

*With the advent of affordable CBCT,  
oral surgeons are adding 3D imaging systems  
to their practices in increasing numbers.*

***Is it just a trend?***  
*How is CBCT impacting the practice?*

**Why 3D.....?**

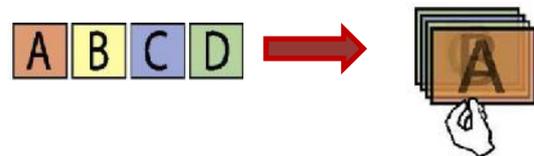
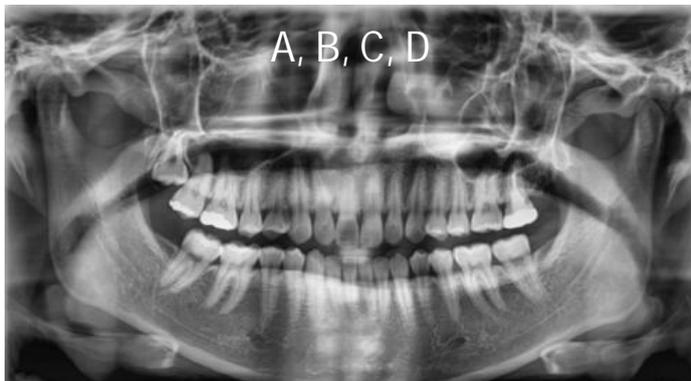
# About 3D Accuracy,



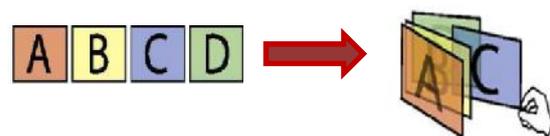
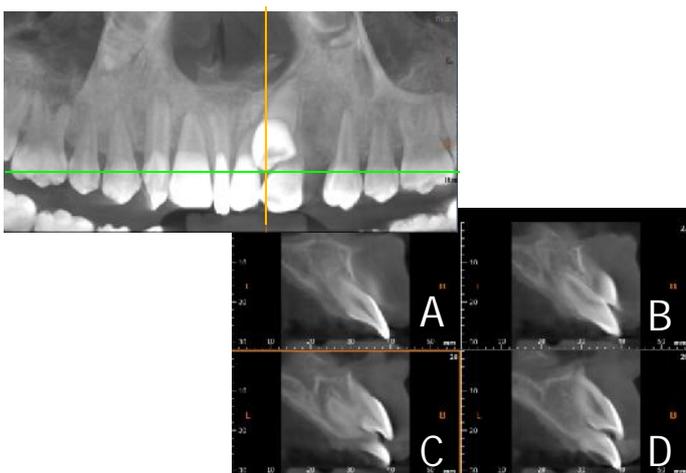
Dr. Nick Fahey

“ The ability to look at a tooth, pathology or an anatomical situation in any direction and orientation, as well as in 3D, eliminates much of the guesswork commonly experienced with 2D radiographs. ”

# 2D Vs. 3D



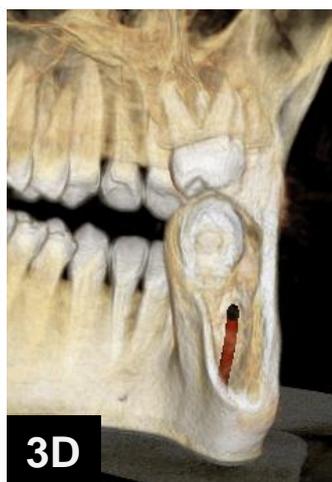
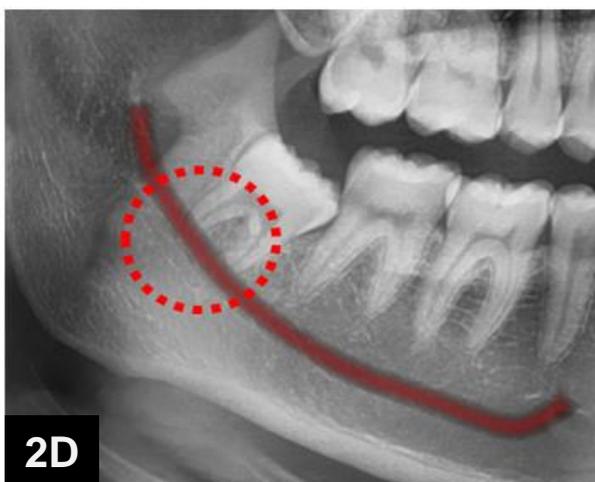
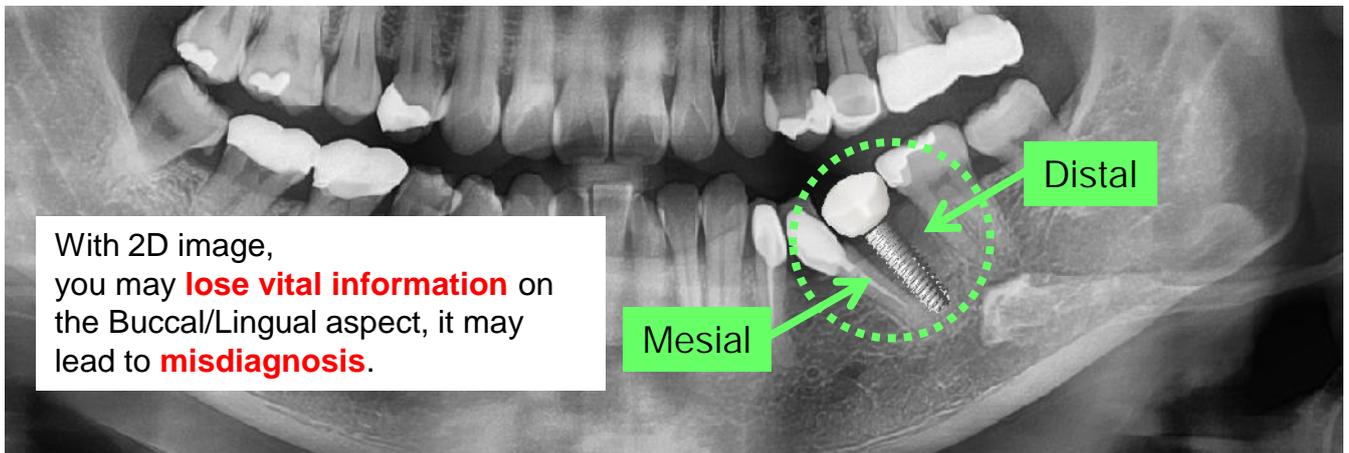
Images of multiple planes are taken to make up the composite panoramic image. So the anatomical structures are **superimposed and distorted**.



The anatomical structures are **clearly examined with each sectional view**. It helps in gaining a better view of bone structures and supports a wide range of diagnosis and treatment planning.



# Looking at All Sides

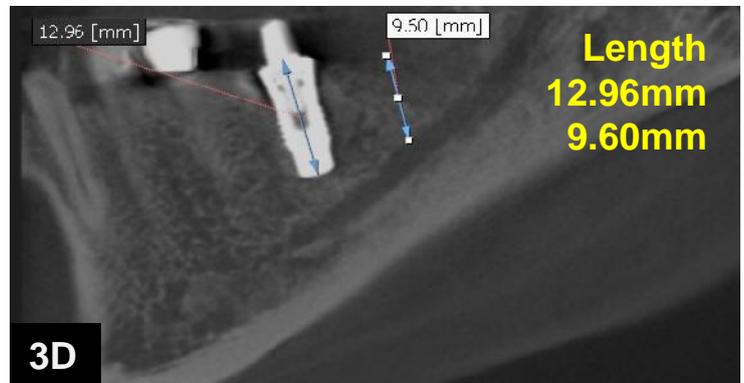
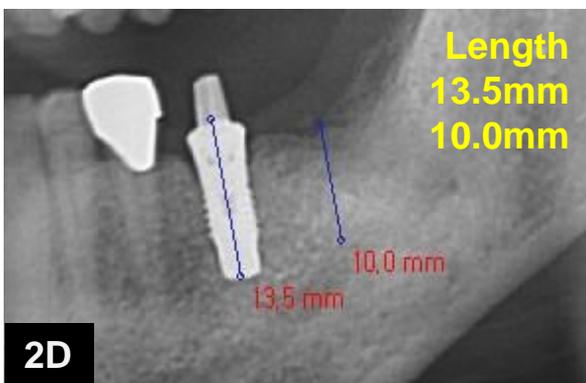


As seen below, it looks like the impacted tooth is touching the mandibular nerve in 2D panoramic view but, in 3D, you can verify that tooth does not touch the nerve. This is an example of 3D being used in successful treatment planning.



# Accurate Measurements

Size distortion is inherent in panoramic imaging because of the geometry of X-ray projection, it produces discrepancies in the measurements in the mandibular third molar regions on panoramic radiographs. Interpretation of angulated 3<sup>rd</sup> molar from panoramic radiographs is often unreliable and may not accurately reflect the true orientation of the tooth. Apparent tilting of the tooth across the arch on the panoramic radiograph exacerbates the problem and appears to correlate with the bucco-lingual inclination of the third molar as visualized on reformatted CT images.



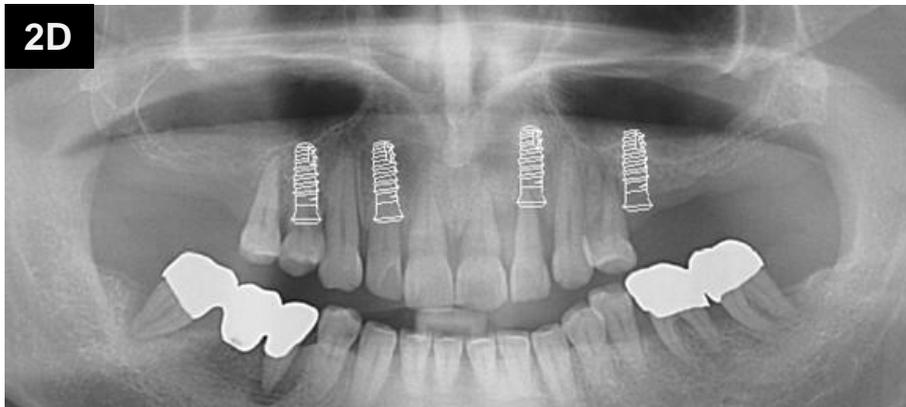
## The difference between 2D & 3D

Implant Fixture **+ 0.54mm**  
Length to canal **- 0.40mm**

❖ Reference : Thesis 'Accuracy of angular measurements and assessment of distortion in the mandibular third molar region on panoramic radiographs.'



# No Superimposition



In 2D panorama view, **palatal bone is superimposed**. It is difficult to clearly identify the sinus, septa and other adjacent structures.



**Single sectional images are available with 3D.** So it is easy to gain information on septum of the sinus. This information is vital for a successful maxillary sinus implant surgery.

# About 3D Simulation,



“ Without question, 3D imaging allows us to directly interpret the anatomy and challenges of the area of interest before direct visualization.

This information allows us to optimally create and sequence the best possible surgical and prosthetic treatment plan.

Most importantly, overall morbidity can be decreased as a result.

”

# Better Treatment Planning

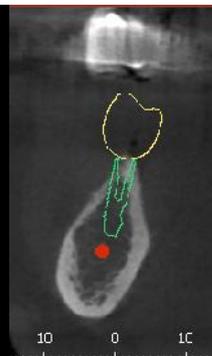


## Improve Treatment Outcomes with Virtual Simulation

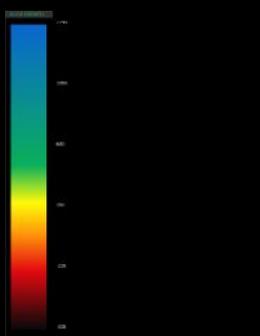
Appropriate use of CBCT absolutely improves treatment outcomes in the oral surgery practice. There is no doubt that using CBCT better prepares you going into a surgical procedure than with 2D imaging alone, and your results will reflect it.



#1  
Get real time  
virtual feedback,  
risk assessment  
before treatment



#2  
Accurate  
positioning within  
2D slice images



#3  
Examine the bone  
quality at the  
implant site



#4  
Review the overall  
implant placement  
and emergence  
profile

# Improve Your Patient Care



***“3D diagnosis is so essential to doing the best for our patients that most of us will provide the service at a reduced cost, or even gratis in some cases. We then have an opportunity to provide confident, high quality care.”***

- Dr. Michael A. Pikos -

## **This will significantly improve patients care**

Global 3D evaluation of patients' present anatomy, as well as identifying potential incidental pathologic findings is imperative in effective patient care.

The information 2D provides you is limited and there is a high probability of limiting treatment on just what patients self-report.



# Improve Your Patient Satisfaction



*“I use a large flat panel monitor and take time to explain what the images represent in 3D.*

***This is an invaluable experience as they understand and take ownership of their condition, diagnosis and proposed treatment.”***

- Dr. Michael A. Pikos -

**It's a far cry from the days when you only consulted with 2D**



Showing a patient what needs to be done with 3D is necessary and invaluable, and a far cry from the days when a dentist would hold up a tiny black and white film image and expect the patient to understand it. It absolutely raises the treatment acceptance rate and improves patient satisfaction.

# About **Diagnosis Range,**



My partners and I use CBCT for a variety surgical procedures such as third molar impactions, impacted maxillary canines, supernumeraries, and so on.



The volume of cases I do translates into a good return to justify cost of this technology.

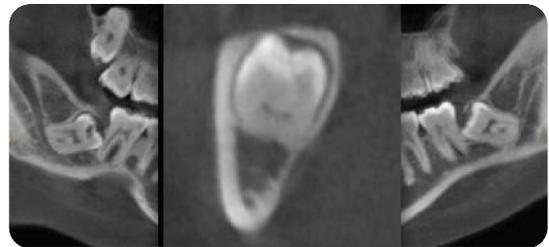
Beyond this, having an in-office unit gives me many benefits.



# Beyond Implant Surgery

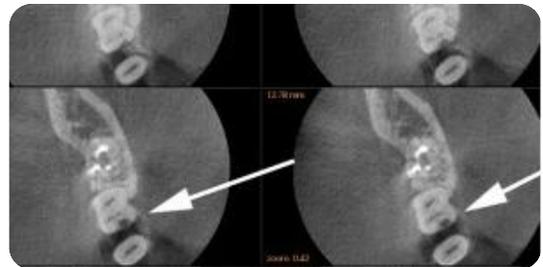
## 01. Tooth Impaction

**Such as** third molars, impacted maxillary canines, supernumeraries, mesiodens



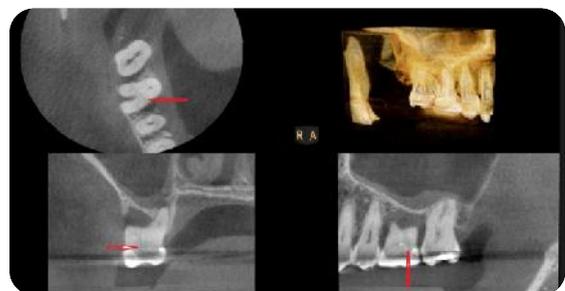
## 02. Pathology Identification

**Such as** cysts, dentoalveolar lesions, root resorption, periapical disease



## 03. Maxillofacial Trauma

**Such as** bone fractures, tooth fractures, sinus treatment



❖ Reference : [Pajdds.wordpress.com](http://Pajdds.wordpress.com/) / [www.endomicrosurg.net](http://www.endomicrosurg.net)

## About In-House Unit,



Dr. Ajay Murgai

“ I’ve come to realize that we can only ensure our patients get the very best treatment journey, catering to all of their needs, **if everything can be done in-house**. Up until last year we could offer in practice every service, except for 3D imaging.

Unfortunately, we had issues where we were referring patients out for scans and patients weren’t getting the kind of service that we would like them to receive. ”

# Additional Benefits

## 01. See Patients Immediately

It is essential to have an in-office unit for immediate utilization to eliminate the logistics and inherent problems with referral and delay for an external diagnostic



## 02. Competitive Marketing Tool

Both clinicians and patients have been realizing that 3D scan is imperative for an effective treatment. Having 3D imaging in your office keeps you ahead of the curve, and set you apart from the competition.



## 03. Impress Your Patients

Patients think it looks like space age technology. It helps to show that you are cutting edge.



*Many clinicians have trouble  
utilizing 3D in their practice.*

*Why is that?*

***Why are they hesitant to use it?***

**Why SMART....?**

# “Is 3D Software really for me?”

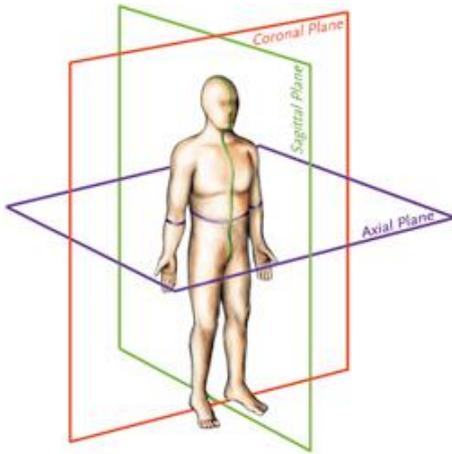


Many clinicians are concerned that “**3D software is too complicated to use everyday**”

It is true that there are **barriers** which make it difficult to utilize 3D software, and it can be stressful.

How can we overcome these **barriers**?





***Axial orientation*** can be daunting and confusing to most clinicians, question is how do you get to the region of Interest?

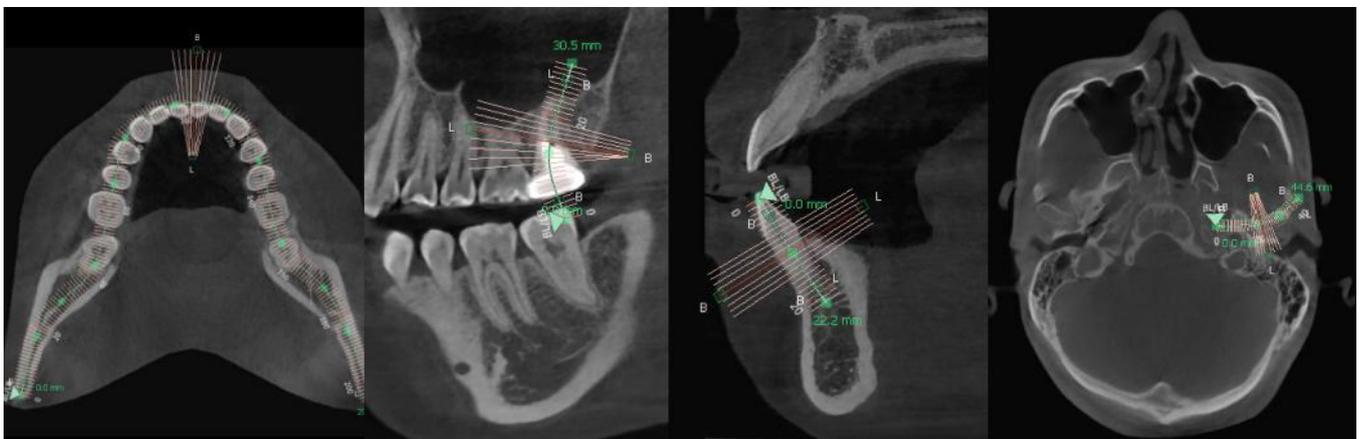
SAGITTAL  
CORONAL  
AXIAL

Approximately, **70% of clinicians** have trouble utilizing 3D software, because even the simple act of manipulating the axis and getting to the region of interest can be difficult and time consuming.

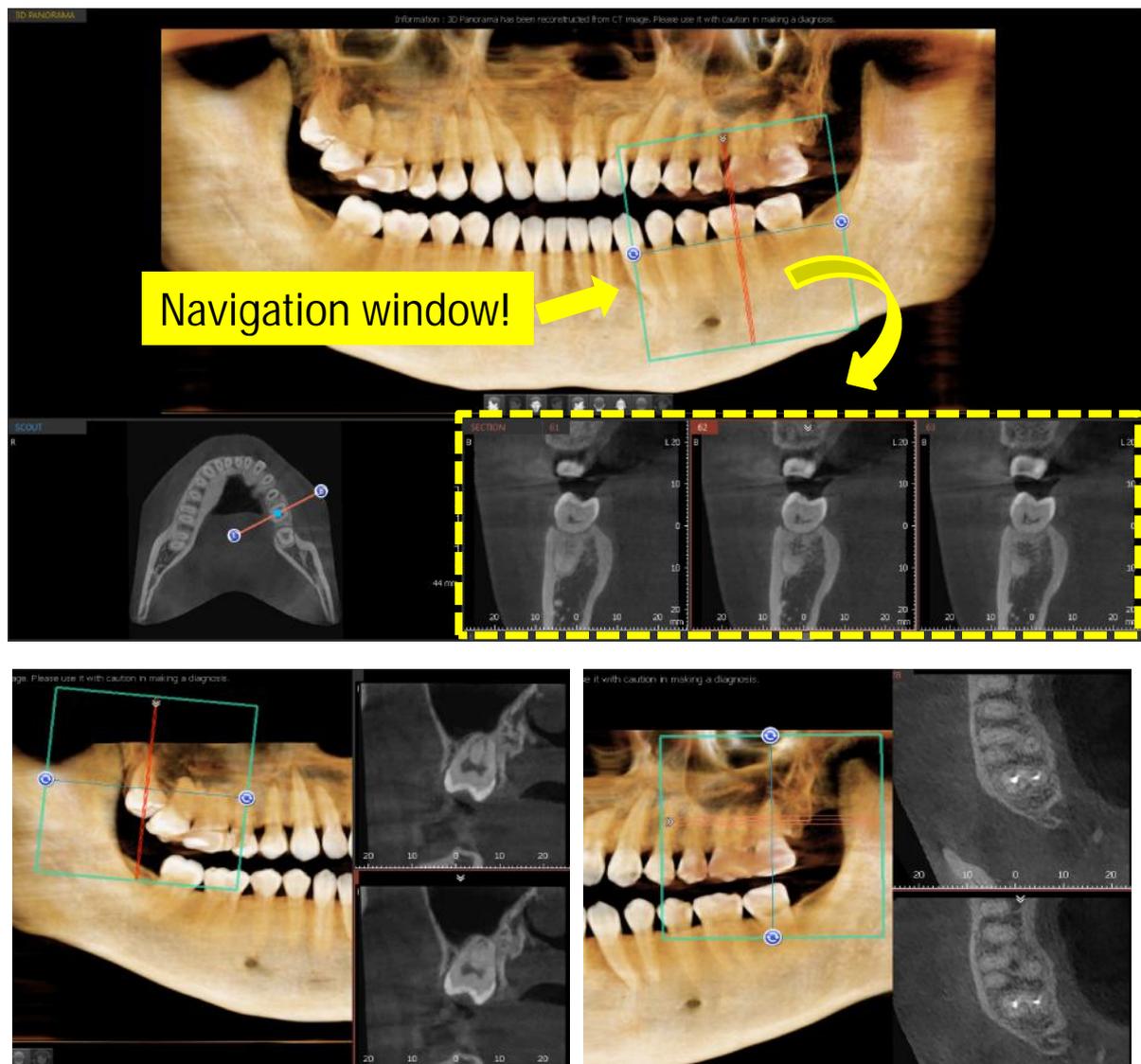
Traditionally, with the 3D software you are first required to adjust the axial, coronal, sagittal axes and draw the panoramic curve but even at this stage it can get confusing.

This is also time consuming , even when one receives sufficient training and becomes proficient in the process.

What if you no longer need to adjust the axes?  
What if you no longer need to draw a panoramic curve?



# One Click Sectioning Simplifies the process.

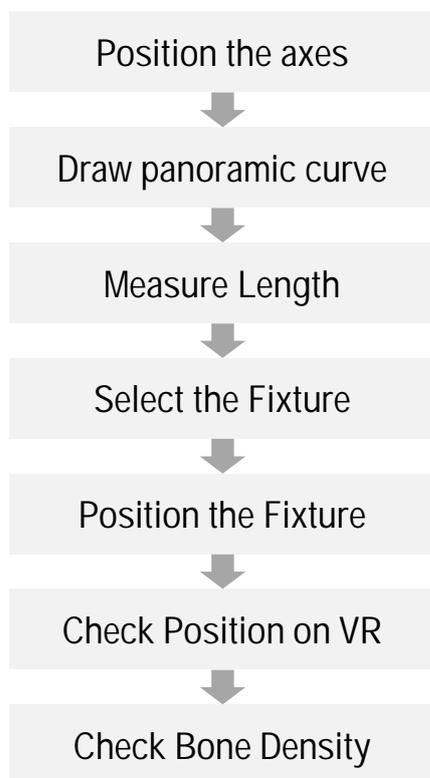


This is as simple and intuitive as positioning the navigation window. Then the sectional images of the region of interest will be shown below. It removes the hassle of manipulating the axes and drawing the panoramic curve. This also precludes the need to understand the complex axial orientation/manipulation. Let's compare conventional and current process in detail.

# One Click Sectioning

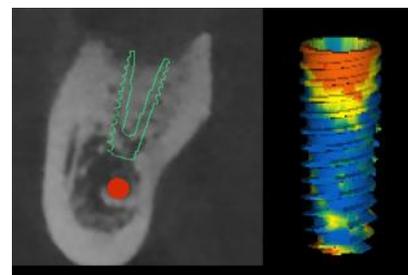
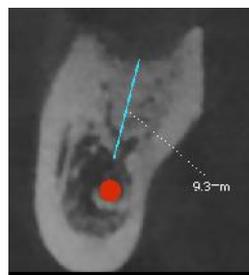
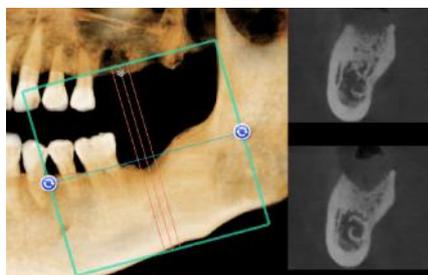
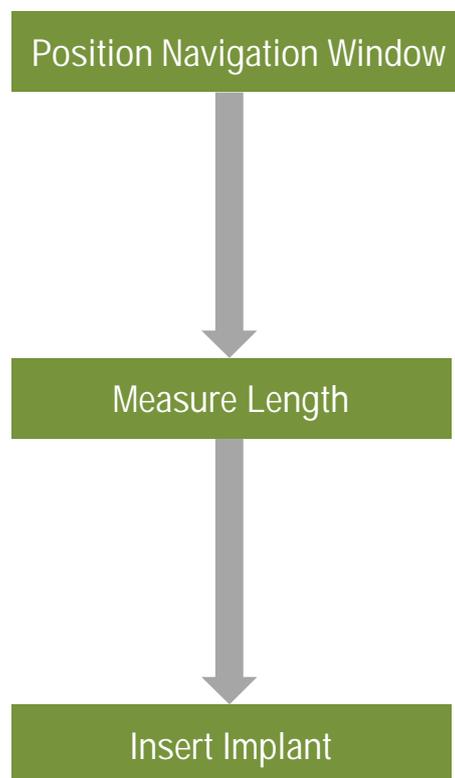
Simplifies the process.

## [Conventional Process]



vs.

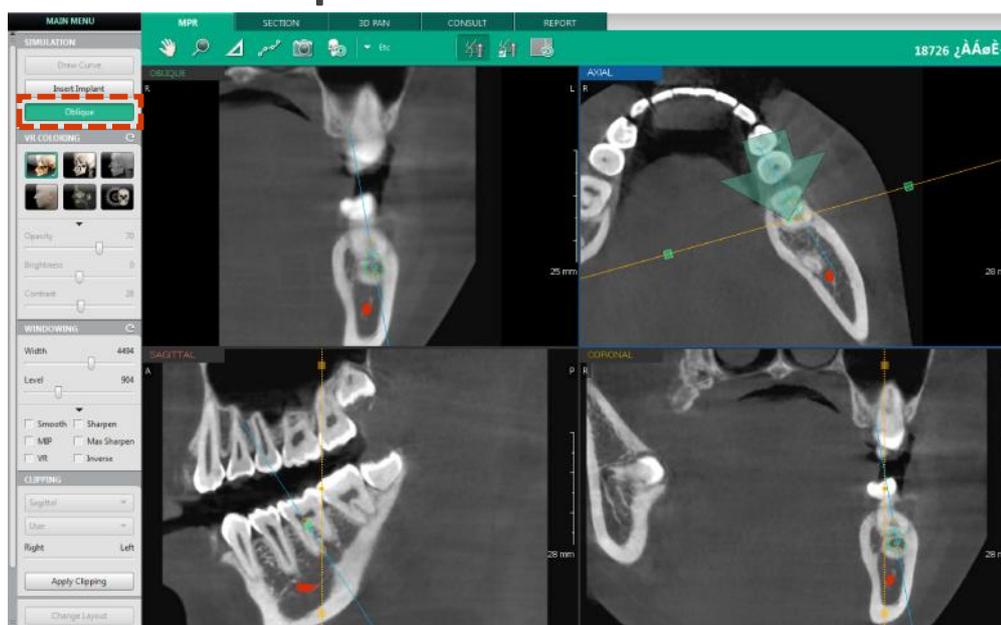
## [Ez3D-i Process]



Save time with this simple workflow and see more patients.

# Helping Tools for Quick Diagnosis

## 01. Smart Oblique



After clicking Oblique on MPR tab, ROI can be verified quickly by rotating the axis 360 degrees.

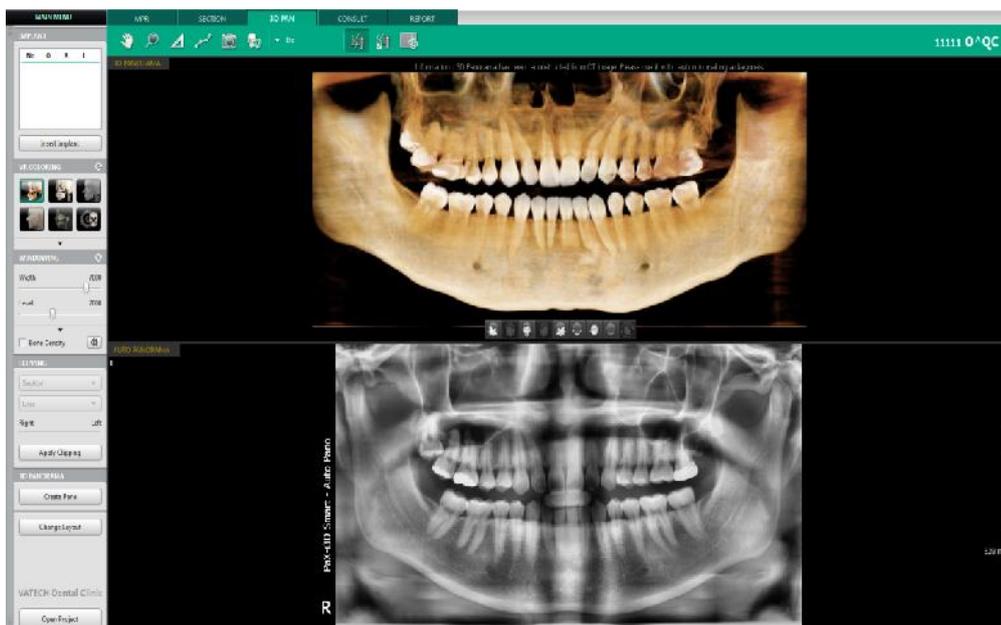
## 02. Smart Clipping



Easily verify ROI by clipping 3D images in the direction of user's view.

# Helping Tools for Efficient Consultation

## 03. 2D and 3D in One Viewer



No need to utilize two different software programs and it helps patients better understand the images, which will eventually result in increasing acceptance rates.

## 04. EzCodi (Virtual Consultant Tool)



With over 200 animations possible to not only educate patients on treatment plans, but show how this plan is relevant to their specific case.

Ez3DiV4.1



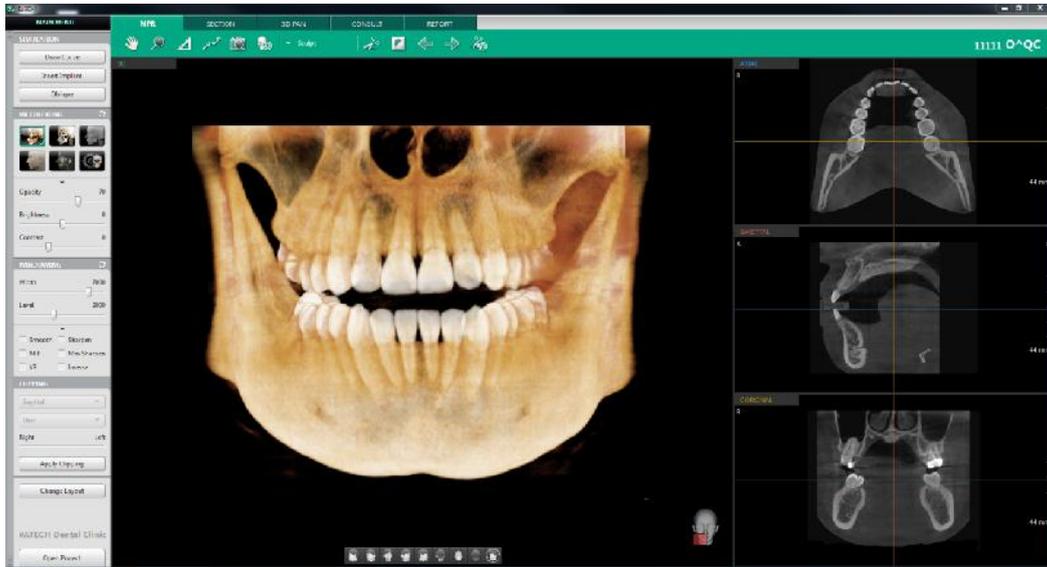
VCT Case #1



VCT Case #2



# Additional Benefits, Simple UI / UX

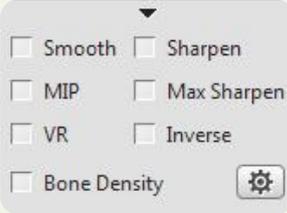
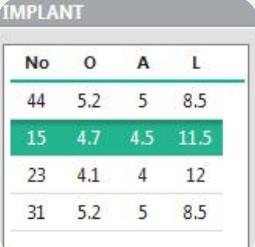


Ez3D-i is composed of very simple UI. It gives you totally different experience which other 3D viewers have never provided before.

## [Simple Workflow with One Click Actions]

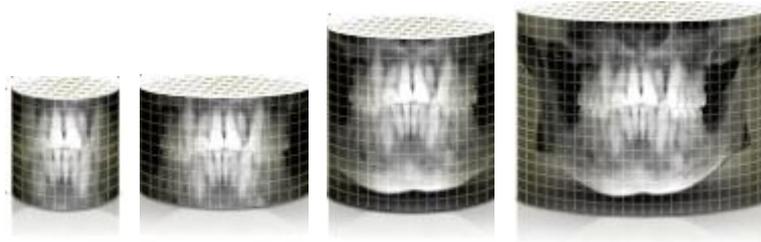


Ez3D-i is consist of five tabs and useful tools are located in each tab. According to what you want to do, you can choose the tab and easily find tool button.

- 1)  2)  Most functions as below can be activated with just one click of a mouse.
  - 1) Changing VR Coloring modes
  - 2) Using Diagnosis/Consult Tools
- 3)  4) 

No	O	A	L
44	5.2	5	8.5
15	4.7	4.5	11.5
23	4.1	4	12
31	5.2	5	8.5

  - 3) Applying Filtering to 2D Images & Checking Bone Density
  - 4) Aligning sectional images according to selected implant fixture



*“Buying small FOV CT looks like a good choice.  
It has reasonable price and it can be enlarged with stitching.”*

## ***Is that right?***



Of course small FOV imaging machine is less expensive when compared to large FOV ones because normally price is determined by the size of X-ray sensor.

**However, small FOV machine is only suitable in single implant cases**

To maximize return on your investment, it is important to not limit the number of patients you can see and treat, if you are to place multiple implants on a patient, you will need a larger FOV device. Even if you are satisfied with small FOV machine now, someday you will be looking to upgrade and capture those patients who needs multiple implant treatment, at that point it will cost you more to purchaser a larger FOV device as you have just forfeited the investment you have made on the smaller FOV machine.

Alternatively, you might consider dual scanning to enlarge the image via ‘stitching’.

**Are you really getting a larger FOV image through stitching?**



# Stitching is Imperfect

- ✓ More **Time-consuming**
- ✓ Unnecessary **X-ray exposure**
- ✓ Impossible **to acquire accurate images**

**Image stitching** is the process of combining multiple small images with overlapping fields of view to produce a large single image.



Dual scanning means scan time will be doubled and it means your time to see other patients will reduce.



Stitching has no choice but to require overlapped area for accuracy. It means patients will be subject to additional unnecessary radiation.



Stitching process requires image registration. Perfectly matching images is not possible.

## Stitching is Substandard Patient Care



# "Is FOV 8x8 really enough?"



**With FOV 8x8,  
it's not possible to capture the  
entire arch.**

As it does not cover the full arch you will **limit  
the scope of diagnosis**

## **FOV 8x8**



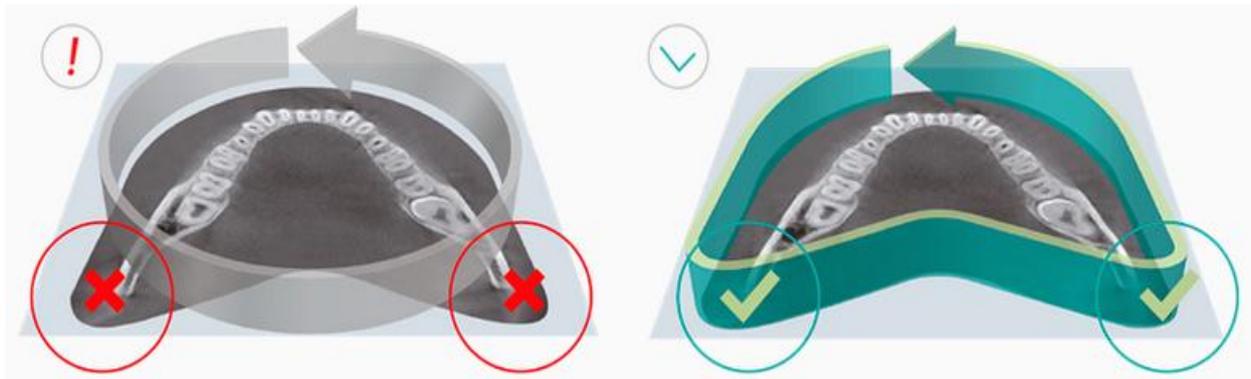
- Surgical guides
- Complex extractions
- Bone grafting

## **FOV 12x9**



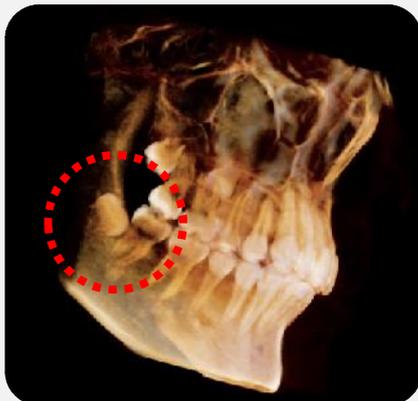
- Surgical guides
- 3<sup>rd</sup> Molar extractions
- Sinus lifts for both sinuses
- Oral and maxillofacial surgery for a full arch reconstruction

# Anatomically Equivalent to FOV, 12x9

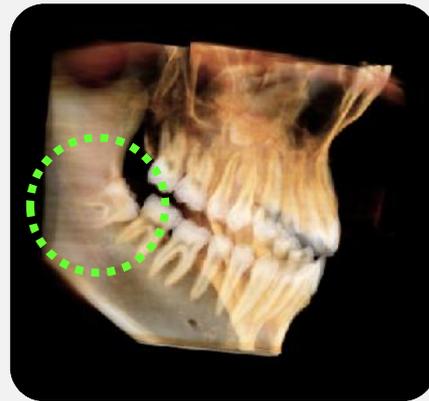


## Arch-shaped volume captures an anatomy equivalent to 12x9

Normally, a FOV 10x8.5 image shows the 3<sup>rd</sup> molars. However, when the tooth is lying on its side, there is a high probability that the tooth will be cut out of the image. With this limitation, it is not possible to perfectly gauge the anatomical relationship between the tooth and the mandibular nerve.



**Conventional  
FOV 10x8.5**

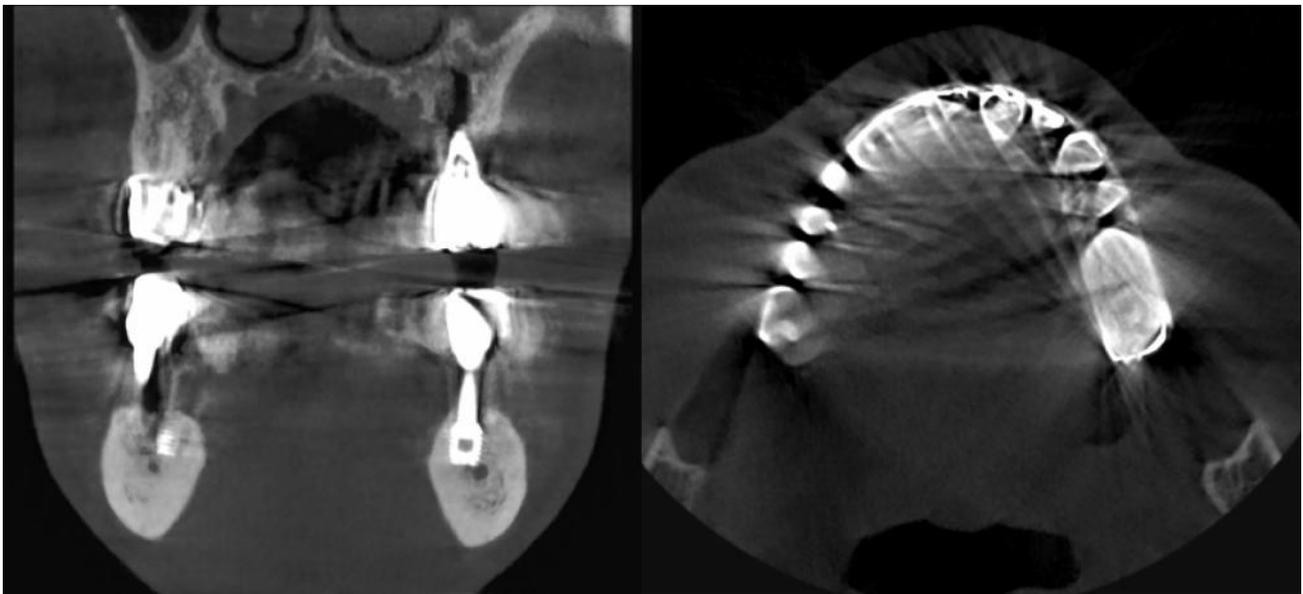


**Anatomically Equivalent  
to FOV 12x9**

# Artifact, Metal Artifact



- Produces **bands or streaks** on images
- Hinders diagnosis**
- Reduces diagnostic confidence**
- Leads to **misdiagnosis**
- Makes it **difficult to merge 3D and STL data**



# Stay Confident with MAR Solution



Metal artifact reduction has advanced to a point where, the metal and other high-density anatomies such as enamel is differentiated with much higher efficacy.

## **Compare images**

**SMART MAR Off** vs. **SMART MAR On**

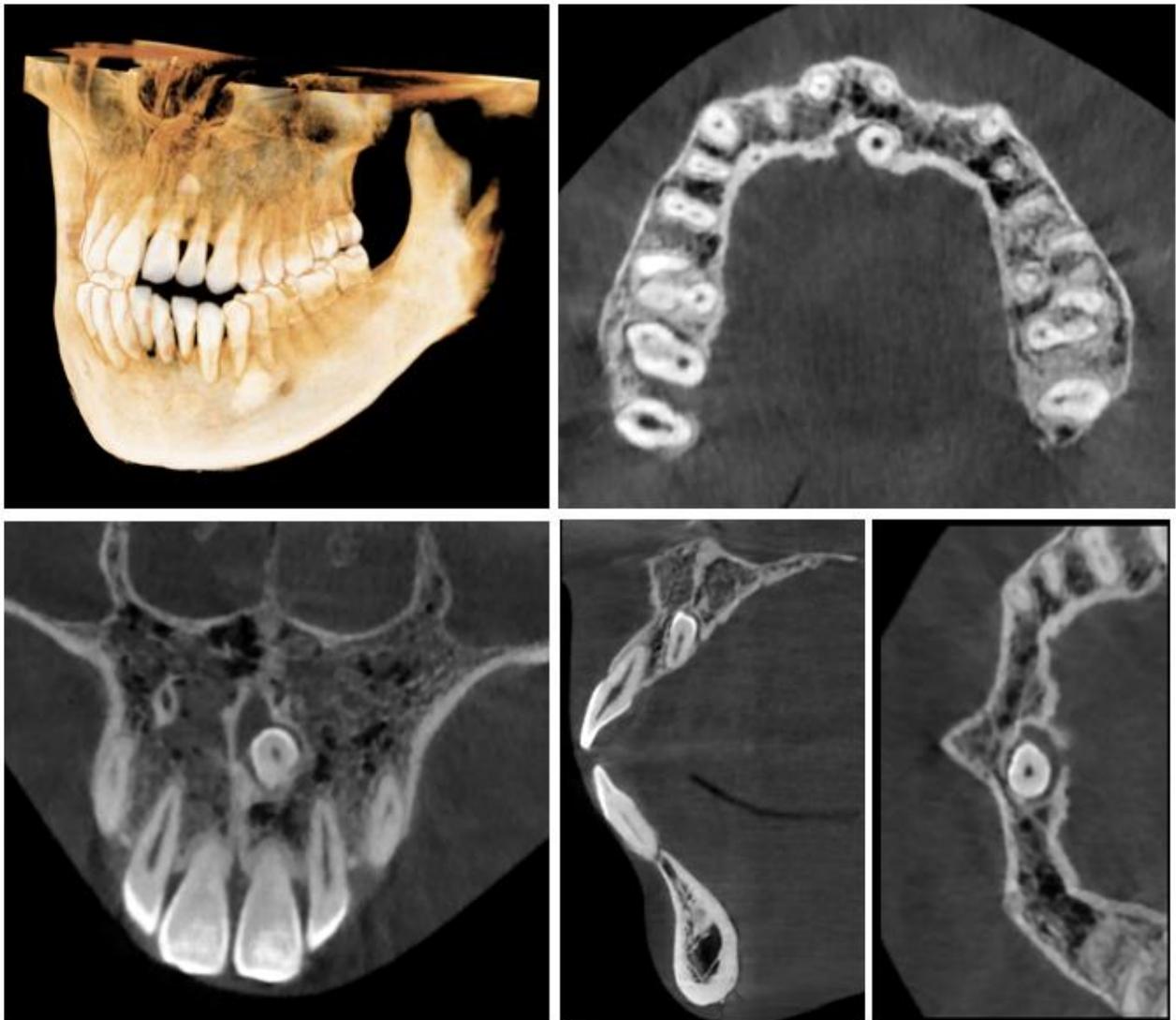


No.1 key benefit:

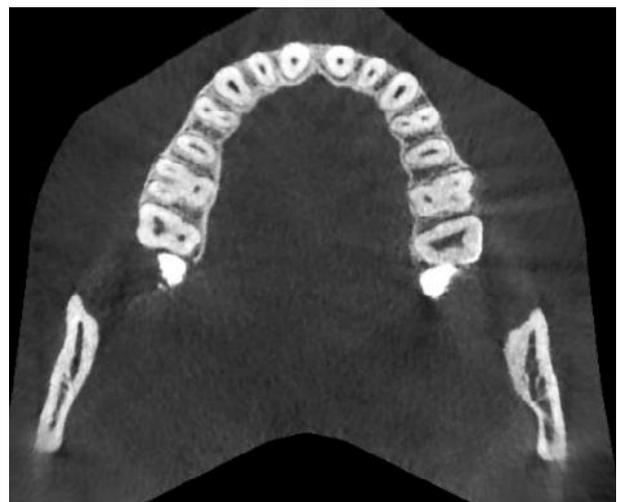
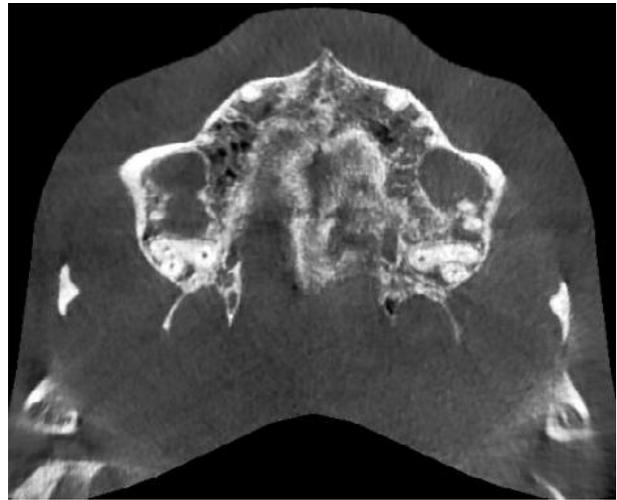
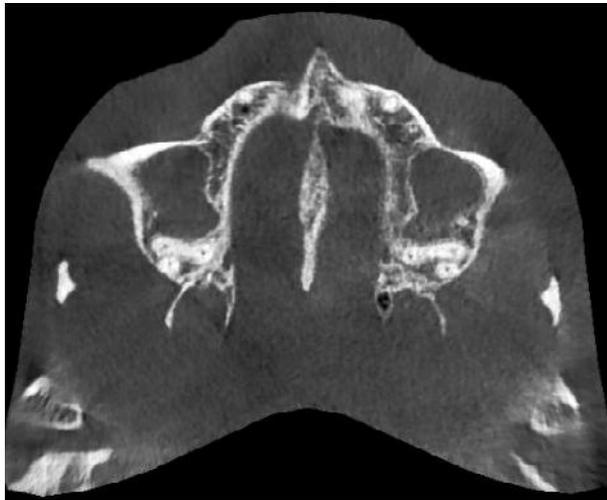
## Image Quality

There are many factors one needs to consider before purchasing a 3D. But the most important factor is, after all, image quality.

**Low Dose Mode 95kV / 8.7mA / Scan Time 18sec. / 0.2voxel**



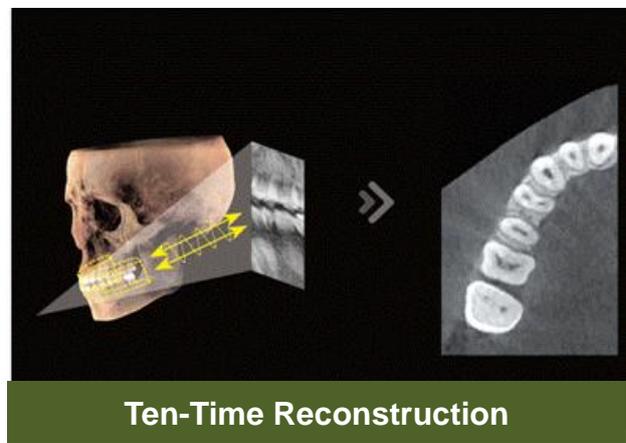
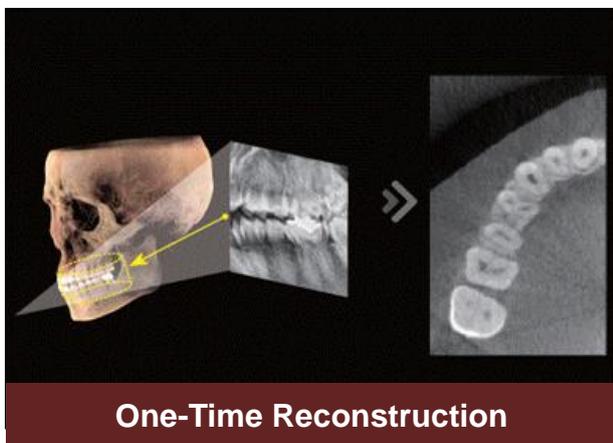
Ultra Low Dose Mode 80kV / 5mA / Scan Time 18sec. / 0.2voxel



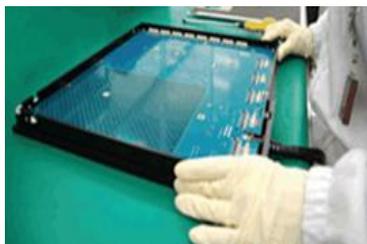
# Advanced image acquisition

## VATECH's SMART Iterative reconstruction

Through SMART, VATECH replaced conventional reconstruction algorithm with the medical reconstruction algorithm. Simply put, it repeats the reconstruction process 10 times and it produces high quality image as the result. Under the same exposure condition, the image reconstructed using this method has significantly better image quality with reduced noise and better contrast resolution.



## Hybrid Sensor with Super Fine/High Resolution Pixel Size



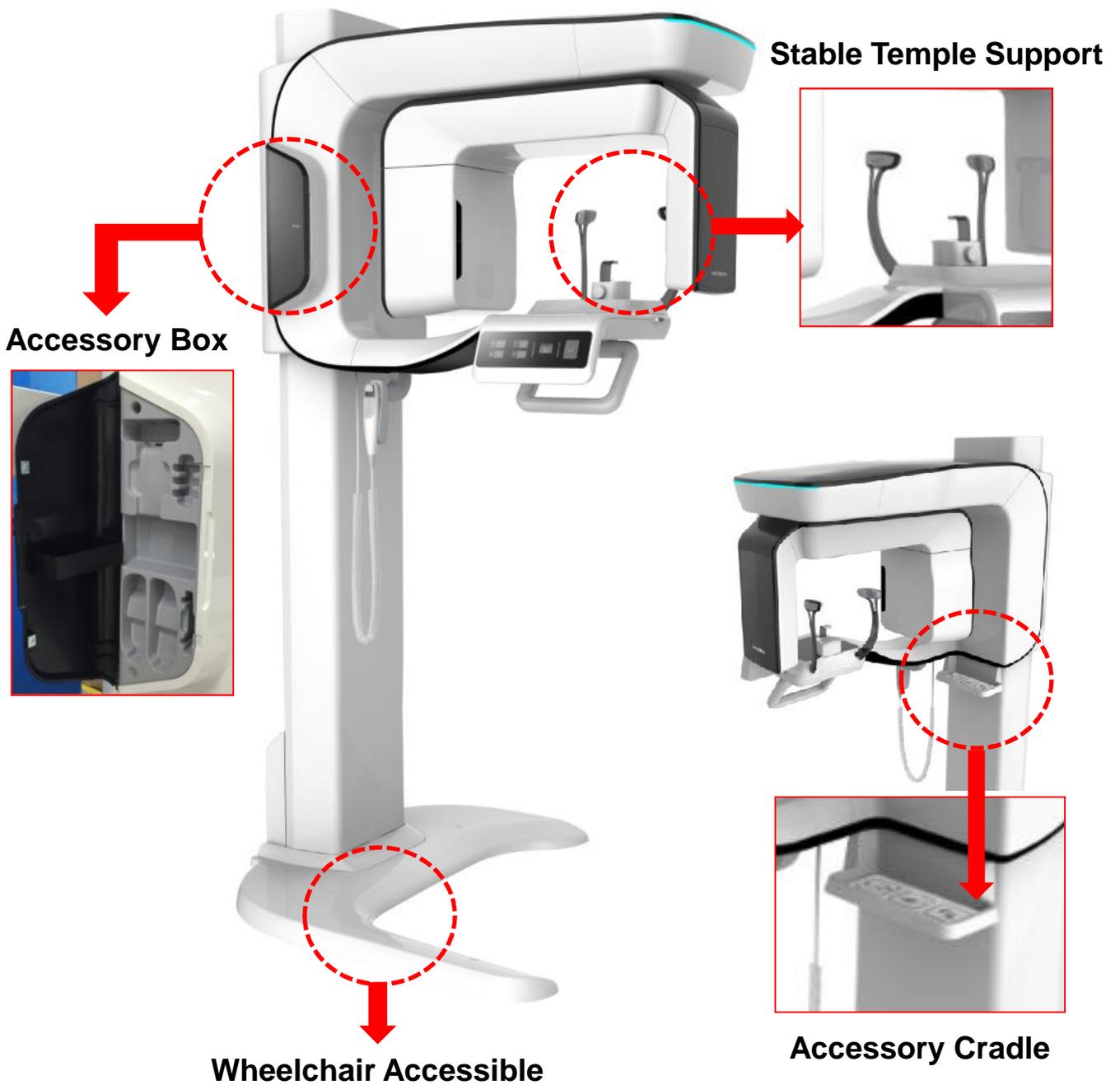
PaX-i3D Smart utilizes **49.5 $\mu$ m** high resolution X-ray sensor. With the latest 49.5 $\mu$ m pixel X-ray sensor, it is the smallest pixel/high resolution dynamic X-ray sensor for CBCT currently available on the market.



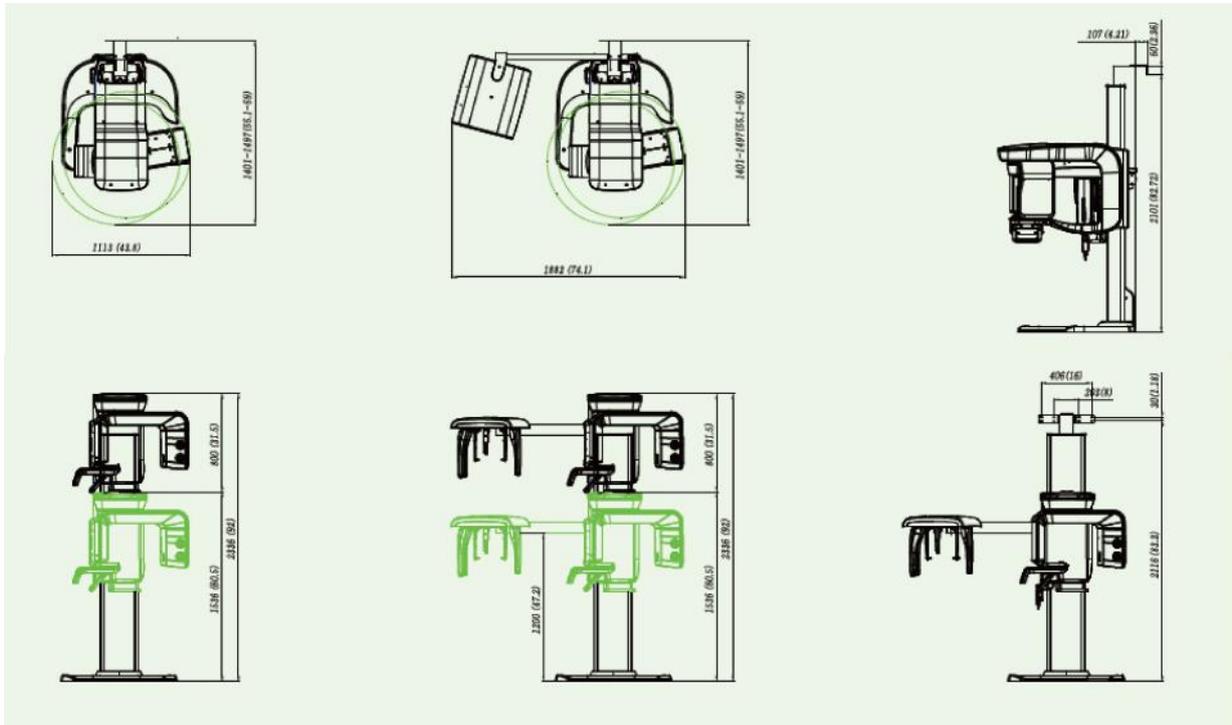
Hybrid CT – Pano sensor improves image quality through its unique radiographic properties. Sensor imparts better CT image quality by collimating the X-ray beam in to a linear slot, there by reducing scatter and concentrating the X-ray for better image resolution.

# Added Values

PaX-i3D Smart has not only the state-of-the-art features but also other user-friendly design and features.



# Dimensions [Unit: mm]



# Specifications [PHT-30LFO]

Function	CT(with Auto Pano) + Pano + Ceph	
Focal Spot	0.5 mm	
CT FOV Size	Adult	10x8.5 cm
	Child	10x7 cm
Voxel Size	0.2 mm / 0.3 mm	
Scan Time	CT	18.2 sec
	Pano	13.6 sec / 7 sec (Optional with Magic PAN)
	Ceph	Scan : 12.9 sec / One-Shot : 0.7 sec
Gray Scale	14 bit	
Tube Voltage / Current	50~99 kVp / 4~16 mA	

You might have questions in your mind such as...

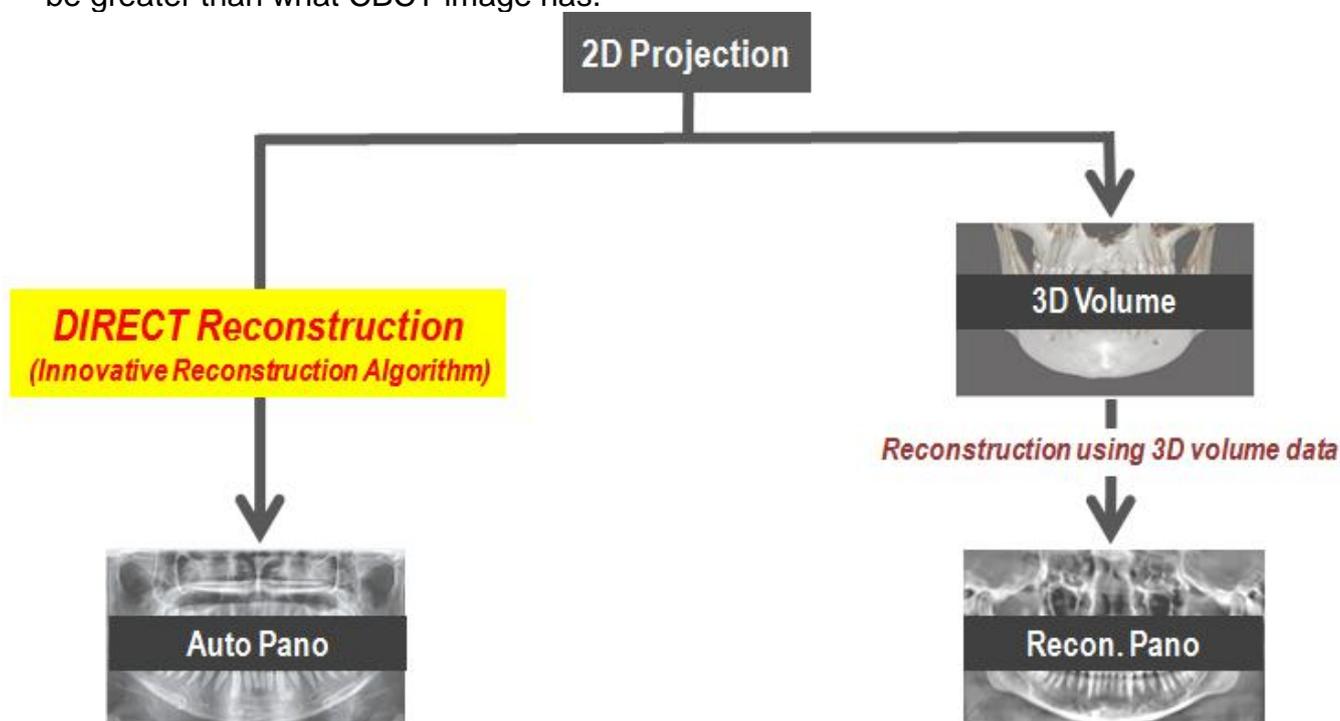
- How does PaX-i3D Smart produces Auto Pano + 3D image with a single scan?
- Does it have sufficient image quality for diagnosis?
- What extra benefits does it have except for radiation and workflow?

***“As far as I know, 3D viewer can create reconstructed panoramic image. Is it different from Auto Pano?”***

Yes. It is totally different.

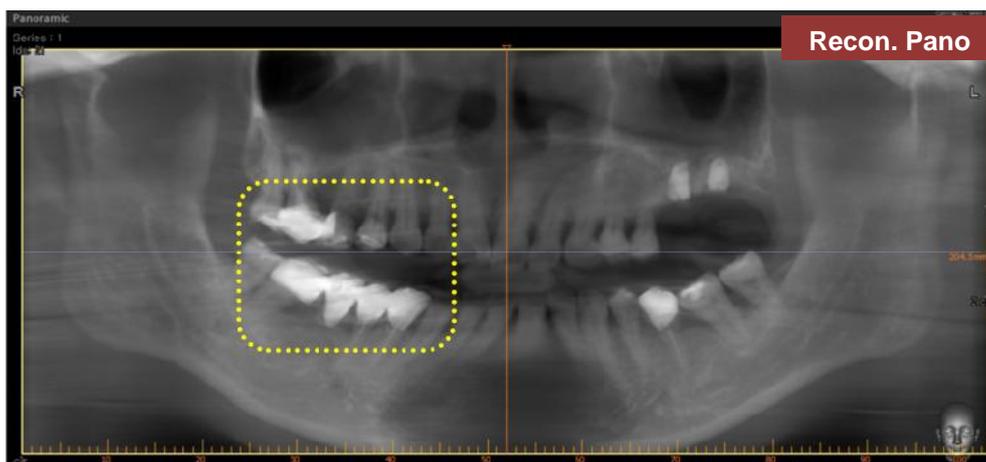
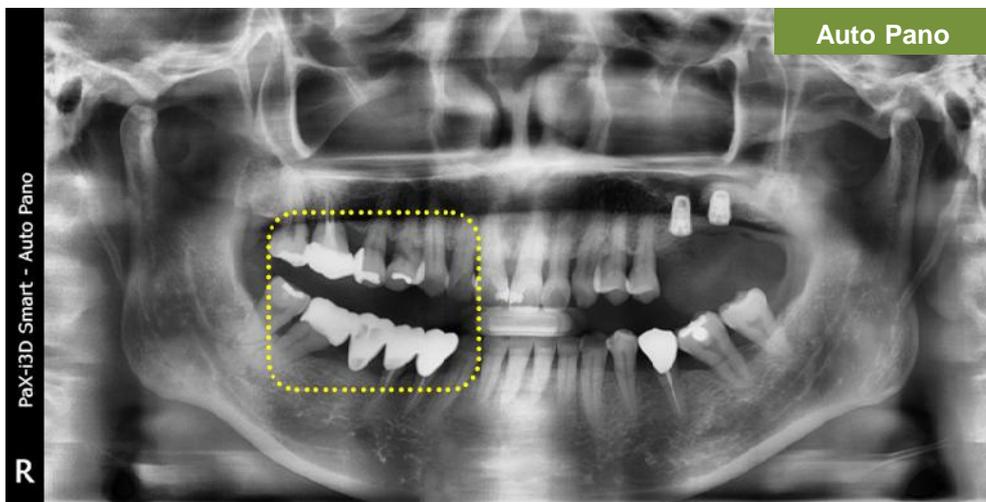
Auto Pano images are produced from raw data which is acquired during initial data acquisition stage. This process is done separately with 100  $\mu\text{m}$  pixel size before reconstruction of 3D volume. Its reconstruction method is nearly identical to acquiring conventional 2D Pano and Ceph images. It is the result of innovative technology of VATECH SMART algorithms.

On the other hand, Recon. Pano is literally a “reconstructed” image from 3D volume data. As it is reconstructed with fixed level of voxel size such as 200 $\mu\text{m}$ , the resolution cannot be greater than what CBCT image has.



Differences in Auto Pano Vs Recon. Pano image

	Auto Image	Recon. Image
Image Quality	Higher resolution	Lower resolution
Metal Artifact	No metal artifact	What is present in CBCT image
Image Size	Same size as the conventional panoramic image	Limited to 3D volume size (FOV)



Thank you.

[www.digitaldental.co.uk](http://www.digitaldental.co.uk)