Digitally guided implant surgery: Setting the bar higher

Prosthetically driven implant placement is considered the optimal treatment approach in implant dentistry. The planned definitive restoration determines the number, location and size of implants required to support the prosthesis. This approach can reduce the frequency of aesthetic, biological and/or mechanical complications. Although current trends are challenging the biomechanically based dogma regarding implant number and size, prosthetically driven implant placement remains a fundamental concept.

In the past, surgeons performed freehand surgery with or without analogue-generated surgical guides. Achieving optimal implant positioning required greater operator skill and experience. This approach also demanded a significant amount of time to fabricate study casts, diagnostic waxups and surgical templates. As the template was not coupled with anatomical information from radiographs, an open design was often needed to provide the surgeon with greater visibility and flexibility during implant positioning.

At present, several methods are available to facilitate image-guided implant surgery. Static guides include pilot, partial and fully guided template designs, and may be supported by bone, mucosa or the teeth. A study found that tooth-supported guides yield the highest accuracy and mucosa-supported guides exhibit the greatest variance[1]. Dynamic guidance offers real-time visualisation during surgery without the need for a restrictive drill guide, and may be performed using navigational systems or robotic assisted units. Both static and dynamic guided surgery offer advantages and disadvantages in different clinical situations.

Guided surgery requires the collection of digital information and incorporation of the data into a digital workflow. The virtual representation of the patient may be used for diagnosis, implant planning, guidance for implant surgery and fabrication of a provisional prosthesis. CBCT is now widely available and employed routinely by many implant surgeons. Although most dental practitioners do not use optical scanners in their office, the percentage of those who do is increasing every year. As an alternative, dental laboratories can employ 3D scanners to digitise stone casts for use in the digital workflow. Hundreds of companies now offer implant planning software with online training. Entry into the digital realm of implant dentistry has been facilitated by technological advances and standardised workflows.

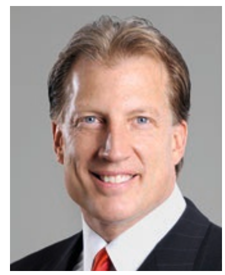
Some dental practitioners have looked to guided surgery as a means of incorporating implant surgery into their practice and compensate for inexperience; however, any practitioner that performs implant surgery should be prepared to change course and employ conventional methods to manage ill-fitting guides, inadequate space and other unexpected complications that may arise[2]. Guided surgery can make the experienced surgeon better, but it cannot make the novice a proficient surgeon. It takes an experienced surgeon to use guided implant placement effectively.

One obstacle to incorporating guided surgery into practice is the learning curve involved in adopting new technology; however, the clinician can outsource much of the process to a third party. Many companies and laboratories will merge the datasets between the computed tomography scan and the optical scan of the dentition (or dual scan template) and plan the implants virtually. The plan can then be reviewed by the dental practitioner for modifications and approval prior to fabrication of the guide. In the future, artificial intelligence may assist with virtual planning. Although this service will increase costs, the improved accuracy is often worth the higher fee. As more laboratories begin to offer guide fabrication, the increased competition will likely reduce the cost.

Many dental offices have purchased 3D printers to fabricate drill guides in-house. Although this can reduce costs compared to outsourcing their fabrication, additional time is required for designing, printing and constructing the guide and maintaining the printer. Future studies should investigate the time consumption associated with in-house guide fabrication to evaluate the time–cost relationship. For a busy implant practice, it may be more efficient to delegate this task to a third party and bill the added cost to the patient.

Systematic reviews and meta-analyses of in vitro and clinical studies have consistently shown that computer-generated surgical guides offer better control and precision in implant placement than freehand surgery[1,3]. Furthermore, research suggests that any degree of guidance yields better results than freehand surgery and increasing the level of guidance improves accuracy[1]. Although dynamic guided surgery has also been shown to improve accuracy in comparison to freehand implant placement[3], evidence is limited and further investigations are needed.

Technological advances have made guided surgery more accessible for clinicians and improved and streamlined the process. The mounting evidence of higher precision in implant placement is compelling. This approach can also improve the quality of implant restorations and reduce complications. The efficiency of chair time can increase significantly for multiple implant and full-arch reconstruction. Although it may not be necessary for every procedure in implant surgery, implant surgeons should consider incorporating this technology into their practice to improve patient care.



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References

1. Varga E Jr, Antal M, Major L, Kiscsatári R, Braunitzer G, Piffkó J. Guidance means accuracy: A randomized clinical trial on freehand versus guided dental implantation. Clin Oral Implants Res 2020;31:417–430.
2. Tatakis DN, Chien HH, Parashis AO. Guided implant surgery risks and their prevention. Periodontol 2000 2019;81:194–208.
3. Gargallo-Albiol J, Barootchi S, Marqués-Guasch J, Wang HL. Fully guided versus half-guided and freehand implant placement: Systematic review and meta-analysis. Int J Oral Maxillofac Implants 2020;35:1159–1169.