower molar, and the position of the mandibular canal is not very clear on a 2-D image anyway, and even on the 3-D image the position is still a little confusing. Here we decided to use the AIS software’s FlyMode option, which is like a virtual endoscope that follows the mandibular canal tract from within, and aids to clarify the path and double check if our nerve tracking was correct (Fig 6).

This is one of the unique features of the software that can help clarifying and controlling nerve-tracking.
Day 3

Obtaining the correct position and trajectory of a retained upper canine has been traditionally dealt with by taking different 2-D images (periapicals) at different angles and possibly an occlusal film to determine the correct position in the bucco-palatal aspect together with some guessing work.

3-D imaging can be an invaluable tool for this matter. The patient refused orthodontic extrusion of the upper left canine and wanted both the deciduous and permanent canines extracted in order to be replaced by an implant support crown. In planning the case, a CBCT scan was obtained to serve many purposes as to assessing the positions including any anatomy and bone surrounding these teeth. Since this image was taken, both teeth were extracted and the socket was grafted fully to prepare the site for a later placement (Figs. 7 & 8).

Day 4

Case 1

A lower molar case was in the planning stage, and the position of the mandibular canal was located.

At this stage, different implant sizes were tested to check for best fit and maximum integration prognosis in the future.

The AIS software indicated that the first implant was too long and there was a risk of nerve damage (Fig. 9), thus another implant size was chosen to allow sufficient clearance above the nerve and the density of the bone was chosen at the same time, indicating good “green” values that the patient also could understand (Fig. 10).

These tools as mentioned above can be quite an eye opener for patients and their engagement can affect the outcome positively.

Case 2

A broken and lose bridge was planned to be removed. The lower left second molar which served as the most posterior bridge abutment tooth was beyond saving (visual inspection and probing).

3-D imaging helped with planning the case. It helped tracking the position of the mandibular canal in relation to the proposed implants (Figs. 11 & 12).

In addition, the density of the bone was also checked (Fig. 13), indicating that a wider implant possibly is a better choice to improve integration rather than the current one used from the implant library. This will also allow us for deciding to perhaps perform an under preparation of the osteotomy site in order for the implant to engage in the bone better, this obviously depends on the type of implant used and other factors that the expert clinician will be familiar with.
Day 5

This case was performed by another clinician who was hoping to achieve good integration after placing two anterior implants with grafting material.

According to the colleague, primary stability was good at the time of placement and the implants were 'buried' in the bone with some buccal fenestrations, hence the grafting. So everything indicated success.

After the patient complaining about some threads showing through the soft tissue, the colleague suggested further grafting to 'secure' the implants.

A CBCT scan was obtained (Fig. 14) as part of case planning, and clearly the scan shows that, this may prove difficult or at least very challenging. In addition, on the 3-D image we noted that the tip of the implant on the left side might be colliding with the root of the adjacent tooth, with long-term uncertainty as a result (Fig. 15). In this scanning slice (Fig. 16) we also noted the challenge ahead for grafting this implant successfully, which indicated that a lot of consideration has to be given and careful planning has to be employed in order to make the case successful.

However and despite the outcome so far with these two implants, the patient appreciated the high value of the 3-D technology and being able to see the problem clearly and from different perspectives, eliminating any guesswork that might affect the final outcome, and guiding the treatment in the right direction.

Conclusion

These cases and many more every week pass through any dental clinic, with patients hoping for best available treatment under best circumstances (clinical, timescale, financial etc).

We know that 3-D imaging is here to stay and in order to make treatments safer and more predictable for our patients, we have to engage in these technologies and involve the patients more in showing them their clinical conditions and perhaps the limitations (anatomical, structural etc.) together with other factors that may affect treatment planning and outcome, hopefully for the better. We hope to be able to use our CBCT scan for more indications, especially in endodontics as few times we have seen amazingly positive results in using a CBCT scan in some difficult endodontic cases since we acquired this 3-D technology. It is the way forward and we wish we had the X-Mind Trium 3D Scanner earlier.

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Contact

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MIS announces release of B+ implant surface

In March 2017, MIS Implants Technologies is officially launching its latest in-plant engineering, the B+ implant surface treatment, at the International Dental Show in Cologne. The B+ layer bonds chemically with the surface of the titanium dioxide of an implant and integrates perfectly with existing and newly forming bone, achieving greater initial osseointegration and longer-term stability.

Dr Björn-Owe Aronsson, who developed this unique surface together with his team at Nano Bridging Molecules, has presented case studies in which B+ proved very efficient in maintaining the bone level over time. This is particularly beneficial for patients with compromised bone healing and poor blood supply. The specific bone-bonding properties of the surface have proved to produce greater fixation of the implant in the early stages post-placement, as well as greater stability later on.

Aronsson explains: “Titanium is used as implant material due to its inertness and high acceptance by the body. Over the years, however, a wish for faster and more predictable integration with the bone has been driving research on the importance of the surface structural and chemical properties.”

The surface consists of a monolayer of multi-phosphonate molecules. These have a very high affinity to titanium dioxide, enabling a true covalent bond. The unique properties of this layer also make it extremely hydrophilic, which facilitates the colonisation of cells on the surface naturally. Research has even shown that blood vessels grow directly into the surface of the implant, which is unaffected by the oral environment and has been proved very stable in different pH levels.

“With the initial results from testing of the B+ surface, it was discovered that, for the first time, specific biochemical bonding can be obtained already at the very early healing phase after implantation,” Aronsson said.

MIS was very excited to learn about these discoveries and immediately saw the potential for a major breakthrough. Having been seeking a suitable company to partner with, Aronsson and his team were equally enthusiastic about embarking on the commercialisation phase with a company able to achieve rapid implementation in clinical practice and with a strong position in the market to advance their product.

Most recently, MIS has launched a user experience project involving 250 participants worldwide, who will be placing ten implants each with the B+ surface and reporting their experiences. The results of studies conducted by Aronsson and his team are extremely promising and both partners are exploring future applications for this advancement.

For more information on MIS products and services, visit www.mis-implants.com.
INTERDENT will present its new products at IDS

INTERDENT d.o.o. is a family owned company established in 1978 in Celje, Slovenia. Today the company offers tested and certified products for dental laboratories. INTERDENT produces materials and equipment for dental laboratories. It provides high-quality and rigorously tested products that comply with domestic and international regulations and standards, and are reliable and environmentally friendly. If you plan to visit the International Dental Show (IDS) in Cologne, do not forget to stop by our booth.

Experienced dental technicians will present the biggest updates in the CAD/CAM field, where you will be able to see five different milling machines (CC POWER, CC COSMO+, CC COSMO/STAR, CC TRENDY and CC CHIC), which differ depending on the power and way of milling. Due to their wide range, they are able to advise you on a milling unit that best suits your needs and requirements, no matter if you have a milling lab, a large lab, or a small lab. The complete CAD/CAM range represents a fully open system and freedom at your work. Besides milling units, we also offer scanners from Medit: Identica Blue and Identica Hybrid, as well as the software programme Exocad. The modern digital technology also includes material such as: CoCr, premilled abutments, Ti2, Ti5, Zr, Zr HT, Zr Smile, Zr Multicolour, PMMA, PMMA X-ray, PMMA transparent, wax and much more.

Visit us at IDS! (Hall 10.2, Booth P060)

www.interdent.cc

Full-contour zirconia restorations are growing in popularity. Long-associated with high strength, advances in zirconia materials have led to substantial improvements in aesthetics and efficiency. A perfect example is the high-translucent, multilayered full-contour zirconia from NobelProcera.

Achieve aesthetic results in less time

With NobelProcera’s full-contour restorations, aesthetics and efficiency have been considered at every step. At the start of the process, powerful CAD tools in the NobelDesign software make it straightforward to design an aesthetic restoration. At the production stage, the restorations are produced with the consistent quality and precision of fit NobelProcera production is renowned for.

NobelProcera full-contour restorations do not require veneering or sintering, so less labour is needed to finalise the restoration. Excellent occlusal details and surface finish mean the technician need only apply subtle staining, if desired, before polishing and glazed.

The multilayered nature of the zirconia also helps save time. By mirroring the natural colour variations between the cervical margin of a tooth, the dentine and the enamel, the technician has less work to do to achieve an aesthetic result. Aesthetics are further enhanced by the high translucency of the material, making NobelProcera full-contour zirconia restorations suitable even for anterior cases.

In cases where the technician feels traditional ceramic layering is required to achieve the desired aesthetic result, a partial cutback of the material is easy to do in the NobelDesign software. The ceramic can then be layered on top to create an optimised blend of high-end aesthetics and high-strength monolithic zirconia.

There are aesthetic advantages for the clinician when it comes to placement of the restoration, too. As the colour runs throughout the material, any final adjustments will not cause colour variations or white spots on the restoration.

Chosen for strength that lasts

Strength remains a key benefit of monolithic zirconia and NobelProcera’s full-contour zirconia exhibits strength at a level that helps prevent remakes.

NobelProcera’s full-contour zirconia has been selected for properties that support outstanding durability. It has been shown to undergo minimal monoclinic shift, meaning its structure resists changes caused by pressure and moisture over time, making the material highly durable. Plus, with full-contour restorations, the risk of veneer chipping is removed.

NobelProcera is expanding its range of full-contour zirconia solutions over time, increasing choice and flexibility, with each option designed to address the patient’s long-term functional and aesthetic needs. Given the benefits in terms of strength, durability, aesthetics and ease of use, NobelProcera full-contour zirconia restorations are set to be a popular choice for clinicians and dental technicians alike.

To see the latest additions to the NobelProcera range of full-contour zirconia solutions, visit Nobel Biocare at IDS in Hall 10.1.

www.nobelbiocare.com
MIS 2017 global learning programme

Sharing knowledge and experience through education

March will mark the start of a series of workshops organised by MIS Implants Technologies that will focus on various topics and be led by world-famous practitioners in different parts of the world. The offering includes courses on basic implantology in Germany and China, a workshop on the MULTIFIX solution in Portugal and a course taught in Turkey on the fundamentals of aesthetic smile design.

Dr Eric Van Dooren, a key opinion leader in implant dentistry and the co-developer of MIS’s V3 implant, will be teaching a course on the VCONCEPT in his training centre in Antwerp in Belgium, where he has been conducting courses and workshops for the past 12 years. He explained that the purpose of the centre is to offer courses with a focus on periodontology, prosthetics and implantology that give participants the opportunity to witness live surgeries. Participants enjoy high-tech audio-visual and are able to take advantage of live streaming.

The latest series of courses will focus on the integration between prosthetic and surgical implant treatment concepts and will highlight soft-tissue management in the aesthetic zone, both through theoretical material and a live surgery demonstration.

Van Dooren added: “Since we are focusing on new concepts and trends, the VCONCEPT really helps us in explaining that modern implant dentistry is changing compared to a few years ago.”

Van Dooren also incorporates the MIS MGUIDE guided surgery solution in the curriculum to show students that guided surgery today is really a very predictable tool to obtain excellent functional and aesthetic results. Furthermore, course participants will plan a case using the MIS MSOFT guided surgery planning software.

Participants who have taken Van Dooren’s courses in previous years have provided positive and enthusiastic feedback. The hands-on experience with the MGUIDE system has led to a great response from dentists, who have begun using these methods in their practices since attending the course.

Van Dooren plans to continue lecturing on these topics and incorporating the V3 implant and MIS digital dentistry tools and methods in future courses at the training centre.

More information on MIS global educational events can be found at www.mis-implants.com/education/MTC.aspx.

implant treatment

Growing the business with mySimplant Planning Service

mySimplant Planning Service eases dental professionals into the world of implant treatment, as well as facilitates the more complex cases—a solution to grow the business without compromising the clinical outcome of the cases. Think of it as a behind-the-scenes coach supporting and empowering you with the tools needed to easily plan and safely execute a surgery, and giving you the possibility to rely on an experienced partner to build your business while staying in control of your implant planning cases.

Easy to learn and use

The intuitive online system lets dental professionals get acquainted with computer guided implant treatment in their own time and on their own terms. They simply fill in the online web order form to receive a Simplant planning proposal from the Simplant technician for review within two days. Taking into account that the guide is manufactured within 48 hours after approval, this entire process can take less than five days.

Save time and money

Outsourcing 3-D implant planning reduces case time significantly and avoids expensive investments in software licenses. With Simplant Editor, clinicians have the freedom to review, adjust if necessary, and approve the plan anytime, anywhere, leaving more time to focus and treat patients.

Precision and protection in each plan

Precise planning is the best measure of a predictable outcome. Designed to achieve higher accuracy and minimise risks involved with standard ‘free-hand’ implant placement, Simplant guides are based on more than 100,000 patient-specific planning cases, giving you confidence and peace of mind. The fact that mySimplant Planning Service operates in the secure environment of mySimplant.com guarantees that patients can rest assured that their data is protected.

Getting started with computer guided implant treatment is easy and affordable—go to mySimplant.com

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FRIDAY 14 APRIL

CAD/CAM Dentistry

• “Digital total prothese”, Mr Max Bosshart & Mr Benoit Gobert
• “All ceramic materials in prosthodontic”, Prof Roberto Sorrentino
• “Tips and tricks to enhance the oral rehabilitation”, Dr Paulo Kano
• “New Occlusion Concepts with New Restorative Materials”, Dr Erhan Comlekoglu
• “Digital Biomimetics – Concepts for predictive treatments», Prof. Dr. Jan-Frederik Güth
The 6th IMAGINA Dental edition, Digital Technologies & Aesthetic Dentistry Congress will be held from 13 to 15 April 2017 at the Grimaldi Forum in Monaco. IMAGINA Dental is the industry’s leading event for new digital technologies, 3-D and CAD/CAM in dentistry.

IMAGINA organisers invite dentists to a new generation of congress designed to help them better understand, learn and share experiences and clinical cases about how digital technologies could change their daily practice. From 3-D imagery and 3-D diagnostic tools to guided surgery, treatment planning, implantology, CAD/CAM, aesthetic restoration and Digital Smile Design, IMAGINA Dental brings a unique educational experience in an intimate setting, to discover and find out more about how enjoyable innovative dentistry can be.

After last year’s edition (7–9 April 2016) it was apparent that IMAGINA has maintained its reputation as the leading congress for digital technology. In particular, participants emphasised the quality of the presentations and remarked that IMAGINA is more personal, giving the opportunity to engage with the presenters. More than 600 visitors from 26 countries attended the event, which received positive feedback from both the presenters and attendees.

**Highlights of 2016 meeting**

IMAGINA 2016 focused on CAD/CAM dentistry and microscopy, innovations in implantology and Digital Smile Design.

The guest of honour at the opening session was Dr Marcus Abboud, Founding Chair of the Department of Prosthodontics and Digital Technology and Director of Continuing Education at Stony Brook University’s School of Dental Medicine in New York in the US. The title of his lecture was “Innovations in CAD/CAM and digital workflow for the daily practice”. Abboud pointed out that digital dentistry and 3-D printing have rendered possible what could only be dreamed of just a few years ago, including individualised bone grafts and trachea replacements for cancer patients. However, it is important to realise that these technologies do not replace knowledge or conventional treatments; rather, they open up new treatment avenues, he said.

“Innovations in implantology” was the theme of the second day and started with a presentation by Drs Luc Manhès and Guillaume Fougerais titled “At the dawn of artificial intelligence, how to leverage technologies to keep hold of our dental treatments?” The speakers demonstrated that using CBCT technology, it is possible to obtain perfect treatment planning in 3-D. They pointed out that very few dentists use the technology and emphasised the value of using CBCT. Only 3 per cent of dentists use surgical guides to place implants, but Manhès and Fougerais encouraged the use of a surgical guide even for a simple case “to see the technology through”.

Dr Joseph Choukroun was the guest of honour of the second day. In his presentation, titled “A-PRF and i-PRF: the latest innovations with the use of mesenchymal stem cells in the dental office”, he explained how it is possible today to treat patients who have lost bone, cartilage and collagen by regenerating the lost tissue with stem cells. In the past, harvesting stem cells and treating them were very difficult to achieve. However, today, stem cells can be extracted directly with a blood sample, and Choukroun presented the technique for quickly extracting stem cells and injecting them where needed.

The theme of the last day of the congress was “Digital Smile Design”. The room was full for Prof. Angelo Putignano’s presentation, titled “Simplicity in dentistry: The Styleitaliano approach”. He began by explaining the guiding foundation for his work—colour and details—and went on to demonstrate this, taking the attendees on a magical trip to see what can be achieved in aesthetics.

Save the date and join IMAGINA Dental in 2017!
Dr Paulo Kano
Honorary Guest (Brazil)

Friday 14 April

CAD/CAM Dentistry
- «Digital total prothese»,
  Mr Max Bosshart & Mr Benoit Gobert
- «All ceramic materials in prosthodontics»,
  Prof Roberto Sorrentino
- «Tips and tricks to enhance the oral rehabilitation»,
  Dr Paulo Kano
- «New Occlusion Concepts with New Restorative Materials»,
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- «Digital Biomimetics – Concepts for predictive treatments»,
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## International Events

### 2017

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<td>3D Congress— The Global Event for Dental 3D Imaging</td>
<td>9–11 March 2017</td>
<td>Las Vegas, USA</td>
<td><a href="http://www.congress.i-cat.com">www.congress.i-cat.com</a></td>
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<td>SCANDEFA</td>
<td>27–28 April 2017</td>
<td>Copenhagen, Denmark</td>
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<tr>
<td>Dental Digital Marketing Conference</td>
<td>28–29 April 2017</td>
<td>Las Vegas, USA</td>
<td><a href="http://www.dentalmarketingconference.com">www.dentalmarketingconference.com</a></td>
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<tr>
<td>12th CAD/CAM &amp; Digital Dentistry International Conference</td>
<td>5–6 May 2017</td>
<td>Dubai, UAE</td>
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<td>Dental Technology Showcase</td>
<td>12–13 May 2017</td>
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<td>Expodental Meeting</td>
<td>18–20 May 2017</td>
<td>Rimini, Italy</td>
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<td>HK IDEAS— International Dental Expo &amp; Symposium</td>
<td>4–6 August 2017</td>
<td>Hong Kong</td>
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<tr>
<td>FDI Annual World Dental Congress</td>
<td>29 August–1 September 2017</td>
<td>Madrid, Spain</td>
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### Other Event

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<td>Academy of Osseointegration Annual Meeting</td>
<td>15–18 March 2017</td>
<td>Orlando, USA</td>
<td><a href="http://www.meetings.osseo.org">www.meetings.osseo.org</a></td>
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<td>37th International Dental Show</td>
<td>21–25 March 2017</td>
<td>Cologne, Germany</td>
<td><a href="http://www.ids-cologne.de">www.ids-cologne.de</a></td>
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submission guidelines:

Please note that all the textual components of your submission must be combined into one MS Word document. Please do not submit multiple files for each of these items:

- the complete article;
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- the complete list of sources consulted and
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In addition, images must not be embedded into the MS Word document. All images must be submitted separately, and details about such submission follow below under image requirements.

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Article lengths can vary greatly—from 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an unusually long article in multiple parts, but this usually entails a topic for which each part can stand alone because it contains so much information.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

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We also ask that you forego any special formatting beyond the use of italics and boldface. If you would like to emphasise certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers. Please do not use underlining.

Please use single spacing and make sure that the text is left justified. Please do not centre text on the page. Do not indent paragraphs, rather place a blank line between paragraphs. Please do not add tab stops.

Should you require a special layout, please let the word processing programme you are using help you do this formatting automatically. Similarly, should you need to make a list, or add footnotes or endnotes, please let the word processing programme do it for you automatically. There are menus in every programme that will enable you to do so. The fact is that no matter how carefully done, errors can creep in when you try to number footnotes yourself.

Any formatting contrary to stated above will require us to remove such formatting before layout, which is very time-consuming. Please consider this when formatting your document.

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Please number images consecutively throughout the article by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate these in a group (for example, 2a, 2b, 2c).

Please place image references in your article wherever they are appropriate, whether in the middle or at the end of a sentence. If you do not directly refer to the image, place the reference at the end of the sentence to which it relates enclosed within brackets and before the period.

In addition, please note:

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Questions?

Magda Wojtkiewicz (Managing Editor)
m.wojtkiewicz@dental-tribune.com
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