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Evolving Dental Technologies...: A New Level of Patient Care and Communication

Drs. Ronald E. Goldstein and David A. Garber

Advances in technology are affecting every aspect of life in the 21st century, and dentistry is no exception. From diagnosis and treatment planning to all areas of dental treatment and global communications, technology is enhancing the level of patient care, practice efficiencies, and professional/patient education.

In order to learn more about how a broad range of technologies can be implemented into dental practice, and how these technologies are shaping the profession now and in the future, Dentistry Today conducted an exclusive interview with 2 dentists—Drs. Ronald E. Goldstein and David A. Garber—who are internationally renowned for their incorporation of technology into every aspect of their practice and global educational activities. Dr. Goldstein is a professor at 3 dental schools and teaches aesthetic dentistry worldwide. He is a contributor to 10 published texts, author of the text *Esthetics In Dentistry* (B.C. Decker), and co-author of other texts, including *Bleaching Teeth*, *Porcelain Laminated Veneers*, *Porcelain and Composite Inlays and Onlays*, *Complete Dental Bleaching*, and *Imaging in Esthetic Dentistry* (all published by Quintessence Publishing Company). His best-selling consumer book, *Change Your Smile* (Quintessence), now in its third edition, has been read by more than 1 million people and has been translated into 6 languages. Dr. Goldstein produced more than 70 consumer-oriented programs on all phases of dentistry for the popular television feature *P.M. Magazine*, and his video, *Anterior Fixed Restoration Esthetic Principles*, made for the American Dental Association, was winner of the 1982 John Muir Medical Film Festival Award for Dentistry. He is co-founder and past president of the American Academy of Esthetic Dentistry.

Dr. Garber is a graduate of the University of Pennsylvania School of Dentistry, received specialty training in periodontics and fixed prosthodontics, and then served as Director of crown and bridge and the Director of the group clinical practice. Among current academic positions, Dr. Garber holds a dual appointment at the Medical College of Georgia School of Dentistry in Augusta as professor in the department of periodontics and as clinical professor in the department of oral rehabilitation. He also serves on the faculty of Louisiana State University in New Orleans, where he is clinical professor in the department of prosthodontics. At the University of Texas in San Antonio he is adjunct professor in the department of restorative dentistry. His list of publications is extensive and includes co-authored texts on aesthetic dentistry, bleaching, porcelain laminate veneers, and aesthetic inlays and onlays. He served on the boards of the American Academy of Esthetic Dentistry and the American Academy of Fixed Prosthodontics.

Drs. Goldstein and Garber both practice at Goldstein, Garber & Salama in Atlanta, known internationally as “Team Atlanta.”

DT: How would you summarize the impact that technology has had on the dental profession?

Dr. Goldstein: Technology has revolutionized aesthetic and restorative dentistry. I have been involved since Jack Preston and I helped produce the first “high-technology conference” in 1985. Later I helped organize the first technology show for the Thomas P. Hinman Dental Meeting, which also encouraged manufacturers to discuss their projects with each other. During the early 1980s most technology was stand-alone. It has taken more than 2 decades to get major equipment makers to integrate technologies and make it easier for offices to work in a more efficient manner.

To perform a diagnosis today without using available technology, such as an intraoral camera, digital radiography, and KaVo’s DIAGNOdent, would be like using an old Brownie film camera in a digital camera world or driving a Model T in the Indy 500. Technology has made implantology into a predictable science. We no longer have to rely on our best guesses! In my opinion, 3-D imaging technology like the i-CAT (Imaging Sciences) will certainly become standard diagnostic fare in years to come. It helps take the guesswork out of knowing whether you will have sufficient bone to place the implant or how to avoid severing an important nerve or perforating the labial or lingual plate. In addition, the NobelGuide (Nobel Biocare) and similar technology (Sim-Plant [Materialise]) have added to the success of implant placement. It speeds the process and leads to more rapid healing and reduced patient time in surgery.

DT: How has technology impacted communication among dental colleagues, both nationally and globally? How has your office utilized technology in this area?

Dr. Garber: Technology has impacted communication among dental colleagues by allowing us to rapidly share the newest development in any particular field without waiting for it to be published months, or sometimes years, later in a journal. Today, Internet-based sites such as DentalXP.com help dentists who might have seen a particular speaker demonstrate a technique or technology but remain a little apprehensive about just how to do it. Sites such as this allow colleagues to access that very lecturer regularly and rapidly and to review just that one aspect of a lecture. It may be in the form of review of a 2- to 7-minute video clip, a 14-minute lecture, or an interactive panel on just how, why, and when to utilize that technology. They could then review it literally 5 minutes before going in to do the procedure. This sharing of information is absolutely an essential component of dentistry today, as there is simply too much information coming out at an exponential rate that has to be collated and synthesized into clinical relevance. Internet sites such as DentalXP allow dentists not only to learn from one of the experts, but utilize the “blogs” or forums that get direct answers, sometimes in video form, specific to the problem at hand.

In the more traditional sense, digital radiographs, digital photographic images, CAT scans, and reformatted scans (SimPlant) all allow us to share relevant information instantly among doctors,



Figure 1. Dr. Garber with a microprocessor-controlled anesthesia delivery system (*The Wand* [Milestone Scientific]).

specialists, and practices literally across the world. This provides patients in one office with the combined intellectual acumen of a group of experts in a particular field, perhaps a whole continent away. On any given patient a plan of treatment can be proposed, and digital images, consultation notes, virtual 3-D models, and radiographs can be uploaded to a specialist before a consult for evaluation. It's a great time-saver and has the ability to get 2 clinicians looking at the same diagnostic information to help interact, often simultaneously, on the Internet and bring their perspectives (and differences!) together to come to a cohesive sequential treatment plan.

With other new technologies such as Invisalign (Align Technology), where a patient's models and mouth are scanned, the teeth are digitally 3-dimensionally repositioned and a sequential series of trays is made to move the teeth, as decided upon in the digital treatment planning. This has certainly brought the realm of orthodontics to a host of new patients who previously would not contemplate metal brackets and bands. Similar technologies will in the not-too-distant future eliminate the wet dental laboratory—digital models, the waxing, stereolithographic modeling, or virtual framework waxing and the production by CAD/ CAM (Brontes Technologies.)

Surgically today we use platelet-rich growth factors (PRGF [BTI]) or platelet-rich plasma (PRP [Harvest]) obtained by spinning down or centrifuging the patient's own blood and separating out the relevant growth factors. This provides for more rapid healing and definitively improves and accelerates soft-tissue healing, all key issues during implant surgery, crown lengthening, sinus lifts, bone grafting, etc. In those cases where patients require a graft but do not want to have their own soft or hard tissues harvested, or do not have sufficient available tissue, allografts and xenografts are combined with the PRGF to potentially open a whole new realm of possibilities.

Lasers continue to be useful in different aspects of soft-tissue surgery, and are slowly evolving into hard-tissue surgery, bone, and tooth material.

DT: What technologies have you found to be particularly useful in your practice, and why?

Dr. Goldstein: From my standpoint, CAD/CAM technology will lead to superior fit and aesthetics in all-ceramic crowns, such as Procera (Nobel Biocare) or Cercon (DENTSPLY), and has also provided us with the type of aesthetics our patients really want. Nanotechnology will also lead to longer-lasting and better-looking composite restorations.

The new generation of imaging systems is so exciting that I cannot wait for the next major leap in this technology, such as holographic-type 3-D images (SimPlant) that can truly replace the diagnostic study models and help provide the images we need to communicate with the patient. It will also help us treatment plan difficult space problems with more accurate results, as well as help us determine if our vision of the final result will actually match the patient's vision. The next generation of aesthetic imaging programs will surely have the ability to predict the size and shape of teeth according to the Golden Proportion, and thus be able to show both patient and dentist the best aesthetic result possible.

Being a visionary also means predicting the future for our patients. I try to do that now by using the intraoral camera on every new patient to help discover tooth defects not seen by the 2.5x magnification loupes that most dentists normally wear. We enlarge the view of the tooth up to 20x and also use the surgical microscope (Global Surgical) to see even more detail.

I also use extraoral digital photography on every patient to help diagnose, treatment plan, and document so many different steps or findings that notes in the chart cannot accurately describe. Another major advantage to using digital extraoral photography is to know you have accurate photos of the patient before any treatment is started. Good photographic records can help protect a dentist from possible legal issues that may arise if a patient makes untrue allegations against the treatment received.

I would really hate to be without air abrasion. Rarely a day goes by that I don't use it both for very small pit-and-fissure caries without anesthesia, as well as for repairs to existing restorations. Air abrasion helps to obtain better bonds to tooth structure, especially if we are rebonding or placing veneers.

And where would we be without lasers today? Both soft-tissue and hard-tissue lasers will continue to be an important part of restorative and periodontal aspects of dentistry.

But what is really exciting is the potential use for what will be the new 3-D stereolithographic printers! Eventually, these futuristic printers will become in-house creators of specially designed instruments, appliances, etc.



Figure 2. Dr. Maurice Salama with the surgical microscope (G6 [Global Surgical]).



Figure 3. Dr. Goldstein with a caries-detecting laser (DIAGNOdent [KaVo]).

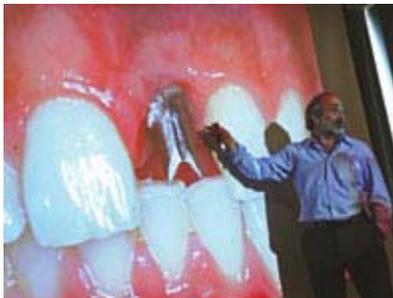


Figure 4. Dr. Garber in continuing education lecture, with high-tech projection.

DT: In terms of patient care, has technology resulted in a higher standard of care?

Dr. Garber: I believe technology has not only resulted in a higher quality of traditional dental care, but has also allowed the dentist to respond to a disease process and be proactive in the whole realm of differential diagnostics. Examples of this include the VELscope (LED Dental), which allows us to evaluate oral soft tissues for cancer, while a biophotonic scanner can now evaluate the patient's level of systemic antioxidants. Dentistry can then evolve to be more than a restorative modality and into the realm of a more holistic domain, which is so important with the oral-systemic link now definitively acknowledged and related to a person's overall well-being.

Some of the technologies are incredibly expensive, such as the i-CAT, but its value is not in question because it allows us not only to evaluate the amount of bone present 3-dimensionally using SimPlant, but also to evaluate the quality of bone (Hounsfield units). This allows us to then prognostically plan the placement of the implant through the reformatted CAT scan with SimPlant software, and then translate that information with Materialise technology into a surgical guide to clinically replicate the digital treatment planning. A less sophisticated and less expensive technology but similarly invaluable is the DENTSPLY Raintree Essix alginate mixer, which provides predictable, high-quality, bubble-free accurate impressions. Both have contributed inordinately to our clinical success.

One other technology essential to mention is the Piezosurgery device (Piezosurgery), which now allows us to do sinus lifts safely and predictably with little or no chance of perforating the membrane, as well as atraumatically extract teeth and obtain bone grafts.

These are 3 items that I wouldn't choose to be without—in fact, we couldn't practice dentistry at the same level without them!

In the same vein, the tried-and-tested but evolving electric handpiece, such as the Brasseler/NSK unit, in routine dentistry such as a conventional crown preparation provides an accelerated and yet a more precise process, allowing you to reduce rapidly with water coolant when necessary and then reduce down to a slow rpm and finish very accurately with direct vision with no water.

Dr. Goldstein: Cone beam technology (i-CAT) has been extremely useful in our office from the very first day we had it installed. I recall the first day we used the i-CAT, where we found what appeared to be a clogged carotid artery and immediately referred the patient to her physician. Just as important was the patient who had long-standing pain in her nasal/zygoma area, and her physician had been unable to discover the cause despite numerous tests. They had even suggested exploratory surgery, but before doing additional tests she came to our office. We took digital x-rays of the area and found what appeared to be perfectly normal-looking teeth and a 6-month-old root canal in the right maxillary cuspid. Next, I recommended a CAT scan with the new i-CAT to see if it could reveal what no other test had. To our amazement, the 3-D technology showed that what appeared to be a root canal in the maxillary right cuspid (done by a previous endodontist) had actually resulted in the perforation of the root toward the lingual, which was the cause of her pain. Despite a series of surgeries and retreatments with an endodontist/oral surgeon, the tooth had to be extracted, complicating her full maxillary arch reconstruction.

Another patient presented to our office with facial pain, and we were able to discover through 3-D technology that her implant (placed by an outside dentist) had fractured the zygoma, causing the pain, which could not be seen in 2-D radiographs.

Dental diagnosis has never been the same for us since implementing the intraoral camera (SOPRO, Kodak, and RF Systems). This technology has allowed us to identify present pathology as well as help us predict potential problems by discovering microcracks, improperly fitting restorations, and hidden caries. I am certain that by using this technology we have helped our patients obtain the optimal oral health they seek and are entitled to.

DT: What advice would you give to dentists who have not embraced new technology?

Dr. Goldstein: There's a new breed of patients today. They're not as loyal and they're much more "media savvy." So you must invest in yourself if you want not only to keep up with the times, but also to meet your patients' expectations of getting optimal care. The most frequent question I hear from my new patients is, "Why hasn't my dentist seen this before?!" Dentists who do not embrace new technology will continue to lose their patient base.

DT: Have you seen any "negatives" in the push for new technology?

Dr. Goldstein: One of the saddest things I have seen is the large number of companies that have gone out of business due to lack of sales. By its nature, technology for any company is an evolving business that has to support ongoing research. Unfortunately, when we first started the emphasis on new technology in the 1980s, there were simply not enough dentists who were interested in embracing new technology. In addition to the financial investment required, there is always a significant learning curve for both dentists and staff. Therefore, this has been a deterrent for both dentists and staff who have resisted change.

I recall one very good dentist who told me he was retiring early rather than invest in new technology. He felt his patients deserved the best.

DT: What do you foresee in the next 10 years in terms of technological advancements and their impact on new professionals?

Dr. Garber: I don't believe the next 10 years will see a dramatic revolution in terms of concepts, but a definite evolution will continue along an exponential curve as technology becomes more sophisticated, user-friendly, and readily available to the entire dental marketplace. We believe the different technologies are becoming routine in the dental office, thereby elevating everyone's standard of care not only relative to the reconstructive aspect of dentistry, but also in the preventive arena, with the opportunity to evaluate the oral-systemic link along those bases. I believe that as high-end products such as the i-CAT continue to come down in initial cost outlay, they will add to the standard of care over the next 10 years, and dentists will find that they had no idea just how much they were missing in terms of diagnosis.



Figure 5. Drs. Garber (center) and Salama (right) performing implant surgery aided by anesthesiologist Dr. Howard Odum (left) with a SimPlant planning image in the background.



Figure 6. From right, Drs. Salama, Goldstein, and Garber consulting with ceramist Dr. Christian Coachman.



Figure 7. Team Atlanta Lab's dental substructure designer, Mark Hamilton, reviewing a computer-aided framework design.

*Disclosure: **Drs. Goldstein and Garber** have been consultants and/or principal investigators or co-investigators in numerous clinical and laboratory studies sponsored through contractual relationships with different corporations and/or universities, which include Nobel Biocare, Straumann ITI, Implant Innovations, Friadent, Brasseler USA, Komet, 3M, Bisco, Biora, Siemens, Premier, Den-Mat, Shofu, ProDentec, Panasonic, Minolta, Kodak, Sony, Vident, DENTSPLY, Hu-Friedy, Moyco/Union Broach, Masel, Global Surgical, Materialise, Dentalxp.com, Imaging Sciences, Sunrise Technologies, Biolase, and Belmont.*