# The next generation of surgical guides

What makes a particular technology a new generation or even "the next generation"? This is an easy question to ask but a challenging one to truly answer with a solid definition. It is important to consider what represents a "new" or "next generation" technology to each individual because this concept is often more subjective than objective. Almost all industries use the phrase and apply it very liberally to many different advances and developments of a multitude of different technologies. A "next generation" should be better than what came before, but that is not always the case as new technology can present new challenges and unforeseen problems. In dentistry, next generation technology has typically involved how easy the product is to use, how fast it is to use, how well it works, or, if in the case of a dental process, a next generation product might reduce steps or combine them. This doesn't always mean that it's less expensive, but it is definitely a plus when it happens to be better and cheaper at the same time, although we cannot always have our cake and eat it, too.

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I think that in order to define a next generation of technology, it is important to first understand the limitations and problems with what is currently available. With any problem, one must first define it, if a solution is to be reached. If a product update solves current limitations or problems without introducing new ones, it could be considered a true next generation advancement.

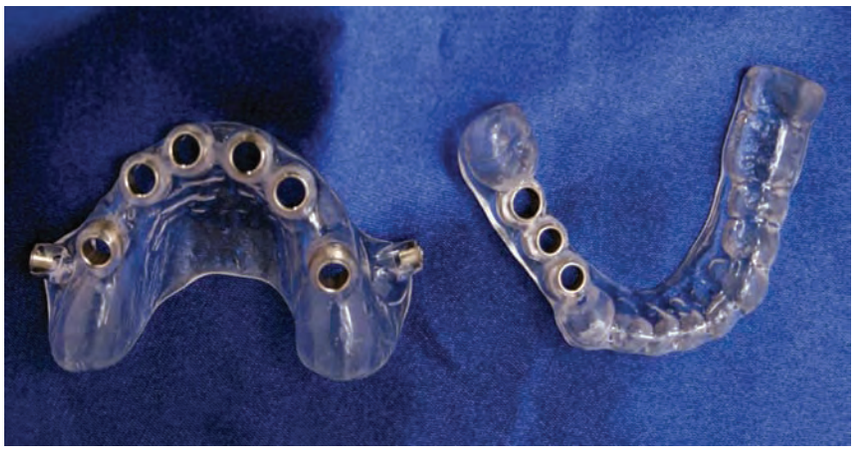

Figure 1: The Anatomage Guide on the right is a tooth-borne guide. The master sleeves are present and work with both insert sleeves or insert handles. The Guide on the left is a soft-tissue-borne Guide for fully edentulous patients. It also has anchor-pin guidance on the sides so that it can be temporarily anchored to bone with a bone screw for maximum stability

When Anatomage set out to design its CBCT-based surgical guide system, we decided that we wanted it to be truly a next generation surgical guide system that would shake things up. We felt that with our innovative capabilities, we could solve the current limitations and problems found in other systems. To do this, we first had to define the problems and challenges of the existing surgical guide technologies. This information was gathered by talking with clinicians who have used other surgical guide systems to come up with a list of the most common complaints. The top three complaints are: The surgical guide process is too difficult and has too many steps; the time involved in the process is too long from beginning to end; and, surgical guides are too expensive.

There are other complaints, challenges, and problems associated with using surgical guides, but these three are the most notable. These issues in other guide systems are problematic to such an extent that they are actually limiting the use of CBCT-based surgical guides. This limiting effect is found in those who already are using CBCT scans for their treatment planning, not to mention those who don't use CBCT yet. Those who use CBCT scans often report using the scans to diagnose and plan the case, but then perform the surgery free-hand without a guide, and only order a guide when the case is particularly challenging or demands exact precision.

We had to create a system that was easier, had fewer steps, took less time from beginning to end, and ultimately had a lower cost. No doubt, this would be a daunting task for our surgical guide system's development on many

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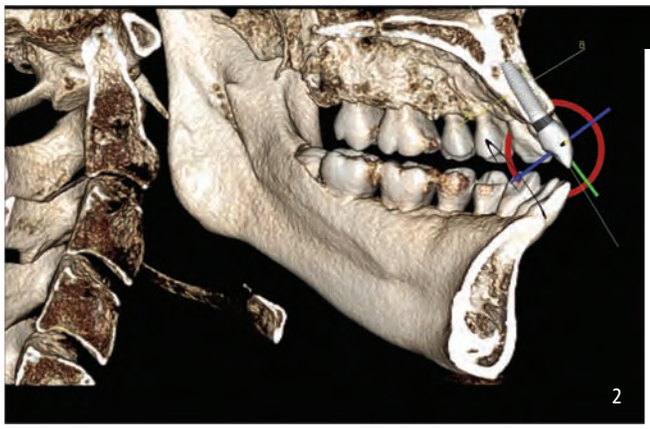

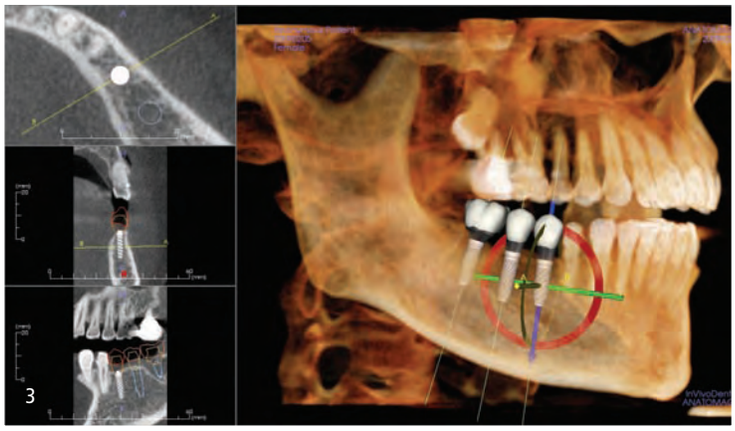

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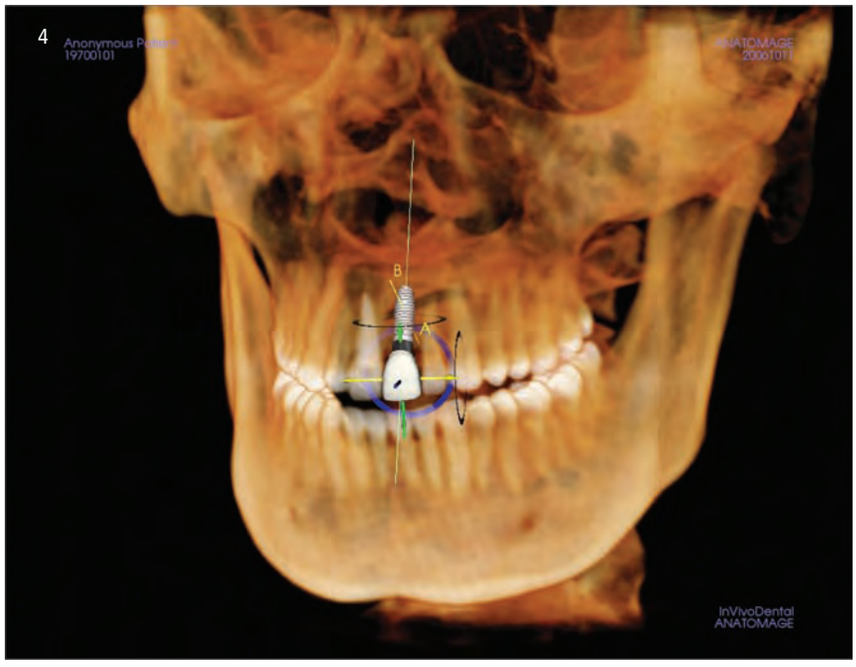


Figures 2-4: The implant planning portion of the Anatomage Guide system, which is preformed in the Invivo5 software. Invivo5 software allows treatment planning for implant size, diameter, position, depth, and abutment angulation, as well as final restoration position and size. With the end goal in mind, planning for restorations at the time of the implant planning greatly facilitates a better functional and esthetic outcome

levels, and its successful completion would be a true next generation surgical guide.

The surgical guide process itself needed to be examined. The prevailing systems have multiple steps, with the following list being an average or typical pathway of obtaining a surgical guide:

1. First, the patient is scanned by a CBCT machine for diagnostics and to determine if he/she is a candidate for the surgery.
2. Second, a radiographic stent is made that the patient wears while taking a second scan in order to translate the treatment plan to the manufacturing process. Sometimes, the radiographic stent is made first, and the patient is scanned only once while wearing it to limit the radiation, rather than taking two scans. Without a doubt, that is better for the patient, but the challenge of doing only one scan with these stent-based systems is that if the patient does not have enough bone or anything else that would preclude the surgery, that radiographic stent would still cost money and time, even though the guide processing would not go forward.
3. After the patient is scanned, the treatment planning is performed in the CBCT treatment-planning software.
4. Some software packages have elements within the software that add additional steps, time, and costs. These software steps are typically in the conversion of the DICOM data to other formats and other processes, such as segmentation and modeling of the region of interest. These steps usually involve the relay of data back and forth between the doctor and the surgical guide company and/or third party service companies. The steps take up more doctor time and add to the overall completion time.
5. Once everything is planned, the treatment file is sent to the companies, and the radiographic stent is physically shipped to the company along with stone models.

6. Assuming the scans and treatment plan followed the proper protocols, the guide is manufactured and then shipped back to the doctor. If there is a breach in protocol, in either the scan or the plan, the case could go back to step one if the problem was with the scan, and step three if the problem was in the plan.
7. Many doctors have an appointment to test the fit for tooth-borne guides, because another common complaint is poor final fit of the guides. Adjustments can be made if there is a slight problem with the fit, but if extensive, the guide no longer provides the precision that was intended.
8. Finally, the surgery is performed with the surgical guide.

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It should be mentioned that the above process is not specific to a particular system, but is rather an average or typical pathway of the dominant surgical guide companies on the market. Some systems have more steps and nuances depending on the case type, and some systems have less. An average turnaround time for the complete process can be about 2 weeks and extend to around a month to complete. The costs, just in terms of dollars, would typically range from $500-$1,000 per guide, not to mention the cost of chair time, staff time, and most importantly, doctor time. For challenging and complex cases where absolute precision is required, many doctors are willing to go through this process for the benefit of their patients. However, this long, challenging, and expensive process precludes many of the less complex cases from being planned with surgical guides. Making a simpler, quicker, and less expensive system would allow many more cases to go through the image-guided pathway of surgical guides. This would ultimately lead to better standards of treatment with more predictable and precise outcomes for all case types.

The Anatomage Guide process confronted the daunting processes of other systems head-on and created one much more straightforward. The process and steps in summary are: to scan the patient, scan the stone model, do the treatment plan, upload the data to Anatomage via the Internet, and get your guide back in the mail. The details and benefits of this process are as follows:

1. The patient is scanned only once, and a radiographic stent is not required. This solves the problems associated with having to fabricate or purchase a device before knowing if the patient is even a candidate for surgery. This also limits the total patient radiation exposure.
2. The stone model itself is scanned in the CBCT machine. This step replaces the need for a radiographic stent. The stone model scans are registered to the patient scans based on the patient anatomy, thus no fiducial markers are needed.
3. The patient scan is opened in the Invivo5 software and treatment planned. There is no need for conversions because Invivo5 opens DICOM data directly from any CBCT machine. There is no need to clean up, segment, or model the data. Implants can be treatment-planned immediately. Another major benefit is that Invivo5 also lets doctors virtually plan out the final restoration and abutment. This is a major advantage because the final restoration is the end goal of implant surgery in the first place and is taken into consideration from the start with the implant planning.
4. The files are simply uploaded to Anatomage via a secure login website. This eliminates the need to physically ship anything before the manufacturing process, which means that the case will start to be processed the day it is treatment planned and uploaded.
5. The Guide is sent back, and the surgery can be performed within 3 to 5 days after being uploaded to Anatomage.

The overall benefits of this process are many; however, the main challenges that were addressed and solved go back to our initial survey of the most common complaints about surgical guides prior to the advent of the Anatomage Guide. This new process greatly shortens the steps and technical difficulty of preparing guides. The turnaround time after the case is uploaded is either 5 days, or 3 days if the express option is chosen. This means that a patient can be scanned and treatment planned at the beginning of the week, and the surgical guide will be returned, and the surgery can be performed by the end of the week. This is a major advance from cases taking up to a month from the scan date to the surgery date.

The third major complaint concerning the cost was also tackled as the Anatomage Guide costs less than $300 per guide, and significantly reduces chair time and appointments, staff time, and doctor time.

Additional benefits, such as more esthetic 3-D renderings, faster software, crown-based planning, domestic support and production, all add to the overall success of this next generation surgical guide system. Without a doubt, the Anatomage Guide is a new generation of surgical guide that solves multiple problems found in current systems, all the while being less expensive.

Essentially, we can now have our cake and eat it too. IP

*This information was provided by Anatomage.*