SCIENTIFIC ARTICLE

Innovative Systems in Implant Dentistry

Michael Klein, D.D.S.

Innovation is what breeds new technology and techniques. The treatment modalities we offer our implant patients were all once innovations that through trial and research allow us to predictably treat a variety of complex dental problems. Three innovative techniques in the realm of diagnosis and treatment of the implant patient are discussed: (1) the use of interactive software both to analyze and interact with CT scan data; (2) the use of a device to monitor bur temperatures generated during osteotomy preparation; and (3) the technique for use of transitional implants to aid in the support of a fixed provisional restoration.

Interactive Software

The CT scan has been in common usage for diagnosis of the implant patient since the introduction of the reformatted CT scan in 1988.[1] These reformatted images allowed easy identification of the inferior alveolar canal, maxillary sinus, nasal cavity, as well as all bony landmarks of the mandible and maxilla. Measurements could be made on these images and an unprecedented three-dimensional view of the maxilla and mandible that was user friendly was available.[2]

It soon became apparent that identification of available bone was not enough information. Bone was only useful if it was in relation to the position that teeth were going to be placed.

Several techniques were made that allowed the doctor to view CT scans so that available bone could be evaluated relative to the position of the prosthetic restoration. All these techniques employed the use of an appliance that was worn by the patient during the CT scan, and all these appliances contained radiopaque markers that demonstrated final tooth position (Fig. 1).[3]

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Today information far beyond this is available through the use of interactive CT scan software. Columbia Scientific, Inc. (Columbia, MD) has produced software called *SIMPLANT*™ that allows manipulation of CT scan data for enhanced diagnostic capability. The key feature is the ability to perform implant surgery three-dimensionally on the CT scan. A complete surgical plan or blueprint can be formulated prior to any real surgical intervention.

Three-dimensional implant forms may be placed relative to radiopaque prosthetic markers demonstrating tooth position (these markers were in a CT scan appliance worn by the patient during the CT scan). Potential prosthetic outcomes may be visualized including the placement of a variety of styles and sizes of abutments (Fig. 2).

One of the primary uses of the CT scan was visualization of the inferior alveolar canal. The new software can enhance the identification of the canal spaces by alteration of the grey scale or making bone that is not dense appear denser than it really is. This helps to identify the canal because it is the cortical bone surrounding the canal that we use to identify the neurovascular bundle. We can identify the canal in some images and not in others. Coloring in the canal in images in which we can see it allows us to connect the dots or traverse those images where it is difficult to identify the canal (Fig. 3).

Crown-to-implant ratio and the position of the prosthesis relative to the position and angulation of the

Figure 1. The CT scan appliance contains radiopaque markers. This appliance is then converted into the surgical template.

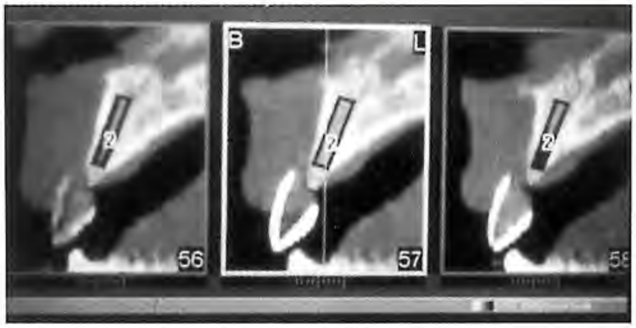

Figure 2. The simulated implant is placed relative to radiopaque markers which demonstrate the buccal and occlusal surfaces of the proposed tooth. The abutment style can be predicted and the best implant position for a specific abutment style chosen prior to implant placement.

implant all contribute to the amount of force and the ability of the implant to withstand that force. Software enhancements allow us to measure that potential force on the chosen implant position relative to the prosthesis position. Crown to implant ratio and buccal lingual cantilever length are measured to help generate a comprehensive treatment plan.

Knowledge of bone density helps us in selecting implant size, surface texture/coating, style, and numbers. Analyzation of Hounsfield units (measurements of bone density) had been available in a given area of bone, but that was the bone that was to be removed to place the implants. Now we can analyze the bone that will come in contact with the implant (Fig. 4). We have no scale that tells us what specific numbers mean; however, it can help make subjective assessments as to style, shape, size, number, coating, and healing times of implants.

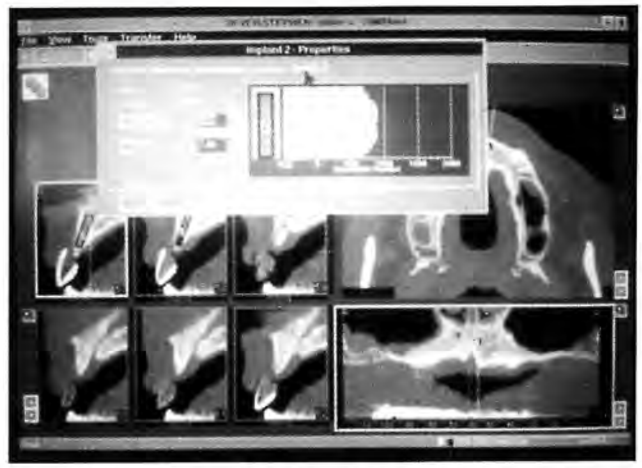

Figure 4. The density of the bone to be in contact with the proposed implant can be evaluated.

Temperature Monitoring Devices

Poor bone quality can affect initial healing of implants through poor stabilization of implants, but dense bone quality may also affect initial healing of implants. Early on it was demonstrated that the excessive temperature generation during osteotomy preparation causes irreversible damage to bone cells, in turn causing hyperemia, fat cell deposition, and resorption.[4] New bone was not formed around implants and these implants would not integrate.

Atraumatic treatment of bone during osteotomy preparation was advocated by Dr. Brånemark to ensure predictable osseointegration of dental implants.[5] High-torque slow speed drills with sharp burs and excessive irrigation were advocated. High success rates of implants were the result.[6] However, not every implant is successful in

Figure 3. The inferior alveolar canal can be painted in the images where it can be identified in the reformatted CT scan images. The software will then transfer these markings to the other images.

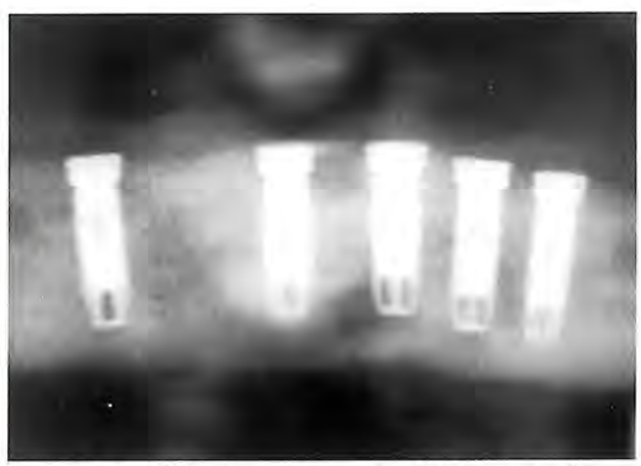

Figure 5. Even following precise protocols of slow speed drilling and continuous irrigation, bone may still be "burnt" (note radiolucency).

Figure 6. Bur flutes may become clogged with bone, preventing necessary irrigation.

Figure 8. The panoramic radiograph shows advanced bone loss surrounding all the remaining maxillary teeth.

bone of good quality with good initial stabilization.[7] Bone is still "burnt" (overheated) on occasion (Fig. 5).

There are too many variables that affect temperature generation to arbitrarily control through slow drilling and the use of irrigation.[8] How many times may a bur be used and in what type of bone before it is dull? How much pressure should be placed on the drill handpiece while drilling? Do different qualities of bone affect the speed and pressure that should be used? How fast should the bur spin and how much torque should there be in the motor? Is adequate irrigation going down the osteotomy through external irrigation or is the internal irrigation port clogged with bone (Fig. 6)? There are so many variables that it is impossible for all practitioners to be consistently predictable with all patients.

A device has been developed that allows the monitoring of the temperature being produced at the cutting tip of the implant bur during osteotomy preparation. Doctors Yacker and Klein have combined the technology of the thermocouple with the current bur and handpiece technology to form a unit that is capable of measuring bur temperature second by second as osteotomies are being prepared (Fig. 7).[9] A thermocouple is two dissimilar metals coming in contact with each other. The thermocouple temperature is measured by a meter. This device will allow the implant surgeon constant knowledge of bur temperature and ensure that critical temperatures (44°–47°) are not exceeded. If the temperature does begin to rise, an evaluation of speed, pressure, irrigation, and bur sharpness can be made to control temperature generation.

Figure 7. The exposed measuring portion of the thermocouple comes in contact with the bur tip.

Transitional Implants

Two primary considerations may be given credit for predictable implant integration, one being atraumatic bone preparation and the second being immobilization of the implant during the primary healing phase.

Most patients in the United States require a provisional dental restoration throughout implant treatment. A removable soft tissue-borne prosthesis is a frequently utilized and traditional provisional modality. Adjustments

Figure 9. Strategically positioned nonacutely infected teeth along with Dentatus implants are utilized to support the fixed provisional bridge.

Figure 10. A full arch fixed provisional restoration with a heavy metal casting is fabricated.

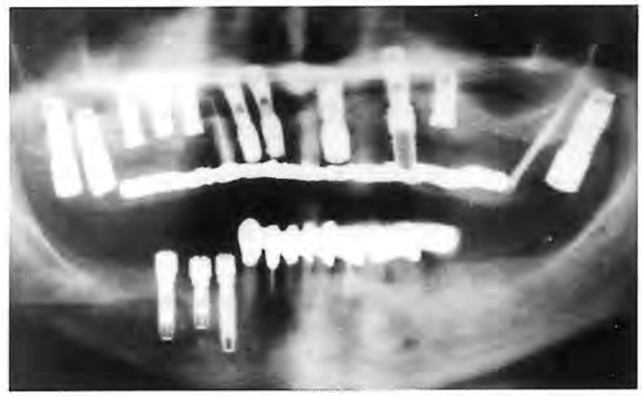

Figure 12. Osseointegrated implants may be placed around the provisional abutments.

and soft reline material are utilized to aid in preventing loading and transmission of micromovement to the healing implant.

Fixed provisional prostheses are certainly a more desirable interim restoration. No soft tissue support is required, thereby eliminating the possibility of micromovement transmission to the implants. Fixed surgical templates may be used, allowing greater accuracy of implant placement. There is increased treatment acceptance by the patient due to the avoidance of a removable prosthesis through the course of treatment. The use of teeth that may require future extraction and the use of metal castings within laboratory processed provisionals help to keep patients in fixed provisional restorations as long as nonacutely infected or nonpainful abutments are present.[10]

A provisional implant called the MTI or Dentatus implant (Dentatus, New York, NY) originally designed by Victor Sendax may also be used to immediately lend abutment support to fixed provisional bridges. The implant is 1.8 mm in diameter and is manufactured in varying lengths. A single twist drill prepares the osteotomy; the titanium implant is screwed into position and may be immediately loaded. The provisional restoration is relined over the implants (Figs. 8–13). Ideally the transitional Dentatus implant position should be in a nonessential osseointegrated implant position so the future long-term implant may be placed without delay. The provisional restoration should be cemented and left in place for 2 months without being removed. This transitional implant may osseointegrate or may develop a fibrous encapsulation. It does not matter as long as it supports the provisional restoration without pain or infection. If pain develops the implant should be removed and additional transitional implants may be placed if necessary.

Figure 11. The Dentatus implants help the remaining maxillary teeth support the fixed provisional bridge. The metal casting within the provisional bridge may be seen.

Figure 13. The patients' esthetic needs can be met throughout the course of treatment with their provisional restoration.

All predictable procedures with research and long-term data began as innovation. Innovation is to be encouraged and sought after. This creative effort must also be tempered with the potential morbidity associated with the new technique or technology. The excitement of creativity must coincide with the doctor causing no harm to the patient.

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COMMENTARY

Stage I Surgery: Normal Ridge Anatomy

The initial incision, as originally advocated by Brånemark, was placed in the mucobuccal fold.[1] This kept the incision line away from the implant and excluded the epithelium from the implant site. There was often significant postoperative swelling and discomfort following this incision. Additionally, in the mandible, the genioglossus muscle of the tongue tended to pull the flap lingually, causing loss of the buccal vestibule and lingual displacement of the zone of keratinized gingiva. As subsequent research has found, the percentage of success is as high with a straight line crestal incision as with the vestibular incision. Thus, the former has replaced the latter as the incision of choice.[2]

An alternative initial incision called the lap flap has been developed by Langer.[3] As opposed to making the incision perpendicular to the crest of the ridge, the scalpel is angled so a slip joint is created. When the flaps are coapted they overlap as opposed to meeting at a butt joint. This permits healing to occur over a wider surface area.

From an esthetic standpoint, a critical aspect in developing the appropriate soft tissue architecture around an implant-supported restoration is achieved by preserving the existing interdental papillae or recreating them if absent.

Thus the ideal initial incision in implant dentistry today provides adequate access to the ridge without compromising circulation or inducing a deformity to the papilla or gingival margin of the adjacent teeth. This principle holds true with multiple implants as well as the single tooth implant.

In the single tooth replacement, if the proximal teeth are less than 6 mm apart, the incision is made mesiodistally at the linguoproximal line angles preserving the faciolingual dimension of the papilla and including them in the facial flap. However, if the teeth are more than 6 mm apart, the papillae are left in place, and access is achieved by the use of vertical incisions.

When the papillae are missing or are insufficient to fill the embrasure space, a dilemma exists as they are difficult to predictably recreate or enhance. The placement of ovate pontics into extraction sockets or onto a ridge prior to Stage I surgery is often an effective means to prevent this problem. This can be done for single or multiple units. The ovate pontic is then modified at Stage I surgery to avoid pressure on the ridge.

Keratinized Gingiva

The need for keratinized gingiva around implants is controversial. Although some studies[4,5] concluded that an inadequate width of attached gingiva contributed to implant failure, others[6,7] demonstrated that gingival health was not dependent on a zone of keratinized tissue.

STAGE I SURGERY: NORMAL RIDGE ANATOMY — COMMENTARY

Further evaluation of the research showed that implant surface was a significant factor in determining the need for keratinized tissue. Based on the above results, there is reason to believe that a rough plasma-sprayed surface might be more susceptible to plaque accumulation and inflammation once it is exposed to the oral environment, and that hydroxyapatite-coated implants may be more problematic than titanium plasma-sprayed surfaces.

Keratinized tissue supported by underlying bone around teeth is felt to inhibit recession. Additionally, clinicians have reasoned that dense keratinized tissue may be more resistant to gingival inflammation than alveolar mucosa.

More longitudinal studies are needed to evaluate gingival stability around implants with keratinized tissue as opposed to alveolar mucosa. These, in turn, should be correlated with the type of implant placed (i.e., threaded titanium, plasma-sprayed titanium, and hydroxyapatite-coated).

Recession, causing the apical migration of the gingiva, could result in a situation where the margin of the restoration is exposed and the cosmetic continuity with the adjacent teeth is compromised. Additionally the presence of chronic gingival inflammation could lead to continual patient discomfort and peri-implant bone loss.

Currently, the authors feel that the routine augmentation of implants with keratinized tissue is unwarranted with machined titanium implants, although it may be indicated for rough-surface implants. Chronic inflammation and patient discomfort or the inability to properly clean around an implant may be an indication of the need for gingival augmentation. An uncovering technique is presented during the discussion of Stage II surgery that solves the problem by providing for a zone of keratinized gingiva around most implants.

Implant Site Development

Esthetic and anatomic considerations in implant dentistry have led to the utilization of the forced eruption techniques of orthodontics as well as the development of surgical techniques to reform lost tissue. The placement of an implant in a ridge with adequate amounts of hard and soft tissue requires techniques that will not compromise what is already present, and when significant deficiencies exist, they must be corrected.

Dennis Tarnow, D.D.S. and Paul Fletcher, D.D.S.

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forced eruption has been examined to illustrate the variety of these remodeling phenomena. The extension of this technique as a means to orthodontically extract hopeless teeth so as to augment potential implant recipient sites is explored histologically.

The utilization of the body's natural reparative mechanisms to alter morphology demonstrates advantageous results.

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Implant Dentistry in the 21st Century: A Salute to New York University

Dennis P. Tarnow, D.D.S. and Paul Fletcher, D.D.S.

While, as faculty members, we are extremely proud of the development and accomplishments of the New York University Department of Implant Dentistry, it would seem at first glance extremely gratuitous and self-serving for us to salute our own program. But on a larger scale, we look at NYU as being symbolic of the achievements of all of dentistry and its allied sciences in a few short years in the field of implantology.

From the work of pioneers like Leonard Linkow and Isaiah Lew came the work of an innovator like Per Ingmar Brånemark, who subsequently stimulated other thinkers to think. The modern era of implant dentistry was born and flourished. Centers of learning sprouted in Europe, North America, and the rest of the world.

In its incipient stage the implant program at NYU was first directed by I. Kenneth Adisman and then by Francis V. Panno. Then in 1993, Dean Edward Kaufman, recognizing New York University College of Dentistry's responsibility to the worldwide dental community and to New York City's patient population at large, established a separate Department of Implant Dentistry, chaired by Dennis P. Tarnow D.D.S. Funded by gifts from around the world to endow a chair honoring Dr. Leonard Linkow, and by a magnanimous donation from Dr. Arthur Ashman, a 2-year postgraduate fellowship program was established. The three students selected had completed specialty training in either oral surgery, periodontics, or prosthetics, and the department utilized four operatories in the prosthetic clinic.

From these modest beginnings the implant department has grown. As word of the program spread, applications for participation were being received from all over the world. Dean Kaufman, cognizant of the growth of the department, recently allocated school resources toward the construction of a new 44-chair clinic with state of the art equipment, including eight surgical operatories equipped for closed circuit television.

The program teaches the surgical, prosthetic, and basic science aspects of implant dentistry and now has 13 periodontists and prosthodontists who return as implant fellows 2 days a week for 2 years, and a 2-year full-time residency program with 27 dentists from 13 foreign countries. Following the completion of their training the implant fellows become clinicians, teachers, and researchers, and the international students return to their countries to become leaders in the field and respected educators in their own right.

An active undergraduate curriculum has been developed, and a close interdisciplinary cooperation has been established between the Department of Implant Dentistry and the other departments at the university. Currently, the department has 35 faculty members, including periodontists, prosthodontists, oral surgeons, and generalists with long time implant experience. Relationships have been fostered with other implant programs and Interscholastic Northeast Dental Implant Treatment Seminars are held regularly.

A learning institution, besides being clinically oriented, must be on the forefront of research. Manufacturers, recognizing the viability of the New York University program, have generously provided funding for no fewer than eight ongoing implant-related research projects. These grants, besides stimulating student research, have most importantly allowed the school to offer implant den-

tistry to a patient population for whom the cost might normally be prohibitive.

Providing continuing education for dentists already in practice has always been a responsibility that has been taken seriously at NYU. Because of the interest in implant-related continuing education courses, and because of the different levels of knowledge each practitioner may have or desire to obtain, New York University Director of Continuing Education, H. Kendall Beacham, has structured a program that attempts to meet the needs of the entire spectrum of practitioners seeking more knowledge about dental implants.

Currently the course offerings include a hands-on implant training course. Forty-four general practitioners are supervised by experts as they each treat five pâtients both surgically and prosthetically over a 2-year time period. Additionally, 12 implant groups from five different countries return to New York for three 2-week sessions over the course of a year, and receive both clinical and didactic experience. More than a dozen 1- and 2-day courses are also offered, providing the latest information in all aspects of implantology. The NYU dental implant study group meets eight times per year and brings in lecturers from all over the world. There is an annual 1-day implant symposium the first Friday in December where prominent national and international clinicians and researchers present the latest clinical and scientific data in the field.

While we feel proud of NYU's accomplishments, we also feel all of dentistry can pat itself on the back for the way that implant dentistry is evolving. Implant dentistry is developing as it should, with a strong scientific basis. If a theory does not hold up to testing, it will be discarded. Manufacturers are extremely supportive, and are generously funding worldwide research to ensure this scientific growth. But there is still much more to be done, and the successful placement of a dental implant, possibly the ultimate accomplishment of dentistry, will surely be one of the primary challenges for the 21st century.

GUEST EDITORIAL

Implant Dentistry in the 21st Century

Dennis P. Tarnow, D.D.S. and Paul Fletcher, D.D.S.
Guest Scientific Editors

The advances in implantology that have occurred over the last 15 years have had a broad impact on almost all aspects of our profession. The finding that bone will fuse or integrate to pure titanium if it is not overheated has raised the relevance of implant dentistry to an entirely new plane.

Brånemark's original restorative protocol stated that implants were to be used only in totally edentulous arches. The abutments lifted the final prosthesis 3–4 mm above the soft tissue, and the cosmetics, at best, left something to be desired.

Today we can place implants in partially edentulous arches, and we can place a single-tooth implant that actually challenges the viewer to cosmetically distinguish it from an adjacent natural tooth.

Previously we had to place an implant where we had bone, using various angled abutments to fabricate a working prosthesis. Today, we can place implants in proper alignment in the arch and use ridge-augmentation procedures to grow bone around them. The sinus can be lifted in the maxilla, and the mandibular nerve can be transposed in the mandible. But, as with all science, the more we learn, the more questions we have.

While we now know how to predictably achieve osseointegration, we are also realizing how much there is to learn about stress, occlusal loading forces, and the occlusal design of the final restoration. Should the restoration be freestanding? Should it be interlocked? Can it be rigidly splinted to natural teeth? These are all questions we have heard asked more than once.

Can ailing implants be rescued by detoxifying the implant surface and then obtaining reintegration? This is also a question for which a solution is eagerly awaited by every practitioner who has anything to do with placing or restoring implants.

Today, periodontists, prosthodontists, oral surgeons, general restorative dentists, physicists, biomaterials experts, and dental materials experts attend meetings together to interchange the knowledge they have gained since they last met. Each year brings a greater understanding of the dynamics of the field.

Dental schools are now required to provide training in implant dentistry for all students, and dentists who are planning to practice in the forseeable future realistically must provide this treatment if they wish to remain current

Dennis P. Tarnow, D.D.S.

Dennis P. Tarnow is a diplomate of the American Board of Periodontics and is board qualified in Prosthodontics. He is founder, and has been chairman of the Department of Implant Dentistry at New York University since 1993. Additionally, he is an Associate Professor in both the departments of Prosthetics and Periodontics. Dr. Tarnow is on the staff of the New York Hospital Medical Center, the New York Veterans Hospital, and the Manhattan Eye, Ear, and Throat Hospital. He is on the editorial board of five different journals, has authored over 20 research papers, and contributed chapters to five books. Dr. Tarnow travels extensively, actively lectures all over the world, and practices periodontics, prosthetics, and implant dentistry along with his partners in a group specialty practice in New York City.

Paul Fletcher, D.D.S.

Paul Fletcher received his dental degree from the University of Maryland in 1972 and his advanced education in periodontics at the New York Veterans Hospital Medical Center from 1974–1976. Currently he is an Associate Clinical Professor at New York University Dental School where he teaches postgraduate periodontics. He was co-chairman of the Periodontal Prosthesis Department at Booth Memorial Hospital in New York for 15 years, is now on the staff of the New York Hospital Medical Center, and has been on the faculties of both Columbia University and the University of Oregon dental schools. Dr. Fletcher has published over a dozen research papers and has lectured both nationally and internationally on periodontal prosthetics and implant dentistry. He is a partner in a group periodontal prosthetic-implant practice in New York City and has a practice limited to periodontics in Rye Brook, NY. Dr. Fletcher is an active member of the Westchester New York Chapter of Alpha Omega.

in their fields. It's approaching the point where they are actually shortchanging their patients if they are unable to offer an implant-supported alternative to a bilateral, distal free-end extension partial or a complete denture.

Implant dentistry has come a long way in the past 15 years. Our approach to a problem is based on biology and not someone's empirical findings. Manufacturers can no longer get away with producing a product because it is an expedient way to deal with a situation.

Although there is still controversy, more often than not it is not a case of right versus wrong, but alternative choices, with each having its strengths and each being preferable in a given situation. Yes, there are still problems. All cases do not go smoothly, but an overwhelming majority do, and that is the nature of dentistry and the same for any procedure we do. Yes, we are still learning, but implant dentistry works, and you owe it to yourself and to your patients to incorporate it into your practice.

Some practitioners say that they do not have many patients that need or want implants. The response is that it is just a matter of how you approach the patient. If you believe in the treatment, they will believe in the treatment.

Take some more courses. Speak to your colleagues that are placing and restoring implants, and work with someone that will be there to consult with you on all aspects of the procedure. It will add a whole new dimension to your practice.

In this issue of the *Alpha Omegan* we would like to bring to the reader the state-of-the-art of implant dentistry as it exists today. Our commentary describing the factors involved in achieving the ideal implant-supported restoration will be supplemented by articles written by faculty members of the Department of Implant Dentistry at New York University.

Besides reviewing their subjects, our authors will present cutting edge information and data on their topics, and will offer their own observations and innovative solutions to some of the questions that still remain unanswered.

We hope you find the issue both stimulating and thought provoking, and we hope you enjoy it.

COMMENTARY

Implant Dentistry in the 21st Century

Short of reimplanting an actual tooth, the placement of a functional implant must be considered the ultimate achievement for the dentist.

Men like Leonard Linkow and Isaiah Lew were true pioneers in the field; however, it was not until the initial investigations of the Brånemark group beginning in the late 1960s, throughout the 70s, and into the early 80s that the ability to predictably achieve osseointegration was established.

With the publication of Brånemark's 15-year longitudinal study in 1981,[1] a new era in dentistry was born. Far-reaching thinkers in periodontics, prosthodontics, oral surgery, and biomaterials never looked back. While function was initially the primary focus of the osseointegrated implant restorations of the early 80s, practitioners and their patients immediately demanded prostheses that also fulfilled their esthetic expectations. Consequently, in 10 short years, and with much energy and thought by many talented clinicians and researchers, the state-of-the-art restoration evolved from Figure 1A on the left to Figure 1B on the right to the single tooth implant-supported restoration (Fig. 2).

As with all of dentistry, the attainment of an ideal result is built on a solid foundation. Although good technical skills are imperative to produce optimum esthetics, those skills will be for naught if they are not based on sound biologic principles.

Proper diagnosis and treatment planning are the base of the pyramid. Stage I surgery, along with hard and soft tissue augmentation procedures, is the next layer of the foundation, with Stage II surgery, abutment selection, and tissue sculpting of the sulcus still higher on the pyramid.

Achieving the ultimate cosmetic result then becomes an even more subtle endeavor. Crown contours and natural anatomic form, and preservation or reconstruction of the interproximal papilla and associated tissues are among the critical elements involved in achieving esthetic success.

Each step builds on the other. Each step has its special nuances, and understanding each nuance is invaluable when attempting to produce the ideal. The following articles discuss the myriad factors involved in maximizing the esthetics of an implant-supported restoration.

Diagnostic Methods and Treatment Planning

The optimal esthetic implant restoration is best achieved by working backwards. Originally implants were inserted where the most bone was available, and then the prosthesis was adapted to the implant placement. This often produced restorations that left much to be desired cosmetically (Fig. 3).

Esthetics begin by conceptualizing the ideal final implant restoration. The placement of the implants at Stage I surgery must then be guided by these ultimate esthetic considerations.

A diagnostic wax-up is developed that simulates an ideal restoration in harmony with the patient's mouth and with the rest of the dentition. The wax-up will provide a basis for subsequent implant placement as well as the soft and hard tissue requirements that will result in an esthetically pleasing restoration.

The initial diagnosis must include a thorough soft tissue examination. The gingival unit is a key factor in anterior esthetics of both the natural dentition and of implant-supported restorations. The marginal radicular form, the interdental tissues, and the color and texture of healthy keratinized gingiva are essential ingredients in an esthetic soft tissue to tooth or implant relationship.

Gingival form and marginal height of each tooth must be considered, as well as root eminence and cervical width,

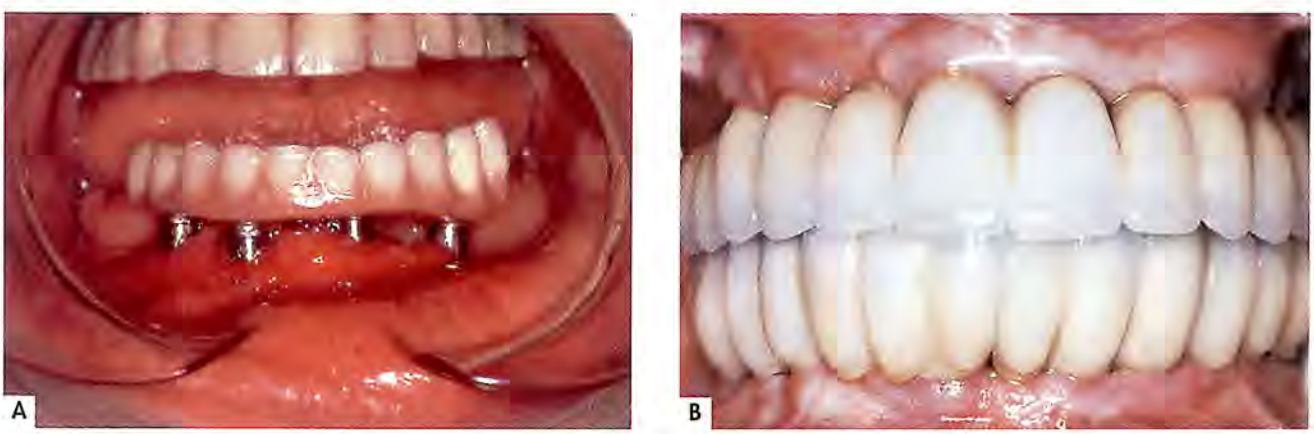

Figure 1. *A*, Original Brånemark-type prosthetic restoration. *B*, Maxillary implant-supported cemeted esthetic restoration.

IMPLANT DENTISTRY IN THE 21ST CENTURY — COMMENTARY

Figure 2. Single tooth implant restoration in the cuspid position.

Figure 3. Implants poorly positioned and without regard for prosthetic requirements.

which are extremely important in developing an appropriate interproximal papillary relationship.

A determination must be made as to whether any hard or soft tissue deficiency present is significant enough to require treatment. If a deficiency exists, at what point should the correction occur (at or prior to Stage I or Stage II surgery), and should a hard tissue or a soft tissue graft be utilized?

From the diagnostic wax-up a surgical template is subsequently fabricated. This template should minimally provide the surgeon with either the buccal or lingual incisal edges of the teeth to be replaced, as well as their mesiodistal dimensions. Although they can be produced by a laboratory and become extremely sophisticated, omnivac templates for the partially edentulous patient are often more than adequate.

In addition to its use in the surgical phase of implant placement, the template is utilized in obtaining diagnostic radiographic information. Besides periapical and panorex x-rays, a three-dimensional analysis of the potential implant sites utilizing a CT scan is invaluable.

The patient's medical and social history and treatment expectations, along with the diagnostic information that has been acquired, are evaluated and utilized to develop a treatment plan. This consists primarily of a sequence of therapy reflecting both the surgical and restorative steps required to produce an optimal esthetic result. The treatment plan must, however, be subject to reevaluation and modification as circumstances necessitate.

Dennis Tarnow, D.D.S. and Paul Fletcher, D.D.S.

Reference

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