

CT-BASED DIAGNOSTICS AND SURGICAL GUIDANCE IN ORAL IMPLANTOLOGY

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Recent worldwide analyses of the growing dental implant market estimate that an increase in implant-based products will outstrip all other areas of dental devices and products. It is estimated that 40% of the western population is missing at least one tooth.¹ In the United States, roughly 10% of the population is edentulous, and every year, approximately two million Americans lose one or more teeth due to sporting accidents.¹

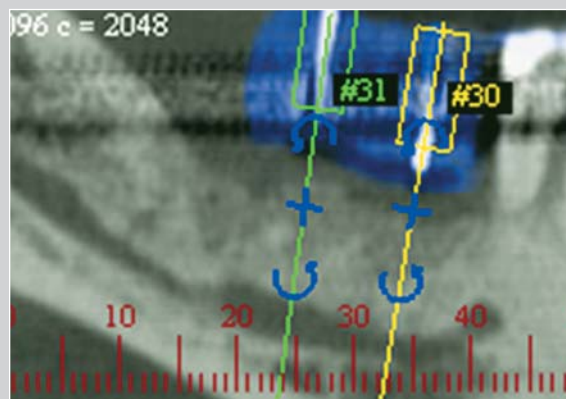


Figure 1. A Cone-Beam CT study was performed (ie, i-CAT, Imaging Sciences International, Hatfield, PA) to determine accurate implant positioning.

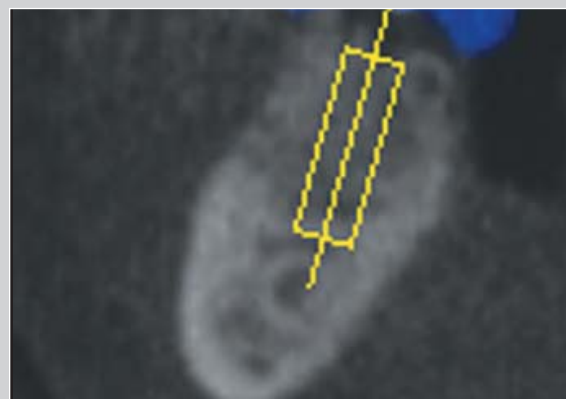


Figure 2. A radiographic guide was constructed using radio opaque restorative pins. These pins represented optimal, prosthetically driven access holes and trajectory for teeth #30(46) and #31(47).

According to a number of renowned professionals, in order to serve the American public well and in adequate capacity, many more practitioners should make the effort to become proficient in this area.² Universal proficiency in the field of oral implantology is, however, lacking. Many implants are malpositioned, with either inadequate angulations and/or distribution. Furthermore, the placement of a fixed partial denture (FPD) is contraindicated between natural healthy teeth; implants are the option of choice if adequate bone is present when restoring anything from a single missing tooth to an entirely edentulous mandible or maxilla.

One of the most common complications encountered when restoring the dental implant patient is the lack of adequate preoperative treatment planning. Over the years, numerous reports and preliminary clinical studies documented clinical complications with implants and implant prostheses.^{3,4} A recent Meta Analysis reported extensively on such complications. Therefore, as dental implants become an increasingly viable treatment option for replacing missing teeth, and the number of practitioners involved in oral implantology (specialists and generalists alike) continues to rise, preoperative diagnosis has become a critical issue. Placement of implants in aesthetic zones and/or critical anatomical regions that require precise consideration for implant trajectory, depth, and distribution further complicate the viability of these restorations.

The concept of using CT-based dental imaging coupled with radiographic guides has been advocated to further enhance the scope of the preoperative diagnostic information. This concept is gradually becoming evidence-based through review of recent preliminary clinical studies and case reports.⁵ These studies describe interactive imaging programs that allow CT studies to be used for planning and construction of surgical guidance templates, facilitating the safe delivery of dental implants at the time of implant placement. One such study demonstrated correlating evidence to imaging technology, demonstrating that the use of such technology before placement of single-tooth implants increased the efficacy of periapical plus panoramic images, with respect to the prediction of appropriate implant size, by a factor of 2.5.⁶

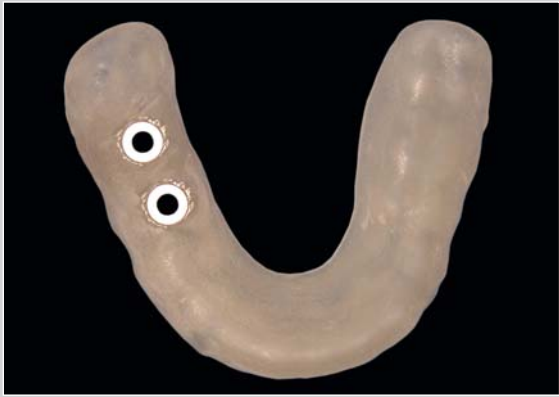


Figure 3. A three-dimensional reconstruction of the patient's anatomy was also created (ie, Implant Master, iDent, Hod Hasharon, Israel), and a surgical guidance template was designed and fabricated using precise drilling sleeves to obtain distribution and trajectory.

While the researchers studying these CT-based imaging and surgical guidance platforms' methodologies agree that more outcome-assessment research has a long-term value, in the meantime we must work together to optimize our patient's health. To that effect, the recent introduction of numerous associated Cone-Beam CT-based imaging systems and surgical guidance platforms are gradually taking our profession through key changes. We can expect these changes to yield substantial public health benefits (eg, more predictable outcomes, preservation of adjacent teeth, protection of critical anatomical landmarks, improved aesthetics and function) and have a major impact on the way we view and practice oral implantology (Figures 1 through 3).

References

1. Kalorama Information. Implant-based dental reconstruction: The world-wide implant and bone graft market [abstract]. 2005. Available at: <http://www.kaloramainformation.com/pub/1099235.html>. Accessed October, 2007.
2. Christensen GJ. New directions in dentistry. *Dent Today* 2006; 25(2): 106-110.
3. Perel ML. Throwing darts. *Implant Dent* 2003;12(4):267.
4. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications with implants and implant prostheses. *J Prosthet Dent* 2003; 90(2):121-132.
5. Parel SM, Triplett RG. Interactive imaging for implant planning, placement, and prosthesis construction. *J Oral Maxillofac Surg* 2004;62 (9 Suppl 2):41-47.
6. Schropp L, Wenzel A, Kostopoulos L. Impact of conventional tomography on prediction of the appropriate implant size. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2001;92(4):458-463.

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