

straumann® Pro Arch



Table of Contents

Double Jaw Immediate Load Hybrids: Case Abstract 3

Scott E. Keith, DDS, MS

John J. Petrini, DDS, MS

**The Team Approach in a Complete mouth Pro Arch Hybrid
Reconstruction using the Indirect Method for Provisionalization** 6

Robert A. Levine, DDS, FICPP, FISPPS

Harry Randel, DMD

**Mandibular Pro Arch hybrid reconstruction
with immediately loaded fixed provisionalization** 11

Mariano A. Polack, DDS, MS

Joseph M. Arzadon, DDS, MD

**The Straumann Pro Arch Concept in Practice:
Immediate Implants and Immediate Loading** 15

Sameh K El-Ebrashi BDS, MS, FACP

Jeff Burstein DDS, MD

Eric Manzone CDT

Double Jaw Immediate Load Hybrids: Case Abstract



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A 56 year-old male patient was referred to our specialty private practice in August of 2014 for an evaluation and consultation to determine if he would be a candidate for treatment with dental implants. The patient's main concerns included multiple missing teeth, dissatisfaction with his smile and gradually increasing difficulty eating certain foods. He did also report that he had recently noticed his teeth becoming looser and an inability to wear a maxillary removable partial denture due to an extreme gag reflex. He was able to wear a mandibular removable partial denture but found it uncomfortable and only used it when out in public, at work and in social situations. He was told by his General Dentist of more than 20 years that he was not a candidate for dental implants due to his smoking habit of about 1 pack per day for more



Fig. 1 Pre-Operative patient presentation



Fig. 2 Pre-Operative Intra-Oral view of terminal dentition

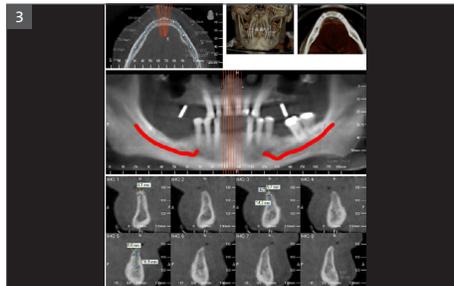


Fig. 3 Diagnostic CBCT scan



Fig. 4 Maxillary tooth removal, alveolar ridge reduction and osteotomy preparation

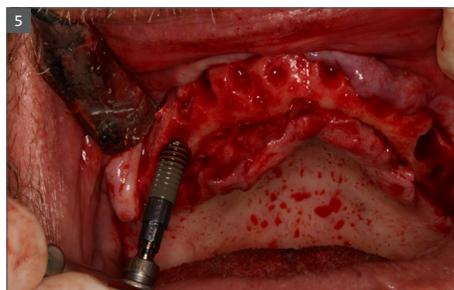


Fig. 5 Placement of Straumann Roxolid Bone Level implants x 6 in maxillary arch



Fig. 6 Confirmation of maxillary implant placement with surgical template

than 25 years. He was in fairly good overall health and managed his borderline hypertension with diet and mild exercise. In fact, he had managed to quit smoking in the prior year and was very motivated to seek dental treatment to replace his failing teeth and removable partial dentures with fixed, implant supported hybrid restorations.

After a complete history and clinical examination were completed, diagnostic alginate impressions and photographs were obtained (Figs. 1-2). The patient made clear during his initial visit and throughout the treatment planning process that he would not be able to tolerate conventional complete removable dentures at any stage of treatment. He had thoroughly researched some potential treatment options online, and specifically sought out our office with the desire to receive immediate load provisional hybrids the same day his teeth were removed. His diagnostic study casts were mounted on a SAM-3 articulator with a facebow transfer and evaluated for skeletal relationship, basal alveolar bone, and potential ideal tooth position. A cone beam CT Scan was obtained to evaluate bone quantity and quality in both arches (Fig. 3A, 3B). A three-dimensional reformat of the patient's maxillary and mandibular anatomy allowed for identification of available bone volume for implant placement in both jaws to maximize implant distribution and support and avoid vital structures including the inferior alveolar nerves and maxillary sinuses and nasal floor. Informed consent was obtained for removal of all remaining teeth under local anesthetic with conscious sedation and placement of 5 to 6 implants in each arch. In addition, the goal of treatment that day included fabrication of immediate load fixed provisional hybrids to provide the patient with a complete dentition.

His wife escorted the patient to our office on the day of surgery. The patient's vital signs were monitored throughout the procedure and treatment was initiated in the maxillary arch. After reflection of a

muco-periosteal flap, the six remaining upper teeth were removed. The crestal alveolar bone was removed with a straight surgical hand-piece under copious sterile saline irrigation. Upon completion of the maxillary osteotomy, preparation of the distal implant osteotomy sites was initiated (Fig. 4). These distal implant sites were tilted to avoid the anterior wall of the maxillary sinuses yet maximize the amount anterior-posterior implant distribution (Fig. 5). Implant site preparation and final placement was confirmed with the assistance of a clear surgical template (Fig. 6). A total of six Straumann Bone Level RC Roxolid implants were placed in the maxilla with insertion torque between 35-55NCm. In order to achieve placement of screw access hole location in ideal prosthetic positions for the prosthesis, three 17° angled and three straight SRA (screw-retained abutments) were placed using 35NCm of torque on the abutment screws (Fig. 7). Any residual extraction socket defects were grafted with Straumann Allograft large particle cortico-cancellous mix and the gingival flaps were closed with 4.0 Chromic Gut interrupted sutures. A Maxillary complete denture was then inserted over the abutments and protective caps to transfer position of screw access hole locations to the prosthesis (Fig. 8). Titanium copings for the SRA abutments were attached at 15NCm to confirm proper modification of the denture. Teflon tape was placed into the titanium copings and a non-latex dental dam was cut to size and placed over the copings in preparation for an intra-oral pick up of the cylinders (Fig. 9). A dual polymerizing resin (Triad DuaLine) was placed in the denture and injected around the copings to firmly index and attach the titanium copings within the denture. The maxillary prosthesis was disinfected and taken into the in-house laboratory for conversion into a fixed provisional hybrid.

The patient was then given some time to use the restroom and consume a small protein shake. After this brief stretch break, the patient was again prepared under sterile surgical drapes for treatment of the



Fig. 7 Placement of SRA angled abutments at 35NCm



Fig. 8 Indexing of implant positions in maxillary denture



Fig. 9 Intra-Oral pick up of titanium cylinders with dual polymerizing resin



Fig. 10 Conversion of immediate dentures to immediate load fixed provisional hybrid restorations



Fig. 11 Final impressions with open tray SRA impression copings in place



Fig. 12 Fabrication of master casts with soft tissue analog

mandibular arch. After delivery of local anesthetic, the lower teeth were removed, the alveolar shelf was prepared and five implants were placed according to the same protocol described above. Three straight and two angled (one 17° and one 30°) SRA abutments were placed at 35Ncm. The converted maxillary hybrid was delivered on the abutments with prosthetic screws at 15Ncm to allow a reference for orientation of the lower denture. A mandibular complete denture was then indexed and copings were picked up in the same manner as the maxillary arch. The mandibular prosthesis conversion was completed in the same approach to create a highly polished tissue surface with cleansable contours and minimal cantilever length to minimize fracture potential in the healing phase. The screw-access holes were closed with Teflon tape and Telio soft setting composite resin. The occlusion was evaluated with a T-Scan digital occlusal analyzer and adjusted to achieve evenly distributed occlusal contacts, accurately eliminate interferences, and confirm proper bite force around the arches. Post-operative written instructions were reviewed with the patient and his wife. They were reminded for the patient to adhere to an extremely soft diet the first 6 weeks. The patient was thrilled to leave the office that day with a complete dentition (Fig. 10).

The patient was seen for a series of follow up appointments to evaluate healing over the first 2 months. Peri-apical radiographs were made at 8 weeks post-op at which time the patient was instructed to begin using an oral irrigator on a low setting to better clean the tissue surface of the hybrids. After 5 months of uneventful healing, the patient was brought back to begin fabrication of the final prostheses. The fabrication of the final hybrid restorations usually requires a series of 5 one-hour appointments, which usually do not require the administration of local anesthetic. The screw-access hole fillings were removed and both provisional hybrids were removed. All abutment screws were checked to confirm and tighten at 35Ncm. Open tray SRA

impression copings were placed over the abutments and final full arch impressions were made with a Polyvinylsiloxane material (Fig. 11). Master casts were poured using SRA analogs and a soft tissue moullage material (Fig. 12). The casts were then mounted using the patient's provisional hybrids during the second clinical appointment. A tooth set up on wax rims was tried in to verify esthetics and phonetics at the third clinical appointment to confirm tooth position. The dental laboratory then digitized the verified tooth and implant positions in the Straumann CS2 scanner. Using the CARES software, the technician designed the CAD/CAM titanium bar to precisely fit the implant abutments and support the final denture teeth in the permanent prostheses (Fig. 13). The CARES titanium bars were tried in to verify passive fit on the implant abutments prior to final processing (Fig. 14). The teeth were then transferred to the bars in the laboratory using a putty matrix of the confirmed tooth position for one final try in. The hybrids were then returned to the lab for opaquing of the bars, final flasking and processing with an injection molded acrylic resin (Fig. 15).

The final hybrids were delivered to the patient and occlusion was again adjusted and verified using a T-Scan (Fig. 16). An orthopantomogram of the completed treatment verified ideal implant healing and fit of the final CAD/CAM titanium bars (Fig. 17). The patient's post-operative clinical result revealed a patient who was extremely pleased with the process and the definitive outcome (Fig. 18). "I can't believe I was able to get my all teeth back and I never once wore a denture!" exclaimed the patient. "I can comfortably eat again and my teeth have never looked better!"



Fig. 13 Mounted casts on SAM-3 articulator and CARES CAD/CAM Titanium Frameworks in place



Fig. 14 Intra-oral verification of titanium frameworks to confirm passive fit



Fig. 15 Completed maxillary hybrid prosthesis



Fig. 16 Intra-Oral delivery of maxillary and mandibular final fixed implant supported hybrid restorations

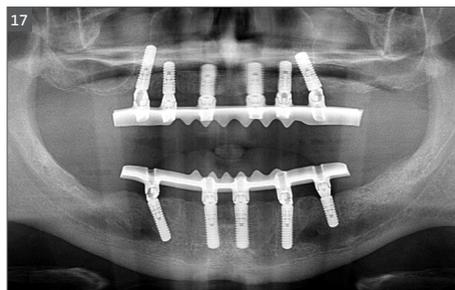


Fig. 17 Orthopantomogram of completed full mouth restorations



Fig. 18 Final post-op smile of completed treatment and satisfied patient!

The Team Approach in a Complete mouth Pro Arch Hybrid Reconstruction using the Indirect Method for Provisionalization



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INITIAL SITUATION

A Periodontist and ITI® colleague whose office is two hours from our practices referred this patient to our team. Initially, she was seen by the Prosthodontist, Dr. Harry Randel, and subsequently referred to the Periodontist, Dr. Robert Levine, for a team approach to solve her failing dentition.

The patient presented as a 65 year-old non-smoking female (ASA 3: Illnesses under treatment: anxiety/depression, osteoarthritis, fibromyalgia, hypothyroid and history of myofascial pain dysfunction) to our office (Figs. 1-3). There was a history of TMJ issues (ie., clicking and pain with her right side TM joint) which presently is under control and pain-free. Her chief complaint was to improve her esthetics and comfort with desire for a permanent and quick solution to replace her failing dentition. She also desires a reduction of her maxillary anterior gummy smile in the final prosthesis. She arrived to our office for a third surgical consult for an immediate load maxillary and mandibular hybrid restoration using the Straumann Pro Arch treatment concept (tilting of the distal implants to avoid anatomic structures of the maxillary sinus, mandibular mental foramina). This treatment concept reduced the need for additional surgeries and number of implants needed to provide a fixed hybrid restoration with a first molar occlusion. A medium to high lip line was noted upon a wide smile with a bi-level plan of occlusion. Also noted was supraeruption of her maxillary and mandibular anterior teeth (#7-10 and #25-27) creating a deep bite of 6mm (Fig 2). A Class I canine relationship was recorded with 6 mm overjet & 6 mm overbite. Due to her medication-related dry mouth issue, generalized recurrent caries were noted. Periodontal probing depths ranged generally 4-7mm in the maxillary jaw and 4 to 6mm in the mandibular jaw with moderate to severe marginal gingival bleeding upon probing in both jaws. Tooth #6 was noted to have a vertical fracture clinically. There was generalized heavy fremitus in her maxillary teeth and mobilities ranging 2-3 degrees on the following teeth: #3, 7 thru 13, 20-26 and 29. Her compliance profile was good with her previous dentists, however, she states as always having “issues with my gums.” The tentative treatment plan that was discussed at the initial visit, with the patient and her husband, included the following:

Diagnosis: Generalized moderate to advanced periodontitis; generalized recurrent caries related to medication-related dry mouth; posterior bite collapse with loss of occlusal vertical dimension (“mutilated dentition”).

Prognosis: all remaining teeth are hopeless.

Plan:

1. Obtain a CBCT of both arches to evaluate bone quality, bone quantity, and anatomical limitations.(Fig. 4)
2. Articulate study models with fabrication of diagnostic full upper denture (FUD), full lower denture (FLD) and surgical guide templates.
3. Team discussions to develop the final surgical and prosthetic treatment plan for hybrid restorations using the Straumann Bone Level Tapered Implant (BLT) with a first molar occlusion. Utilization of an indirect technique will be used to fabricate the converted fixed laboratory metal-reinforced provisionals in one day.
4. Coordination of the surgical visit (Dr Robert Levine) with the prosthodontist's office (Dr. Harry Randel), dental laboratory (NewTech Dental Laboratory, Landsdale, PA), and the dental implant company representative (Straumann USA, Andover, MA) are arranged. The patient is aware of the possibility of needing to wear one or both dentures during the healing phase if the insertion torque values are inadequate for immediate loading. This may be due to bone quality, bone quantity, or need for extensive bone grafting requiring a membrane technique for guided bone regeneration (GBR) and a 2-stage approach. This is very important to review with all patients especially when only four implants are planned in the maxillae as the distal implants(s) may record poor insertion torque values due to bone quality and quantity. The ability to use longer, tapered (BLTs), and tilted implants- as in the present case- with adequate buccal bone available for the anticipated 4.1mm implants help to reduce this possibility significantly.
5. Delivery of the fixed provisionals in one day in the prosthodontist office.
6. Post-operative visits every 2-3 weeks with the periodontist

7. Completion of final case at least 3 months post-surgery. Since the patient will be spending the winter in Florida, she will commence her final treatment when she returns in the spring.
8. Periodontal maintenance every 3 months alternating between offices.

Based on CBCT analysis it was decided to place 5 implants in the upper jaw using sites: #4 (tilted), #7, between #8 & #9 (midline), #10 and #12 (tilted) after vertical bone reduction for prosthetic room. Four implants were anticipated to be placed in the lower jaw in sites #21 (tilted), #23, #26, & #28 (tilted). The anticipated position of each implant is desired to be palatal in the maxillae to the original teeth and lingual to the original mandibular teeth. This is to allow for screw-access holes exiting away from the incisal edges anteriorly, and if possible lingual to the central fossae in the posterior sextants. An additional benefit of palatal and lingual placement of each implant is that their final position will be at least 2-3 mm from the anticipated buccal plates, which is beneficial for long-term bone maintenance and implant survival. If the necessary 2 mm buccal bone to the final implant position is not available, then contour augmentation (bone grafting) is recommended to create that dimension. The goal is to prevent buccal wall resorption over time using slowly resorbing anorganic bovine bone and a resorbable collagen membrane. This membrane allows easy contouring and flexibility over the graft material when it



Fig. 1 – 3 The patient presented as a 65 year-old non-smoking female (ASA 3: Illnesses under treatment: anxiety/depression, osteoarthritis, fibromyalgia, hypothyroid and history of myofascial pain dysfunction).



Fig. 4 A CBCT was taken at presentation of both arches to evaluate bone quality, bone quantity, and anatomical limitations.

Fig. 5 – 6 The bone cuts were made measuring from the mid-buccal of the guide (10-12mm) and extended beyond the anticipated cantilever length to create adequate strength and thickness of the final prosthesis.

is wet. It is also important to evaluate tissue thickness. It is ideal to have at least 2mm of buccal flap thickness over each implant as thin tissues are associated with bone loss and recession over time. Either connective tissue grafts from the palatal flap or tuberosity can be harvested and sutured under the buccal flap. Alternatively, an allograft connective tissue or a thick collagen material can be used to thicken the buccal flaps when necessary.

SURGICAL APPOINTMENT:

The patient was pre-medicated with oral sedation (Triazolam 0.25mg), amoxicillin, a steroid dose pack and chlorhexidine gluconate (CHG) rinse all starting 1 hour prior to surgery. The patient's chin and nose were marked with indelible marker, and the OVD was measured using a sterile tongue depressor with similar markings while the patient remained closed. The patient was then given full mouth local anesthesia. Starting with the maxillary arch, full thickness flaps were raised and sutured to the buccal mucosa with 4-0 silk to provide improved surgical access and vision. The teeth were removed with the goal of buccal plate preservation using the PIEZOSURGERY® (Mectron: Columbus, OH) for bone preservation (tips EX 1, Ex 2, Micro saw: OT7S-3). The sockets were degranulated with PIEZOSURGERY® (tip: OT4) and irrigated thoroughly with sterile water. With the anatomically correct surgical guide in position and firmly held in place by the surgical assistant, measurements were made from the mid-buccal of each tooth. Surgical cuts were made going from the anticipated cantilever of site #3 to site #14 using the PIEZOSURGERY® saw (tip: OT7). Our team goal was to create the prosthetic room necessary for a hybrid restoration i.e. 10-12 mm. The cuts were intentionally extended beyond the anticipated cantilever length to create adequate strength and thickness of the final prosthesis in these unsupported cantilever areas. (Figs 5-6)

The mandibular arch was treated in a similar manner. Additionally, bilateral mandibular tori reduction were accomplished with the aid of the PIEZOSURGERY® saw (tip: OT7) after the extractions and prior to the vertical bone reduction of the mandibular ridge. Subsequently the implants were placed.

The implant sites were prepared using the manufacturer's protocol (except for bone tapping) for the Straumann BLT implant. The implants were placed using the surgical guide template with the following insertion torques measured: site: #4, #7, #8-9, #11, #13, #21, #23, #26. All torques were >35Ncm with #28 recording 20Ncm insertion torque values. All implants were 4.1mm in diameter and 14mm in length except #7, #8-9, and #11, which were 12mm in length (Fig 7). All 17 and 30 degree-angled implants were bone profiled prior to SRA abutment placement. This allowed the complete seating of the SRA abutment at the recommended 35Ncm torque. Using the available Straumann bone profilers with the appropriate Narrow Connection (NC) or Regular Connection (RC) inserts was a critical step for an abutment to fit correctly. The following SRA abutments (all were 2.5mm gingival heights) were then chosen: **straight**: #23, #26; **17 degrees**: #4, #7, #8-9; and **30 degrees**: #11, #13, #21, and #28. Tall protective healing caps were then placed (Fig 8), and the dentures were checked to evaluate that there was adequate space for the pink acrylic to allow for bite registration material thickness. All sockets and buccal gaps to the immediately placed implants were bone grafted. Prior to suturing, the tissue flaps were scalloped with 15c blades to reduce overlap of the flaps over the protective caps. This not only aided in post-operative healing, but also aided in the visualization of the abutments by the restorative dentist for the provisional insertion. The patient was sutured with resorbable 4-0 chromic gut and 5-0 Vicryl™ sutures (Ethicon: Johnson & Johnson) and was released to be seen immediately by

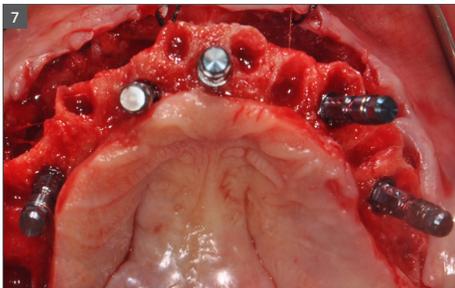


Fig. 7 All implants were 4.1mm in diameter. #7, #8, #9, and #11 were 12 mm in length; #4 and #13 were 14 mm in length.

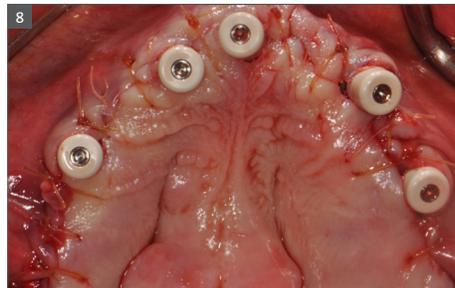


Fig. 8 All SRA abutments were 2.5mm in height. #4, #7, #8 and #9 were 17 degrees and #11 and #13 were 30 degrees. Tall protective healing caps in place.



Fig. 9 Bite registration material was used to confirm there was no contact of the healing caps with the intaglio surface of the denture.



Fig. 10 Provisional prostheses

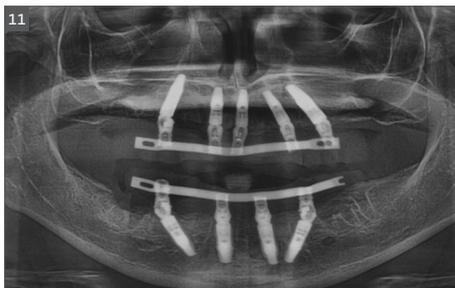


Fig. 11 Panoramic radiographic confirming proper seating of the provisional restorations.



Fig. 12 GC verification jig

Dr. Randel for the coordinated restorative visit. As discussed below, his responsibilities included: bite registration, impressions, and the dental lab conversion of the complete denture to a metal reinforced fixed transitional prosthesis (indirect provisionalization technique). Our team of restorative dentists have been treating full-arch immediately loaded cases on 5-8 implants (depending if restoration is a hybrid or C&B) since 1994. Our earlier experiences, for approximately the first two years (1994-1996), have us all presently using the indirect technique, which in our hands is easier for everyone involved (especially the patient). We handle these coordinated visits between offices, the dental lab, and our Straumann representative weeks prior so we are all on the same page with timing. These coordinated efforts could be compared to a symphony orchestra, where each musician knows their specific part and when and where they are expected to be. Many of our patients have described this fluidity as a seamless experience that they witness first hand and greatly appreciate.

SAME DAY RESTORATIVE APPOINTMENT WITH DR. RANDEL (PROSTHODONTIST):

The patient was seen from Dr. Robert Levine's office for restorative records in preparation for immediate load protocol. The previously processed dentures were first checked with pressure paste to insure there was no contact of the intaglio surface with the tall healing caps. Bite registration material was then used to confirm there was no contact (Fig 9) and later will be used by the lab to articulate the models. Efforts were made to confirm the OVD (with the marked tongue depressor provided by Dr. Levine), incisal position, midline, plane of occlusion, and centric position with the prosthesis in place. Adjustments were made as needed. Photographs were acquired to document and relay information via e-mail to the lab technician. The

lab will use the registration material left in the intaglio surface of the prostheses, as healing caps will be placed on the newly fabricated models. This allows the index to transfer the OVD and centric relationships with contact just on the healing caps. The soft tissue plays no role in this relationship. A bite registration was made to confirm centric relation. Healing caps were then removed and open tray impression copings were placed. If the connection between the implant abutments and the impression copings are not visualized, then x-ray confirmation of the connection is needed. Transfer Impressions were made using a custom tray and rigid impression material of choice, in this case polyether was used. Our lab courier delivered the dentures and impressions to the lab for the conversion to metal-reinforced, screw retained provisionals, which were delivered back to the restorative office within 24 hours.

The next afternoon, the prostheses were inserted (Fig 10) and panoramic radiographic confirmation of proper seating was obtained (Fig 11). Any necessary occlusal adjustments were then completed. The patient was then seen every 2-3 weeks for deplaquing and plaque control review per our earlier discussed protocol. The occlusion was also refined as needed. The patient's TMJ symptoms were significantly reduced within the first 3 weeks. A water irrigation device was given and reviewed at 6 weeks post-surgery.

As the patient was in Florida for the winter, and unable to come in after the typical 3 month protocol, she was seen 4 1/2 months after the surgery. At that time, periapical x-rays of each implant were done to confirm bone healing. The prosthesis were removed and cleaned. GC verification jigs (Fig 12), made on the original models and fabricated prior to the appointment, were tried in. If passivity is not confirmed, then the GC jig can be cut and re-indexed. Once the fit of the verification

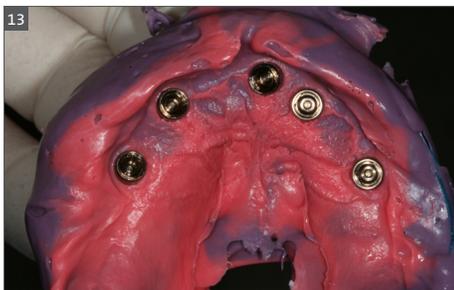


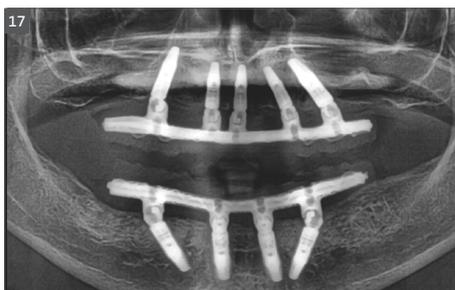
Fig. 13 Tissue transfer impression with verification jig



Fig. 14 Wax try-in verifying occlusion, esthetics & phonetics



Fig. 15 – 18 The completed case is shown



jigs was confirmed, custom trays were used to transfer the relationships (Fig 13). During the following appointments, OVD and centric relations were obtained, and the wax try-ins were confirmed for esthetics, phonetic, and occlusion prior to the milling of the framework (Fig 14). It is important to confirm tooth location prior to milling the framework so that the framework was designed within the parameters of the acrylic/tooth borders.

At the insertion appointment, the healing caps were removed and cleaned with Chlorhexidine. Figure 15 demonstrates the excellent healing of the soft tissue prior to insertion of the prosthesis. Once inserted, the esthetics, phonetics, and OVD of the prosthesis were confirmed. The occlusion was adjusted as needed. Screws were tightened to 15 Ncm, screw access openings were filled with Teflon tape to within 2mm of the surface, and a soft material such as Telio or Fermit was used to seal the access. A maxillary acrylic nightguard was fabricated to aid in protection of the occlusal surfaces from wear and to help reduce any parafunctional habits. The completed case is shown (Figs 15-18). At subsequent appointments, the prostheses were evaluated to determine if they needed to be removed to assess the soft tissue or if any contouring of the acrylic was necessary. Eventually the soft material used to close the access can be replaced with a hard composite material.

CONCLUSION

A Complex-SAC Straumann Pro Arch Case was presented. Management of this treatment utilized the advantages of the team approach for maximizing our combined knowledge to benefit the patient, consistent with ITI doctrine. The use of the BLT implants, due to excellent initial stability, gave us the confidence in our ability to not only use immediate extraction sites (Type 1 implant placement), but also, to increase avoidance of anatomic structures. In this case, the structures include the maxillary sinuses, nasopalatine and mental foramina, as well as the inferior alveolar nerve canals. In addition, with the tapered design of the BLT implant, maxillary anterior areas could be utilized by the surgeon to avoid apical fenestrations where undercuts could become problematic using straight walled Bone Level implants. The coordinated appointments, along with the symphony-like steps in the procedure, created a positive, “seamless” experience for the patient.

Mandibular Pro Arch hybrid reconstruction with immediately loaded fixed provisionalization



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INTRODUCTION

A 76 year-old woman presented to the prosthodontist's office with the chief concern of painful, broken and discolored teeth (Figs 1 to 4). The patient also desired an improved smile with a cost-effective solution that would allow her to function comfortably. A complete clinical, radiographic examination and study models were obtained. The medical history was significant for high blood pressure, diabetes mellitus type 2, and depression. Her medications included Losartan, Glimepiride, and Prozac. The patient presented with generalized advanced periodontal disease with gingival inflammation, recession, heavy calculus and advanced bone loss on the lower anterior teeth. The posterior mandible also showed severe bone loss. In addition, both arches had several tooth remnants, and the anterior teeth presented significant buccal flaring. The panoramic radiograph showed multiple radiolucent periapical lesions on several teeth (Fig 5). The patient's dentition was deemed unrestorable, and a Straumann Pro Arch solution was proposed to restore the mandibular arch. Due to the lack of available bone in the posterior mandible, four implants would be placed, with the two distal implants tilted at 30 degrees. A complete maxillary denture would be fabricated to restore the maxillary arch. As a result of the severe gingival inflammation and presence of multiple periapical infections the patient was not considered a good candidate for immediate implant placement. It was decided to delay implant placement for 4-6 weeks to allow for improvement of the soft tissue health and to increase the amount of attached gingiva, especially in areas of recession. This would facilitate the handling of the flaps, as well as the resolution of pathology. It was therefore proposed to extract all remaining teeth and deliver immediate complete maxillary and mandibular dentures. Approximately 6 weeks after extractions, the mandibular implants would be placed and immediately loaded with an interim hybrid prosthesis. The definitive restorative procedures for a complete maxillary denture and mandibular hybrid prosthesis reinforced with a Straumann CARES milled bar would begin eight weeks after implant placement.

TREATMENT

The study models were used to fabricate custom trays and final impressions were made to fabricate the immediate maxillary and mandibular complete dentures. Teeth #21-30 were extracted without difficulty and with minimal to no flap elevation. The apical granulomas were removed with currettes and socket granulation tissues and diseased bone were removed. Minor alveoplasty was completed to allow the insertion of the immediate dentures. Weekly follow up appointments were made for one month, to monitor healing and adjust the prostheses, as needed. In addition, two weeks after the extractions, the patient was seen for implant preoperative evaluation using a CBCT (Fig 6 –8).

The extraction sites healed well with healthy gingiva over the sockets and resolution of the active periodontal and periapical infections. The patient's personal affairs prevented her from scheduling surgery until two months after the extractions, at which point implant placement was completed. After successful induction of IV sedation, Lidocaine 2% with 1:100,000 epinephrine x 7.2 cc was injected as block and infiltration to the surgical sites. Crestal and distobuccal releasing incisions were made to elevate buccal and lingual flaps. The crestal bone reduction was measured according to the prosthodontist's instructions and marked with a #701 bur. The osteotomy was completed with the #701 bur to remove 6mm of crestal bone and tapered posteriorly to the molar crest. A midline osteotomy was made to stabilize the Straumann Pro Arch Guide to help make the posterior angled osteotomies. The mental foramina were identified and the distal angled osteotomies were just anterior to each mental foramen. Starting with the #20,29 sites, Straumann Bone Level Implant system was used starting with the 2.2 mm drill, followed by standard drilling sequence using copious amounts of normal saline irrigation in type 3 bone. Guide pins were used to confirm position, orientation, and depth. The #23, 26 osteotomies were made without the guide. The osteotomies were lightly profiled, then Straumann RC SLActive ROXOLID implants 4.1 x 14 mm were placed with primary stability using a torque setting of 35 Ncm. A hand torque was used to seat the implants to the proper depths with torque above 35 Ncm and the height markings oriented buccally for the posterior implants and facially for the anterior implants (Fig 9 -12). Angled 30 degree, D4.6mm, GH 4mm, Type A screw-retained abutments (SRA) were connected to the posterior implants. Straight 0 degree, D4.6mm, GH 4mm screw retained abutments (SRA) were connected to the anterior implants. The abutments were torqued to 35 Ncm and the flaps were approximated with 4-0 chromic sutures making sure that the abutment margins were visible (Fig 13). The patient was dismissed to the prosthodontist's office, located at a short

distance from the surgeon's office, to convert the immediate provisional denture into an interim provisional hybrid restoration.

At the prosthodontist's office, occlusal registration material was injected on the intaglio surface of the mandibular denture and the prosthesis was seated over the SRA abutments (Fig 14). In this manner, the position of the abutments relative to the denture was registered, and perforations were made in those areas to facilitate the conversion process. Non-engaging titanium NC/RC copings were connected to the SRA abutments (Fig 15). After confirmation of clearance of at least 1 mm between the copings and the perforations on the denture, a rubber dam was placed over the cylinders, to protect the surgical wound (Fig 16 – 17).

Access holes were covered with teflon tape, and autopolymerizing acrylic resin was mixed and injected with a Monoject syringe to connect the copings to the immediate denture. Profuse irrigation was used to prevent the heat of polymerization from affecting the surgical site. The interim hybrid prosthesis was removed, and SRA analogs were connected to the NC/RC copings. Additional acrylic was mixed and added over the intaglio surface of the prosthesis, to eliminate concavities and porosities (Fig 18). Flanges were removed, and the tissue side was finished with a slightly convex contour to facilitate hygiene procedures (Fig 19). An impression of the implants was made to fabricate a verification jig to be used at the beginning of the definitive restorative phase (Fig 20). Screws were torqued to 15 Ncm, occlusal access holes were sealed with teflon tape and a semi-rigid composite, and the occlusion was adjusted (Fig 21). A panoramic radiograph was taken for post treatment evaluation. After care instructions included a soft food diet, a 0.12% chlorhexidine rinse and follow up appointments at 1, 2 and 6 weeks. Approximately 2 months after the implant surgery, the provisional was removed and torque tests were completed.



Fig. 1 Initial extraoral presentation.



Fig. 2 Initial intraoral presentation. Notice the flared teeth, heavy calculus and obvious esthetic compromise.



Fig. 3 Pretreatment, occlusal view, maxillary arch



Fig. 4 Pretreatment, occlusal view, mandibular arch.

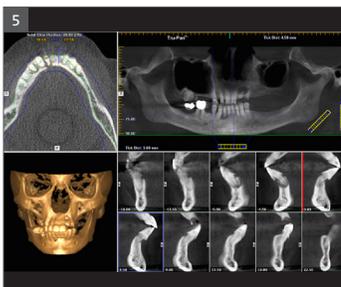


Fig. 5 Pretreatment CBCT.



Fig. 6 Two months after extraction of all teeth, soft tissues show improved quality and health.



Fig. 7 Occlusal view of mandibular arch with healed ridge and presence of keratinized gingiva.



Fig. 8 Implant preoperative CBCT.

Tissues looked healthy with no evidence of mucositis or infection. There was moderate calculus on the bottom of the prosthesis and some food debris around the abutments. After cleaning and irrigating with Peridex, the abutments were torqued to 35 Ncm without pain and mobility of the implants. The provisional was placed back and the occlusal screws tightened with finger pressure. The access openings were covered with cotton, then a semi-rigid composite resin. The patient was referred back to the prosthodontist's office for fabrication of the final restoration.

The interim mandibular hybrid prosthesis was removed, and final impressions for the definitive maxillary complete denture and mandibular hybrid denture were made with custom trays and vinyl polysiloxane. At the next appointment, the accuracy of the implant master cast was confirmed with a verification jig. Occlusal and vertical dimension records were obtained and a final shade selected. A trial tooth setup was tried in and approved by the patient and prosthodontist at the following appointment. The models and tooth setup were sent to Straumann CARES to be scanned for the fabrication of the CAD/CAM titanium bar. Seamless communication between the Scan & Shape team, the prosthodontist and the dental laboratory facilitated minor modifications to the bar design which was then milled and shipped back for try in (Fig 22 – 24). At the next appointment, the passive seating of the Straumann CARES CAD/CAM bar was confirmed visually and radiographically (Fig 25). An additional try in appointment was scheduled to assess the tooth setup on the bar, and the upper and lower prostheses were processed and finished (Fig 26).

At the insertion appointment, the maxillary denture was evaluated with pressure indicating paste and adjusted. The esthetics, phonetics and cleansability of the prostheses were evaluated, and minor

occlusal adjustments were made. Screws were torqued to 15 Ncm and the occlusal access holes were sealed with Teflon tape and composite resin. Hygiene instructions were reviewed with the patient, and she was placed on a 3-month implant maintenance program in order to promote healthy oral tissues and assess her biologic and mechanical needs on a regular basis (Fig 26 – 29).

CONCLUSION

The patient's needs and desires required a cost effective, flexible solution that would maximize clinical and esthetic results, while minimizing cost and the number of appointments. Straumann Pro Arch provided an excellent outcome that surpassed her expectations. The angled posterior implants made optimal use of the available bone anterior to the inferior alveolar nerve, eliminating the need for additional procedures, like nerve lateralization. The SLActive Roxolid Bone Level implants permitted the team to immediately load the fixtures with confidence. The angled SRA abutments compensated for the distal tilting of the posterior implants, allowing for a prosthesis supported with fewer fixtures, and a smaller cantilever. The expertise of the Scan & Shape team, and their fluent communication with the dental laboratory and restorative doctor facilitated the fabrication of an accurate, properly designed CAD/CAM milled bar to support the definitive prosthesis. Since the treatment was completed, the patient has returned for a consultation to receive a Straumann Pro Arch fixed solution on her maxillary arch.

The authors want to thank Dennis Purinton for the fabrication of the final restorations.

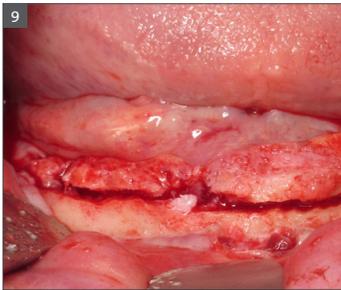


Fig. 9 Osteotomy of the crestal bone with reduction according to prosthetic requirements and leveling of the ridge.

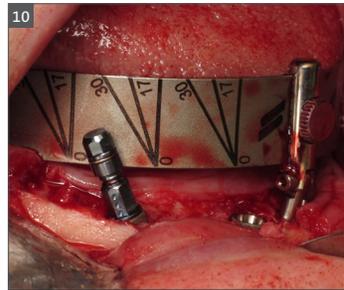


Fig. 10 Placement of implant #29 angled at 30 degrees using the Pro Arch Angulation Guide.

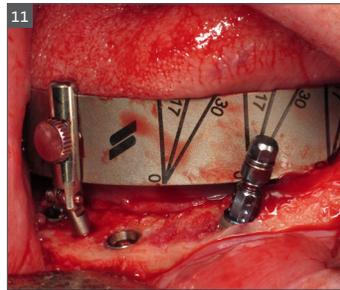


Fig. 11 Placement of implant #20 at 30 degrees using the Pro Arch Angulation Guide.

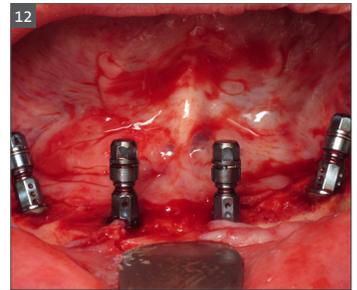


Fig. 12 Implants fully seated with height markings oriented on the buccal for the posterior implants and labial for the anterior implants.



Fig. 13 SRA abutments torqued to 35 Ncm and the flaps sutured around the SRA abutments.



Fig. 14 Bite registration material injected on the intaglio of immediate mandibular denture to locate the position of SRA abutments. Perforations to accommodate the NC/RC copings were done through those indentations.



Fig. 15 NC/RC copings connected to the SRA abutments.



Fig. 16 Perforations done on mandibular denture to accommodate the NC/RC copings.



Fig. 17 Immediate mandibular denture seated over NC/RC copings. At least 1 mm clearance between the perforations and copings is desirable to allow for enough acrylic to pick up the copings. Notice the rubber dam protecting the surgical wound, and the teflon tape covering the access holes on the copings



Fig. 18 Intaglio surface of the prostheses with SRA abutment analogs connected to the NC/RC copings. Additional acrylic was added to eliminate concavities and porosities.



Fig. 19 Tissue side of interim hybrid prosthesis. Notice the slightly convex profile to allow ease of cleansability.



Fig. 20 Impression posts connected to SRA abutments. An impression was made to fabricate a verification jig that would be used at the start of the definitive restorative process.



Fig. 21 Immediate postoperative view of the interim hybrid prosthesis and immediate maxillary complete denture.

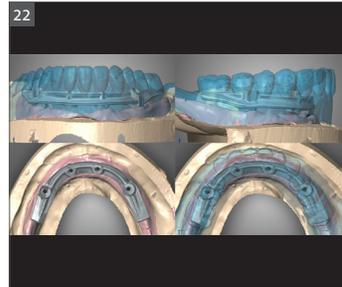


Fig. 22 Initial proposed design by the Scan & Shape Team for the CAD/CAM Straumann Cares bar. Fluent communication between the restorative team and Straumann Cares and allowed for quick design modifications specific to the case.



Fig. 23 Finished CAD/CAM Straumann Cares bar.



Fig. 24 Straumann Cares bar, intraoral view. Passive fit was confirmed at this appointment



Fig. 25 Finished complete maxillary denture and mandibular hybrid prosthesis.



Fig. 26 Intraoral postoperative view.

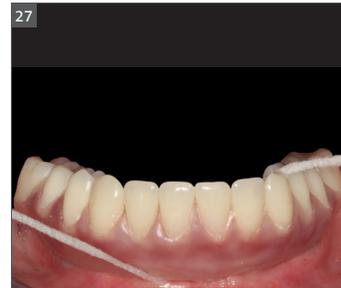


Fig. 27 Close-up, mandibular hybrid prosthesis. The design allowed for adequate room for oral hygiene.



Fig. 28 Extraoral postoperative view. An excellent esthetic and functional result was obtained. Detailed hygiene and maintenance instructions were given, and the patient placed on a 3-month recare program.

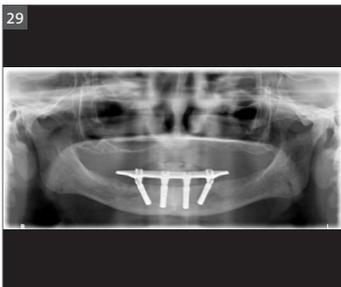


Fig. 29 Final radiographic presentation confirming the accuracy of fit of the Straumann Cares bar.

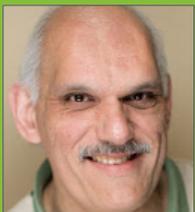
The Straumann Pro Arch Concept in Practice: Immediate Implants and Immediate Loading



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INITIAL SITUATION

A fifty- five year old female presented to our clinic with several aesthetic and dental complaints: missing posterior teeth, root sensitivity, and poor facial and dental esthetics. Her medical history was unremarkable. Her vital signs were within normal limits (WNL): Pre-operative blood pressure was 155/77, pulse was 60 b.p.m., and oxygen saturation was 97%, (ASA I).

Extra-oral examination revealed brachycephalic features, with a short, square face, and a small chin (Fig 1.). The Vertical Dimension of Occlusion (VDO) was inadequate, causing the lower 1/3rd of the face to appear collapsed, with a deep mentolabial fold. (Fig 2.)

Smile analysis revealed a pleasant, but unnatural smile due to the excessively wide maxillary incisors (Fig 3.) A straight facial profile was evident, with a deep over - bite (OB), and excess over - jet (OJ) (Fig 4.).

Examination of the Temporomandibular Joints (TMJ's) revealed a normal range of motion, with a maximum opening >40mm, with no history of locking. There was no history of Joint sounds, muscle pain, and all muscles palpated WNL.

Intra-oral examination revealed multiple missing posterior teeth, with three Fixed Dental Prostheses (FDP's): A maxillary anterior FDP replacing teeth #'s 7, 8, 9, with abutment teeth #'s 6, 10, and 11. Also, bilateral distal - cantilever mandibular FDP's: (29), 28, 27, and 22, 21, (20) (Fig's 5 & 6.).

INTRA-ORAL RADIOGRAPHIC EXAMINATION

Radiographic examination revealed multiple missing posterior teeth, with endodontic therapy on teeth #'s 4 and 13. Peri - apical (PA) pathology was evident on teeth #'s 5,13, 21, and 22. Marginal Bone Levels (MBL's) around existing teeth showed generalized moderate horizontal bone loss (Fig 7.).

Intra-oral examination revealed multiple missing teeth, and mucogingival (MG) defects around teeth #'s 4, 5, 6, 10, 11, 21, and 28 (Fig's 8 and 9.), and missing interdental papillae around teeth #'s 10 and 11.

DIAGNOSIS

Partial-Edentulism: (missing teeth #'s 2, 7, 8, 9, 14, 15, 18, 19, 20, 29, 30, & 31). Moderate, generalized, chronic periodontitis, with multiple mucogingival defects. Root sensitivity on the buccal surfaces of teeth with muco-gingival defects.

PROGNOSIS

A thorough discussion was conducted with the patient regarding her dental condition, and the possibility of saving teeth. She understood that there was a good prognosis for performing multiple connective tissue grafting (CTG) procedures, and implants in the following locations: #7, 9, 14, 19, 20, 29, and 30. This, in conjunction with a full - mouth rehabilitation would allow an increase in VDO, improve function with a 1st molar occlusion, and correct esthetic problems. The patient rejected this approach due to the complexity associated with a sinus lift for #14, multiple CTG's required, 7 implants in total, and sixteen crowns (eight / arch).

PLAN

Analysis of the CBCT revealed sufficient bone to place 4 implants / arch at the same time as extracting all remaining teeth. This required placement of two distal tilted implants (approximately 30°) anterior to the Maxillary sinus, and the Mental Foramina, and two axial anterior implants (Fig 10.). Pre-surgical planning determines the amount space required for an esthetic, functional prosthesis. Ideally, 15 mm is required, from the incisal edges of the teeth to the restorative platform (Fig 11.) Failure to create this prosthetic space leads to aesthetic and prosthetic failure. The use of Multi-unit abutments (MUA's) allows for compensation of non-axial implants, and a convergent path of insertion for the prosthesis.

Removable Prosthesis were fabricated prior to surgery based upon the need to restore the VDO, arrange the teeth ideally, and minimize prosthetic bulk. The intention was to use the prostheses to attach to the implants if primary stability was adequate.

SURGICAL APPOINTMENT

PRE-OPERATIVE

Antibiotics: Amoxicillin 500 mg PO q6hrs x 2 days given preoperatively, and continued for 5 days. Preoperative rinse with Peridex, and carefully wiped circumorally with Peridex rinse with no rinse contacting nasal cavity or orbital area.

INTRAVENOUS SEDATION

Intravenous (IV) sedation performed using 10 mg Midazolam and 200 mcg Fentanyl.

LOCAL ANESTHESIA

Local Anesthesia (LA) administered using 4.5 carpules of 2% Lidocaine w/ 1:100k epinephrine, 1 carpule of 0.5% Marcaine w/ 1:200k epinephrine; and 2 carpules of 4% Septocaine w/ 1:100k epinephrine (infiltration only)

A 27g Needle (Mandible) and 30g Needle (Maxilla) with 2 alternating syringes were used with aspirating technique; needles switched out after injection of infected area

MANDIBLE

Local anesthesia was administered via nerve blocks and local infiltration. Next, using a crestal incision, a full thickness mucoperiosteal flap (FTMP) was reflected buccal and lingual to the area between #19 to 30. All remaining mandibular teeth were then removed atraumatically without complications, taking care to remove as little bone as possible. All sockets were curetted and all diseased tissue was removed. The lingual plate was evaluated and intact throughout the arch. The inferior alveolar nerve was not visualized apical to any extraction sites. The mental nerves were then atraumatically isolated and visualized.



Approximately 2-4 mm of crestal bone was then removed. The bone reduction guide provided by the prosthodontic team was used to help determine appropriate bone reduction.

All implants were placed according to the Straumann protocol using sequential burs and saline irrigation, taking care to avoid the mental nerves. A depth gauge was inserted into the osteotomies to insure intact bony walls and that the mandibular canal was not invaded, with a positive apical stop.

- #20 Osteotomy, 4.1 x 12 mm Straumann SLA BLT, 35N torque, type 2 bone, 30 degree SRA torqued to 35N
- #23 Osteotomy, 3.3 x 12 mm Straumann SLActive BLT, 35N torque, type 2 bone, straight SRA torqued to 35N
- #26 Osteotomy, 3.3 x 12 mm Straumann SLActive BLT, 35N torque, type 2 bone, straight SRA torqued to 35N
- #29 Osteotomy, 4.1 x 12 mm Straumann SLA BLT, 35N torque, type 2 bone, 30 degree SRA torqued to 35N

Remaining autogenous bone paste was placed around any exposed implant threads and within extractions sites, prior to the gingiva being trimmed and closed. 3-0 chromic gut was then used in an interrupted fashion to obtain primary closure.

MAXILLA

A similar approach was used, with the following exceptions: apical infection was removed from the apex of # 13 and site irrigated with saline. There were no communications with the sinus apical to any of the extraction sites. All implants were placed according to the Straumann protocol using sequential burs and saline irrigation:

- #4 Osteotomy, 4.1 x 12 mm Straumann SLA BLT, 35N (throughout) torque, type II bone, 30 degree SRA torqued to 35N
- #7 Osteotomy, 3.3 x 10 mm Straumann SLActive BLT, 30N torque, type III bone, 17 degree SRA torqued to 25N
- # 10 Osteotomy, 3.3 x 8 mm Straumann SLActive BLT, 35N torque, type II bone, 17 degree SRA torqued to 25N
- #12 Osteotomy, 4.1 x 12 mm Straumann SLA BLT, 35N torque, type II bone, 30 degree SRA torqued to 35N

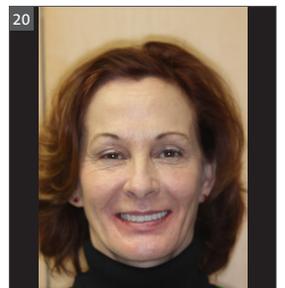
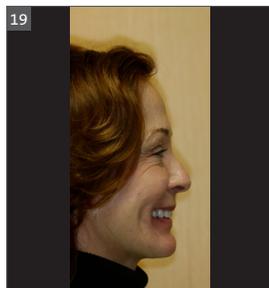
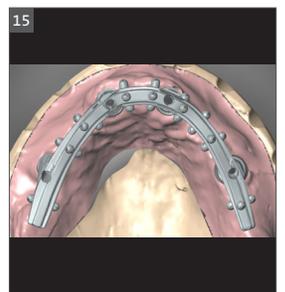
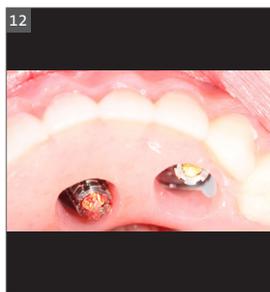
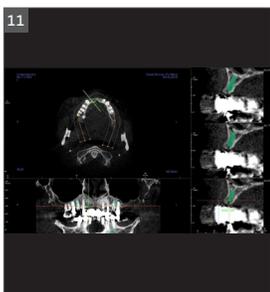
There were no complications and blood loss was minimal. The patient remained stable throughout the procedure and was alert and oriented at the completion of the procedure.

PROSTHETIC APPOINTMENTS

#1. PROSTHETIC CONVERSION

Healing abutments were removed, and Impression copings were attached to the MUA's to make an abutment level impression with splinted copings using orthodontic wire and GC pattern resin. A putty material was used in an open impression for maximum rigidity. After removal, impressions were checked for rigidity of all components. Impressions were poured up in the laboratory using appropriate analogues and vacuum - mixed die-stone to fabricate a master model.

A bite registration material was used within the dentures to index the position of the healing abutments within the prostheses at the correct VDO. Holes were drilled around abutment #'s 7,10, 23 and 26 to allow seating of the prostheses around the -temporary cylinders on these implants. Adequate relief was provided circumferentially for acrylic to be syringed around the temporary cylinders. Screw access holes were blocked with PTFE tape prior to this (Fig 12.). Acrylic was mixed and syringed, and the patient was guided into centric-relation at the



correct Vertical Dimension of Occlusion. After four minutes, prostheses were removed, and checked to ensure that the temporary cylinders were rigidly encased in acrylic. The prostheses were transferred to the laboratory, to undergo the conversion process from removable prostheses with flanges to fixed-detachable hybrid prostheses.

The prostheses were delivered that day, and prosthetic screws were torqued to 15Ncm. Peri-apical radiographs (Fig 13.) were taken to verify seating of the prostheses prior to occlusal adjustments etc. The patient was given written instructions regarding soft diet, swelling, and the use of NSAIDs for the first week.

2. TEN DAYS POST OPERATIVE

The patient was examined, and healing was unremarkable. Oral hygiene instructions were reinforced, and general questions answered.

#3. THIRTY DAYS POST OPERATIVE

The patient was pain free and adapting well. She was happy with the appearance of the teeth and lack of complications. Oral hygiene instructions were reinforced and general questions answered.

#4. NINETY DAYS POST OPERATIVE, FINAL IMPRESSIONS

The patient was re-examined and had been symptom free for the last sixty days. Peri-apical radiographs confirmed good bony healing around all implants. A new face-bow, and intra-oral CR records were made prior to final impressions being made. Prostheses were removed, and peri-implant soft tissues had healed well. All abutments percussed normally, and were torqued to 35Ncm without incident. Verification jigs were connected intra-orally, and final impressions were made in poly-vinyl siloxane. New master casts were poured, and the temporary prostheses were used to articulate the case. Esthetic and functional changes were noted at this appointment, and were communicated to the dental laboratory.

#5. WAX TRY-IN:

Prostheses were tried in, and Centric Relation and Vertical Dimension of Occlusion were verified. Tooth position, as well as shade and general appearance was confirmed (Fig 14.). The patient was satisfied that the new prostheses allowed more space on the palatal aspect.

#6. TITANIUM BAR AND WAX TRY-IN

A CAD-CAM program was used to plan for the Straumann® CARES® Titanium framework to optimally support the prosthetic teeth (Fig 15.) This included both horizontal and vertical diatoric support to increase the available surface area for bonding of the acrylic on the titanium frames (Fig 16.). A layer of pink opaque was applied, and a final full contour try-in was performed to verify passivity of fit, esthetics, occlusion, and general satisfaction with the prostheses. Peri-apical radiographs were taken to confirm passive seating of the metal framework (Fig 17.). Centric relation occlusion was verified (Fig 18.) prior to flasking and processing.

#7. INSERTION

Prostheses were delivered and oral hygiene instructions were reinforced regarding the use of SuperFloss® and a WaterPik®. Occlusion was refined, allowing a posterior bilateral maximum intercuspal position, with anterior disclusion. A soft night guard (NG) was provided. Fig 19. shows the esthetic improvement after the VDO has been restored, and the relative harmony between all 1/3rds of the face compared to the pre-operative profile picture (Fig. 2). Also, the arrangement of smaller maxillary incisors in an optimum position provided good lip support and a harmonious smile (Fig 20.).

#8. 30 DAY PO

The patient adapted well to the prostheses. Her speech was much improved, and she had been using the SuperFloss and a WaterPik. There was some cheek biting initially, but this improved. The patient was extremely satisfied, and is seeing a hygienist every six months for maintenance. Radiographs will be taken at the 1-year recall.

CONCLUSION

This patient demonstration illustrates the need for a dedicated TEAM concept. While some of our colleagues may argue that that the treatment plan was aggressive, many patients desire a single surgical procedure, with a more simple approach vs multiple surgical procedures for grafting (soft and hard tissues), followed by staged implant placement with removable provisional prostheses. This presents a paradigm shift for some practitioners. However, using a patient-centered approach when discussing treatment options allows us to provide predictable outcomes for patients who otherwise would require more complex and time-consuming treatment.

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