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What's New in Implant Dentistry?

From examination to surgery, the implant category has seen major advances

Michael Sonick, DMD

Dentistry recently mourned the loss of Professor Per-Ingvar Brånemark, inventor and developer of the modern era of implant dentistry. Not a day goes by when implant surgeons do not think of his pioneering work and the gift he gave to dentistry and to their patients. Thanks to Professor Brånemark, implants, which were deemed experimental and relegated to the fringes of conventional dentistry 30 years ago, are today routine and placed in offices worldwide.

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Since he first introduced his implant technology to North America in 1982, much has changed. The profession has seen the advent of altered implant surfaces, cone beam computed tomography (CBCT) scans, growth factors, guided bone regeneration, membrane development, piezosurgery, immediate loading, and routine use of computers and the Internet in dentistry. All these technologies have led to differences in the way dental services are delivered and performed. However, the basics have remained the same. Homo sapiens have remained relatively unchanged for thousands if not millions of years; epithelium still migrates at the rate of 1 mm a day; sutures are left for 7 to 14 days; bone still regenerates at the rate of 1 mm a month; and extraction sites still take 3 to 6 months to fill with bone, depending upon the size of the defect.

Imaging Advances

The basic requirements for the comprehensive care and treatment of patients are unchanged. Comprehensive examination followed by a diagnosis remains the *sine qua non* of dental and medical care. A carpenter does not build a house in the absence of an architectural plan. Similarly, a dental surgeon requires a treatment plan based upon an adequate examination and diagnosis prior to performing dental implant surgery.

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Focus On

With the advent of the CBCT scan, the clinician now has the ability to accurately diagnose the quantity and quality of bone prior to implant surgery. In-office CBCT units are now becoming the norm in busy implant practices. In addition to improving diagnostic acumen, CBCT technology is ideal for patient education. This allows the patient to become a vital component of the treatment-planning process. Without the benefit of a CBCT, patients were often told that they could not receive dental implants due to inadequate bone. With CBCT technology, the practitioner can evaluate the position of vital structures, including the mandibular nerve, maxillary and nasal sinuses, adjacent teeth, and limits of the alveolar bone. Bone quality, which is often predictive of implant success and stability, can also be evaluated. Previously, surgeons operated at a disadvantage because the bony anatomy could not be determined pre-surgically. With the advent of the CBCT, surgeons can virtually plan cases, select implant sizes in advance, determine implant angulation, and understand if pre-implant bone regeneration is necessary. Patient safety is improved, because vital structures are identified three-dimensionally prior to surgical care. Patients are better informed pre-surgically, thus allowing shared responsibility between dental surgeon and patient. CBCT also serves as a critical patient education tool; on a computer screen, implant placement in the patient's "own bone" is visualized prior to care. Patients appreciate the ability to see their treatment in advance.

Improvements in Implant Design

The initial design of dental implants has also undergone changes since the 1980s. Originally, the cylindrical implants were tapered, polished titanium with an external hex. The success rate of these initial implants approached 94%. However, their initial stability was not always ideal due to their macro- and micro-geometric design. An additional concern was screw loosening, which often resulted in fractured screws and damaged implants, as well as increased patient visits and complications. The advent of tapered implants allowed for greater implant stability. This has led to a higher success rate, especially in poorer quality (eg, Type IV) bone, such as that in the posterior maxilla, which showed failure rates approaching 35% with the original machined titanium straight-walled implants.

Implant surfaces have also undergone a metamorphosis and are now uniformly roughened. Roughening creates a greater surface area, resulting in a higher percentage of bone-to-implant contact and an increased success rate of osseointegration. The success of immediate placement of dental implants into extraction sites, as well as immediate loading of dental implants, depends upon good implant stability. Changes in implant shape and surface texture have made these procedures more predictable, with success rates for immediate placement approaching that of a delayed approach—over 98%. Patients are well served because there is a reduction in the number of surgeries as well as treatment time, a win-win for both doctor and patient.

Surgical Innovations

Advanced dental practices frequently begin the implant procedure at the time of extraction. Preservation of bone at the time of extraction is critical in assuring implant placement in the proper position. The removal of teeth has become an atraumatic event, because the use of piezosurgery at the time of extraction enhances bone preservation. Piezoelectric surgery is a process that utilizes controlled 3D ultrasonic micro-vibration to cut bone tissues. Its unique design and cutting

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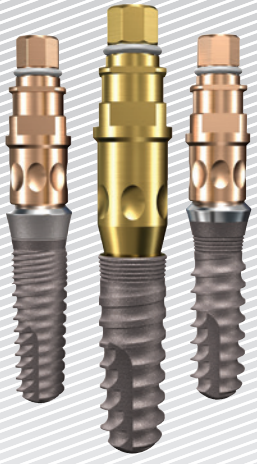

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action provides ultimate surgical precision and high intraoperative visibility, while the selective cutting action allows surgeons to cut mineralized tissue while minimizing trauma to the soft tissues. During tooth extraction, the piezosurgical unit is used to atraumatically separate the tooth from the alveolar bone, allowing complete preservation of the entire alveolus. Piezosurgery is also useful for ridge splitting, bone-graft harvesting, and sinus surgery. It has become an indispensable tool for atraumatic surgery.

"Changes in implant shape and surface texture have made procedures more predictable, with success rates for immediate placement approaching that of a delayed approach—over 98%."

Previously, some patients were told that they were not candidates for dental implants due to inadequate bone. Today, for patients healthy enough for in-office dental surgery, this is rarely the case. The primary rate-limiting factor in dental implant placement is bone quantity. Techniques are available to predictably regenerate bone three dimensionally. Procedures vary, depending upon practitioner experience and skill. Peer-reviewed literature documents a variety of surgical techniques for successful regeneration. These include guided bone regeneration, ridge splitting, block grafting, and combinations of procedures. A variety of dental membranes (eg, bovine, porcine, human, synthetic) predictably enhance bone regeneration when used with proper surgical technique. The use of growth factors—including the patient's own platelets (PRP, PRF, and PRGF), recombinant PRGF (Gem 21), bone morphogenic protein (Infuse®, Medtronic, www.infusebonegraft.com), and porcine amelogens (Emdogain™, Straumann, www.straumann.us)—are now commonly used to augment the quality and enhance the speed of bone regeneration.

Conclusion

The basics essential for predictable dental implant care include examination, diagnosis, treatment options, and treatment. Over the past 30 years of modern implant dentistry, technology has developed the tools to provide basic treatment with greater predictability and less treatment time for almost all patients who desire a return to health, function, and esthetics.

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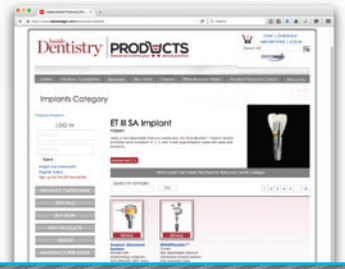

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