Editors' Note: On January 5, 1999, three prosthodontists were asked to submit responses (independently) to the following question:

The phrase “prosthetically driven implant dentistry” is currently used by many journal authors and by many speakers at various professional meetings. In your opinion, is this concept being embraced, and used, by most clinicians involved in implant dentistry or does it ring hollow without actually being implemented?

Herein, in alphabetical order, are the essays submitted by Charles E. English, DDS, Jon M. Finley, DDS, and Scott D. Ganz, DDS.

Significant advancements have been made in implant products, clinical techniques, and diagnostic technologies over the last 15 years. The late Dr. Robert A. James repeatedly stated that “prosthodontics is the diagnostic basis for implant oral rehabilitation”, and that was 20 years ago. Nonetheless, realistic estimates of only 5% to 8% of implant cases currently are correctly analyzed before surgical placement. The vast majority of cases are restored after the fact, with the attendant challenges that one would expect, such as inadequate support, excessive angulation, insufficient interarch clearance, inappropriate abutment connections, improper spacing for pontic spaces and occlusal design, incorrect depth of abutment platform placement, soft tissue support needs, incorrect choice of retention, and esthetically challenging soft tissue defects, etc.

Many restorative clinicians simply do not have a command of comprehensive treatment planning. They use a “one-tooth,” or a “four-tooth” treatment plan instead of evaluating the whole mouth. Economics does play a role in this situation. However, staging treatment over 4 years or so can be done with surgical, clinical, and laboratory communication! Properly planned implant treatment can be more economical and expeditious than some of the more complex dentate treatment approaches that have been used in the past.

Probably 75% or more of the fixed cases can be enhanced with very simple presurgical information. This includes 1) maxillary and mandibular full-arch impressions with adequate extension and occlusal detail made with irreversible hydrocolloid materials; 2) accurate occlusal records, particularly distal extension cases; and 3) a good quality panoramic radiograph. From there, decisions can be made whether to use other technologies such as linear tomograms for the posterior mandible and single-tooth sites, and CT for the very challenging maxillary arch. Often some restorative clinicians do not know any or all of the following 1) the type of implant that was placed; 2) the type of abutment connection; 3) variations of abutment connections for different time periods; 4) the diameter of the implant; or 5) what types of implants may have been placed into the inherent patient from another geographic area.

It is important to evaluate: 1) the occlusal plane; 2) anterior guidance to provide proper posterior disclusion; 3) vertical dimension of occlusion; 4) jaw relationship discrepancies; 5) centric occlusion—maximum intercuspal positional discrepancies; and 6) interarch clearance. Smilie line contour must also be critically evaluated with anterior fixed cases. We also are beginning to see another paradigm shift in treatment planning. Because it is now recognized that the three-dimensional position of an implant adjacent to another implant or natural tooth affects bone loss concerning biological height, width, and papillae support. This will have a profound affect on anterior esthetically challenging cases and the necessary grafting techniques that will accomplish the best results. The depth of the implant abutment platform now will have to be placed at the optimum position in relation to the most apical position of the facial gingival tissue for optimum esthetics.

On the other hand, the complete denture or the full denture wax setup becomes the blueprint for the edentulous patient. It is simple to duplicate a complete denture or wax setup into either a surgical template, a radiopaque radiographic aid for CT, or a diagnostic aid in evaluating hard and soft tissue loss in relationship to ideal tooth positions. Removable prosthodontic principles are the foundation for most of our implant decisions. Concerning the maxillary edentulous arch, the most dangerous statement made is: “we can do fixed bridgework, no problem.” Most patients desire a painless prosthesis for the maxillary arch, which can be provided with various types of prostheses designs such as 1) bar overdenture; 2) precision-milled double-bar overdentures; 3) Andrews bridge; and 4) telescopic fixed restorations. The overall advantage of these concepts is that they can provide fixed function with removable prosthetic advantages, which include esthetics and tissue support.

The abutment connection design is often overlooked, but is very important with various restorations.
The most demanding restoration for the abutment connection is the single-tooth and the telescopic fixed restoration. Special thought should be given to abutment stability, trajectory limitations, and abutment connection strength, inasmuch as not all implant systems are best suited for these types of restorations. The depth of implant placement must be carefully considered because it pertains to maxillary anterior single-tooth cases. There must be sufficient depth to correct for angulation subgingivally and to allow for an esthetic emergence. The abutment platform is usually considered optimum in depth if it is 3 mm below the gingival tissue at its lowest facial point. It is extremely challenging to provide esthetic restorations if the platform is too high. Not all implants system have the variety of abutments that satisfy the necessary range of aesthetic and angulation demands. Some clinicians purchase implant systems without a clue as to the limitations of the abutment connection design and the challenges of the prosthetic abutments. Certain companies do not have the breadth of restorative abutments necessary to cover the spectrum of clinical challenges, and there may not be after-market components to bail out the case.

Many times an extremely important factor is overlooked—the knowledge, technical capability, and management philosophy of the dental laboratory being used. Some laboratories nurture mail-order business and do not want telephone interaction and case discussion; whereas, others create a business that develops a professional relationship based on trust, honesty, and professional confidence. Boutique laboratories may specialize in aesthetic restorations and may not have an interest in implant restorations. Clinicians must feel comfortable with their laboratory relationships because implant success depends on details. And, what about occlusion? The literature demonstrates its importance in so many areas. Yet, implants are being “freehanded” without the use of surgical templates (not “stents”), although the template has been provided by and paid for by the restorative clinician. By the way, I am professionally uneasy about the ubiquitous use of the phrase “make a suckdown.” Certainly, we can create better terminology. Another consideration is to use the proper width of implant for the specific tooth position being restored. For example, narrow implant platforms (not implant thread diameter) such as 3.25s should be used for lower incisors and some maxillary lateral incisor positions, as opposed to the standard 4.1-mm external hex abutment platform.

I think that too many cases are being restored as compromised metal ceramic fixed that would be better restored as implant-assisted overpartials. I feel there is an enormous number of patients that could have Kennedy classifications of Classes I and II distal extension removable partial dentures converted to Class III cases; and in effect, become removable-fixed restorations. Implant placement would not be as critical in these cases because the distal-placed implants would provide vertical support, and perhaps retention, for the RPD. This same concept can also be done with four or five implants in the symphysis with support for the fixed-detachable or bar overdenture restoration. The implant-assisted RPD also has applications in the compromised maxillary arch situation, as well.

It is also my opinion that severely resorbed mandibles are best restored with traditional or tripodial subperiosteal implants, as opposed to endosseous concepts. I think the patient is better served from a biomechanical standpoint, as well as from the diminished treatment time that is required.

Although the implant market has matured, compared with the late 1980s and early 1990s there are many patients who can truly benefit from good implant treatment. The novelty is over and the hard work begins. This work involves the use of solid restorative biomaterials, a familiarity with occlusion, and biomechanical education. This total education is challenging intellectually. It cannot be done with a course, a book, one system, or that kind of mind-set, because it is a journey of learning for decades. That is why we deserve the university-given title of Doctor. My current frustration is that the general patient population, our professional peers, and many others do not have any idea of our sophistication, capability, knowledge, commitment, and professional spirit. The best way to convey this professional skill to our patients and to their friends is to treat our patients properly. That entails a proper workup using the laboratory consultants or restorative clinicians with proper training, experience, and objectivity. Today, implant dentistry is not being driven as it should be by prosthodontic workups. If it does not change and improve in this area, I feel the field will remain stagnant. That is a shame because we can do so much for so many people.

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"Prosthetically driven implant dentistry" is an interesting phrase that should have been intertwined in our thinking from the outset of osseointegration concepts. Initially, the theories involved "just getting the fixtures in the bone." As bone grafting and augmentation techniques progressed, practitioners became more critical of placement depths, trajectories and buccal-lingual positioning. Dr. Burt Melton has long stated: "Implant dentistry is a prosthetic discipline with a surgical component." To aspire to this level of thinking, however, necessitates the constant use of surgical guides (templates), which have grown in usefulness to include positioning guides, trajectory guides, grafting guides, laboratory waxing guides, and CT scan guides (when
coated with barium paste) all encompassed in the same prosthetic device.

Most surgical doctors placing implants realize, at least subliminally, that their final implant placement will greatly affect the quality of the prosthetic outcome. Yet, in my view, most clinicians do not use a surgical guide of any type to predict better the outcome of placement. Some surgical practitioners are so frustrated with the restoring doctors’ lack of knowledge, or interest, in implant dentistry that they resort to making their own types of surgical guide, although they are not the ones making the final restorative decisions. These decisions include the use of restoration material, restoration color, and occlusion, as well as will the prosthesis be fixed with screws or cement, or will it be secured as a removable prosthesis. Many restoring doctors see the surgical specialist as the one dictating the treatment, and they may be intimidated to the point of not making placement decisions and certainly not fabricating a surgical guide. Some surgical doctors go so far as to select and install the abutments for the restoring doctor, including the selection of gingival height, angle, and retention mechanism. Because the shared responsibility for case success creates difficulty in taking charge and assuming control, in my lecturing and meeting encounters there has been an increasing number of doctors doing both the surgical and prosthetic phases.

Surgical guides should be required in all partially edentulous cases. They should be constructed under the supervision of the restoring doctor to force a complete plan of the restorative result. Many techniques of template cementation are expensive, confusing, difficult to make, and not universally adaptable to intraoral use. This does not have to be so. Granted the use of guides is more difficult in fully edentulous applications; but there are techniques available for proper use. The medico-legal issues abound with negative implications if implants fail when inadequate planning included the nonuse of surgical guides.

“Prosthetically driven implant dentistry” is a phrase well-known to most implant doctors. However, my view is that many doctors do not implement its use totally in the TEAM treatment-planning phases. All adjunctive aids are not being used as indicated and when needed. This inadequacy may be because of either a lack of knowledge, laziness, or apathy. We do not need to have the mental gymnastics required in the very challenging prosthetic solutions imposed upon us to gain successful results. Even the simple, straightforward and almost boring cases require proper planning and design. Some clinicians do preestablish and implement the treatment plan so thoroughly that the phrase could be changed to “Implant dentistry can be a laboratory discipline with surgical and prosthetic components.”

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I was the concept of the “prosthetically driven implant” being embraced or does it ring hollow? That may be the question of the day or perhaps of the last decade. During the past 10 years, implant dentistry has evolved into one of the most predictable treatment modalities that can be offered to patients who are missing teeth. Presently, there exists a consensus of confidence in the long-term prognosis of implant reconstruction, and in the techniques that are available to render functional and esthetic results that are indistinguishable from the natural dentition. Successful implant reconstruction requires knowledge, careful planning, and communication among all members of the implant team. However, has there been a significant change in the way practitioners operate on a day-to-day basis since the phrase, “I put the implant where the bone was…” became part of the dental vernacular? Based upon personal contact with many restorative and surgical colleagues involved with implant dentistry around the world, I think that we have advanced the learning curve, have the knowledge, and have developed the tools, but we still fail to implement “prosthetically driven implant dentistry” in many cases.

What do I mean by “advanced the learning curve and we have the knowledge?” For the past decade many top clinicians, researchers, surgeons, and restorative dentists have discovered that the goal of implant dentistry is not osseointegration. It is not just the implant shape or its surface characteristics, or the type of bone that exists, or proper prosthetic component selection, or good communication, or even patient selection. The goal of implant dentistry is the tooth that we replace. Patients come to the dentist to have teeth, not implants. And when there is a missing tooth, often there is more than that which is missing.

Therefore, we must have an understanding of what needs to be replaced, and how best it can be replaced before the scalpel ever touches the patient. When presented with an edentulous area, all pertinent anatomy must be evaluated including the existing height of bone, the width of bone, the volume of lost bone, the mesiodistal dimension, and the quantity and quality of the soft tissue. When an edentulous space is evaluated, often accompanying the lost tooth is missing bone and gingival contour asymmetry that makes an aesthetic replication of the natural dentition difficult. Simply placing an implant, without proper planning, can create a prosthetic result which will be a compromise at best. We as clinicians need to know what is missing first. This is not reverse engineering; but rather it is the proper way to understand what needs to fill that vacant space and the options available to return the patient to ideal function and esthetics.

It is no longer acceptable to state that the implant was placed where “the bone was,” because an osseointegrated implant may be considered a failure if it cannot support or replace the missing dentition because of poor

Implant Dentistry / Volume 8, Number 2 1999 117
placement. If the fixture was placed too deep, too buccal, lingual, mesial or distal, restorative problems can result. We have heard this time and time again. Yet this understanding that the tooth position must be the final and most important determining factor in the fixture placement is still largely ignored. Unfortunately this problem originated when modern endosseous implant techniques evolved through an innovative surgical protocol. Clinicians were thrilled that root-form implants, based on the mystical properties of titanium, resulted in a phenomenon called “osseointegration” that created predictable long-term anchors in bone. The restorative phase, however, was almost an afterthought. During this early adaptation period, periodontists and restorative dentists were clearly not the leaders. They were often asked to restore implants that were placed without having had prior input or planning.

Early in the learning phases of modern implant dentistry, implants were thought of as being “different” requiring “distinctive” and new techniques which were separate, and possibly even elitist, in comparison to conventional restorative techniques. In 1991, I coined a term called “dental amnesia.” Dental amnesia means that when a clinician is presented with a potential implant case, all previous knowledge about conventional dentistry is forgotten. The reality was that once the implant was placed surgically and found to be osseointegrated some months later, the restorative phase would start. Unfortunately, many implants were placed surgically without diagnostic wax-ups, surgical templates, or concern for existing vertical dimension or opposing occlusion. Implants often were placed at obtuse angles requiring restorative gymnastics to allow for the proper reestablishment of occlusion. Even when restorative dentists took the time to create accurate surgical templates to ensure that the implants would be placed in restorable positions, the surgical specialist would often leave the template on the surgical tray because it may have been too difficult to stabilize or to secure satisfactorily during the insertion procedure. If the restorative dentist was not present during the procedure, the surgeon alone was responsible for the placement of the fixture. It was not unusual for a dentist to plan the case and send instructions along with the surgical template, only to be distressed when the surgeon misunderstood the restorative dentist’s requests and placed implants in positions that were not prescribed. Many restorative dentists have related similar experiences wherein they referred a patient for implants only to have the patient return with more implants than had been originally treatment planned. When a restorative dentist asks for two implants to be placed, and the surgeon places three or four, what happens to the increased cost of parts and laboratory fees for the extra fixtures, even if they happen to be well-placed?

So have things changed? Yes and no. There has been a transition over the past decade to understand the prosthetic outcome before surgical intervention. Although there was a heavy emphasis on the surgical aspect of implant placement, more consideration regarding the soft tissue, emergence profile, or the final prosthetic and esthetic outcome was being espoused from the podiums around the world. New techniques of guided tissue and bone regeneration gave way to an understanding that the “proposed site” could be changed so as to render enhanced functional and esthetic results heretofore not available. Because of a lack of proper diagnosis and treatment planning, implants that were placed with good intention in sufficient bone and that had in fact “osseointegrated,” were found to be in poor locations for the final restoration. This created prosthetic nightmares for the restorative dentist who was forced to use nontraditional custom-cast abutments to correct for unacceptable alignment of the implants. This created esthetic compromise for the patient. Restorative dentists often violated conventional prosthodontic protocols, leading to compromised results at best. Implants that emerged through unattached gingival tissue or insufficient keratinized tissue became hygiene management problems or were aesthetically unappealing. Having had the opportunity to visit with dozens of implant study clubs around the country, I have found that the most successful surgical specialists are those who have dedicated themselves to understand, teach, or mentor restorative techniques to their referring general dentists. If the restorative doctors did not take the initiative, the planning was left in the hands of the surgeons.

Why are restorative dentists reluctant to take the initiative with implant reconstruction? Often it is because of the lack of confidence or that education that was not provided during dental school, or there was an insufficient focus on the restorative aspect. As more and more dental schools adopt an implant curriculum into the undergraduate level, proper concepts will be imparted to the next generation of dentists who place and restore implants. Of course, this requires better communication between the politically charged dental school departments who all want to direct this innovative treatment modality. Unfortunately, it has been this “competition” among departments with territorial or philosophical differences that has slowed the progress of implant dentistry. The longer these barriers exist, the longer the segregation of implant doctrines will prevent the industry from progressing to its full potential. An example would be the reluctance of many implant practitioners to accept technological advances that enhance the process of implant dentistry.

During the past decade, the remarkable innovations in computer hardware and software have created tools that literally take the guess work out of the planning and execution of all phases of implant dentistry. The introduction of CT scans for dental applications enabled clinicians to view the edentulous space in three dimensions and visualize anatomical landmarks previously hidden or obscured. Software applications have taken this innovation to the next level by allowing for the digitized CT scan information to be incorporated onto the desktop or laptop computer. This has advanced diagnosis and treatment planning to an accuracy within tenths of a millimeter. Software application tools such as SIM/Plant
(Columbia Scientific Inc., Columbia, MD) have enabled clinicians to develop both surgical and restorative treatment plans so that past mistakes can be avoided. This technology is one of the most important tools available to cement the communication between surgical and restorative phases of implant reconstruction. This technology offers the most accurate means of delivering state-of-the-art care to our patients. Not only can the true undistorted three-dimensional anatomy of the bone be visualized, but also vital information such as bone quality and density can be determined. This allows for simulated implants to be placed into favorable sites before the actual surgical procedure.

Once simulated implants are placed, the prosthodontist or restorative dentist can examine the fixture placement in relation to the bone and the proposed tooth position, and even simulate which abutment would be most appropriate. Evaluations can be made concerning buccolingual orientation, distal position, emergence profiles, abutment selection, soft-tissue depth, quantitative surface contact area within the bone, and relative bite forces. Presurgical and preprosthetic planning can be evaluated and discussed through color printouts of the treatment plans or directly on the computer screen. In this manner, both the surgeon and the restorative dentist can see the consequences of placing implants in different positions. This is not a tool for surgeons only. It is a powerful tool that restorative dentists should embrace because it can empower them to better direct implant placement. This will minimize error and maximize the restorative result. Yet, most surgical specialists still rely on the conventional panoramic radiograph to plan their implant cases, although they readily admit to the inherent limitations of this format. This is the same reluctance that existed when we started to fabricate surgical templates that were never used. The restorative doctor has the most to gain, and the most to lose, depending upon whether a CT scan is taken for preoperative planning.

Although I think that implants are still being placed at the surgeon’s direction, the tide is turning and restorative dentists are learning to take the leadership role.

After all, once the implant has become osseointegrated, the restorative dentist becomes “married” to the patient long-term. Restorative dentists want to limit their liability on malaligned fixture placement that results in compromised functional and esthetic reconstruction. Although restorative gymnastics may be heroic, who pays for the increased laboratory time and increased cost of parts and labor? And then what happens if the implant fails 2 years after being under function and load? Implant dentistry has its foundation in conventional dentistry. An understanding of sound prosthetic/restorative protocols is essential for successful implant reconstruction. Fortunately, most of the organizations that are involved in implant dentistry have expanded their annual or satellite meetings by encouraging specialists to bring their referring dentists to keep parity within the learning curve of successful implant reconstruction. Also, dental schools have increased exposure to dental implant concepts through improvements in the undergraduate and graduate curricula and the incorporation of technological advances.

Digital radiographs and CT are technologies that enhance diagnosis and treatment planning to affect predictable results. These tools allow for a cooperative schematic or a prescription for the surgeon to place the implants where they will best support the tooth, as directed by the restorative dentist. Recent developments now allow clinicians to communicate this digital information over the Internet via email. This expands the diagnosis and treatment planning phases beyond the walls of the operatory, the office, and geographic boundaries. Therefore, I think that the message is finally taking hold. Hopefully, with more restorative dentists becoming educated and gaining confidence and more surgical specialists understanding the prosthetic needs of their patients, implant dentistry will progress to a higher level of functional and esthetic predictability.

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