3D Digital Planning
and the All-on-4® Arena
An Unprecedented Opportunity for Technicians

As a 44-year career technician, who has witnessed and experienced the ongoing evolution of the role and responsibilities of dental laboratories and technicians, I can testify that the modern era of digital technologies has opened many doors. Technology combined with the multiple implant treatment of the edentulous arch arena has allowed for substantial and unprecedented achievements for technicians with regard to involvement, input, responsibility, leadership and yes, even increased respect and financial compensation, on levels that were previously unimaginable.

Since the early 2000’s, when Dr. Paulo Molo’s (from Portugal) revolutionary new implant treatment for the edentulous arch first came to the U.S., a bold new arena for dental technicians was established. This particular treatment arena, utilizing tilted implants and immediate load protocols, typically begins with a denture, often an immediate denture, and thus quickly became the “property” of experienced and highly skilled denture technicians. Long-suffering removable laboratories, departments, and technicians delighted everywhere!

As an owner/operator of a nine-person boutique removable laboratory for 35 years, I can accurately state that it completely changed my business model. The high billing amount per arch increased roughly tenfold from about $500-$600 for a conventional denture or partial (a bit more for a combination case with attachments), to about $5,000 plus per arch when all components and procedures were considered. This would typically include an immediate denture, clear denture replica manual drilling guide (Figs. 1-2), clinical chair-
side conversion assistance on the day of surgery (Fig. 3), and the necessary lab work to achieve a successful screw-retained, immediate-load provisional prosthesis (Figs. 4-5). The CAD/CAM titanium bar final restoration was also included after successful implant osseointegration and tissue stabilization (Fig. 6).
Equally important, it also changed the direction and overall nature of my entire career, my day-to-day interactions and in fact my relationships with my clinical clients. It allowed me to become an actual contributing team member, a true “colleague” if I may be so bold, not only with the restorative doctors, which was not uncommon over the years to a certain degree, but with the surgical doctors, be they Oral Surgeons, Periodontist or General Practitioners (GP) placing their own implants.

This access, combined with what was then a relatively new digital technology known as 3D digital planning (think virtual surgery (Figs. 7-8), which is based on cone beam computer-aided tomography (CBCT- scans of the head/neck and oral cavity), allowed for a wonderful transformation. I went from being a traditional bench technician that only fabricated the prosthesis by fulfilling a prescription to becoming an important and integral team member; often providing valuable insight, including treatment planning and direction, and attending and contributing in the surgical operatory for much of the procedure.

Often times, this new breed of technician is tasked with actually “quarterbacking” many of the clinical aspects of the treatment, including, as the anatomy allows, the frequent need for bone reduction to maximize possible vertical restorative space. Technicians in this realm also need to possess knowledge of strategies for implant placement, along with angle correction abutment placement, to maximize anterior-posterior spread and control long axis/screw access hole location within the contours of the prosthesis.

Assisting the inexperienced restorative GP with the conversion process in the surgical operatory has become a service that is very much in demand. In certain treatment modules, the
implant surgeon works directly with the technician and “bypasses” the involvement of the restorative GP.

While all of this increased involvement, responsibility and reward may sound great to interested dental technicians, it must be clearly pointed out that any technician looking to enter into this foray must absolutely possess knowledge and skill sets typically not associated with being a dental technician. One must become, to a certain degree, an oral engineer! This requires a deeper understanding of oral anatomy, physiology, and intra-oral biomechanics.

There must be a “prosthodontist level” of understanding of how to treatment plan when anatomical limitations, patient expectations, or even financial limitations dictate that you zig, even when conventional wisdom might indicate a zag.

Any competent all-on-four (AO4) technician, especially one who engages in the digital planning aspect, needs to be able to read radiographs and identify specific anatomy, as well as understand bone quality types (Type I, II, III and IV) and the different bone densities, as in the difference between the dense cortical bone in the mandible, as opposed to the more porous trabecular bone in the maxilla (notice the Zygoma implants due to lack of regular bone in Maxilla, Fig. 9).

Bone reduction is an integral part of most AO4 surgeries. Removing and flattening the ridge by four to five mm's is very common and sometimes as much as seven to eight mm's of bone or even more is removed (Fig. 10), especially in the anterior mandible, where there is typically the most “real estate” to work with. It is where the bone is usually the most dense, but can also be thin in bucco-lingual width near the crest of the ridge, so reducing and flattening the ridge in this area often helps the surgeon achieve the flattened table necessary to prepare an osteotomy to accept a nice "regular platform" implant (4+mm diameter - Fig. 11). It is also frequently necessary in the pre-maxilla to get the “transition line” apically positioned above the high lip line, which is critical for a fixed detachable prosthesis.

The general rule of thumb is to ensure that there is plenty of bone available to adequately support the implants, but remove all additional excess of bone, thusly allowing for more vertical restorative space. This translates to greater dimensions for the materials that the final prosthesis is comprised of (bars, PMMA base material, denture teeth or possibly zirconia).

Technicians must understand the “surface area” of implants (number of implants, length and diameter) and connections for abutments (external hex versus internal hex, including the increasingly popular “conical connection” which influences peri-implant bone loss, or “marginal bone loss” under functional load.

They must understand the concept of tilting implants, primarily to increase A-P spread to add support and concurrently reduce prosthesis cantilevering, without the oftentimes necessary grafting procedures in the maxillary posterior region, which add substantial cost and treatment time. Tilting implants can also be utilized to increase possible implant surface area, so that they may endure greater load capacity. The bone may only be able to accept an 11mm long implant in the straight vertical position, but might be increased to a 13mm or 15mm long implant, once tilted.

It is helpful to understand soft tissue at a greater level, keratinized and connective tissues, soft mucosa, vascularization and such, as it is related to implants along with the implant supported or assisted prostheses.

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The areas of most concern are the “anatomical landmines;” the anatomy that must be avoided by the implant. Examples include the sinuses in the maxilla, and even more so, the inferior alveolar nerve and mental nerve in the mandible, which can result in paresthesia, a very serious consequence that simply must be avoided!

The best avenues for a technician to obtain knowledge and expertise in these arenas are:

1. Build relationships with good clinicians, especially experienced specialists (oral surgeons, periodontist, prosthodontist), who are willing to share their knowledge, cases, existing radiographs, etc. Frequently, it is a “trade-off” as surgical specialists in particular are usually glad to learn more about the prosthetics and fabrication nuances, which can be helpful for them to become fully informed and well-rounded.

2. Obtain literature that clearly outlines and explains the detailed anatomy of the oral cavity.

3. Obtain access to digital planning software, then play and practice! I advise technicians from all over the country to obtain access to software regardless of their circumstances. If you are employed at a lab that does not offer access, buy your own, as the potential rewards will be worth it. They typically have “practice cases” pre-loaded and real case radiographs are obtainable, even though they are often “anonymous” to protect the patient’s privacy. This is the single greatest tool for a technician to become knowledgeable and skilled in anatomy and the virtual surgery arena.

**Ethics, Legalities, Compliance and Common Sense**

Be careful! I would be remiss to not discuss the high level of responsibility that comes with participating at this level. The need for clinical oversight at every turn can simply not be overstated. Ultimately, the doctors are the owners of the patient.
and bear the responsibility for their treatment and any effect it might have on their health.

We must ensure that they oversee and approve every aspect of what we contribute, whether it is the digital planning of a case (I did not plan the cases for them, but rather offered “prosthetic review” of their plans), or the chairside participation in the conversion aspect of a surgery. I always participated in an assistant capacity, often coaching the restorative GP, and even occasionally, the implant surgeon, with strategic angle correction abutment placement, but always having them do as much of the intra-oral work as possible. Frankly, I would only “touch” the patient when absolutely necessary and under direct supervision of the doctor (Fig. 12). Unlike some technicians I have encountered, I never worked on a patient without a doctor present in the operatory!

The technician should always follow strict infection control protocols when in an operatory to protect the patient as well as themselves. Many laboratories obtain professional liability insurance as an added layer of protection against possible inclusion in a lawsuit, as yes, it has happened and it is not something to be taken lightly!

Advancement in the “Digital Loop”

While the entire industry is advancing rapidly with digital impressions and fabrication of prosthetics, there are still several challenges when discussing full arch treatment. This is especially the case when the surgical aspect of this treatment greatly alters the dimensions of the mouth and produces a great deal of fluids, bleeding in particular.

Certainly, digital dentures can be incorporated in the first stage of this treatment very successfully as well as the final prosthesis. Currently, however, only a handful of boutique, “cutting edge” clinicians and technicians possess the equipment, software and technical savvy to produce accurate, reliable digital full arch impressions, or digitally produce monolithic provisional restorations that have pre-designed dimensions, occlusion, and concurrently useable cylinders that are accurate and meet the required esthetic and functional demands.

It is my opinion that many of the established manual protocols that have been improving over the past 15 years will be utilized on a wide-scale basis for several more years to come. This treatment, when examined from a bird’s eye view, is still in its infancy. Digital planning is certainly still in its infancy and it is mind boggling that it is estimated that less than 10 percent of the multiple-implant edentulous arch placement procedures are digitally planned!

In conclusion, due to the large numbers of edentulous and nearly edentulous population in North America, the demand for these treatments will continue to rise for both implant supported cases (AO4), as well as implant assisted, direct attached cases (LOCATOR®, over-denture cases). Large DSOs will gain traction in this arena along with increased competition; the lower treatment cost will also contribute to a tremendous increase in demand. In turn, the need for highly skilled and knowledgeable technicians to participate on multiple levels will increase dramatically as well.

Never before has there been such an opportunity for technicians to position themselves to be respected and compensated as the scientist, artist, oral engineers and dental professionals that they truly are! JDT

About the Author

Thomas Wade CDT, is a 1976 graduate of the Dental Technology Program at the U.S. Air Force School of Health Care Sciences, Sheppard AFB, Wichita Falls, Texas. He owned and operated New Horizons Dental Laboratory in Broomfield, Colorado from 1983 until 2018 and has always specialized in the fabrication of Removables and Implant Prosthetics. He is a published author and lectures extensively for Ivoclar and Nobel Biocare on both clinical and laboratory aspects of the multiple implant treatment of the edentulous arch, with an emphasis on 3-D digital planning, the All-on-4® treatment concept, and CAD/CAM milled titanium bar restorations. He is a 2019 recipient of the NADL “Excellence in Education” award.