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From 21st to 25th March, the dental industry once again converged on the city of Cologne, Germany for the 37th International Dental Show, known as IDS (held every two years). The tremendous show delivered an amazing conglomeration of vendors, clinicians, dental laboratory clinicians, dental hygienists, and dental assistants in attendance from 59 countries around the globe. According to the post-show documentation, more than 155,000 visitors were able to discover "more innovation and a wider product range than ever before". If you were to visit the IDS website* you would learn that there were over 1,000 new products presented by over 2,300 companies whose exhibits spanned an incredible amount of square metres over many, many buildings.

It is hard to imagine that in only two short years that so many new products could be introduced, or that any meeting could attract so many participants from all parts of the world to meet, discuss, learn, and network about our chosen industry. For our readership, it should be noted that the major focus was on digital technologies, including intraoral scanners, desktop optical scanners, CAD/CAM software and milling machines, new materials, CBCT imaging devices, advances in treatment planning software, scanning abutments, and much, much more. It was almost impossible to travel down one of the crowded rows of exhibitors without seeing new 3-D printing technologies—in my opinion, it is one of the most important developments in recent years, and a technology now available at multiple price points.

As a student of our industry, the IDS meeting has always been an educational experience. However, the plethora of new products and new technologies can be completely overwhelming, and often is. Just because companies introduce new products does not necessarily mean that clinicians understand how to fully implement these products or technologies in their practices. Each month within the pages of the various Dental Tribune International publications are well-written articles that can aid clinicians to navigate through the maze, and serve as a resource on the new digital workflow and many other topics. Therefore, to answer the question, "Where are we now?", the answer is simple. We have that much more to discover than we did two years ago.

Enjoy the new issue!

Dr Scott D. Ganz, DMD
Editor in Chief

Dr Scott D. Ganz

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Dr Scott D. Ganz

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Demand for patient comfort and product innovations drive the US dental materials markets

Authors: Salma Mashkoor & Kamran Zamanian, USA

The US market for dental materials is experiencing remarkable changes, mainly due to demand for patient comfort and improved productivity. The need to improve patient comfort during dental procedures has demanded pricier products, encouraging market value growth. On the other hand, increasing productivity has been at the forefront of innovative delivery systems and CAD/CAM technology. Unlike the waste-saving measures provided by efficient delivery systems, CAD/CAM technology is creating a consistent downward pressure on the dental material market. As digitisation cannibalises the temporisation and impression materials segments, the growth potential of dental materials is threatened. As a result, the competitive landscape is being reordered to accommodate the growth areas of the overall dental materials market, although the leading competitors in the market tend to maintain their dominant positions.

Innovative delivery systems

Delivery systems within the dental material markets have been evolving, largely tailored towards efficiency and reducing material waste. For most materials, the traditional delivery system involved hand mixing a powder and liquid formula. Although dentists could manage with this technique, it typically led to inaccurate mixing, resulting from either too much liquid or powder. The powder and liquid approach remained somewhat relevant for dental impressions, mostly being used for alginate materials. Nonetheless, this method was originally used in cements, direct and temporary restoratives, bonding agents and core build-up materials and has since fallen in popularity. The overall movement in delivery methods has been targeted towards auto-mix systems, with the exceptions of dental anaesthetics and bonding agents. Although auto-mixing may demand a relatively premium price point, it successfully reduces waste, overcomes the prolonged clean-up time, eliminates the tedious task of hand-mixing and removes the risk of improper mixing.1

Some markets have taken it a step further with even more innovative delivery systems. For instance, direct restoratives are progressing towards unit doses. This is largely due to the fact that the preferred materials for composite restoratives are contained within capsules.

As there are no auto-mix systems currently available for bonding agents, this market has evolved towards unit doses, which entail pre-packaged capsules and lollipops. There has also been an emergence of vial deliveries, which dispense bonding agents from the bottle into a mixing well before the material is applied with a microbrush. Collectively, these tactics allow for the material to be activated quicker and decrease waste.

Core build-up materials have also experienced a slight upturn towards pre-mixed materials, such as pre-packaged pens. However, this strategy is still relatively new.2

Emergence of CAD/CAM dentistry

CAD/CAM dentistry swept across the dental material market, capping the growth potential of both temporary restoratives and dental impressions. The need for dental impressions is dwindling as digital scanners are becoming more affordable and popular. Nonetheless, alginate impressions are relatively resistant against the downward pressure caused by digitisation. As an inexpensive preliminary impression, alginate will serve as a hand-held model for dentists in addition to a scanner model.3

On the other hand, the temporary filling market has already been contracting. With the emergence of intraoral scanners, the preparation phase of restorations will be eliminated as they may be assembled and applied in a single dental visit. This translates into temporary restorations no longer being essential in the preparation stage of the final product.4 However, temporary materials will not go into
new technologies and dental market business

extinction as cost-sensitive patients will continue to rely on them.

Although CAD/CAM dentistry has gradually made strides on the dental material market, it will take years to realise its full potential. The acceptance of digitisation will occur in parallel to the generational displacement of older dentists with younger counterparts that have received training in innovative technologies. As with most modern products in the dental industry, the switchover is further bound by the price premium of these tech-savvy systems and tweaks in its accuracy.5

Dental impressions have similarly undergone a lengthy history of advances. The traditional, rubber-based alginate products were inaccurate and produced a foul smell.6 Alginate impression products were succeeded by the earliest generation of polyether materials. When compared to alginate, polyether impression materials are much more accurate and provide better dimensional stability. Nonetheless, the difficult removal and unpleasant taste offered by polyether impressions has encouraged a movement towards alternative materials, such as costly composite impressions.7

Patient comfort extends beyond the realm of taste and smell, additionally pertaining to hygiene concerns. Regulatory bodies such as the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) continue to tighten

Demand for patient comfort

Evolution of the dental material market is mainly directed towards improving patient comfort. However, a pleasurable dental visit does not come without an inflated price tag. This trend is flagrantly apparent in the dental anaesthetic field. Topical anaesthetics are typically used to numb the injection area before the local injectable needle is administered. However, hypersensitive patients must rely solely on topical products for numbness. As such,

Fig. 1: Effects of CAD/CAM dentistry on the growth rates of temporary restoratives and dental impression materials.
the existing regulations regarding non-disposable products. This is particularly relevant to the "two-paste/syringe" delivery method, which represents a modern rendition of hand-mixing powder and liquid. Although the technique still requires hand mixing, it delivers a more consistent and precise mixture via the assistance of a syringe. According to the CDC, any device that comes in contact with the mucous membranes is classified as "semi-critical" and will require intense sterilisation with a chemical disinfecting solution. The FDA does not support this notion and suggests that any device that is remotely contaminated should be discharged altogether. Therefore, the innovative trail of the dental industry is pushed towards disposable products like capsules.

**Shifts of the competitive landscape**

The competitive landscape of dental materials is highly fragmented and unstable due to economic fluctuations and ongoing product innovation. Nonetheless, the top players of the market have maintained their position, and will continue to do so in the foreseeable future, largely due to their outstanding reputations. Particularly, 3M ESPE dominates the market, having their presence in every market segment aside from dental anaesthetic materials. As 3M ESPE has been involved with dental materials for quite some time, their products have been subject to many academic studies and proved to be highly effective.

The presence of smaller competitors in the market is accentuated in the highly fragmented arena of composite materials, particularly in direct restorations. They gain the majority of their appeal by offering niche products that specialise in a specific area of restoratives, such as low shrinkage. Needless to say, 3M ESPE leads this space with the Filtek product line, which offers an assortment of products ranging from nanohybrid to flowable composites.

The competitive portfolio of dental anaesthetics will be prone to reorganisation in the upcoming years. A multitude of competitors are entering the space with innovative ideas tailored towards improving patient comfort and numbing effectiveness. Even foreign players are experiencing notable growth in the US market. Pierrel Pharma, for instance, has been importing their articaine product Orabloc from Italy and despite the shuffling of the current anaesthetic competitive landscape, private label companies will maintain a large share of the market. Distributors such as Benco, Darby Dental Supply, Dental Health Products, Henry Schein, IQ Dental Supply, Patterson Dental and Safco Dental Supply sell their own brand-named anaesthetics. Since these products contained the exact same drugs, and were slightly cheaper than competitors, they continue to be an intriguing option for dentists.

**Editorial note:** This article has been published courtesy of iData Research. iData Research is an international market research and consulting firm dedicated to providing the best in business intelligence for the medical device, dental and pharmaceutical industries.

**References**


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Treatment options for the edentulous arch

Author: Dr Mark Montana, USA

Introduction

Historically, when a patient's dental condition reached a state of total tooth loss, treatment was limited to a complete denture with no hope of improving that status. The greatest challenge, particularly when working with a lower jaw, was providing a denture with reasonable stability and retention. Success was greatly dependent upon the skill of the practitioner but also on the neuromuscular ability of the patient, their supporting structures and a philosophical attitude toward their condition. Treatment for patients suffering complete edentulism has been revolutionised by the ongoing success of dental implants so that the standard of care for the mandible is an implant overdenture.

The spectrum of prosthetic modalities developed since the acceptance of endosseous implants to the dental market ranges from the very simple to the astoundingly complex. Once directed by specialists, this field of study has evolved into a mainstay of the general practice, and so favour of expeditious and reproducible methods has gained dominance over complex therapies. Implant overdentures and fixed hybrid prostheses are choices typically offered by the dentist based upon a patient's financial ability. While both are generally successful, the overdenture and the hybrid prosthesis are not without pitfalls.

The implant-retained overdenture

The implant-retained overdenture is described as a prosthesis that covers, and is supported by, the natural tissues retained by the dental implant; the design is considered implant-assisted rather than supported. Placement of two to five implants is commonly found for the edentulous mandible with emphasis on creating a large anteroposterior (AP) spread between the endosseous pillars. If more than two implants are clustered in a small AP range, the prosthesis cannot move freely about a single axis of rotation and the denture may dislodge during function.

By creating the fulcrum on the most posterior overdenture abutments, the denture will pivot in function resulting in disengagement from the attachment mechanism and cause premature wear of the retentive components. Therefore, an increase in the number of implants beyond two does not necessarily provide a linear increase in retention and stability. In fact, the opposite may be true. Because support is provided by the mandible itself, resorption of the supporting structure will result in increased tipping of the denture during function, resulting in dislodgement. Therefore, the dentist and patient must be cognisant of the need for relining of the prosthesis periodically to assure optimal performance.

Recommendation is, therefore, placement of two implants in the anterior mandible to allow one axis
of rotation. These implants should also be positioned so that future implants may be considered should the patient wish for an implant-supported alternative.

The hybrid prosthesis

The screw-retained hybrid prosthesis is a fully implant-supported structure and, therefore, is not affected by incremental resorption of the residual ridges. It has gained in popularity as the technically difficult and costly gold frameworks have been replaced by CAD/CAM titanium structures, and by proven success of angled implant placement to increase the AP spread. Because the hybrid has a metal substructure, it is possible to cantilever posterior to the terminal abutment, increasing the length of the functional arch.

However, the aesthetic component of the restoration—namely the denture teeth and acrylic resin matrix—are inherently weak materials originally intended for use in complete and partial dentures where functional load is comparatively low. If insufficient interarch space is available, the risk of fracture or displacement of denture teeth or resin base is high as the materials will be too thinned to withstand forces generated during function and especially parafunction.

Unfortunately, this is an increasingly common occurrence, especially in restoration of the maxilla with a fixed hybrid prosthesis. Inconvenient screw-access holes may further weaken the prosthetic teeth. Repair of a fractured or lost tooth requires removal of the hybrid prosthesis and correction in the dental laboratory. The dentist must be prepared to remove the structure and later re-seat it once the repair is completed. The patient must accept they will be without “teeth” for the length of time required for the technician to fix the problem. Attempts to prevent fracturing by increasing the thickness of the resin is limited by the space available to do so. If inadequate interarch space is encountered, correction cannot be achieved by adding more material. Rather a change in design to a different and possibly more expensive restoration may be needed.

When hybrids are used in the maxilla, conflict may arise in attempting to improve the aesthetic and phonetic result by use of ridge lapping and the limitations such shapes impose on proper oral hygiene.

The benefits of the fixed hybrid prosthesis are clearly improved function and minimal post-treatment complications as long as the patient is able to properly clean it and breakage is avoided. Because it is fixed, the patient cannot remove it to clean away entrapped debris and properly remove plaque. Repair or replacement of the resin teeth requires removal and re-seating by a dentist.

Atlantis Conus concept: the removable implant-supported bridge

As described above, the tissue-supported overdenture performs best with only two implants placed in the anterior region. When more than two implants are placed, the goal should be to provide a completely implant-supported result.4,5 The Atlantis Conus concept (Dentsply Sirona) provides the optimal functioning convenience of a fixed hybrid, but also allows patient retrievability for unobstructed oral hygiene practice, regardless of the degree of ridge lap. It is, in effect, a prosthesis that can be removed by the patient, with the stability of a fixed bridge.

The concept centres around patient-specific abutments, each milled to a 5-degree convergence, and parallel to each other in the dental arch. Recommendation is for at least four implants in the mandible and four to five implants in the maxilla.

These uniquely designed, conical abutments are fitted by corresponding metal SynCone caps (Dentsply Sirona), which are incorporated into the prosthesis. The result is a friction-fit, stable, retentive and fully implant-supported bridge that remains removable by the patient.6 No special latches or plunger attachments are necessary to retain it. The patient merely slides the bridge in vertically onto the abutments and removes it in the opposite way. Because the abutments are a part of the Atlantis (Dentsply Sirona) portfolio, it is available for all major systems.

In addition, because each abutment is custom-made, correction of angled implant placement is pos-

Fig. 3: Duplication of an acceptable denture serves as a custom tray. Holes of sufficient diameter to accommodate impression copings have been prepared.

Fig. 4: Open tray impression copings seated on the dental implants. One implant is selected for disuse and covered with a transmucosal abutment.
sible up to 30 degrees. Two major requirements are necessary: the dentist must make an accurate, implant-level impression and a scan must be made of either an approved denture set-up or of a completed denture to be retro-fitted. The Atlantis Conus Abutments are then designed to be positioned optimally within the denture confines. The fixed yet removable prosthesis offers the advantages of excellent chewing function, improved aesthetics and fracture resistance (as no screw access holes are present) and optimally facial supporting contours, without compromising cleaning by the patient.

Case report

A 73-year-old woman with a history of 11 years of complete edentulism of the maxilla and mandible, and five endosseous implants in the anterior mandible, presented with a chief complaint of a non-retainive and unstable lower denture. The implants were standard diameter, externally hexed, Brånemark fixtures. She had moderate resorption of both the maxillary and mandibular residual ridges (Fig. 1).

The patient had bone loss involving the implant bodies but comparing the radiographic evidence available, documenting her condition through the years, it appears the bone loss occurred soon after implant placement and no appreciable change was seen thereafter.

During those 11 years, her treatment history included initial restoration of the implants with a complete denture retained by the LOCATOR Attachment System (Zest Dental Solutions); and the maxilla was restored with a complete denture. She advised that the result was unsatisfactory as the lower denture displaced during function.

Her history further reveals that the Locators were replaced with PRECI-CLIX attachments (Ceka Attachments) with no demonstrable improvement. The patient was later retreated by the author, with new maxillary and mandibular complete dentures and new Locator attachments used to retain the lower prosthesis. The attachment male components were secured intraorally using auto-polymerising resin to eliminate the possibility of laboratory error.

The patient continued to experience problems with the lower denture coming loose during function and required frequent replacement of the nylon male inserts; replacement with Extended Range inserts did
not vary performance. The metal abutments demonstrated considerable wear as well (Fig. 2). Relining the lower denture did not improve the performance of the anchor system.

At the subsequent appointment, the patient was presented with the Atlantis Conus concept as a potential solution to her ongoing dilemma. Treatment options were presented as well including a fixed hybrid prosthesis and a 2-in-1 bar overdenture. These were rejected as interarch space was less than optimal, requiring compromise to the strength of the design. The patient also expressed a desire for a removable design as she was concerned with having adequate facial support and wished to be able to remove the prosthesis for proper hygiene and maintenance. It was agreed that a new maxillary and mandibular complete denture would be fabricated, and Atlantis Conus Abutments would be made to secure the lower restoration.

**Clinical and laboratory procedures**

Because the existing dentures were made within the last five years and were acceptable with regard to tooth position and vertical dimension, it was decided that clear, acrylic resin duplicates of each denture would be made to serve as custom trays. Double-sided impressions of each denture were made and delivered to the dental laboratory for fabrication of the duplicates. Once processed, the copy denture borders were shortened by 2 mm to allow border moulding. The duplicate of the mandibular denture clearly showed the position of each Locator housing and therefore the position of the dental implants. Holes of adequate diameter to allow the duplicate denture to be placed in the patient’s mouth over impression copings were prepared (Fig. 3). The intaglio surface of both the upper and lower duplicate denture were relieved to allow for a wash impression.

The patient returned for final impressions, and the Locator abutments were removed and kept in appropriate order to avoid confusion when reseating them at the appointment completion. Open tray impression copings were connected to each of the four dental implants to be restored and tightened into place; one implant with greater bone loss and placed significantly more shallowly than the rest was omitted (Fig. 4). Light-body polyvinyl siloxane (PVS) was injected around the base of each impression coping and medium-body PVS was placed in the custom tray.

The tray was seated, ensuring that the impression copings were completely accessible through the holes previously prepared. The patient was instructed in facial and tongue movement to achieve proper peripheral border extension. Regisil Rigid (Dentsply Sirona) bite registration material was injected around each impression coping to rigidly adhere them to the impression tray. This step is critical as reliance on flexible impression material may allow transfer error when constructing the working cast.

Once the impression materials were fully set, the screws retaining the impression copings were removed and the final impression and tray were withdrawn from the patient (Figs. 5 & 6). All Locator abutments were reseated and tightened. Final impression of the maxilla was completed with border moulding using modelling plastic and a wash impression with light-body PVS. Upon completion, the patient was dismissed.

In the dental laboratory, implant analogues were secured to the impression posts, gingival moulage was injected around the analogues to an adequate depth to completely cover the coping-analogue interface. The impressions were boxed with wax and...
poured in vacuum-mixed die stone. After setting, the impression coping screws were removed and the impressions were separated from the hardened casts; standard laboratory procedures were followed in cleaning and trimming the working casts. Base plate and wax rims were made for continuation of the denture fabrication. The impression materials were removed from the duplicate denture and it was positioned back onto the mandibular cast to be scanned. An online order was completed including identification of the implants involved and the case was shipped to Dentsply Sirona for the design and manufacture of the Atlantis Conus Abutments.

The working cast, implant analogue connections and the denture duplicate were scanned at the Atlantis production site and the abutments were individually designed using Atlantis VAD (Virtual Abutment Design) software to ensure that all abutments were parallel to each other. The restorative margin of each abutment were placed close to the soft tissue height surrounding each implant, but always supragingival to guarantee unobstructed seating of the finished restoration.

Each abutment was milled to a 5-degree taper to match the SynCone caps ensuring an intimate friction-fit. Upon design completion, the images of the abutment designs were made available for review and approval before manufacturing (Fig. 7). Once the design presented was found to be satisfactory, approval for production of the patient-specific abutments was granted. It is important to note that no fees are incurred by the dentist or dental laboratory during this process until design is agreed upon and authorisation to proceed is given. The abutments are custom-designed to fit specifically to the denture set-up or duplicate denture provided; there are no sizes, heights, angles or collars to select from a catalogue and, therefore, no risk of choosing incorrectly.

When received, the Atlantis Conus Abutments were secured to the working cast with abutment screws, along with four prefabricated SynCone caps (Figs. 8 & 9). The caps were seated onto the abutments and sent to the dental laboratory to be impressed. The impression was poured twice, one in improved dental stone and one in refractory material for fabrication of a cast metal frame. While waiting for the frame to be completed, final try-in appointments for the denture set-up were completed, and the patient approved fabrication of the dentures.

The denture set-up with a final bite record were returned to the dental lab, the cast metal frame was seated on the improved dental stone cast and areas around the stone copy of the SynCone caps were blocked out prior to processing. The SynCone caps will be captured intraorally, rather than having them processed in the dental laboratory. All work was completed on the duplicate stone cast rather than the original working cast. The cast metal frame was opaqued to prevent grey show-through. The set-up was transferred to the cast with the metal frame and the dentures were processed (Figs. 10 & 11).

Because the Atlantis Conus concept results in a fully implant-supported prosthesis, the peripheral borders of the finished structure were greatly reduced and the occlusal table was abbreviated at the first molar. The length of functional arch follows the identical AP spread principles used for hybrid prosthetics to avoid excessively long cantilevers.

At this point, the structure is a bridge and not an overdenture. To facilitate seating of the abutments in the patient, a clear matrix was made with the abut-
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ments on the original working cast; where they have remained since receipt. Each abutment was identified with one, two, three and four black ink dots respectively, based on their position on the cast. The clear matrix was seated over the abutments and corresponding black dots were drawn on it to line up exactly with those on the abutments. The completed mandibular bridge was double-side impressed by the dental technician and an injection-mould copy of clear acrylic resin was made.

The patient was scheduled for completion of treatment. The Locator abutments were again removed and Teflon tape was placed in the implant excluded from the design. The abutments were seated onto the dental implants (Fig. 12), and the clear matrix was placed to verify that each abutment was correctly orientated by checking that the dots on the matrix superimposed with those on the abutments.

Once verified, the abutments were torqued to 20 Ncm, appropriate for the implants involved. The SynCone caps were placed and viewed with magnification to assure that they were superior to the gingival tissues (Fig. 13). The prosthesis was placed over the caps to verify there was no obstruction of complete seating. The prosthesis was removed and vent holes were drilled through the buccal contours of the acrylic resin to relieve hydraulic pressure during capture of the caps. The SynCone caps were lifted and a rubber dam was placed around the abutments to prevent pick-up resin from locking into undercuts, and the caps were reseated (Fig. 14).

Attachment processing material (Chairside, Zest Dental Solutions) was placed in the reservoirs of the prosthesis and seated over the SynCone caps. The upper denture was placed and the patient was instructed to gently close into full occlusion and to maintain position for two minutes while setting occurred. After two minutes, the excess flow of pick-up resin was checked for hardness and after an additional minute the prosthesis was ready for removal. Removal was uneventful although retention was considerable; removal of the bridge can only occur following the long axis of the abutments, no tipping or rotating is possible (Figs. 15 & 16).

Once removed, the excess pick-up material was removed and the bridge was properly polished where needed. The abutments were packed with Teflon tape to within 3 mm of the surface, and the remaining space was filled with flowable composite resin (Fig. 17). The patient was instructed on placement and removal and repeated the exercise until we were satisfied she would experience no difficulties performing this. The clear, duplicate copy of the bridge was seated onto the abutments using a chairside soft lining material (Fig. 18).

This copy serves as a temporary device for the patient to wear when cleaning the finished bridge or when sleeping to protect the tongue from scraping against the abutments. A panoramic radiograph was taken at completion of treatment (Fig. 19).

The patient returned after one week and again after six weeks, and reported at both visits that the lower bridge did not move at all during function and stayed seated until she removed it. She commented on the ease of cleaning the dental abutments, and she reported no discomfort and no food entrapment. Overall, the patient was very pleased with the result (Fig. 20).

Fig. 15: Completed bridge with SynCone caps processed in position. Because they have been processed intraorally, there is no error in fit, these caps are extremely retentive allowing only vertical displacement of the prosthesis.

Fig. 16: Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Fig. 17: Atlantis Conus Abutments torqued to specified level, obturated with Teflon tape and composite resin.

Fig. 18: Laboratory processed, clear duplicate prosthesis with siliconised reline material to improve retention; to be used as a night-time appliance to protect the tongue from the sharper edges of the abutments.
Discussion

The number of implants placed for an edentulous patient should be based upon whether the design is to be implant-assisted or implant-supported. If the goal is a minimalist design utilising the soft tissue for support, two implants using Locator attachments are appropriate to retain a mandibular denture and will provide a predictable outcome. However, when more than two implants using resilient overdenture retainers are employed, there is not a corresponding linear increase in retention of the denture and the result may suffer. Therefore, when at least four implants are planned, the restoration should be designed as implant-supported to maximise the value of the patient’s greater investment.

This article discusses just such a situation where a patient had experienced repeatedly low value from her investment of five implants. By redesigning her treatment to become implant-supported through the use of the Atlantis Conus concept, a successful result was achieved without the greater expense of a fixed hybrid. The final result was functionally comparable to a fixed restoration while providing lip and cheek support of a removable prosthesis without complicating or obstructing oral hygiene.

The telescopic design of the Atlantis Conus concept provides outstanding retention of the prosthesis during function as edentulous patients chew in a relatively flat elliptical pattern and the bridge can only be removed vertically. The abutments themselves are patient-specific and can be made for all major implant systems, allowing rescue of many frustrating results with overdentures.

As long as there is sufficient interarch space (at least 12 mm), existing finished dentures can be retrofit with Atlantis Conus Abutments, reducing patient cost while providing a stable result. Cast chrome frame reinforcement is advised for all new Atlantis Conus prostheses as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required inter-arch space.

The clinical procedure is relatively simple and comparable to implant overdentures; however, because the abutments are patient-specific, tooth position must be established before the design of the abutments is begun.

Conclusion

A patient with an 11-year history of frustration with her dental implant investment was treated successfully with the Atlantis Conus concept using patient-specific abutments and Syncone caps, providing an implant-supported, removable bridge with all the benefits of a fixed design and none of the limitations.

Acknowledgements

The author would like to thank Fred Senne, John Bergstresser and Sean Ferguson for their expertise and information. The author would also like to thank Tom Wiand and the talented team at Wiand Dental Laboratory for the laboratory procedures and products described in this article.

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

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Removable prosthesis in digital times

**Authors:** Drs Gualtiero Mandelli, Giuseppe Salvato & Carlo Borromeo, Italy

**The main problem** that brings patients to our surgery is an edentulous maxilla, which motivates the patient to want a functional restoration, with particular attention to the aesthetic result. The evaluation of the soft tissues of the face, from front and side view, shows a big reduction of the labial support induced by a centripetal bone retraction. More than that, the lack of sagittal and vertical bone support reduces the degree of dental-gingival exposure in case of peri-prosthetic crestal design (Figs. 1 & 2).

Considering the above parameters, to centre the aesthetic requirements it is proposed to the patient a removable implant-prosthetic rehabilitation; the goal is to achieve, with the prosthetic flange, a "prosthetic reconstruction" of the atrophic bone, thus favouring a suitable labial support with a correct teeth set-up.

The operating sequence therefore seeks to verify the soft tissues' support by using an intraoral try-in of the set-up made on a model from a preliminary impression in alginate (Fig. 3).

The aesthetics were controlled and also confirmed by the patient's involvement and approval who wanted a removable prosthetic solution without the palate area, and still have a good stability.
Guided by the duplication of the teeth set-up (replica), the implants were placed in the most suitable position and in a sufficient number to build a stable, aesthetic removable prosthesis without the palate. During the osseointegration period, the patient was provided with a temporary prosthesis in the zones adjacent to the implants. After the period of osseointegration, the implants were inspected.
and the gums had healed. The final phase also followed all the directions given to the patient about her experience with the temporary restoration.

All this information is critical to improving the aesthetics and the functional aspects in the final phase. For this reason, a new alginate impression was taken to produce an individual tray in order to produce an edentulous model and a preliminary registration rim for the mounting of the models in the articulator using a face bow. After the first phase was achieved, a teeth set-up restoring the aesthetics and the correct function was created (Fig. 5). Once these parameters were determined, the teeth set-up was duplicated using the silicone masks with a transparent resin (Fig. 6). The replica was perforated to correspondence with the implants in order to take a definitive impression in the centric relationship and with the same vertical dimension of the teeth set-up (Figs. 7 & 8).

After the production of the master model, a resin jig was created by screwing the transfers on the model and by connecting them with resin that was cut around each implant; the dentist reconnected it in the mouth, assuring the correct impression position of the implants. When the jig was returned to the laboratory, a small model was created with the new analogues; this is an important model for the verification of the passivity and the precision of the structures (Figs. 9 & 10). With the same model, the accuracy of the position of the analogues in the master model was verified. At this stage the models, the implants and the teeth set-up were scanned in order to have all the information to verify the available spaces, and the number and position of the implants; only now is it possible to correctly plan a suitable prosthetic project, according to the available spaces; this also means choosing the correct attachments that will guarantee a good retention without modi-

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**Fig. 15:** At this stage, the most suitable areas for positioning the retentive systems are identified, according to the aesthetics and functionality given by the teeth set-up. — **Fig. 16:** Side view scans. — **Fig. 17:** The vertical attachments are placed distally from the last implant in order to improve the prosthesis’ retention. — **Fig. 18:** Positioning of the distal attachment. — **Fig. 19:** Once positioned, the distal attachments from the tissues should be well evaluated; otherwise the cap and its housing may compress the soft tissues. In this phase, keeping the scan abutments in transparency also provides an opportunity to check the cuff height. — **Fig. 20:** Virtual bar. — **Fig. 21:** Buccal view of the virtual bar.
Fig. 22: The milled structure is tested on the model obtained from the resin jig, to verify its accuracy and passivity; this also ensures a better view of the contact areas.

Fig. 23: The structure is screwed and controlled on the working model.

Fig. 24: The structure is screwed on the working model to verify the soft tissues’ areas and the spaces for a correct hygiene.

Fig. 25: After the laboratory checks, the bar is checked in the oral cavity, paying attention to the soft tissues and the cuff height.

Figs. 26–28: Control of the connection with an X-ray.

Fig. 29: After a first polish, the attachments are selected and screwed into the bar.

Fig. 30: After screwing the attachments in, a final polish of the structure is performed.

Fig. 31: The superstructure was produced and the retentive caps are tested.

Fig. 32: Final polish of the two structures.
Case report: Restoration of the edentulous maxilla

The aim of the present case report was to describe the process of restoring a maxillary prosthesis using CAD/CAM technology. The project was carried out with the teeth set-up (Figs. 11–21).

The file was sent to the New Ancorvis milling centre for the production of a Cr-Co bar. After a few days, the bar was returned to the laboratory, and tried first on the replica model to ensure its accuracy and passivity (Fig. 22); then the bar was positioned on the master model to verify it was a good fit even compared to the soft tissues, the cuff height and the correct spaces for hygiene (Figs. 23 & 24). After that the bar was sent to the dentist to double check the precision, passivity, correct spaces for hygiene, with the help of X-rays (Figs. 25–28). After those checks had been carried out, the bar was finished and polished. At this stage, the attachments were chosen accordingly to the type of prosthesis and the project and screwed into the structure (Fig. 29).

Once the attachments were screwed in, the bar was thoroughly polished (Fig. 30). The counter-bar was produced, polished and the retentive caps were inserted (Figs. 31 & 32). With the help of silicone masks, the teeth were repositioned and waxed on the superstructure, for the final try-in in the mouth (Figs. 33–35). A final check that everything had been completed was confirmed.

Fig. 33: With the help of some silicone keys, the teeth are easily repositioned on the superstructure.

Figs. 34 & 35: Final examination of the structures with the teeth reassembled on wax.

Fig. 36: With an injection muffle, the prosthesis is transformed in resin.

Fig. 37: The prosthesis after the resin is finished.

Figs. 38 & 39: Front teeth and vestibular lateral flange after the polishing.
carried out, including: the phonetics, aesthetics and the correct support of the soft tissues. Once the pink flange was finished, the prosthesis was positioned in the muffle furnace for the curing steps (Fig. 36). These systems provide a good precision and an excellent detail reproduction. Once cured, the prosthesis was extracted and finished (Fig. 37) and then to the final polishing prior to the delivery (Figs. 38–40). Finally, the superstructure and the prosthesis were placed in the mouth (Figs. 41–43), verifying the good aesthetics, function and also the satisfaction of the patient (Figs. 44–46).

Conclusion

The teeth set-up, and digital systems allow us to accurately design a complete rehabilitation, and is important in highlighting from the very early stages which solution (fixed or removable) is most suitable for the patient. In this case, the solution of a removable prosthesis made possible an optimal functional and an aesthetic result.

about

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.
Fixed and removable implant restorations: A solution for every arch

Author: Dr Paresh B. Patel, USA

Introduction

When a patient presents with an edentulous arch or terminal dentition, implant treatment can be provided that improves not only form and function, but also quality of life. For patients desiring better chewing capability, stability, aesthetics and comfort than a traditional denture can offer, both removable and fixed implant restorations are superior alternatives.1 While the appropriate implant solution can vary depending on the patient’s oral health, anatomy, quality and quantity of bone, and financial resources, full-arch prosthetics have progressed to the point where virtually every patient can have their teeth restored.

Although fixed, implant-supported restorations offer the highest levels of stability, function and patient satisfaction, removable overdentures are also a dramatic improvement over conventional complete dentures.2 Both treatment options effectively mitigate the bone resorption that occurs following the loss of teeth, helping to preserve the oral and facial structures and, by extension, the self-confidence of the fully edentulous patient. Determining which solution is appropriate requires a careful evaluation of the individual patient’s circumstances and desires. Even when an implant overdenture is delivered, the prosthesis can eventually be converted to a fixed restoration.

As evidenced by the case that follows, in which one arch is restored with an implant overdenture and the other with a BruxZir Full-Arch Implant Prosthesis, practitioners today have a great deal of clinical flexibility. Whatever prosthetic approach is adopted,
immediate, life-changing relief can be provided to patients suffering from terminal dentition or an uncomfortable, poorly functioning traditional denture. Further, the dramatic overhaul of this patient’s oral health demonstrates the life-changing capabilities of implant therapy, which helped him overcome severe functional and aesthetic challenges that were impacting practically every facet of his life prior to treatment.

Case presentation

A 47-year-old male presented with terminal dentition in both arches resulting from periodontal disease and severe caries (Figs. 1a–c). The patient had already lost many of his teeth, and the dentition that remained had been rendered unstable by his periodontal condition (Fig. 2). He had saved up enough money for a fixed implant restoration for his upper arch, for which he desired the most functional, lifelike prosthesis possible. While he couldn’t afford such a restoration for both arches, he wanted a retentive appliance for his mandible, with the option of later upgrading to a fixed prosthesis.

The patient accepted a treatment plan in which his maxilla would be restored with a BruxZir Full-Arch Implant Prosthesis and his mandible with an Inclusive Locator Implant Overdenture. Fabricating his maxillary restoration from monolithic zirconia would ensure maximum long-term durability. This was important provided the relatively young age of the patient, who would not have to worry about his upper prosthesis succumbing to fractures, chips or stains.

His lower appliance would be held in place by connecting to the implants via LOCATOR attachments (Zest Dental Solutions), which are an economical means of improving prosthetic retention and stability. The overdenture caps that connect to the Locator...
The surgical phase of treatment called for the extraction of the patient’s remaining teeth followed by the immediate placement of eight dental implants. CBCT scans were taken to help determine the optimal placement of the implants within the available bone and away from the patient’s vital oral anatomy. Evaluation of the CBCT scan determined that there was sufficient height, width and quality of bone to place the implants in the appropriate locations and angulations via freehand surgery. Four 3.7 mm Inclusive Tapered Implants (Glidewell Direct) would be placed in each arch to support the fixed maxillary restoration and the removable mandibular prosthesis.

At the surgical appointment, the patient’s remaining teeth were removed, and a flap was raised to visualise the socket sites and areas of implantation. Bone levelling was performed on the patient’s maxillary arch to elevate the patient’s smile transition line above the upper lip.
The maxillary osteotomies were positioned to facilitate an All-on-4 configuration, with the posterior implants tilted to maximise the anterior-posterior (AP) spread, avoid the sinuses and accommodate the patient’s bone limitations (Fig. 3). Osteotomies were created for the placement of four mandibular implants, as opposed to the minimum of two required for a Locator overdenture. This would enhance retention of the overdenture while affording the possibility of upgrading to a fixed restoration at a later time.

Following the creation of the osteotomies, the implants were placed (Figs. 4a–c). Inclusive Multi-Unit Abutments (Glidewell Direct) were attached to the maxillary implants, correcting for the divergent angulation of the implants. This would both position the restorative platform in a manner that would situate the screw access holes of the eventual prosthesis toward the lingual aspect and allow for a molar-to-molar restoration (Fig. 5).

Note that when patients present for treatment with terminal dentition, they are commonly anxious about losing their teeth and the effect this will have on their speech and chewing capabilities. For this reason, it is important to make every effort to ensure that the patient leaves with functional appliances in place.

Thus, traditional dentures were fabricated from preliminary impressions in advance of the surgical appointment for modification and delivery following placement of the implants (Fig. 6).

Having achieved sufficient primary stability, the Inclusive Tapered Implants placed in the patient’s maxilla could be immediately loaded. Thus, the upper denture was trimmed and modified chairside to connect to the multi-unit abutments through temporary cylinders (Figs. 7a & b).

This would satisfy the patient’s desire to leave the surgical appointment with a fixed, fully functional maxillary prosthesis in place. Note that the two most distal molars were removed to minimise the cantilevers and the forces transmitted to the implants during osseointegration. Healing abutments were placed in the mandibular implants to begin developing the transmucosal passages. The lower immediate denture was then modified and relined to seat over the implants during healing.

This approach provided the patient with same day temporary restorations, and he walked out of the office with properly functioning teeth for the first time in many years. The effect this had on the patient’s comfort, function and appearance was immediate and profound (Figs. 8a & b). The final radiograph taken after seating the temporary appliances confirmed excellent positioning of the implants (Fig. 9).

The patient returned after three and a half months of healing so the stability of the implants and health of the soft tissue could be evaluated. Removal of the temporary appliances revealed excellent tissue health around the healing abutments of the mandible and multi-unit abutments of the maxilla (Figs. 10a & b). Vinyl polysiloxane (VPS) impressions were taken to begin the restorative process (Figs. 11a–c). Because multi-unit abutments and healing abutments were placed on the day of surgery, the restorative process began above the tissue level, without any need for secondary surgery or anaesthetisation.

The restorative protocol for both prostheses included wax rims and set-ups, which the lab produced on the working casts fabricated from the impressions (Figs. 12a & b). The maxillary wax rim incorporated temporary cylinders through which screws could connect to the dental implants. The
lower wax rim was designed to seat over Locator attachments.

At the next appointment, the wax rims were seated, the jaw relationship was recorded using conventional denture technique, and a bite registration was taken (Figs. 13a & b). A VPS “wash” impression of the mandibular arch was also taken with the wax rims and Locator impression caps in place (Fig. 14). This would aid the lab in designing an overdenture that fully rests on the tissue instead of the implants.

The case was returned to the lab, and wax set-ups were produced (Figs. 15a–c). During the try-in appointment, the wax set-ups were evaluated to confirm the vertical dimension of occlusion, interocclusal relationship, phonetics, aesthetics, midline, tooth arrangement, tooth colour and shape, incisal edges, and function (Figs. 16a–c).

After final approval of the wax set-ups, the restorative protocols for the two prostheses diverged, as the lab moved directly to the final implant overdenture from the approved wax set-up, while the process for the BruxZir Full-Arch Implant Prosthesis included an implant verification jig, custom final impression, and provisional implant prosthesis. These extra measures were taken to make absolutely certain that the definitive prosthetic design was accurate before milling the final restoration from monolithic zirconia.

The implant verification jig was attached to the implants so a precise final impression could be taken (Figs. 17a–c). The custom tray provided by the lab was filled with VPS material and seated over the implant verification jig. As the VPS material set, the relative positions of the implants represented by the verification jig remained fixed, ensuring an extremely accurate final impression.

The approved wax set-ups and final maxillary impression were returned to the lab so the final mandibular implant overdenture and maxillary provisional implant prosthesis could be produced. The final lower appliance was fabricated on the master cast and included recess wells in which metal housings with overdenture caps would be cured chairside (Figs. 18a & b). These denture caps provide retention and stabilize the prosthesis by seating over the Locator attachments and keeping the appliance in place during function.
A new master cast of the maxilla was produced based on the custom open-tray final impression. The new master cast and final-approved wax set-up were scanned. A virtual model was generated, upon which the fixed monolithic prosthesis was designed using CAD software (Figs. 19a & b). Because this digital model was based on the final impression containing the verification jig, screw access holes were created in precise alignment with the positions of the maxillary implants.

The CAD design was used to mill a provisional implant prosthesis from poly(methyl methacrylate) (PMMA) (Figs. 20a & b). This appliance was tried in and worn for a trial period, thus ensuring an accurate prosthetic design. The provisional implant prosthesis is an essential element of the restorative process, as significant adjustments cannot be made to the final restoration once it has been milled from BruxZir Solid Zirconia.

Aesthetic were verified (Figs. 21a & b). With both appliances in place, the interocclusal relationship was checked (Figs. 22a & b). Minor occlusal adjustments were made directly to the maxillary provisional implant prosthesis, as PMMA is easily modified.

Slight alterations were also made to the lower implant overdenture. Then, block out shims and the retentive overdenture caps were seated over the Locator attachments (Figs. 23a & b). Quick Up self-cure material (VOCO America) was added to the recess wells of the overdenture before seating the appliance over the metal housings.

After letting the material set for approximately 3 minutes, the overdenture was removed, picking up the denture caps in the prosthesis. The minor voids surrounding the denture caps were then filled with Quick Up light-cured pink composite (Fig. 24). The appropriate retentive inserts, which are available in a variety of strengths depending on the functional capabilities of the patient and the number of implants, were swapped into the metal housings (Fig. 25). The implant overdenture was reseated, providing excellent retention, stability and function for the patient.
With the final mandibular restoration in place, the patient wore the provisional full-arch implant prosthesis for a trial period of two weeks (Fig. 26). This opportunity to wear the appliance during actual day-to-day function instilled a high degree of confidence in the prosthetic design for the patient and doctor alike. Following patient approval, the provisional implant prosthesis was returned to the lab so it could serve as the blueprint for the final restoration and the minor adjustments made to the appliance could be included in the definitive prosthetic design.

The final BruxZir Full-Arch Implant Prosthesis was digitally fabricated with precision (Fig. 27). As an exact reproduction of the test-driven provisional, the definitive prosthesis fit perfectly and offered the aesthetics and function the patient had come to expect (Figs. 28a & b). The final restoration effectively addressed the unique circumstances of the case, providing the most durable, stable prosthesis possible for his upper and lower restoration that greatly improves prosthetic retention and can be upgraded to a fixed prosthesis should the patient’s situation change.

Conclusion
Practitioners now have the clinical flexibility to offer patients a wide range of treatment options, from entry-level, economical restorations like the Inclusive Locator Implant Overdenture, to the fixed, highly durable BruxZir Full-Arch Implant Prosthesis. There is a viable means of treating nearly all patients, whatever their oral health, needs and finances. Given the life-changing benefits of implant therapy and the straightforward restorative protocols of today, all patients should be offered this service to confront the challenges presented by complete edentulism.

References

about

Dr Paresh B. Patel, DDS, graduated from the University of North Carolina at Chapel Hill School of Dentistry in 1996. He graduated from the Medical College of Georgia/American Academy of Implant Dentistry MaxiCourse in 2009. He has been in private practices in Lenoir and Mooresville, NC, from 1996 through the present. Patel is a founding member and on the editorial board of Journal of the International Academy of Mini Dental Implants. He is a clinical instructor at the Reconstructive Dentistry Institute and a diplomat of American Academy of Small Diameter Implants. Patel was president of the Iredell County Dental Society in 2012; is a member of the American Dental Association, the North Carolina Dental Society and the American Academy of Implant Dentistry; and is a clinical consultant on dental implants and prosthetics. He lectures nationally on implant and restorative dentistry, and he has published numerous articles in leading dental journals.

Photos provided by Dr Paresh B. Patel.
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Aesthetic replacement of maxillary premolar with immediate implant placement and metal ceramic crown over CAD/CAM abutment

Author: Dr Larry R. Holt, USA

This article describes treatment to solve a common dental complication (loss of tooth due to vertical root fracture). Contemporary implant therapy and subsequent CAD/CAM laboratory procedures provide an elegant solution to this patient's dental emergency. Treatment was accomplished during a period of approximately six months.

The patient was a healthy, 52-year-old female with an unremarkable medical history. Her dental history and general dental health were excellent. Unfortunately, she suffered a vertical fracture of tooth #5, which necessitated its extraction (Fig. 1).

The treatment plan was for extraction and immediate implant placement with concurrent bone grafting as required. A temporary partial was planned to provide aesthetic replacement and to support and shape tissue during the healing process. A final restoration was to be a cemented PFM crown supported by an Atlantis gold hue abutment.

Material selection was based on the patient's crossbite occlusion that transitions from normal to crossbite across this particular tooth's occlusal table. Crown and abutment could potentially be subject to occlusal stress due to this transitional relationship.

A restoration that provides maximum strength was desirable for long-term stability of the restoration.

The patient has a thin biotype; the gold hue abutment provides both strength and the gold colour provides a more natural tissue colour.1 The gold colour provides "warmth" of colour in the critical transmucosal region. Titanium abutments provide strength but can telegraph a greying effect on thin tissues.

The treatment began with a pre-operative appointment to take necessary records (impressions of both arches, facebow transfer, shade taking, bite registration and clinical photography).
A prescription to the lab was provided, ordering a partial denture fabricated from duracetal resin and to develop a tooth born surgical guide. The lab was instructed to simulate the extraction site by removing the tooth from the study cast provided. This model was duplicated for fabrication of the two appliances.

The laboratory product was provided to the surgeon. Atraumatic extraction was accomplished and an immediate implant (Legacy 3, Implant Direct) was placed with facial bone grafting (Figs. 2 & 3).

There was a healing screw placed and the site was closed with appropriate membrane and suturing techniques. The unilateral partial was not delivered at time of surgery. The patient was seen in the restorative office, and the partial (DuraTek, Drake Precision Dental Laboratories) was modified to provide tissue support and begin development of an ovate tissue site. The partial was delivered uneventfully. These appliances are extremely retentive and not subject to dislodgement or pressure over the implant site during function. The patient was seen one week later for a postoperative check and adjustment of the temporary appliance (Fig. 4).

The patient was instructed to return to the surgical clinic in approximately four months for final evaluation prior to restorative procedures.

Four months after surgery, the patient was seen by the surgeon to uncover the implant, remove the healing screw and place a temporary abutment. The temporary partial was adjusted to accommodate the added height of the healing abutment (Fig. 5). The patient was instructed to return to the restorative office for definitive restoration of the implant in approximately three weeks.
The patient attended the restorative office for evaluation and to develop necessary records for laboratory fabrication of the definitive restoration. The implant site was evaluated and deemed adequately healed to proceed with restorative procedures (Fig. 6).

The healing abutment was removed and a closed tray impression coping was fitted onto the implant (Fig. 7). A radiograph was taken to confirm complete seating of the impression coping. A full-arch impression was taken with heavy body PVS impression material (Panasil tray Soft, Heavy Body Regular Set, Kettenbach) (Fig. 8).

The healing abutment was replaced once the impression was taken. A bite registration (Futar D Fast Set, Kettenbach), new opposing impression (Silginate plus Panasil Light Body Fast Set, Kettenbach) and shade map were taken. All clinical products were sent to the laboratory along with shade photography and a complete written prescription. A PFM high noble crown and Atlantis gold hue custom abutment were prescribed. The abutment was ordered as tissue contouring with 1 mm deep margin placement circumferentially (Atlantis, Dentsply Sirona).

The use of a custom abutment allows modification of transmucosal tissue profile and to ideally position margins. Tissues were previously shaped with the ovate pontic of the temporary partial. The final crown was planned to be chairside custom stained. The lab was cautioned that occlusion on this restoration was in the path of patient’s crossbite transition from normal to crossbite.

The laboratory (Drake Precision Dental Laboratories, Charlotte, NC) partnered with Atlantis (Dentsply Sirona) for the abutment design and milling and then fabricated the PFM crown (Figs. 9 & 10). The patient was given an appointment for definitive restoration delivery.

The delivery appointment was uneventful. The healing abutment was removed and the Atlantis abutment was placed (Fig. 11). Because of positive tissue pressure from tissue contouring, the abutment was slowly placed with incremental turns of the retention screw. Tissue blanching was carefully observed.

The abutment was fully seated and, within five minutes, tissue blanching had disappeared. The Atlantis abutment was torqued to manufacturer’s specifications (30 Ncm). A radiograph was taken to confirm final seating of the abutment.

The PFM crown was tried on and interproximal contacts adjusted to allow complete seating of the crown. Occlusion was marked with appropriate articulation ribbon and adjustments were accomplished, with particular attention to functional path and centric contacts.

The final occlusion respected the crossbite while providing a light occlusal contact that became normal in intensity upon biting force. All functional contact was adjusted to be in minimal contact during excursions. Adjacent teeth provided partial group function.
Once all clinical adjustments were done, a laboratory technician was consulted for final shade matching. The initial shade was very close to ideal. The technician accomplished minor modifications (minimal characterisation staining and reduction in final surface gloss). Proximal contacts and occlusal table were polished after final glazing.

The crown was lined with silicone tape and then bite registration material was injected into the crown to fabricate a cementation jig (Fig. 12). This step is very important to avoid excess cement extrusion during final seating of the restoration.

All pre-cementation procedures were completed, including approval by patient of both aesthetics and bite comfort. The abutment screw access hole was sealed with silicone tape, respecting the external contours of the abutment to allow complete seating of the restoration. This is a critical step to maintain patency for future access to the retention screw.

The crown was then seated on the previously fabricated cementation jig to extrude excess cement. Cement adaptation to the internal walls of the crown was confirmed and the crown was seated over the custom abutment. Excess cement was removed by a combination of hand instrumentation and dental floss after initial cement setting.

The crown was steam cleaned and thoroughly dried. Intraorally, the abutment was thoroughly cleaned and dried in preparation for cementation procedures. The attending dental assistant maintained cheek retraction and a dry field.

The walls of the crown were lined with implant cement (Premier Implant Cement, radiopaque, Premier). The crown was then seated on the previously fabricated cementation jig to extrude excess cement.

This case study reveals the potential for implant-supported tooth replacement. The aesthetic result was excellent, and final gingival contours were consistent with adjacent dentition. The tissue colour was natural and did not reveal any hint of the underlying implant or abutment. Restoration margins were concealed within the gingival sulcus. This treatment provided an elegant solution for this all-too-common dental emergency. The patient was extremely pleased with the result (Figs. 13–15).

Note: The author would like to express gratitude to Drake Precision Dental Laboratories (Charlotte, NC) for all services provided for this treatment. In addition, Dr Todd Engle, DDS, (Charlotte, NC) provided extraordinary care during extraction and immediate placement of implant.

References

Dr Larry R. Holt, DDS, FICD, graduated from the UNC School of Dentistry in 1978. He was in private practice from 1978 to 2008. Since 2008, he has been the director of clinical education and research at Drake Precision Dental Laboratories in Charlotte, NC.
Hybrid ceramics in practice
A CAD/CAM material for patients with functional disorders

Author: Dr Sjoerd Smeekens, Netherlands

The treatment of patients with functional disorders is a challenge for dentists. The extent to which the VITA ENAMIC hybrid ceramic (VITA Zahnfabrik, Germany) with its dentine-like elasticity may be a suitable material for treating patients with bruxism is described in this article. Although reconstructions with VITA ENAMIC are still experimental for this indication, I have already implemented them with clinical success.
Initial situation

The 48-year-old patient had suffered for ten years from severe temporomandibular joint pain and headaches, resulting in depression, which had led to his inability to work. Numerous visits to the dentist and treatment attempts (including occlusal splinting) had brought no relief. The patient had rejected the corrective jaw surgery recommended for the existing Class III skeletal abnormality owing to the uncertain therapy outcome. Figures 1 to 3 show the initial situation.
Preliminary treatment

After the patient’s referral to our clinic, we first tried to stabilise the occlusion via a reversible correction of tooth position. The optimal length of the incisal edges, the occlusal plane, and the horizontal and vertical dimensions were determined with a maxillary bite registration in wax (Fig. 4). It was shown that, through an elevation of the vertical dimension by 8 mm, a correction of the Angle Class III relationship was possible.

For the long-term evaluation, a PMMA splint for permanent use was fabricated on the basis of the bite registration (Figs. 5 & 6). Ten hours after its insertion (Fig. 7), the patient reported, with tears of joy, that he was pain-free. This situation has been maintained for the wear time of two years.

Material selection

Only after successful elevation of the vertical dimension were the permanent restorations fabricated. The objective was to preserve the healthy tooth substance through a non-invasive procedure. In order to achieve an exact fit, a restorative material that could be milled very thinly at the edges was required. Furthermore, a material with properties as close as possible to those of the natural teeth was needed. With its high durability and elasticity, as well as the possibility of adhesive bonding, VITA ENAMIC met these prerequisites.

Fabrication of the definitive restorations

For the precise transfer of the optimal tooth position, the digital moulding was performed once with and once without the splint. The superimposed scans formed the basis for the virtual design of the monolithic restorations made of VITA ENAMIC (Figs. 8 & 9). After fabrication, these were characterised and polished (Figs. 10 & 11).

When tried in, they exhibited a high-precision fit, and the patient was very satisfied with the shade; therefore, the adhesive bonding was performed immediately. In order to create an invisible transition to the tooth substance, pre-warmed composite filling material was used.

Summary

With the integration of the VITA ENAMIC restorations (Figs. 12–14), the patient’s self-confidence increased and he took up a new profession. This example shows that the non-invasive treatment concept presented can achieve outstanding results, leading to a significant increase in quality of life, even in patients with extreme functional problems.

Editorial note: This article was first published in the 1/2016 issue of the digital dentistry magazine (OEMUS MEDIA AG).

trends & applications hybrid ceramics

cAD/CAM

Dr Sjoerd Smeekens is a well-known specialist in the field of restorative dentistry. He runs his own practice in Beuningen in the Netherlands and can be contacted at administratie@reconstruktieve-tandheelkunde.nl.
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.

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- CC Disk Multicolour

CoCr DISCS
- For all metal ceramics
- CTE 13.9 - 14.0 × 10⁻⁶ K⁻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

Photo: Milling unit CC POWER
Multilayered zirconia solutions with ASC (angulated screw channel) and Omnigrip tooling

By Nobel Biocare

**True innovation** is about finding new and improved ways of doing things. At Nobel Biocare, this means developing new products and solutions that help dental professionals treat more patients better.

With the NobelProcera ASC (angulated screw channel) solutions and Nobel Biocare’s unique Omnigrip tooling, true innovation has been achieved. These products allow clinicians to offer screw-retained restorations in a practical and aesthetic way that would previously have been impossible in some cases.

**Increased restorative flexibility with no cement: It’s as easy as ASC**

With NobelProcera ASC solutions, the screw channel can be placed with an angle of up to 25 degrees from the axis of the implant, anywhere within a 360-degree radius. In the anterior aesthetic region, this makes it possible to use screw-retained restorations where a buccal/labial screw access point would previously have ruled them out.

In the posterior region too, NobelProcera ASC solutions come into their own. When used on molars or premolars, the ability to tilt the screw channel mesially makes it easier for the clinician to place and access the restoration. And, because of the strength of the material, the full-contour zirconia implant crown with ASC can be utilised in the posterior, providing the clinician with even greater support in delivering the best possible restoration.

**Leading restorations now available for a range of indications**

The angulated screw channel feature was first made available for single-unit zirconia abutments and full-contour implant crowns with Nobel Biocare’s internal conical connection. Now, the benefits of the ASC and Omnigrip tooling have been extended to multi-unit implant bridges on conical connection implants, in NobelProcera’s latest high-translucency, multilayered full-contour zirconia material.

Combined with ASC, this high-strength material offers great solutions both in the anterior and posterior, especially with the option to create a cutback and to design natural aesthetics by veneering restorations intended for the aesthetic zone. High translucency allows the material to blend in naturally with neighbouring teeth, and being multilayered means that colour changes in gradual, natural-looking layers...
that pass right through the material. And being full contour, the restorations come in their final shape, with great occlusal detail.

**Come to grips with better handling with innovative Omnigrip tooling**

The benefits of ASC are possible thanks to the associated Omnigrip tooling. A further innovation from Nobel Biocare’s product development team, it’s more than just a screwdriver.

The unique tip of the Omnigrip Screwdriver allows the screw to be tightened and loosened within the angulated channel with easy accessibility, as well as easy handling from multiple angles, even in the posterior.

The pick-up ability of the special tip is also an outstanding feature. The Omnigrip Screwdriver delivers a strong hold for full insertion torque—even at an angle—to offer convenience and, most importantly, safety. The Omnigrip is designed to hold the screw firmly when it matters most—when the clinician is working in the patient’s mouth.

**An advantage from every angle**

Together, the benefits of NobelProcera ASC solutions and the Omnigrip tooling can be seen by all. Clinicians gain not just new treatment possibilities, but opportunities to increase the number of screw-retained restorations they place. Patient satisfaction is likely to improve as the barriers of accessibility and flexibility are overcome to achieve optimised aesthetics, potentially in less chair time. And, with the adapter being mechanically retained, ASC solutions save time for labs too.

Nobel Biocare innovates to help its customers treat more patients, and to treat them better. These products do just that.

Find out more about how NobelProcera ASC solutions and the Omnigrip tooling can help improve restorative results at nobelbiocare.com/asc, or contact your local NobelProcera sales representative to experience aesthetics from a different angle.

*Available in up to five units.
Dynamic navigation for precise implantation in cases of critical anatomy

Author: Dr David Burgess, United Kingdom

Introduction

Using the CBCT image as a map, dynamic navigation guides surgeons just like a GPS guides drivers. The clinician virtually plans where implants should be placed. During surgery, the navigation system dynamically tracks the drill and the patient’s jaw, providing guidance and visual feedback to ensure the implants are placed according to plan.

There are several advantages with dynamic navigation. The technology allows clinicians to place implants more accurately than free-hand. This results in improved safety and aesthetics, as it helps the clinician to anticipate and to avoid potential complications. Other advantages are the ability to have more minimal invasive treatments, which means less chair time, less patient discomfort and less recovery time. This treatment option has generally been seen as a “blind” procedure in the past, but the ability to avoid delicate anatomical structures due to the real-time surgical feedback makes so-called flapless surgery a valuable option.

In the following case report, Dr David Burgess describes how using computer-guided dynamic navigation helped him overcome clinical challenges for dental implant placement in the lower posterior region.

Case report

A 75-year-old male patient had endured a gap for five years, following removal of his lower left second molar due to an acute apical infection. He was finding mastication increasingly difficult and sought advice about the treatment options available.

Planning for optimum implant positioning

As there was no tooth distal to the space, conventional fixed bridgework was not possible. The treatment options were either a unilateral single saddle lower partial denture or restoration of the space with two dental implants. The patient chose to have...
dental implant treatment as he did not wish to have any form of removable prosthesis.

What makes Navident dynamic navigation stand out is it precisely guides the surgeon to prepare and place the implant in a pre-determined position (Fig. 1). This allows me to achieve greater accuracy and certainty than I have previously been able to, using conventional protocols. Whilst there is no physical guide, a simple scanning template (NaviStent) is used to hold the fiducial in place whilst taking the CT scan, and secure the jaw reference (JawTag) for the navigated osteotomy.

In this case, the NaviStent was fabricated, the fiducial marker attached and a CBCT scan taken two weeks prior to surgery (Fig. 2). The treatment plan was created immediately after the scan (Fig. 3), with the patient present. He was able to see the proposed treatment displayed by the Navident software and appreciated that great care was being taken to achieve the optimum implant positioning, with minimal risk of potential complications (Fig. 4). The patient was impressed with, and reassured by, the state-of-the-art technology.

**Confidence from continuous feedback**

Treatment was carried out under local anaesthesia. Prior to preparation of the implant sites, the simple Navident protocol for calibration and verification of the drill axis and drill tip was carried out. A crestal incision was made, with a minimal flap reflected. The software shows the drill position on the scan in real time, as it enters the jaw. This allows adjustments to be made, if necessary, whilst the

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**Fig. 1:** An illustrative image of Dr Burgess using Navident. – **Fig. 2:** A CBCT scan was taken two weeks prior to surgery. – **Fig. 3:** The treatment plan was created immediately after the scan. – **Fig. 4:** The patient was able to see the proposed treatment displayed by the Navident software.
A site is being drilled. Two Dentsply Ankylos® CX 3.5 mm diameter dental implants were placed subcrestally in the lower left first and second molar sites, with implant lengths of 11 mm and 9.5 mm respectively.

Avoiding damage to the inferior alveolar nerve was a crucial factor in the treatment planning of this case. Access was difficult, due to the limited opening of the patient’s mouth. The issue was compounded by the plan to place an implant as distal as the second molar. These challenges were overcome using Navident’s continuous internal visual feedback, which gave the author the confidence to use the optimum length of implant, whilst staying within a safe distance from the inferior alveolar nerve and avoiding post-surgical complications, such as paraesthesia.

Navident provided guidance for accurate implant location, even with restricted visibility and the drill being impeded by opposing teeth. Tactile feedback can often be reduced when using a physical drill guide. Dynamic navigation removes this obstacle. The author was able to achieve the best-possible buccal and lingual position of the implants, and their relation to each other and to adjacent teeth (Fig. 5). This would allow for optimal shape, position and occlusal function of the final restorations.

Ankylos® Balance posterior sulcus formers were fitted and the incision was closed with simple interrupted sutures. There was no need for bone augmentation. Two to three months after surgery, the implants will be restored with Atlantis® custom-made CAD/CAM titanium abutments and screw-retained linked zirconia crowns.

Conclusion

The clinical outcome was excellent. The planned placement was restoratively driven and the implants were well positioned, with good primary stability. Having used the Navident dynamic navigation system for more than a year, the author would not want to go back to preparing and placing dental implants without its 3-D visual guidance. The patient was comfortable and reassured, with no postoperative pain, swelling, bruising or paraesthesia. He was delighted and, if he needed any implant treatment in the future, would insist on dynamic navigation.

Fig. 5: I was able to achieve the best buccal and lingual position of the implants, and their relation to each other and to adjacent teeth.

contact

Dr David Burgess BDS DPDS MScConSed has been principal of Carbis Bay Dental Care in Cornwall since 1988 and has placed over 2,000 implants. Throughout his career, David has striven to combine clinical perfection with the ultimate in patient care. He has been a willing pioneer of new technology, particularly in the field of digital dentistry. David was the first UK clinician to introduce the Navident dynamic navigation system into his implant treatment workflow, with the objective of achieving a higher degree of precision and greater patient comfort.

David Burgess is also a member of the Dynamic Navigation Society as a Master Clinical Trainer, providing courses for implantologists who wish to experience how dynamic navigation can help to simplify their digital workflow. More information can be found on http://dns.claronav.com

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Abstract

Traditionally, the diagnosis in orthodontics gives a lot of importance to cephalometry and the analysis of the dental casts. The development of new technologies does not intend to discard traditional concepts, in fact, it intends to provide more information allowing a wider approach of our patients and resulting in a more thorough diagnosis.

Introduction

Adapting to new three-dimensional concepts is not an easy task and is even harder considering that the information is so vast that it can result overwhelming. That is why when evaluating a patient for orthodontic treatment, it is intended to use a systematic method so that we can obtain the most essential information that these methods provide.

The method consists of the following:
- Coronal, sagittal and axial general visualisation
- Teeth and surrounding structures
- Airways and paranasal sinuses
- Soft tissues
- Temporomandibular joint (TMJ)

General visualisations

To perform a general exploration, it is necessary to know the three anatomical planes: coronal plane, sagittal plane and axial plane.
Coronal plane (Figs. 1 & 2)

The coronal plane is located in the anterior part of the face, approximately parallel to the buccal surfaces of the anterior teeth. It divides the skull in two; anterior and posterior. Structures can be seen from back to front or front to back.

Sagittal plane (Figs. 3 & 4)

The sagittal plane divides the skull in two symmetrical parts. Has a transversal orientation allowing examining two segments: right and left.

Axial plane (Figs. 5 & 6)

The axial plane is parallel to the floor and the occlusal plane. It divides the skull in two equal parts: superior and inferior, allowing the view of structures from top to bottom and bottom to top. The overview of these three anatomical planes should give the specialist a complete exploration of the 3-D anatomy. The result is a deeper knowledge of the anatomy of the patient or, like in some cases, a number of findings that might result in the modification of our treatment plan.

Teeth and surrounding bone structures

For obvious reasons, one of the main areas to check is the dental zone. Images that allow to check the teeth that are present and the ones in process of eruption, if that is the case, should be generated. As well as the characteristics of the adjacent bone and even take some numeric references.

Airways and paranasal sinuses

Breathing is the foundation of life. CBCT scans offer a precise visual of the airways and surrounding craniofacial structures that influence them, such as the mandible, palate, paranasal sinuses, facial relations, adenoid tissue, tonsils and more.

This view of the airway completely changes the perception of the specialist and, most important, the life of the patients.

Soft tissues

The evaluation of the soft tissues in a three-dimensional system and without magnification is ideal for the orthodontist because he/she can now evaluate the patient fully with one exam, completely changing his perspective. Previously, with 2-D images we only had the possibility of making a unilateral evaluation of the skull and structures unless, of course, several X-rays were taken and complementary analysis in each of them. The other option was performing photographic analysis to see the facial aesthetic from different photographic angles and requiring a major number of shots that surely resulted difficult for the patient. The diagnostic evaluation with 3-D systems allows in one exam to evaluate the patient from the angles necessary as well as evaluating the soft- and hard-tissues resulting visually stunning and attractive for the patient, being this extremely positive considering that the patient has a better understanding of his/her aesthetic problems and how the specialist will proceed to eliminate them.
Temporomandibular joint

The TMJ is, by definition, a ginglymus diarthrodial complex joint. This complexity is reflected in the knowledge and importance that each professional gives it. There are a number of specialists for who the TMJ is remote from the teeth and does not interfere with orthodontic treatment. On the extreme opposite side, for the other group of specialists, the TMJ is the foundation on where they base all their treatments. Whichever concept the doctor has on this, the evaluation of the TMJ should be included in the diagnosis.

Conclusion

The specialist cannot be unaware of the constant advances in technology. Of course, these developments have to be taken in moderation and with responsibility because it does not substitute the knowledge acquired during ones professional training and even less the experience obtained from treating patients. Needless to say, an effort is required for the training and understanding of these new systems but such systems are every time easier and perceptibles and the quality, quantity and usefulness of the information it generates is unquestionable.

It is important to remember the concept that we are healthcare providers and our goal is more than to just straighten teeth. Therefore, it is mandatory to diagnose our patients fully and when necessary, seek consultation from other specialists, since nowadays a great number of our patients require multidisciplinary treatments.

Acknowledgement

The author would like to thank the Group Cedirama Digital, for their constant support in the realisation of the exams and software managing; especially to Elie Matta Haddad, BBA.

Dr Enrique González García is a member of the World Federation of Orthodontics, Academia Mexicana de Ortodoncia and Colegio de Ortodoncia y Ortopedia del D.F. Has specialised in the interpretation and handling of images in the areas of: Maxillofacial Surgery, Orthodontics, Implants, Prosthetics and Endodontics. Professor of Imaging for Postgraduate of Restorative Dentistry and Prosthodontics and Endodontics. Professor of Imaging for Postgraduate of Restorative Dentistry and Prosthodontics at UNITEC. Invited professor of the Facultad de Odontología División de Estudios de Posgrado e Investigación de la UNAM, Posgrado de Ortodoncia de la UABC Campus Mexicali and Posgrado de Ortodoncia de UNITEC. Author of many scientific articles and magazines in Mexico, Spain and USA. Author of the books: “Tomografía Cone Beam. Atlas de Aplicaciones Clínicas” 1º and 2º edition and “Oclusión Práctica. Conceptos Actuales” and the 3º chapter of the book “Ortodoncia y Microimplantes”. Advisor for KaVo Kerr Group in the area of Imaging and for Cedirama Digital. Currently runs his exclusive practice of Orthodontics and TMJ Dysfunctions in Mexico City and is a national and international speaker.
Small changes, big impact

Bite raising, malocclusion correction and prosthetic treatment for a new smile with CEREC Ortho

Author: Dr Ariane Schmidt, Germany

Introduction

Functional therapy and a new smile with CEREC? That’s always an interesting challenge for me. I only recently completed a very complex case thanks to the new CEREC Ortho software, selective restorative procedures, and the outstanding compliance of the patient.

In my practice, I deal very frequently with aesthetic issues. I have been using the CEREC system since 2008 for these situations; I began with CEREC 3, after 2010 I worked with CEREC AC and Bluecam, and one year ago, I acquired the powder-free Omnicam in order to integrate the CEREC Ortho orthodontic software. Functional or orthodontic indications are not one of my specialties, but my requirements for the aesthetic treatment of my patients, which for me always included small corrections of incorrect positions, made CEREC Ortho a logical step for me.

CEREC Ortho offers digitisation that provides me with a higher level of precision and a deeper understanding of the overall workflow in this area—as is also the case with CEREC for prosthetics. Furthermore, I can also treat my patients more quickly and to their satisfaction, as the splints are manufactured in my own laboratory using the already converted models delivered by CA Digital.

Case report

I recently employed the full spectrum of these treatment options with a 30-year-old female patient who initially presented with tooth 26 broken off. I also diagnosed an end-to-end bite with severe loss of substance in the front (Figs. 1a & b).

I wanted to give the young woman a beautiful smile again and it quickly became clear that repairing the compromised tooth would not be enough. To achieve
the desired smile, correction of the malocclusion was needed in addition to bite raising and various restorative treatments. In the first step, the patient received an occlusal splint for six months (raising the bite by 2 mm as a fixed splint, Fig. 2).

In the second step, clear aligners were manufactured for the patient to correct the malocclusion in the upper jaw. This was necessary in order to optimise the anterior teeth axes for the prosthetic treatment. Due to the very short teeth, I was aware that there were only limited chances of success. I advised the patient of this and indicated that even small changes in the axis would improve the situation. Furthermore, I had already seen in other cases what changes are possible and have a good load-bearing capacity. The patient was 100% ready and persevered until this stage of treatment was completed, otherwise, we would probably have seen no progress.

Five times the patient received three splints in different thicknesses with which the teeth were moved gently and retained with the hard splint until the end. Every step was based on an altered situation that always came closer to the objective. At CA Digital, a new impression of the situation was needed after three steps, which made it possible to better check the situation and also to adjust the movement situation.

After three months, we had achieved an unspectacular but very important result: the correct axis of the anterior teeth was almost achieved. We were able to “tip” the incisal edge labially, which was very important for the prosthetic treatment. It can barely be seen with the naked eye as we are dealing in the micrometre range, but this alteration was significant for bite raising in the extension of the axis, as it would make correction possible. The result can be seen clearly in Figure 3 as the anterior teeth were moved in facial direction by around 0.4 mm—a small but decisive advance from the initial situation of the prosthetic construction.

I then produced the posterior tooth restorations that were required for the bite raising in just one session using hybrid ceramics. The advantage for patients is that, due to the flexible structure thickness, the ceramics increase the level of comfort with the level of pressure expected. Furthermore, the restoration was not necessarily perceived as a change in comparison to the natural tooth after the splints for bite raising were worn. I treated the teeth that were free from defects without additional preparation, which requires a material with a high edge strength that can be prepared extremely thinly in order to allow a clean transition to the tooth. The defect at 26 was integrated into the restoration for the bite raising. Like all teeth of the upper jaw, 27 also received a table-top or fixed bite block (Fig. 4a).

Five days later, the mock-up, which had already been produced in the session for the posterior tooth...
treatment, was transferred into the final restoration made from silicate ceramic. The mock-up gave the patient the opportunity to check the aesthetics and functioning for herself. The software provides the option of directly transferring the shape confirmed by the patient, i.e. the situation previously produced in plastic is recorded digitally and the shape can then be implemented one-to-one chairside (Figs. 6a & b).

With the bite raising, the patient obtained a new smile as a result of a slight shift of the dental arches and preparation-free treatments.

The unusual thing about this case was that a better result could be achieved through tooth movement for the anterior tooth restoration in connection with bite raising. It is an enormous advantage for us now to be able to digitise malocclusion correction. As an experienced CEREC user, it was initially unusual for me to be able to exchange the patient's data with the laboratory (CA Digital) immediately from the computer, as a systematic digital workflow had not yet been integrated into the practice in all treatment areas. Now I also use this option for major prosthetic restorations that we cannot manufacture chairside and take advantage of the speed. I scan in a case and I can then discuss the case directly with the laboratory, even when the patient is still sitting next to me in the treatment chair. If there are any deficits in the data set, I can rectify them immediately by carrying out a new scan, which is no problem for the patient and costs me only a small amount of time. I feel that this is a great advantage as I now receive direct feedback if I want, when otherwise the impression taking, transport, and transferring into plaster would take a great deal of time—not to mention the loss of precision. It is no longer necessary to schedule an additional session as a result of inaccuracies in the impression that only became apparent hours later.

The patient, who cooperated very well, benefited in the case presented here primarily from the direct transfer of the new bite situation to the final restoration and also from the mock-up to check the anticipated outcome.

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In the field of dentistry, the opportunities of current technologies are very concrete, very tangible as the International Dental Show 2017 (IDS) in Cologne demonstrated. In this way, the visitors experienced substantial enhancements to established digital workflows—from imaging techniques through to 3-D printing. In addition, the exhibiting companies also presented innovations for traditional working methods in the laboratory and practice.

What form will the work in practices and laboratories take on tomorrow and how can dentists and dental technicians seize the opportunities that are already visible today?

This specifically applies to the digital processes. In the field of implantology, they have already significantly contributed towards exploiting the healing potential of the body to a maximum through optimised planning.

Implantology has long since been considered to be the flagship discipline for the implementation of digital technologies. How far these have pushed forward in the spectrum of dentistry is demonstrated in a field that some people initially considered to be rather difficult terrain: orthodontics. With virtual models for orthodontics not only can diagnostic issues be processed and a virtual set-up created, but also more and more often orthodontic appliances can be planned, such as, for example, fixed devices. Even the largest orthodontics challenge for digital technology is increasingly coming under focus: removable devices such as stretching plates, activators, etc.
3-D printing—which displays great future potential—is a production process that is already implemented in orthodontics, as well as in other disciplines. Alongside drilling templates, different splints, dental technology models, individual impression trays and plastic base casts for the metal cast will most probably depict the most frequent indications.

In general, speed plays an increasingly more important role in all sections of dentistry. For example, patients ideally want prosthetic treatments to be carried out in one session if possible or at least completed on the same day. Digital technologies make this possible more frequently than to-date.

**Practice and laboratory riding at high speed**

The increased speed is achieved through pure chair-side therapies or by accelerating the workflows across the entire process chain in the practice and laboratory, from A for activators to Z for zirconium oxide. Attractive optimisation options are arising now at all levels.

This begins with digital moulding. At IDS, a whole series of new intraoral scanners enriched the existing offer. Some of them can simply be carried from one treatment room to the next, almost as conveniently and inconspicuously as a pen in the pocket of the dentist’s coat. Beyond this, connecting it to the tablet facilitates the patient communication. Other intraoral scanners are consciously kept small to ensure high patient comfort and yet exploit the possibilities of voice and motion control.

A prosthetic restoration can subsequently be carried out in the practice more and more often. A milestone here is the production of bridges from zirconium oxide, which enables the dentist to carry out more than just single-tooth restorations. Dentures that are printed out of plastic in the practice using the DLP method (Digital Light Projection) are also almost within reach.

The process for classic production in the dental laboratory is being accelerated enormously. At the same time, the communications are becoming more intensified; the dentist and the dental technician are moving closer together. Technology in the laboratory—for example a new dental microscope with a 3-D mode—is assisting here. Besides quality control, it can be used for the direct exchange of digital images with the practice (screenshots, videos, split-screen function). Furthermore, it ensures a constantly relaxed, ergonomic posture.

But even the production steps themselves are becoming faster all the time. For instance, the guidance of instruments on curved shape tracks when processing glass and hybrid ceramics promises great time savings in comparison to the conventional milling or sanding techniques. A fine structure feldspar ceramic infiltrated with polymer now offers an interior colour gradient with six layers in fine nuances in a time-saving and convenient process for patient-friendly aesthetics. The general trend is moving towards the more frequent production of monolithic restorations.

Interesting new surface finishing materials are appearing here. The dental technician sprays a thin layer of a transparent version on sintered zirconium oxide restorations; the spray diffuses during the firing process in the surface where it bonds intensively, homogenously, non-porously and smoothly after the first firing without additional polishing.
In addition to milling and sanding the possibilities of the printing techniques are expanding considerably. A wide range of splints, models, drilling templates, indirect bonding trays, in the near future temporary and permanent dentures—almost everything can be printed. Laboratory systems now offer even bigger building platforms and convenient remote maintenance for network-compatible models. Meanwhile, the speed is picking up—just to get an idea of the magnitude: seven splints in one hour are definitely possible today.

Innovative software even enables a combined additive/subtractive production: where it comes down to the highest precision, the machine subsequently carries out an automatic milling process and thus creates overall a consistently high surface finish. Today, multi-material printers are perhaps visible on the horizon. For example, six plastics are mixed to make a new compound with the defined required properties; for instance, with specific colouring or interior colour gradients for a patient-specific design.

As an alternative to their own production, the laboratory can also outsource jobs to a central or industrial supplier. Models can be delivered within short lead times, prompt service is offered using digital technology.

**Target figure = primary stability**

If a tooth is no longer worth preserving despite today’s endodontic and tooth preserving possibilities, implantology treatment is more and more frequently an option, which is now becoming even more interesting: new instruments with sharp working tips and a thin profile enable a tissue-saving extraction and thus often make elaborate bone augmentations superfluous.

Fibre-reinforced composites are used as superstructure material to provide a “shock absorber” effect, which offers a plus in durability and biting feeling. Corresponding CAD/CAM blocks can be processed chairside in the meantime even without separate firing processes.

When fixing implant prosthetic constructions using locators (often an alternative to full dentures) a high pivoting capacity now allows divergences of up to 40 degrees between two implants. And thanks to a special holding mechanism, the dentures can be extracted particularly easily using a hydraulic release system during the recall appointment.

If a conventional mucosa-supported full denture is chosen, cold curing resin with many of the material characteristics of heat curing polymer offer the dentist totally new possibilities. Such pink denture plastics are high impact, lie nicely on the gums of the patient and can nevertheless still be comfortably processed in the laboratory.

**Step towards the practice and laboratory of tomorrow**

New super-sharp scalers, new tiny mini implants, new ceramics for press technology processing, new embedding materials—this list is ongoing. The industry heads the ranks in many areas with both analogous and digital innovations. During their tour around IDS in Cologne the dentists and dental technicians took advantage of this to collect ideas for their practice and laboratory of tomorrow, based on well-founded knowledge thanks to the comprehensive offer of the exhibitors._

*Editorial note: IDS (International Dental Show) takes place in Cologne every two years and is organised by the GFdI Gesellschaft zur Förderung der Dental-Industrie mbH, the commercial enterprise of the Association of German Dental Manufacturers (VDDI) and is staged by Koelnmesse GmbH, Cologne.*
The next phase of Nobel Biocare’s integrated treatment workflow will launch in CE-mark-accepting countries in the summer 2017. The updated workflow has been developed to improve collaboration between treatment partners while increasing both treatment efficiency and acceptance. It will offer a time-efficient protocol for providing screw-retained provisionals on the day of surgery through the fully digital design and in-lab production of a TempShell temporary restoration.

As with the current integrated workflow, the clinician will take a CBCT scan in line with their usual diagnostic procedures. This scan information will then be combined with STL data from either an intraoral scanner or other surface data from a digitised model based on a conventional impression. This hard- and soft-tissue data can be combined effortlessly using the SmartFusion function in the NobelClinician software to provide a detailed visualisation of the anatomical situation. The clinician can then diagnose and plan the implant treatment based on accurate intraoral tissue information and the underlying anatomy. The planning process will be made even more efficient by the introduction of the SmartSetup feature. This will automatically create a digital wax-up for the teeth identified as missing, allowing an appropriate prosthetic-driven treatment plan.

The final treatment plan can then be used to order a surgical template for pilot-drilling or fully guided implant placement. On the day of surgery, the clinician then places the implants and adjusts the TempShell restoration chairside to form a passive-fitting, screw-retained provisional.

In the new collaborative workflow, the clinician will be able to share the NobelClinician treatment plan via the cloud to a partner laboratory that is using the DTX Studio design software. The lab can then use information from the digital plan to finalise the provisional design for the TempShell. This can be produced in-lab and sent directly to the clinician. As the provisional restoration was produced based on the digital treatment plan, the technician can be confident it meets the needs of both the clinician and the patient.

Important note: The new workflow described above is due to launch summer 2017. It is not yet available for dental professionals and does not yet have all required regulatory clearances. For information about Nobel Biocare’s collaborative treatment workflow, please visit nobelbiocare.com. Please note that immediate loading protocols should only be followed when the relevant clinical requirements are met.
digital workflow

Orchestrating digital excellence

Expanding your treatment options while increasing profitability and productivity

Digitalisation is impacting the world of dentistry immensely as it becomes one of the most innovative and fastest growing areas in the field. Completely new concepts are changing the way in which dental businesses are operated. This dynamic shift allows lab owners and dental practitioners to adapt their business model to better match patients’ ever increasing expectations. New software and hardware advances are substantially changing the way dental restorations are carried out these days, and a digital workflow provides a competitive edge by expanding your treatment options while increasing profitability and productivity. Our mission, therefore, is to provide dental professionals with the most efficient and comprehensive solutions. Through its digital competence centres, as well as strategic collaborations based on the open standard philosophy and partnerships (i.e. Dental Wings, Amann Girrbach, 3Shape, etkon and Createch), Straumann has become the leading provider of dental digital technology worldwide, always offering its customers state-of-the-art solutions and comprehensive support.

State-of-the-art dental equipment with digital technology and premium materials

Nowadays, a trend can be observed in the dental field whereby standard implant prosthetics are substituted with individualised, digitally designed and manufactured components. Computer-aided design and manufacturing (CAD/CAM) for tooth- and implant-borne prosthetics seems to be more efficient than conventional methods. The Straumann CARES Digital Solutions represent a unique and valid offer for dental labs and dentists who wish to have easy access to dedicated dental digital excellence, comprehensive support for their individual workflow, followed by fast amortisation, safe investments and a fairly free choice of vendors and equipment. The Straumann CARES Digital Solutions combine state-of-the-art dental equipment with digital technology and premium materials to provide a seamless, open and fully validated workflow for dental professionals. It represents a complete dental solution, from digital impression-taking by means of intraoral scanning to the computerised production of prosthetics using state-of-the-art CAM processing.

Offering for dental labs

For dental labs, Straumann provides an all-round solution complemented by our high-volume, high-precision centralised milling service. This includes scanning, milling and 3-D printing devices, accompanied by software for their efficient operation, as well as consumables and comprehensive service. Straumann offers different series of laboratory milling and grinding machines for in-house operation. They are designed to provide reliable and predictable precision when milling glass ceramic and hybrid materials for a wide variety of indications. Prosthetics can be milled or ground in wet or dry modes from different materials, including glass ceramic, zirconia, PMMA, cobalt chromium, sinter metal, wax, lithium disilicate, ceramics and resin nano ceramic. In addition to this, Straumann successfully manufactures the glass ceramic, n!ce. Its key advantages are high translucency and flexural strength, short milling times and easy finishing.

Offering for dental practices

For dental practices, Straumann provides a comprehensive portfolio of integrated solutions, including leading chairside scanning, milling and 3-D printing technologies. Our offer combines interconnected software platforms, open and fully validated workflows, together with a wide variety of materials—truly a benchmark in digital dentistry. Every product features state-of-the-art solutions for its efficient and successful use. For example, intraoral scanning, an emerging technology that will have a substantial impact on the future of dentistry, enables the dental practitioner to create a 3-D image of the patient’s teeth, resulting in a highly efficient, precise process that is also more comfortable for the patients. Using our devices, customers can successfully design a wide range of restorations: from simple copings to complex full-arch implant restorations.

digital.straumann.com
EGS presents new products at IDS 2017

With a huge turnout and appreciation from visitors, EGS confirms and consolidates its status as leading 3-D scanners manufacturer in the dental industry through innovative CAD/CAM solutions for both dental laboratories and for dental clinics.

During the International Dental Show 2017 (IDS), EGS presented a wide range of innovations showing to have perfect solutions for those looking for products easy to use but able to efficiently cover the entire workflow in digital dentistry.

In order to show the capability and innovative potential of the company to the international market, EGS unveiled its new range of products that combines state-of-the-art 3-D technology with in-depth dental expertise to provide cutting edge solutions for modern digital dentistry and much more.

“LoScanner”, strong suit and newest advocate of its range of high performing 3-D scanners, is about to revolutionise dental 3-D scanners as we know them. A quick glance at this digital dentistry masterpiece is enough to understand that its innovative, high-profile design is something previously unseen among scanners of this kind. EGS took on the ambitious task to bring a beautifully designed object on a working space, a piece whose looks and structure will amaze even before its functionality has had a chance to do so.

EGS shed light also on the novelties brought by the latest versions of its CAD software and scanners, which further increase the accuracy, simplicity, flexibility and reliability of the earlier releases.

Pioneer of digital dentistry’s CAD modelling software, EGS also presented the upgrades brought by the new release of DentalCad 6, an open and customisable system that integrates a compatibility converter to make the import/export of STL files with an automatic, simple and intuitive wizard. The latest version of the software provides even higher flexibility thanks to the new “library manager”, which allows users to take advantage of a fully customisable dental library. Another feature that strikes a chord in the new DentalCad 6 is the implementation of “hybrid jobs”, a novelty that allows the possibility to operate on various dental works on the same arch or double arch and the model builder.

The software features a range of modules designed to fit specific needs: the implant module for the design of abutments, the virtual verticulator for check of dynamic occlusion, the bars module for the design of simple and advanced bars, and the provisional module for temporary crowns and bridges.

EGS offers a perpetual license with no obligatory fees, while providing regular free-of-charge updates that grow the software’s value over time. These capabilities, together with the CAM integration in a single graphic interface, make DentalCad 6 a customisable and comprehensive solution for 3-D printing, milling and laser sintering that is suitable for all users, regardless of their level of digital expertise.

EGS is an Italian company with over 15 years of experience in the CAD/CAM industry. Always at the forefront in offering innovative solutions, it is recognised worldwide for its expertise in 3-D technology. EGS designs, develops and manufactures entirely in-house products for the OEM market, to ensure full control of the process, safety and quality. It works closely with partners and offers complete customisation of hardware and software possibilities.

For more information please check the EGS website: www.dentalcad.egsolutions.com/eng/
International Events

2017

Dental Technology Showcase
12–13 May 2017
Birmingham, UK
www.the-dts.co.uk

Dentsply Sirona World Summit Tour 2017
23–24 June 2017
Nice, France
www.worldsummittour.com/nice/

HK IDEAS—
International Dental Expo & Symposium
4–6 August 2017
Hong Kong
www.hkideas.org

ICOI World Congress XXXV
17–19 August 2017
Vancouver, Canada
www.icoi.org

FDI Annual World Dental Congress
29 August–1 September 2017
Madrid, Spain
www.world-dental-congress.org

EAO
5–7 October 2017
Madrid, Spain
www.eao.org

American Association of Oral and
Maxillofacial Surgeons—Annual Meeting
9–14 October 2017
San Francisco, USA
www.aaosms.org

American Academy of Implant Dentistry—
Annual Conference
11–14 October 2017
San Diego, USA
www.aaid.com

BDIA Dental Showcase
19–21 October 2017
Birmingham, UK
www.dentalshowcase.com

Expodental Meeting
18–20 May 2017
Rimini, Italy
www.expodental.it

Expodental Meeting
18–20 May 2017
Rimini, Italy
www.expodental.it
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;
- all the image (tables, charts, photographs, etc.) captions;
- the complete list of sources consulted and
- the author or contact information (biographical sketch, mailing address, e-mail address, etc.).

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.

Text length
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.

Text formatting
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.

Image requirements
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:
- We require images in TIF or JPEG format.
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- These image files must be no smaller than 80 KB in size (or they will print the size of a postage stamp!).

Larger image files are always better, and those approximately the size of 1 MB are best. Thus, do not size large image files down to meet our requirements but send us the largest files available. (The larger the starting image is in terms of bytes, the more leeway the designer has for resizing the image in order to fill up more space should there be room available.)

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Questions?
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