SPECIAL ISSUE

- Product presentation COMFOUR™ System
- Case study
- Interview with Dr. F. Steidl and ZTM S. Schuldes, M.Sc.

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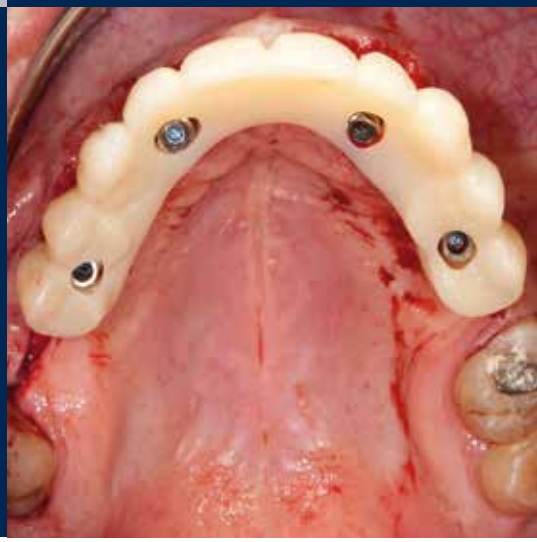
IMMEDIATE RESTORATION OF AN UPPER JAW WITH FOUR IMPLANTS USING THE COMFOUR™ SYSTEM

Dr. Ferenc Steidl, Sömmerda and Bad Frankenhausen, and
MDT Sebastian Schuldes, M.Sc., Eisenach



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THE COMFOUR™ SYSTEM

VERSATILE AND COMFORTABLE FOR BOTH USER AND PATIENT

Occlusal screw retention is a state-of-the-art treatment method. COMFOUR™ equally enables several different treatment concepts. It is a multi-option system that permits bar and single-tooth restorations for straight and angled bar abutments in addition to screw-retained bridges for immediate and delayed restorations. The COMFOUR™ System is available for the CAMLOG® and for the CONELOG® Implant Systems. The major advantages of the new abutment system are its versatility and the product design, combined with safety and a high level of comfort for user and patient.

The aim of the COMFOUR® development was to market a system for occlusal screw-retained treatment concepts that provided value-added advantages to both users and patients.

After detailed analysis, the development team and product management at CAMLOG decided to develop the new abutment system for occlusal screw retention on the basis of the former bar abutments. The range of bar abutments was greatly expanded and modified, and the collaboration with experienced clinicians enabled the creation of the new COMFOUR™ Abutment System.

Slender and stable

New machinery was specifically purchased for the production. This enables the angled bar abutments to be designed to be as slender as possible, which leaves plenty of room around the abutment for the hard and soft tissues. Presuming sufficient primary stability of the implant, the sterile bar abutments can be immediately inserted after surgery and fitted with the temporary restoration. Alternatively, the bar abutments can be sealed with a healing cap. All other treatment steps such as impression taking and the definitive restoration are done at abutment level. This avoids irritating the gingival cuff as a result of repeatedly detaching the soft tissue attachment during insertion and removal of the abutment.

The COMFOUR™ System provides clinicians with a modern, easy to handle abutment system not only for restorations on four or six implants, but one that also comes with a range of options to meet the challenges of routine clinical practice. The refinement of the tried and tested bar abutments is welcome. A comparison with current comparable systems offered by competitors shows that the prosthetic screws of the COMFOUR™ System (M1.6) have greater dimensions – for greater stability.

Comprehensive range of abutments

Along with straight bar abutments, the COMFOUR™ System also includes 17° and 30° angled bar abutments. These are available as type A and type B (60° offset cam arrangement). All bar abutments are available in two gingival heights; straight bar abutments from a diameter of 3.8 mm are even available in three gingival heights. Useful additional components are the titanium caps for bar abutments for both temporary and definitive restorations as well as the aligning tools for making fine adjustments to the cam alignment during implantation. The aligning tools are compatible with the CAMLOG Guide System and are inserted using the Guide insertion posts for precise alignment of the inner implant configuration.

The scan caps for bar abutments create an interface in digital fabrication. They allow the position of the bar abutments and the lab analogs to be digitalized, thus enabling the fabrication of frameworks and bars using DEDICAM®.

Sterile and flexible

To ensure that the handling of the components in the COMFOUR™ System is as simple as possible, a critical change was made to the previously familiar bar abutment system. All components used during surgery are packaged sterile. This means that there is no need to sterilize the bar abutments, healing caps for bar abutments, the impression caps for bar abutments, and closed trays before use.

The insertion of the angled bar abutments is simplified by an ingenious flexible handle that is used as an insertion aid. The handle is fixed in the thread of the prosthetic screw and holds the bar abutment in place. In order to screw the abutment screw that is already located in the bar abutment into the implant, the handle can be simply bent to one side. Particularly when the vertical space available is limited, this greatly facilitates the procedure (see page 15).

If impression taking with the open tray technique is indicated, the titanium caps for bar abutments are mounted and combined with screws of three different lengths, each of which can be shortened by 2.5 mm.

New light blue screws

The familiar bar abutment components such as the burn-out, laser-weldable, solderable, and cast-on bases are fully compatible with the COMFOUR™ System. Only the abutment and prosthetic screws have been modified. All screws and screw-retained components are color-coded light blue for easy identification.

An immediate, comfortable solution

The new COMFOUR™ Abutment System enables permanent, occlusal screw-retained restorations and satisfies patient desires for an immediate, comfortable, and permanent denture. COMFOUR™ saves time during use and offers clinicians and dental technicians greater flexibility for occlusal screw-retained designs. With its options for bar and single-tooth restorations, COMFOUR™ extends the prosthetic options available at bar abutment level and has a number of impressive technical advantages such as its anti-rotation mechanism, a pre-mounted flexible handle, the aligning tool which is compatible with the Guide, and an extremely slim design.

Fig. 1: The patient presented in the dental practice with an inadequate denture.

Fig. 2: The current oral situation shows periodontally compromised and non-preservable teeth.

Fig. 3: The model of the situation in the upper jaw was prepared by etching tooth 22 for the creation of a Guide template.

Fig. 4: The dentition in the lower jaw: Free-end situation on the left and a shortened row of teeth in the 4th quadrant.

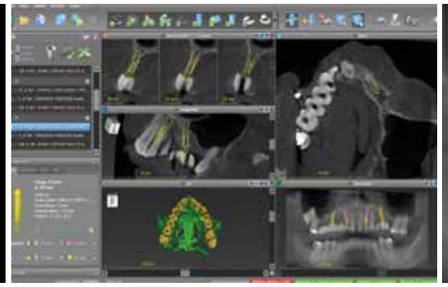

Fig. 5: Taking the anatomic structures into account, the implant positions were planned virtually.

Fig. 6: Optimal use was made of the original jaw bone thanks to angled implants.

IMMEDIATE RESTORATION OF AN UPPER JAW WITH FOUR IMPLANTS USING THE COMFOUR™ SYSTEM

Dr. Ferenc Steidl, Sömmerda and Bad Frankenhausen, and MDT Sebastian Schuldes, M.Sc., Eisenach

Fig. 7: To prepare the pre-fabricated immediate restoration, the anterior teeth were etched for bridge retention.

Fig. 8: The implant areas were ground away for insertion of the lab analogs.

Fig. 9: The lab analogs were screwed in using the Guide insertion aid and the loose fit was checked in the model.

Offering edentulous patients a fixed restoration on four or six implants is not new and has been easily achievable to date using the CAMLOG® VARIO SR System. In close dialogue with its customers, CAMLOG developed new system components with sophisticated features for the bar abutments. The range was expanded by bar abutments angled at 17° and 30° as types A or B. CAMLOG presented the new COMFOUR™ System components to VARIO SR users and made the components available to users for the clinical test phase. The therapeutic concept underlying the following case report is a temporary immediate restoration after extraction of non-preservable and periodontally compromised teeth in the upper jaw on four implants, based on the concept developed by Professor Paolo Maló [1, 2, 3], using the new components of the COMFOUR™ System.

For the long-term success of an immediate restoration, the experience of the clinical team comprising the surgeon, prosthodontist, and dental technician is of critical importance. Thorough preliminary examinations and carefully determining the indication, knowing how to handle the system components, and positioning the implants to obtain a sufficiently large load polygon without damaging the anatomic structures are criteria that must be met. The implants inserted for an immediate restoration must have a high degree of primary stability and must be splinted or blocked. If these criteria are met, the concept provides a safe and predictable treatment outcome using only a single surgical procedure.

The initial findings

The 37-year-old patient, smoker, came to our practice in January 2015 after referral by his dentist. The initial intraoral situation was characterized by a inadequate plastic clasp-retained denture and periodontally compromised teeth in the upper jaw. Despite therapy that was promptly initiated, no significant improvement could be seen. The highly mobile teeth could not be preserved. The patient expressed a wish for a permanent fixed restoration and a considerable improvement in the esthetic appearance. It was equally important to him to have a temporary fixed denture during the healing phase of the implants. After a meticulous case analysis and a diagnostic setup, we discussed our therapeutic concept with the patient. The concept is based on the Maló Clinic protocol. In our practice it has proven itself to be an outstanding concept following extraction of non-preservable teeth combined with immediate implantation and an immediate, fixed, temporary restoration with a reduced number of implants in the edentulous jaw.

The preoperative phase

After a thorough explanation for the patient and making the decision, we prepared the following treatment plan:

- Professional teeth cleaning with deep scaling in the lower jaw
- Guided surgery after three-dimensional implant planning and template preparation
- Fabrication of a long-term temporary restoration using CAD/CAM high-performance polymer
- Extraction, implantation, and immediate restoration on the bar abutments from the COMFOUR™ System in one treatment session under general anesthetic

For the preparation of a scanning template, we made an impression of the upper and lower jaws in February 2015. The teeth in the lower jaw were professionally cleaned by a dental hygienist including deep scaling, and the tooth color was determined for the maxillary restoration.

The fabrication of the temporary restoration

Because the setup met the esthetic and functional requirements, it was converted into polymer with added barium sulfate using the "backward planning" procedure [4, 5]. In order to visualize the prosthetic tooth axis in the DVT data set, holes were drilled through the radiopaque teeth in this axis **(see Fig. 8)**.

The DVT imaging was carried out in the practice. The digital data were fed into the implant planning system and the optimal implant position and length were determined, taking into account the anatomic structures and the prosthetic requirements **(Fig. 5)**. The prerequisite for a successful outcome using this treatment concept is achieving a sufficiently large support for the restoration. The positioning of the dorsally angled implants is a critical requirement for the success of this treatment concept **(Fig. 6)**.

After the 3D planning, a precise drilling template was prepared in the laboratory for fully guided surgery using the guide sleeves from the CAMLOG Guide System. The template should be stably fixed intraorally over the natural teeth and the palate. In order to precisely position the angled bar abutments of the COMFOUR™ System the indexing of the inner implant configuration must be aligned with the marking on the guide sleeve. After preparing the template, the plaster teeth were removed and we used the drilling template for model implantation.

The model was ground away around the implants taking the axis alignment into account **(Fig. 7 and 8)**. **Figure 9** shows the use of the aligning tool that is placed on the Guide insertion aid for precise positioning of the cam in relation to the 17° and 30° angled bar abutments. The lab analogs screwed onto the CAMLOG® Guide insertion posts were fixed in the model, corresponding to the aligning tool **(Fig. 10 and 11)**. Near the lateral incisors, we inserted 17° and 30° angled bar abutments in regions 15 and 25.

The abutments were supplied pre-mounted on an insertion handle. This handle makes the positioning of the short bar abutments easier and ensures that the screwdriver has free access to the abutment screw **(see Fig. 28)**.

Fig. 10: With the help of the aligning tool of the COMFOUR™ System, the inner configuration of the implant can be aligned.

Fig. 11: The extension of the aligning tool shows the screw channel of the prosthetic restoration.

Fig. 12: Two 17° angled COMFOUR™ bar abutments were used in the anterior region and two 30° angled bar abutments were used in the dorsal area.

Fig. 13: COMFOUR™ bar abutments angled at 17° and 30° and with various gingival heights. They are also available as type B. Not shown: Straight bar abutment.

Fig. 14: The titanium caps were shortened according to the occlusion and screwed on.

Fig. 15: The model with the titanium caps screwed on was scanned …

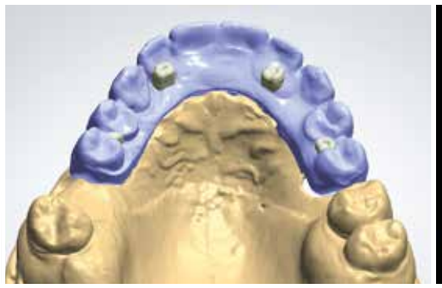

Fig. 16: … and matched with the previously scanned setup.

Fig. 17: The immediate temporary restoration was milled from high-performance PMMA and the areas around the titanium caps were generously ground away.

Fig. 18: To ensure the hygiene of the restoration, the basal rest areas and the interdental areas were polished.

Fig. 19: Checking the fit on the model indicated that the immediate restoration can be bonded in the mouth without tension.

Fig. 20: Tooth 22 was first carefully extracted.

Fig. 21: The Guide template was stably fixed over the remaining teeth.

Fig. 22: In compliance with the minimally invasive Guide protocol, the implant bed in region 22 was prepared.

Fig. 23: The CAMLOG® SCREW-LINE implant Ø 4.3 mm/ L 13 mm was inserted through the sleeve to the depth stop.

After the titanium caps for bar abutments were shortened according to the occlusion, we screwed them on and scanned in the model. The digital model data were matched with the data from the setup, the construction was completed digitally, and the temporary restoration was fabricated in the CAM procedure using a high-performance polymer **(Fig. 12 to 16)**. The polymer bridge was separated from the blank and the fit checked, ensuring that there is sufficient space around the titanium caps for the intraoral "adhesion" **(Fig. 17 to 19)**.

The surgical phase

The surgery was carried out under intubation anesthesia on April 23, 2015. Firstly, we carefully removed the lateral incisor 22 because this region was intended for the strategically correct positioning of an implant based on the Maló principle **(Fig. 20)**. The remaining teeth were used for precise and stable fixation of the template during the fully guided insertion of the four CAMLOG® Guide SCREW-LINE Implants **(Fig. 21)**. The four implants (region 12 Ø 4.3 mm CAMLOG® SCREW-LINE Implant 13 mm length, region 22 Ø 4.3 mm/ L 13 mm, region 14 Ø 3.8 mm/L 9 mm and region 25 Ø 3.8 mm/L 13 mm) [6] were inserted using a minimally invasive procedure according to the Guide protocol and the inner configuration was aligned with the marking on the Guide sleeves. The Guide insertion posts were then screwed on, the template removed, and the anterior teeth extracted **(Fig. 22 to 26)**.

The implants were then rinsed, and the 17° angled bar abutments were inserted in regions 12 and 22. These were supplied premounted on a flexible insertion handle in sterile packaging. With the help of this handle, the abutment is positioned with the precise angular alignment into the implant **(Fig. 27)**. To insert the abutment screw, the handle is bent to one side, giving the surgeon free access to tighten the screw using the new, slim socket screwdriver **(Fig. 28)**. In the same way, the 30° angled bar abutments could also be rapidly inserted with precise alignment and then screwed in **(Fig. 29 and 30)**. We then screwed the titanium caps without rotation protection onto the COMFOUR™ bar abutments and checked that sufficient space had been created around the caps to polymerize into the temporary restoration **(Fig. 31 to 33)**.

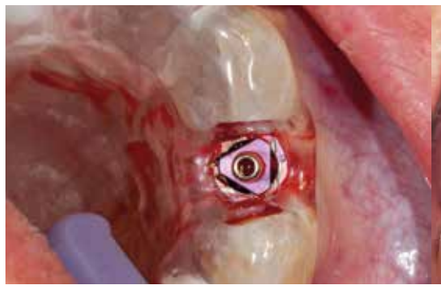

Fig. 24: The figure shows the precise alignment of the insertion post in relation to the inner configuration of the implant.

Fig. 25: After preparing the implant bed, three implants were inserted fully guided.

Fig. 26: The periodontally compromised, non-preservable anterior teeth were extracted after removal of the template.

Fig. 27: The 17° angled bar abutment was inserted into the implant with the help of the insertion handle with precise alignment.

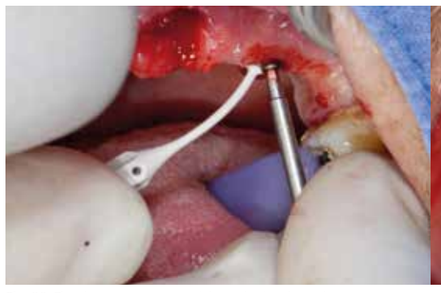

Fig. 28: The abutment screw was tightened using the socket screwdriver. To gain access, the flexible handle was gently bent to one side.

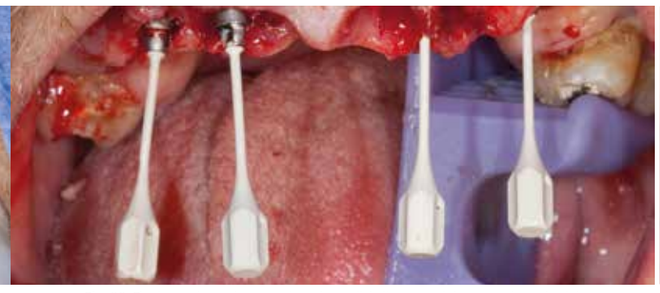

Fig. 29: The figure shows the approximately parallel alignment of the screw channels of the prosthetic restoration by means of the angled bar abutments.

Fig. 30: The flap was formed after a crestal incision with a central band preserved around the incisive papilla.

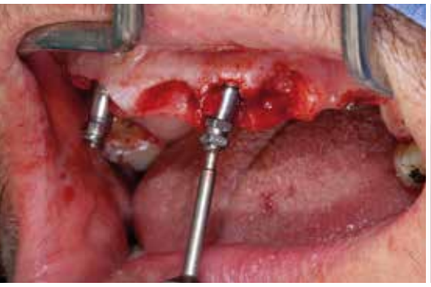

Fig. 31: The titanium caps were screwed onto the bar abutments.

Fig. 32: To check the esthetics and occlusion, the provisional PMMA bridge was inserted…

Fig. 33: … and the tension-free fit around the titanium caps was checked.

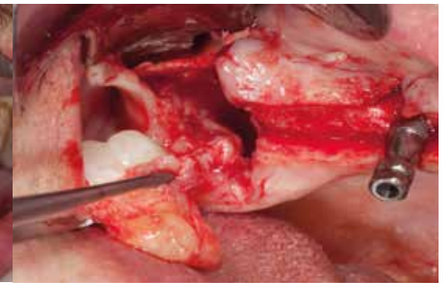

Fig. 34: The remaining teeth were extracted and the osteotomy of the displaced wisdom tooth was carried out.

Fig. 35: The bone chips obtained during the osteotomy were ground and mixed with bone substitute material (Bio-Oss®, Geistlich).

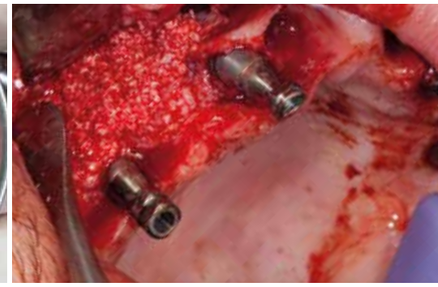

Fig. 36: The virtually identified bone deficits were augmented with the bone mixture.

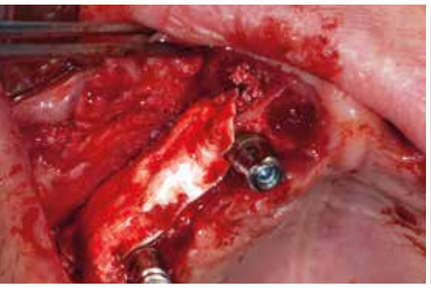

Fig. 37: The augmentation material was covered with a resorbable membrane (Bio-Gide®, Geistlich).

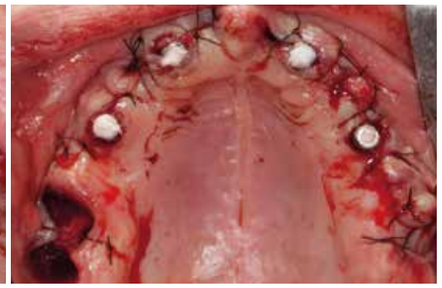

Fig. 38: Using individual button sutures, the soft tissue was closed, and the screw channels were covered with cotton pellets prior to the cold-cure polymerization.

Fig. 39: The titanium caps of the COMFOUR™ system were polymerized free of tension in the immediate temporary restoration.

Fig. 40: At the follow-up three days after the surgical procedure, the soft tissue was free of inflammation and well adapted.

Fig. 41: The follow-up radiograph shows the angulated, well-anchored implants with the angled COMFOUR™ bar abutments.

Fig. 42: The occlusal screw-retained temporary restoration forms an harmonious and esthetic lip line.

After the alveolar ridge incision and the flap formation, the three molars were extracted and the wisdom tooth 18 was extracted using osteotomy **(Fig. 34)**. Sufficient autologous bone chips were harvested in the process, which were then ground in the bone mill and mixed with xenogenous bone substitute material (Bio-Oss®, Geistlich) [7] to augment the bone defects identified virtually beforehand. We covered the augmentation material with a resorbable collagen membrane (Bio-Gide®, Geistlich) and closed the soft tissue with individual button sutures **(Fig. 35 to 37)**.

Insertion of the immediate temporary restoration

To prevent the polymer entering the screw channels of the titanium caps, we covered these prior to polymerization with cotton pellets and then "adhered" the temporary restoration tension free **(Fig. 38 and 39)**. The patient left the practice on the day of the surgical procedure with a screw-retained, temporary, fixed denture and detailed instructions on food intake. This means a diet consisting of only soft foods for the first two weeks and in the subsequent four weeks slowly shifting to more solid food. During the procedure the patient was administered 1000 mg amoxicillin as antibiotic prophylaxis. He was repeatedly and clearly instructed to abstain from nicotine as much as possible in the postoperative period.

Figure 40 shows soft tissue completely free of signs of irritation just a few days after surgery. After two weeks the sutures were removed. A follow-up radiograph was prepared and the occlusion of the temporary restoration was checked and minor corrections were made **(Fig. 41 and 42).**

Conclusion

The screw-retained, fixed reconstruction on four implants is a treatment concept that reduces both effort and costs. Immediate temporary restoration using the Maló Clinic protocol has been scientifically documented. Pre-implantation planning taking into account the surgical and prosthetic requirements is given special priority. With the help of 3D planning in the form of backward planning [8], implants can be positioned in the software in the precise angle (0°, 17°, and 30°) relative to one another, and the screw channels do not have any negative effects on either the esthetics or the function.

The new COMFOUR™ System is highly suitable for using with this treatment concept [9]. The angled bar abutments are available in different gingival heights and as type A or B. The insertion of the abutments in the correct position is safe and easy using the attached handle. To screw the abutment screws in, the flexible handle can be simply pushed to one side.

The new design of the bar abutments, which omits the bend, has a positive effect on the soft tissue augmentation. An additional feature is the aligning tools that are helpful for precisely positioning the cams. The concept is exceptionally well suited for providing edentulous patients with fixed, immediate temporary restorations in one surgical procedure.

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MDT Sebastian Schuldes, born in 1974, graduated from 1991 to 1995 as dental technician, 1998/1999 qualification as Master Dental Technician. Since 1999, he has been Managing Director of Dental Laboratory Schuldes GmbH. From 1999 to 2000 he continued his studies in business administration specialising in crafts; 2006-2008 he studied for his Master of Science (M.Sc.) - Dental Technology at the Danube University Krems/Bonn. In 2007 Schuldes founded 'S-implant', a service provider in the field of 3D navigated implant planning, and in 2011 the milling center zaxocad Dental Solutions. Sebastian Schuldes works as a lecturer and author.

FIRST EXPERIENCE WITH THE COMFOUR™ SYSTEM

CAMLOG has worked closely with its customers and invested in new machinery in order to expand the range of bar abutments by adding angled versions with a slender, pointed design. This new system is called COMFOUR™. Dr. Ferenc Steidl and MDT Sebastian Schuldes M.Sc., users during the test phase, were asked by the logo editorial team about their impressions of and their first experience with the new system.

The concept popularized by Professor Paulo Maló for occlusal screw-retained immediate restorations requires at least four implants in the edentulous lower jaw and edentulous upper jaw. The Implantology Consensus Conference recommends six implants in the lower jaw and eight implants in the upper jaw for fixed restorations. Dr. Steidl, what should guide the clinician's choices here?

Dr. F. Steidl: The Consensus Conference draws up principles or guidelines for implantology treatment. In our opinion, these form a therapeutic corridor with flexible limits which vary depending on the individual situation of a patient and/or clinician. For example, the "one implant per tooth" concept favored and publicized by some colleagues for fixed restorations with eight implants in some cases and ten or twelve in others must be mentioned. This is contrasted by fixed reconstructions with four implants, which is a therapeutic option that saves both effort and costs. The scientific foundation of these treatment strategies ranges from studies conducted by P. Ledermann on immediate restorations on four implants in the interforaminal region in the lower jaw [1] to studies by Professor P. Maló with obliquely inserted distal implants in the upper and lower jaws [2]. The current S3 guidelines from the DGI/ DGZMK (AWMF REGISTER NO. 083-010) do not include any recommendations for or against the Maló concept [3]. The authors believe this to be a highly promising approach.

We consider the Maló treatment method to be a valid concept for fixed immediate oral rehabilitation in our practice and clinic [4]. Consequently, we provide a full 5-year warranty for restorations using the COMFOUR™ System, as we do for other implant treatments.

Many years ago you and your team started to treat your patients using this concept. How steep was the learning curve for this type of treatment?

Dr. F. Steidl: Like every new therapeutic approach, there are details of the surgery and dental prosthesis that are only worked out over many treatments. What was surprising to us, however, was the tolerance of the VARIO SR System, and now the COMFOUR™ System, regarding sources of error. We were therefore able to resolve as a team all those surgical and prosthetic difficulties that arose.

MDT S. Schuldes, M.Sc.: When providing treatment using the Maló concept, you must understand the principle and have a precise understanding of the prosthetic challenges you will face. Pre-implantation planning taking into account the surgical and prosthetic requirements is given special priority. Computer-aided, three-dimensional planning in the form of backward planning has proven its worth here. The implants can be positioned in the planning software in the precise 0°, 17°, or 30° angle relative to one another. From the prosthetic perspective, it is particularly important to position the implants so that the screw channels of the screw-retained immediate restoration – but even more importantly those of the subsequent definitive restoration – do not negatively impact either the esthetics or the function.
On this basis, we then fabricate a CAD/CAM bridge from a polymer that is bonded free of tension in the mouth of the patient following the fully guided insertion of the implants using the CAMLOG® Guide System. In our opinion, this procedure involves considerably fewer compromises than the traditional procedure in which impressions are taken of the inserted implants intraoperatively and a temporary restoration is then prepared using cold-curing acrylic resin.

How often did something go wrong?

Dr. F. Steidl: The implant loss rate during the healing phase with VARIO SR in our patient population does not differ significantly from that of other implant treatment modalities. We will definitely be able to maintain this success rate using the COMFOUR™ System. The COMFOUR™ System offers us even more treatment options. We do not consider there to be an increased risk associated with fully guided, immediate temporary restorations after 3D planning.
Tricky and important is the question regarding the reproducible fixation of the drill templates intraorally if provisional implants are not used. We had a considerable learning curve in this area going from fixation by the assistant to osteosynthesis screws to multiple template operations.

MDT S. Schuldes, M.Sc.: As already mentioned, thorough planning prior to the implantation is very important. A fracture in the immediate restoration can also lead to complications during the osseointegration. In light of this, materials with a high fracture toughness should be used. This is the only way to reduce failures to a minimum.

You actively participated in the development of the new angled bar abutments in the COMFOUR™ System and even treated some of the first patients with this system. Could you describe your impressions of the implementation from a surgical and technical perspective, and what are the differences to VARIO SR?

Dr. F. Steidl: From a implant surgery perspective, nothing has changed in the treatment sequence. The insertion of the angled bar abutments is fun. This is because of the handle that ensures safe transfer of the abutments into the mouth and makes correct alignment easier. The flexibility of the handle and the help of the sophisticated screwdriver means that the abutment screws can be screwed in without any difficulty.

MDT S. Schuldes, M.Sc.: The 17° and 30° angled bar abutments in the A and B versions with various gingival heights provide a generous leeway for the treatment. All the components of the COMFOUR™ System have a slender design and low profile. This makes the prosthetic restoration considerably easier. For improved soft tissue augmentation, the new design of the abutment with the "bend" makes itself felt. Thanks to the impression posts and the titanium caps with the anti-rotation mechanism, occlusal screw-retained single-tooth and telescope restorations at the abutment level are also possible.
If the implants are not inserted under full guidance, the new aligning tools to make fine adjustments of the rotation cams during implantation are an exceptional tool.

Will this type of therapy establish itself extensively in practices?

Dr. F. Steidl: Certainly not extensively. Angled implantation, where necessary also with an immediate restoration, is surgically, prosthetically, and technically demanding. I therefore believe that practices and clinics with a focus on implantology should at least carry out the surgical part.
For general practitioners, the COMFOUR™ System is an interesting option if they are involved in prosthetics. To be able to rehabilitate an edentulous patient not just dentally but also often psychosocially in a single treatment session without repeated impression taking or fittings is an inspirational therapeutic tool.

Thank you for the interview.

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NOTES

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