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Computer-Aided Implantology

Everything you need to know to make guided implant surgery part of your practice.

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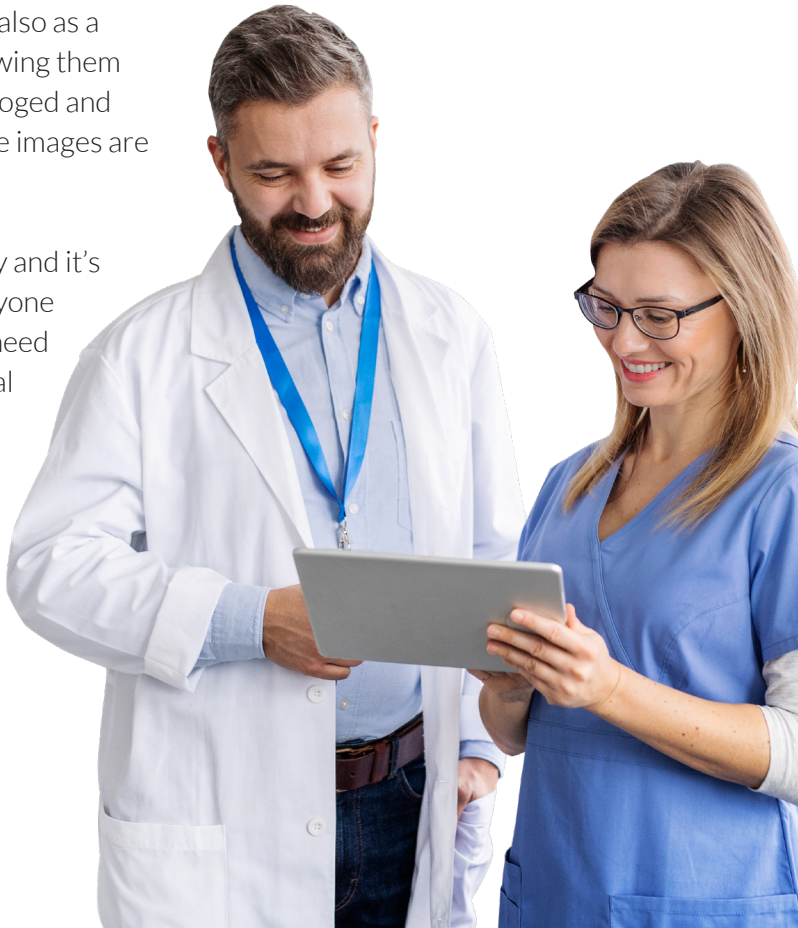
Introduction

If you're anything like me and are solidly entrenched in middle age, you've seen some amazing things in your life, and a lot of these are related to technology. It wasn't long ago when people had house phones, or that people used their phones to make calls, or you had to use a computer to get directions or, even a map. The technologies that drive our lives, that our children have always known, were the things of science fiction 20 years ago.

Although some would argue that life was more personal and relatable when there was less technology, there's no denying that technological advancements have radically improved many parts of our lives. Medical and dental applications are one of those areas.

I remember getting dental x-rays as a child (full disclosure, also as a young adult) and waiting for them to be developed and viewing them on a lightbox. I'm sure those x-rays were meticulously cataloged and retained in my file. Technology changed that, today all those images are captured digitally and stored in a digital patient record.



Now we are seeing another revolution in dental technology and it's the move from 2D imaging to 3D imaging. I know, not everyone has a CBCT, in fact, most doctors probably don't feel they need them, but I suspect many had the same opinion about digital x-rays not long ago.

CBCT technology has allowed dentists to visualize their patient's anatomy like never before. To see more and to make more informed and accurate diagnoses. And there are few treatment areas where CBCT has made more of an impact than implant planning.

In this paper, we'll cover the how and why of guided implant surgery and hopefully, by the end, you'll be able to decide if offering this service is right for you.

How it started, how it's going

The first evidence of dental implants dates to 2500 BC in ancient Egypt, and throughout history, there have been many creative techniques employed for replacing lost teeth. However, the first modern implant was placed in the 1960s.

$4.12 BILLION
2022 Market Value

6.3%
Annual Increase

$6.34 BILLION
2029 Market Value

Over the past decade, the implant market has exploded. According to Fortune Business Insights, in 2022, this market was valued at $4.12 billion and is projected to grow at 6.3% annually through 2029 to a total of $6.34 billion. This demand and growth are driven by an aging population and improvements in materials and technology that make dental implants more broadly available. Implant procedures were primarily performed by oral surgeons, but with advancements in technology, general practitioners are increasingly performing these procedures and now account for nearly 20% of all implant placements.

What is guided implant surgery?

Modern guided implant surgery, also known as computer-aided implantology (CAI), uses 3D imagery generated from a CBCT and specialized treatment planning software to develop a surgical plan that is then used to fabricate a surgical guide. Once fitted to the patient, a doctor can drill the implant sites without worrying about unwanted drill movement that can lead to improper implant placement. The guides can be configured to control trajectory and depth and are designed to be compatible with specific implants and instrumentation.

Guide types

There are three different types of guides that you're likely to see. Which type you should use is based on preference and your patient's diagnosis.

1. **Tooth supported** – These guides are effective for partially edentulous patients where the existing teeth are used to hold the guide in place.
2. **Mucosa supported** – This rests on the soft tissue and is used for fully edentulous cases. They are typically supported by anchor pins, and many cases can be performed completely flapless with this guide type.
3. **Bone supported** – This guide is supported by the bone for fully edentulous patients. The guide is made to fit after the seating area has been tissue flapped and, in some cases, can even be made to fit post-bone augmentation.

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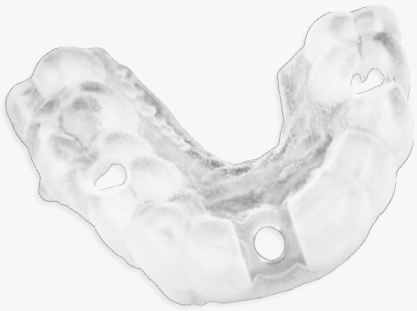
What are guides made of?

The materials used to manufacture a guide are just as important to the success of your procedure as the type of guide. Two types of guides are commonly found.

Thermoform

These guides are created by positive pressure thermoforming flexible plastic resin over a 3D-printed model created from the patient's intraoral scan. Thermoform guides are effective for nearly all procedures, especially those with multiple implant sites close together. These guides also provide increased customization, such as allowing irrigation windows to be added.

3D Printed



These guides are less expensive than thermoform and are the ideal choice for simpler procedures. Created using a bio-compatible resin, these guides don't require a separate model prior to fabrication, hence fewer materials are used.

What makes guided surgery a better option than freehand?

Many doctors currently performing implant surgery will use information from 2D x-rays to determine the treatment plan and then will perform the implant surgery freehand. This technique works quite well and has an extremely low failure rate when performed by a doctor with the skills and experience to execute it. It is also most effective when the implant procedure is simple and there are no complications related to the placement site or bone density. Many doctors who use surgical guides will also perform some implant procedures freehand. Some of the benefits of guided surgery include:

1. **Lower risk of failure** – As stated above, the failure rate in dental implantology is very low, but freehand procedures are three times more likely to fail than guided.
2. **More accurate diagnosis and treatment plans** – Since guided implant surgery starts with a CBCT scan, you can get a much more detailed picture of your patient's anatomy, which can help create a more accurate treatment plan.
3. **More precise implant placement** – Although freehand implant surgery can safely be performed for simple procedures, the risk associated with multi-site dramatically increases, these more complex surgeries are the ideal candidates for a guided solution. Studies have shown that using a surgical guide provides more accurate placement than freehand.

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How does digital implant planning work?

We've talked a lot about surgical guides but have only touched briefly on the treatment-planning aspects, which is really what makes this type of implant procedure so effective.

To get started you'll need three things.

1. A CBCT scan of your patient
2. A physical or digital model
3. Software to perform your treatment plan

There are several different software solutions available, and the price will vary. Here are a few things you should consider when selecting software.

1. Is the software compatible with your scan file? If you're relying on software that came with a specific scanner, they often will only accept files from that scanner. If you will be working with files from multiple scanners, this could be an issue.
2. Does it have the features you need? Many software products, including those which often come bundled with CBCT devices, will be focused on image capture and may have a limited diagnostic feature set. Make sure you've gotten a comprehensive demonstration or better yet, a trial version.
3. Is it easy to use? Not all treatment planning software is created equal. Some may be powerful but difficult to use. If you plan to make guided surgery part of your implant workflows, make sure you select software that will allow you to work efficiently.
4. How much does it cost? There is a lot of variability here with products ranging from free to costing thousands of dollars. We recommend evaluating multiple options to ensure that what you're buying will be worth the investment.

We've covered things that need to be considered when selecting treatment planning software, but what if you aren't familiar with how to perform treatment planning using a digital solution? Fortunately, there are services that can help you do this. Many of the companies that provide surgical guide fabrication also provide consultation services. These services are sometimes included with your guide orders and can be helpful particularly for doctors who are just getting started with this type of procedure, or for more complicated surgeries.

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A few thoughts on surgical guides

As with planning software, not all surgical guides are created equal. As a doctor, you will have a wide range of options available with a wide range of price points. From in-office 3D printing to local dental labs, to national specialists, understanding what the variables are can help you understand what's best for you.

- **Types of guides available** – Companies can offer either thermoform or 3D-printed guides or sometimes both. In most cases, either type can be used, but some procedures are better suited to one or the other. 3D-printed guides are almost always less expensive.
- **Materials and equipment** – The biggest part of the costs of manufacturing are related to the costs of the materials and equipment. To keep costs down, manufacturers will try and save money on 3D printers and thermoform equipment as well as the resins that are used. That's not to say that less expensive options will cause problems with the surgery, but with more complicated procedures, a higher level of guide quality may make the surgery easier to perform.
- **Options and support** – As you start evaluating different manufacturers, you'll see that certain features are not part of the base price. Many manufacturers have additional charges for depth control and multi-site implants. Also, when things go wrong or if you have a question, the company must offer the support you need.

What do I do if I don't own a CBCT?

This is probably the most common question when dentists decide whether to perform guided implant surgery. With high initial costs, unpredictable insurance reimbursement, and a significant technical learning curve, buying a CBCT might not be easy. Here are a few of the alternatives that we've seen practices use:

- **Outsourcing to an imaging lab** – This is the most straightforward option. Imaging labs have the equipment and technical knowledge to deliver the scans you need and can scale to meet your workload. It's important to note that the lab may have multiple scanners from different manufacturers, so you should check to ensure your software is compatible.
- **Partner with another practice** – This is another common option. It can provide many of the same benefits as an imaging lab, but likely with less scalability, but it can also be the basis of a mutually beneficial referral relationship.
- **Become part of a DSO** – Although significantly less common, becoming part of a Dental Services Organization (DSO) can give you access to shared resources, like CBCTs without investing in equipment. There are likely several other financial and business decisions that will need to be considered before choosing this option.

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Conclusion

When it comes to introducing a new service to your patients, there's a lot to consider and that is certainly the case with guided implant surgery. With continued strong demand, being able to offer this service could be a driver of growth and a source of differentiation for your practice. As the technology and methods have matured, several paths will allow you to provide guided surgical treatments with minimal upfront costs.

About Osteoid

Previously Anatomage Dental, Osteoid has been a leader in 3D imaging software and services for dental and medical applications. Our Invivo software is trusted by thousands of dentists, radiologists, orthodontists and surgeons who regularly work with 3D imaging as part of their practices. Osteoid also provides the advanced Invivo Guide surgical guide service. Invivo Guide delivers top-quality guides as well as expert consultation and support solutions all for a competitive fixed price.

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