

The nuances of 3-D Imaging: Bone density

By Dr. Alan A. Winter, DDS, i-dontics president, chairman and founding partner

This is part one of a two-part series. The next part of the series will appear in the November issue of Implant Tribune.

Whether we embrace the latest technological advances or sit back waiting and watching for changes to “take hold” before incorporating them into our dental practices, the age of 3-D imaging is altering the face of dentistry...and there is no turning back. Dentistry is careening toward evidence-based proofs of concepts. We now talk about treatment outcomes. Predictable results. Standards of excellence versus standard of care. And while most are aware of 3-D dental cone beam scanners, many find few reasons to avail themselves and their patients of this breathtaking technology on a regular basis. Like it or not, this is about to change.

The reasons to take a CT scan are apparent:

1. What is the bone height between the mandibular ridge and the inferior alveolar nerve?
2. How much bone is under the maxillary sinus?
3. Is the impacted third molar in close proximity to the nerve?
4. What is the magnitude and exact location of an intraosseous cyst?
5. Is there maxillary sinus pathology that would affect the outcome of a sinus graft?
6. What is the exact location of an impacted canine or supernumerary tooth?

These are only some of the obvious benefits that can be derived from 3-D dental imaging. But there are other, more subtle ones. The purpose of this article is discuss some of the nuances and benefits that make 3-D imaging superior to 2-D dental X-rays with respect to patient care, predictable results, and optimum treatment outcomes. Part I deals with bone density.

Bone density

Bone density has been described in various degrees of hardness from Type I being the densest to Type IV being the most radiolucent and least dense. This soft bone is often found, but not limited to, the maxillary tuberosity area. And while some studies have described poorer implant results in Type IV bone, problems can result from hard, dense, Type I bone. Figure 1 demonstrates that while there are many lucent areas in this patient's mandible, the bone is more radiopaque in the area of the mandibular left incisors, the site where additional implants are to be inserted.

Many interesting facts may be observed in Figure 1. Two observa-

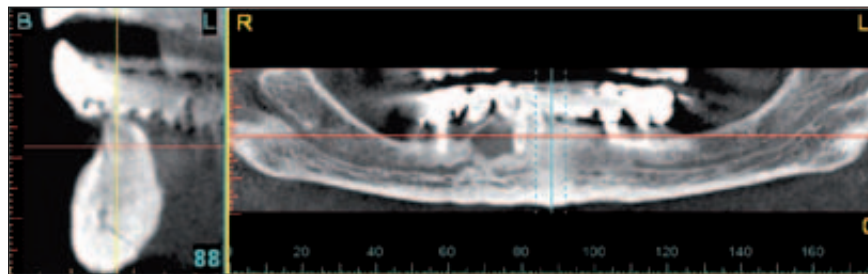


Fig 1. While a variety of bone densities are apparent in this panoramic image, the bone in the anterior region is particularly dense. This is further evidenced in the cross-section through the 25 site. Also note the infection in the right premolar area and the extent of the nerve branching anterior to the mental foramen.

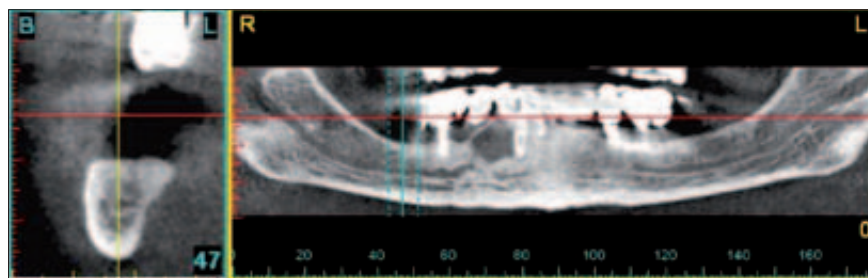


Fig 2. Note the bone in the same patient in site #31. The bone is not as dense as the anterior bone and the nerve is only a few millimeters below the crest. If the decision is to insert an implant in this site, the technique must be adjusted to account for soft bone that is easy to penetrate.

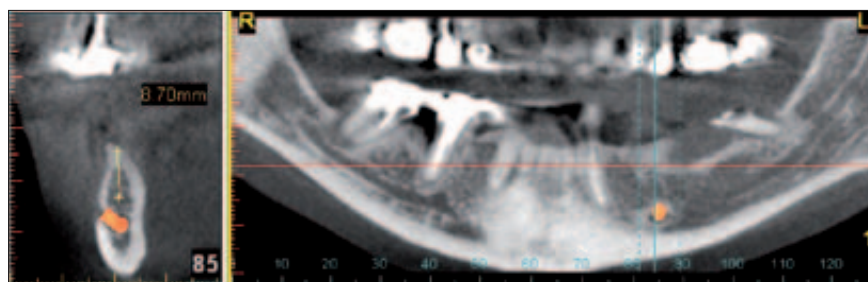


Fig 3. Note the thick lingual bone that continues to the inferior border of the mandible and then wraps around onto the buccal bone and stops at the mental foramen. The thick cortical bone can also be noted on the narrow alveolar crest.

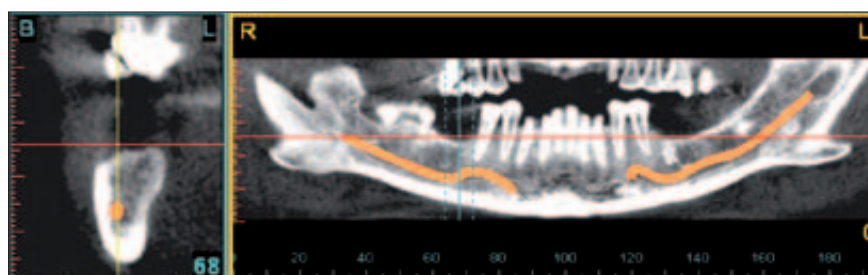


Fig 4. Note the thick buccal cortical bone that extends to the inferior border of the mandible. This will not affect the implant placement. This is an example of when a CT scan demonstrates that no problems should be encountered when inserting implants.

tions that can easily be seen are the large radiolucency distal to tooth #27. This was a large infection that had been degranulated and filled with a bone graft. Healing appeared poor in this area and the site was deemed unsuitable for implant insertion. In addition, it should be noted that significant branches of the inferior alveolar nerve extended anterior from the mental foramen.

Note the cross-section – slice #88 – attached to panoramic image in Figure 1. This slice passes through the site where #25 had been. The bone is so dense it almost appears “white” on the image. This is significant for a variety of reasons. The most important reason is that dense bone may be difficult to penetrate with drills designed for implant surgery rotating at slow RPMs. The harder the bone, the

more heat is created, and increased heat increases the risk of cell death that may affect bone healing. When faced with Type I bone, it is prudent to advise the patient that it exists, that the surgery may be more difficult than expected, and there may even be a greater risk of implant failure due to this anatomic entity that can easily be observed on the cross-sectional view of a 3D scan. While not desirable, a high speed drill was needed to create the osteotomy in this case due to the bone density. Because this was discussed with the patient prior to surgery, the patient was prepared for complications that could result from this procedure.

Of further interest in this image is that the lingual artery inserts in two locations: just above the genial tubercle and right below it. While this

lingual artery is less than 1mm in width and poses no hemorrhagic threat if severed, it is important to remember that lingual arteries greater than 2 mm in diameter do pose a potential threat if severed during implant placement. Therefore, when implants are planned for the anterior mandible, it is recommended that close scrutiny be performed with respect to the size and insertion of the lingual artery that is most commonly found between sites #s24-25. This is best done with from a cross-section from a 3-D scan.

Now note in this same patient, the cross-section at slice #47, in the site of tooth #31. This bone is less dense than in the anterior area, and serves as an example that bone densities vary in the same patient from area to area. The drill passes through less dense bone more easily. This becomes particularly significant when drilling above the inferior mandibular nerve or under the maxillary sinus. Less pressure is needed on the drills, and some manufacturers provide stops that are placed on the drills to limit their depth penetration and avoid unnecessary trauma to the nerve or sinus.

While a textbook could be filled with examples of anatomic varieties in bone density, bone width, bone height and all the permutations that result from using 3D imaging for pre-surgical implant planning, two more examples will be presented here that illustrate the variety and thought processes in edentulous sites in two different patients.

In Figure 3, an implant is considered in the #19/20 location. This site is used only for illustrative persons because it includes the mental foramen. Note that while a measurement of 8.70 mm gives an indication of bone height, the shape of the crest leads an experienced clinician to a sequence of observations in planning to insert an implant in a site similar to this one.

To begin, note how the buccal and cortical bone are extremely dense. Observe the inferior border of the mandible. This bone is not only dense, but unusually thick. This thick bone is also found at the alveolar crest as seen in slice #85 found in Figure 3. This should immediately indicate that the initial drill will not easily pass through the crestal cortical bone. And when the drill does pierce through the cortical bone and enter the cancellous bone, the surgeon should be prepared that it will do so quickly and requires a high degree of control.

The nuances of 3-D Imaging: Bone density

← IT page 8

But that is not the only critical observation noted on this cross-sectional image. The crest of the bone is narrow and is lingual so that if an implant were inserted into this bone, it would be narrower than is usually preferred, short, and lingually placed, which will impact on the final restoration. With respect to wound healing, mention must be made that cortical bone is relatively avascular. This needs to be taken into consideration because if an implant were inserted to the collar in this site, the likelihood would be that some of the crestal bone would resorb due to the trauma and threads may very well be exposed when the healing was completed. If possible, with thick cortical bone, it is beneficial to insert the implant a little deeper than usual since crestal bone resorption can be expected. Should that be attempted in this case, there must be concern as to the proximity of the inferior alveolar nerve.

So what should be done to treat this area? While it is not the purpose of this article to get into detailed treatment planning discussions, consideration must be given to augmenting the labial bone or possibly expanding the bone (as reported by Bruschi and Scipioni) in order to have better placement for the implant. The limiting factor in this case is not only the excessive cortical bone but both the inferior alveolar nerve and the location of the mental foramen. A short implant may be considered.

Figure 4 is another example of thick cortical bone. However in this example, thickest bone is found on the buccal and inferior borders of the mandible which will not influence the implant placement. As can be seen below, the crestal bone is not dense and that the implant can be placed so that it emerges in good position to the opposing teeth. While it is rarely mentioned as a

benefit of obtaining a CT scan as part of pre-surgical planning, is to learn (from the scan) that there are

no special factors that will affect the surgical procedure or anticipated results. IT

IT About the author



Dr. Alan Winter received his DDS degree from New York University College of Dentistry and completed his dental residency at Albert Einstein College of Medicine, also in New York. He received his certificate in periodontology from Columbia University School of Dental and Oral Surgery and is a

Diplomate, American Board of Periodontology and a Fellow in the American College of Dentistry. Dr. Winter is Assistant Professor of Clinical Dentistry, Department of Periodontology and Implantology at NYU College of Dentistry. He lectures extensively and has been widely published in numerous journals on 3-D imaging and implant surgery.

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AAID brings its own bag of evidence to Vegas



← IT page 1

“Many academic people emerge from this society, and we are pleased to devote a day to their symposium,” Iyer said. “We are bringing about 40-50 physicians to speak.”

The event’s main draw, of course, will be the opportunity to hear from top experts in the field of implant dentistry.

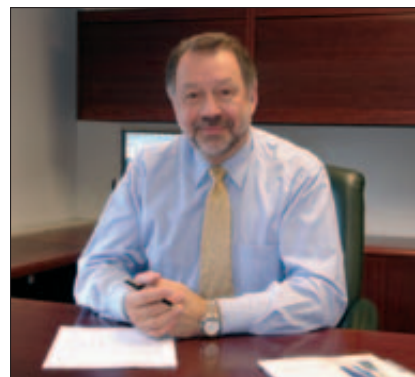
“Everything has been planned so it’ll have an evidence-based touch aspect to it,” Iyer said. “For instance, Dr. Gordon Christensen will be speaking about ‘Gold Standards’: What should we really be looking at;

what is it we are going to go by? What the company says, or is there real evidence to back it up?”

“World-renowned expert Sascha Jovanovic and Dr. Dennis Tarnow will give an excellent overview of the surgical side of implant dentistry.

“Dr. Andre Saadoun will talk about the soft-tissue support for these procedures and how he obtains ideal esthetic outcome. Dr. Michael Glick will speak to the medical diagnoses of implant outcome.

It’s not often you see Dr. Saadoun at U.S. conferences, so this is a rare treat.



“Also Dr. (Makoto) Shiota from Japan, who will be speaking about radiology, and Stefan Paul, who has written several expert chapters, will make one of his first appearances in the U.S.,” Iyer said.

Attendees of the conference will go home with unique information, he added.

“They will go home with the comfort of knowing there is merit as to what they’re doing or not doing because now they can really have the raw data to support those procedures, and it’s not just going to be anecdotal,” Iyer said. “They’ll know they’re doing something with sound backing instead of ‘experimenting’ on the patient.”

For more information about the AAID’s annual meeting in Las Vegas – or for next year’s event in San Diego – check out its Web site at www.aaid-implant.org. IT

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1/8 Page iDontics