Image Diagnostic Technology Ltd
IDT Ireland, 15 Market Street, Kinsale, Co. Cork, Ireland P17 XN65
Tel: +44 20 8819 9158 Mob: +44 7767 366596 IRL: +353 21 470 9501
Web: www.simplantscans.com Email: info@ctscan.co.uk

Dental CT and CBCT Scans

Anthony Reynolds BA MSc PhD

Registered Clinical Scientist CS03469

Image Diagnostic Technology Ltd.

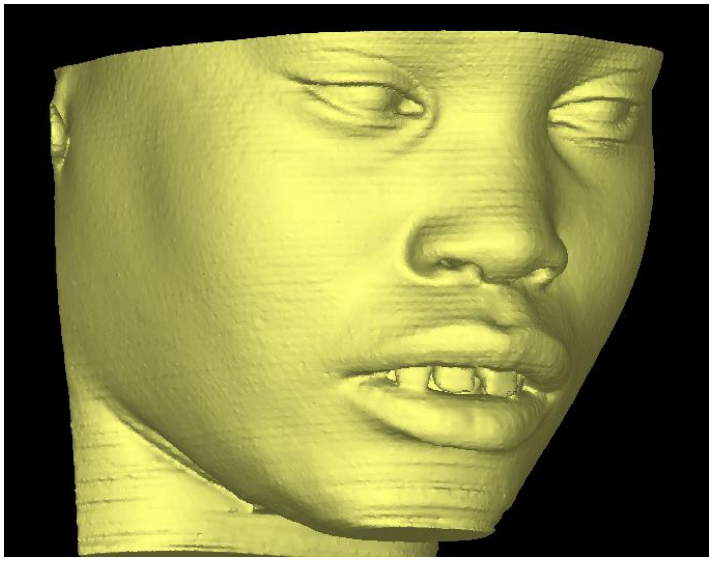
Who is IDT?

Image Diagnostic Technology Ltd

Trading as: IDT Scans

specialising in arranging CT scans and data conversion

since 1992



www.SimPlantScans.com

£GBP €EURO $USD

Fast : 24 hour turnaround available

Simple : Online booking & delivery

Precise : Get the most out of your 3D

Unique : 20 Years of experience with SimPlant

Flexible : Data accepted from all CT/CBCT

making the most IDT of your image™

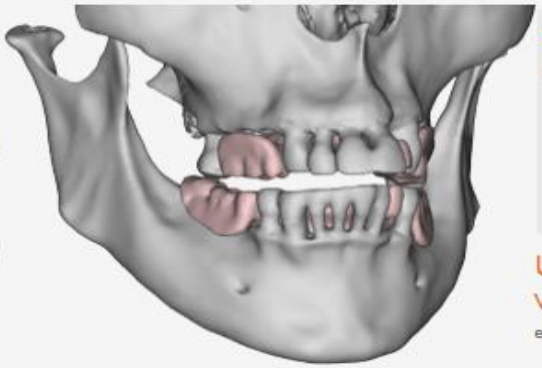
Find your nearest scanning site

Request a new Dental CT Scan

Search by First Letter Keyword or Location

How would you like your SimPlant® scan converted?

- SimPlant View **€60** (single arch)
- With Separate Teeth **€90** (single arch)
- With Separate Teeth & Skin Surface **€120** (single arch)



Download our Price List or Login or Register

email

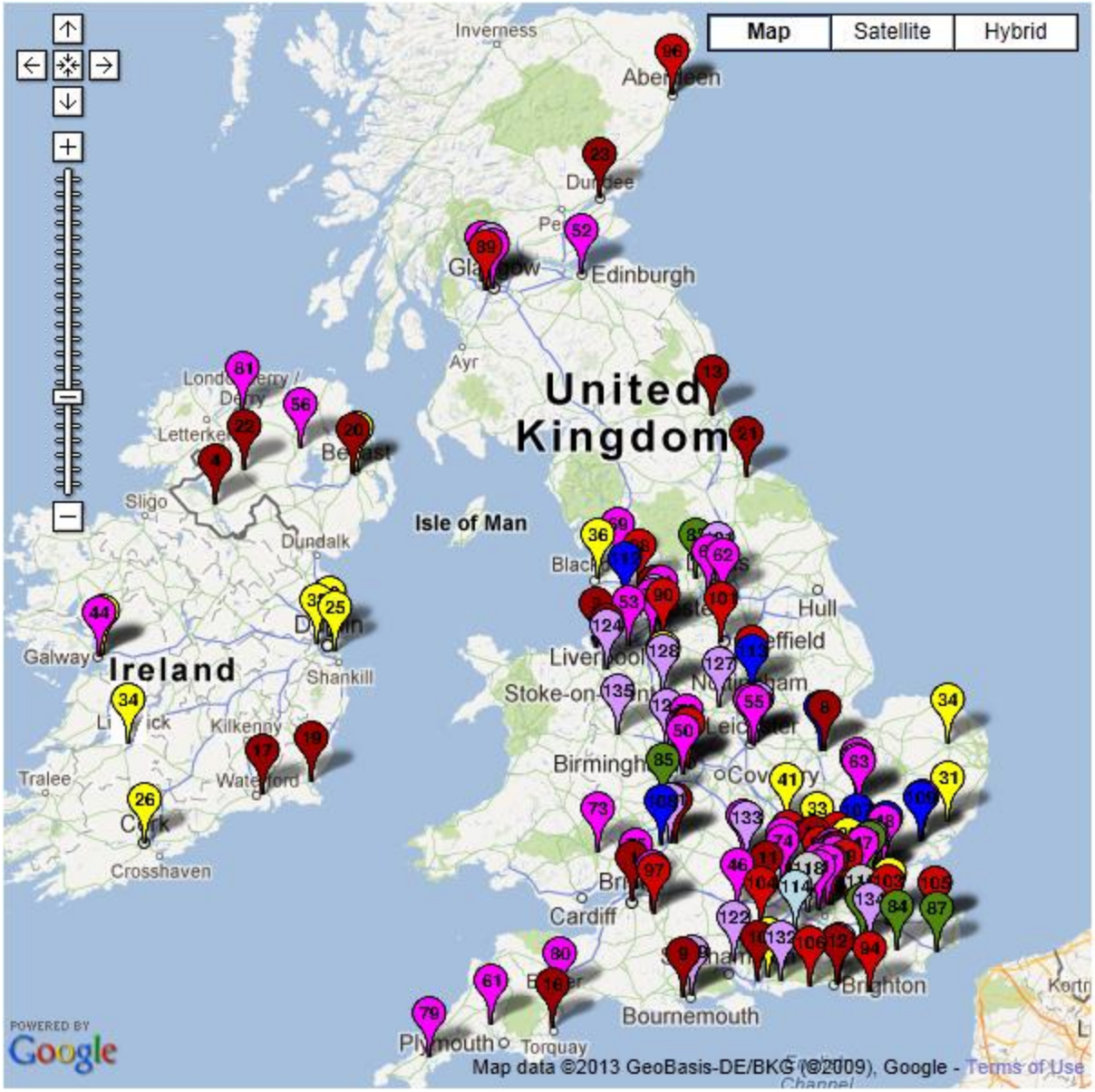
password

Login

Upload your scan without registering

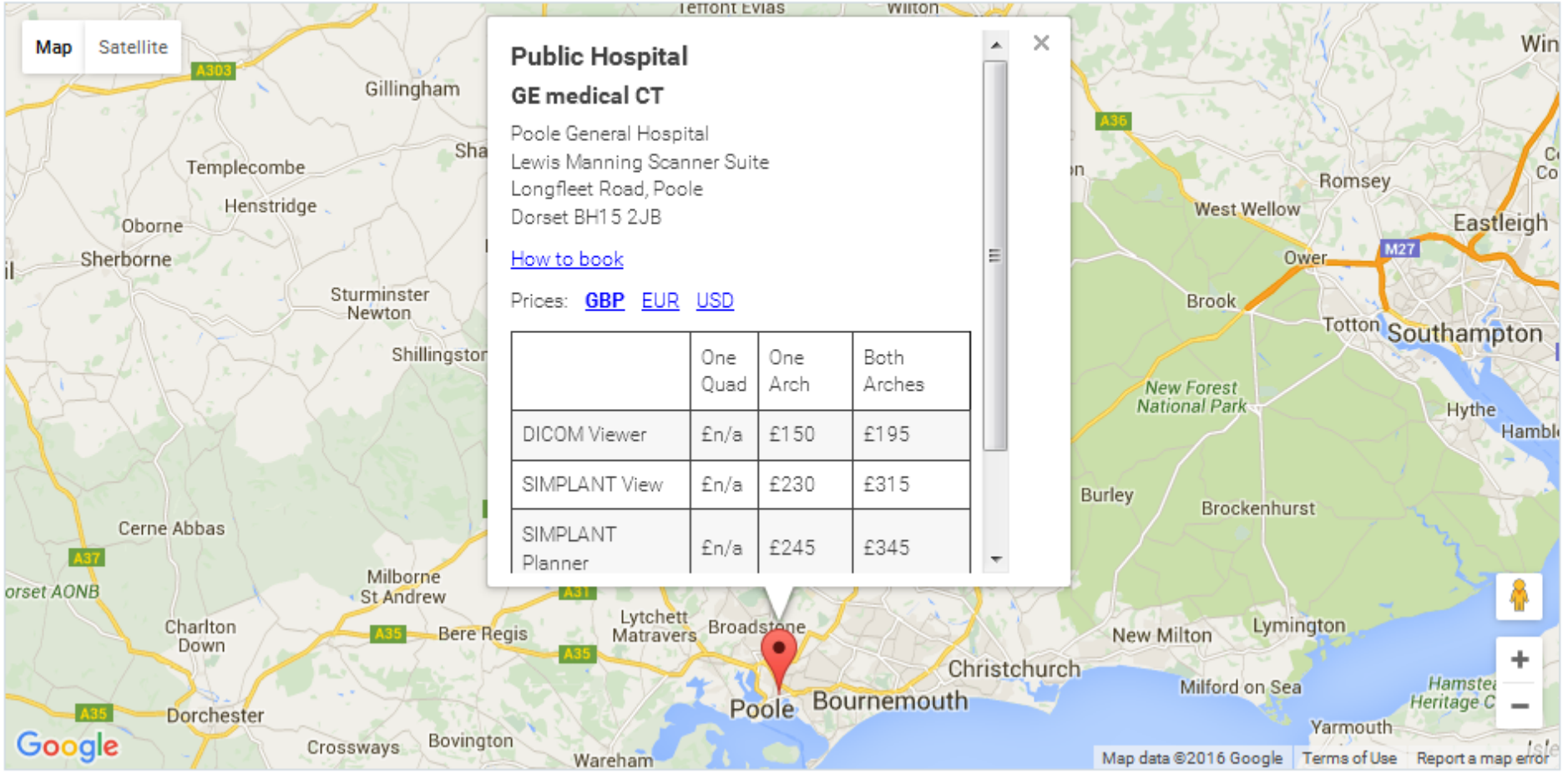
extra charges may apply

New! Preview your Scans with our iPhone App



[Search home]

Map for Poole General Hospital - click the icon for more information



Booking and Payment

- **Dentist books and pays online at**
  www.simplantscans.com

- **Poole Hospital invoices IDT after each scan**

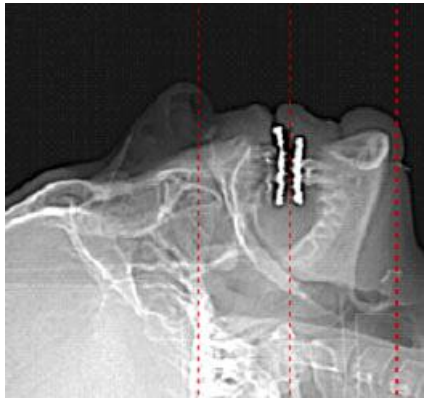
Outline of Presentation

- **What are Dental CT Scans Used For?**
- **IDT Scanning Protocols**
- **Positioning the Patient**
- **How Many Slices?**
- **Sending the Data to IDT**
- **Checklist and Feedback Form**

What are Dental CT Scans used for?

- **To convert the CT data into a format more useful for diagnosis or surgical planning**
- **To make customised Models by 3D Printing**
- **To make Surgical Drill Guides**

Dental CT Scans



- **Bony anatomy of Mandible, Maxilla, Zygomatic Arches**

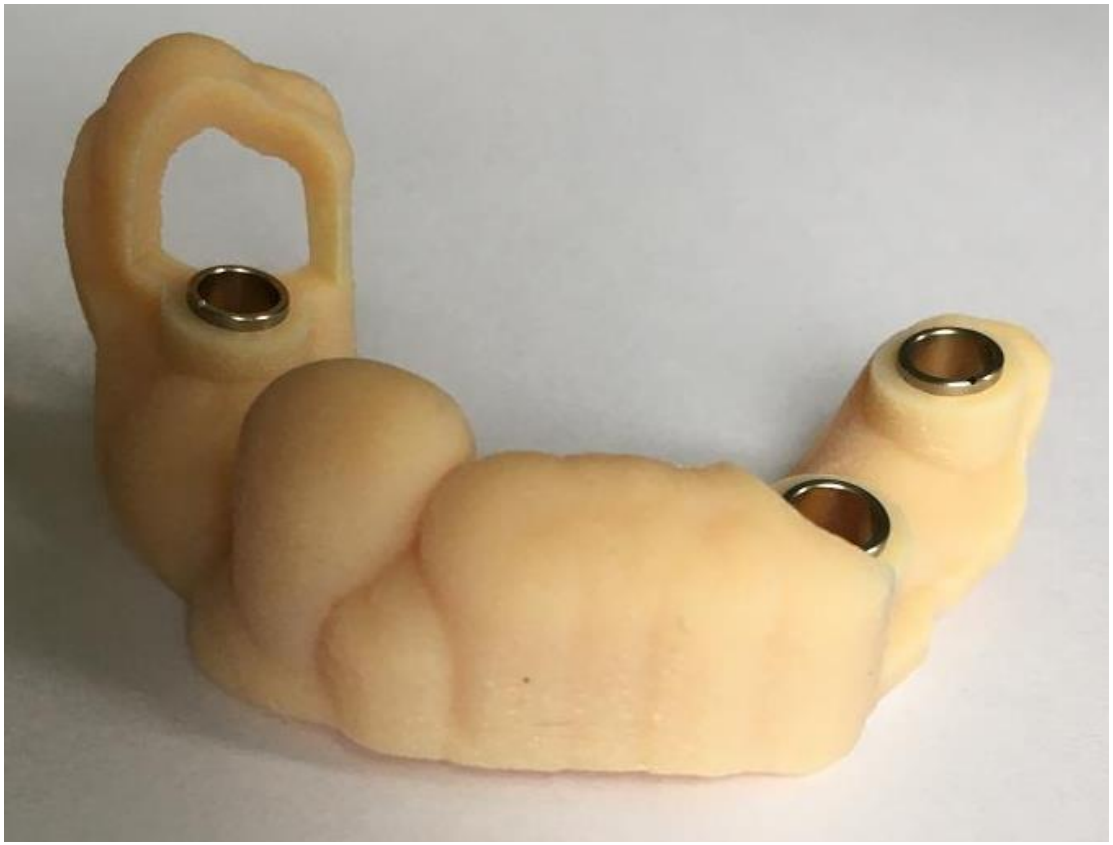
- **Useful for:**
  - **impacted, supernumerary and abnormal teeth**
  - **root canals, root fractures**
  - **planning dental implants**
  - **periapical disease**
  - **cleft palate assessment**
  - **TMJ and airway analysis**

Surgical Planning software:

- **Osirix™**
- **i-CATVision™**
- **Blue Sky Plan™**
- **In Vivo Dental™**
- **SIMPLANT™**
- **Nobel Clinician™**
- **coDiagnostiX™**

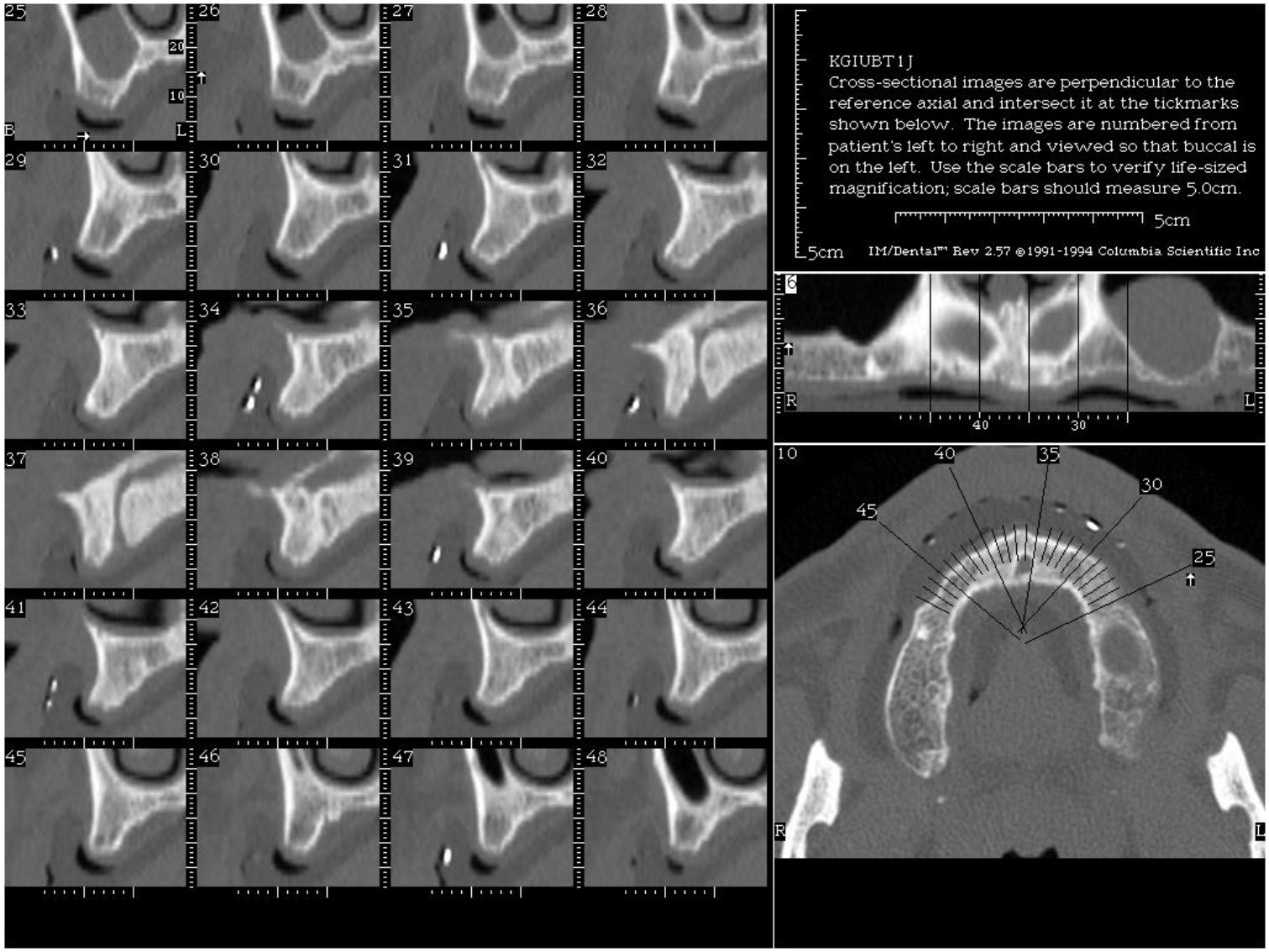
IDT Scans, 15 Market Street, Kinsale, Co. Cork Tel +353 21 470 9501 Email info@idtireland.ie

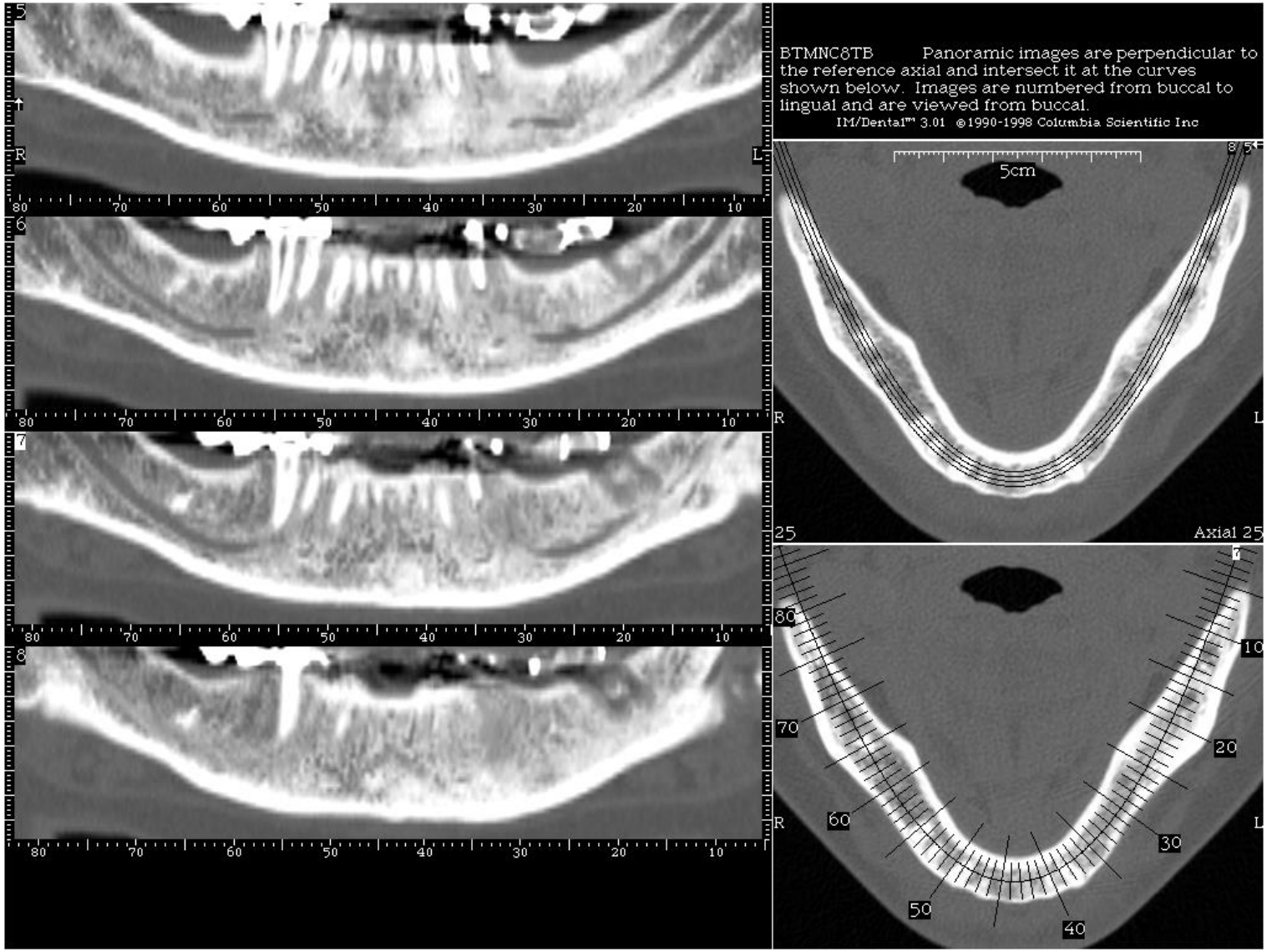
Surgical Drill Guides



Reformatted CT Scans

Kodak Prints




5
R
L
80 70 60 50 40 30 20 10
6
80 70 60 50 40 30 20 10
7
80 70 60 50 40 30 20 10
8
80 70 60 50 40 30 20 10
BTMNC8TB Panoramic images are perpendicular to the reference axial and intersect it at the curves shown below. Images are numbered from buccal to lingual and are viewed from buccal.
IM/Dental™ 3.01 ©1990-1998 Columbia Scientific Inc
5cm
8
5
R
L
25
Axial 25
80
10
70
20
60
30
50
40
R
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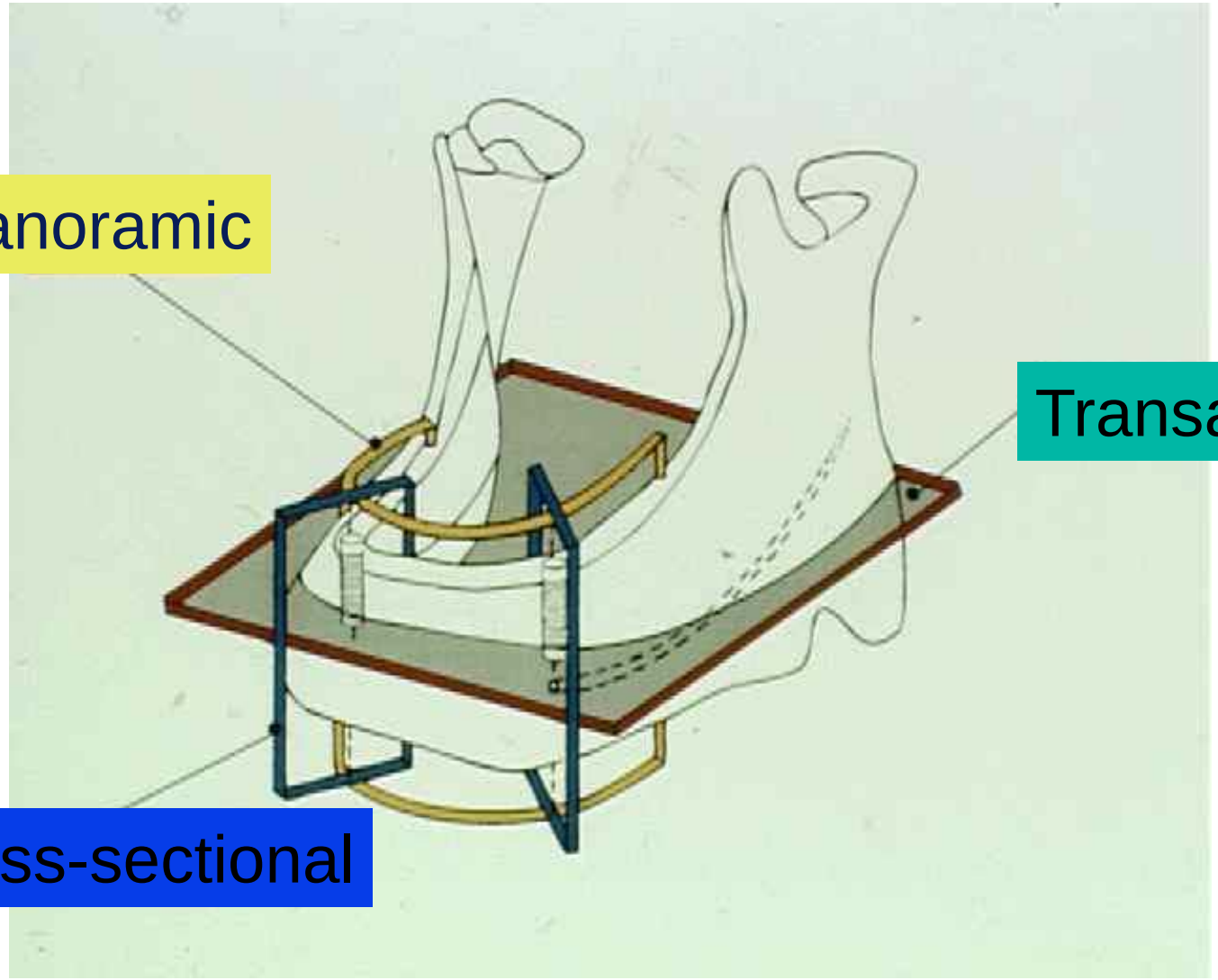
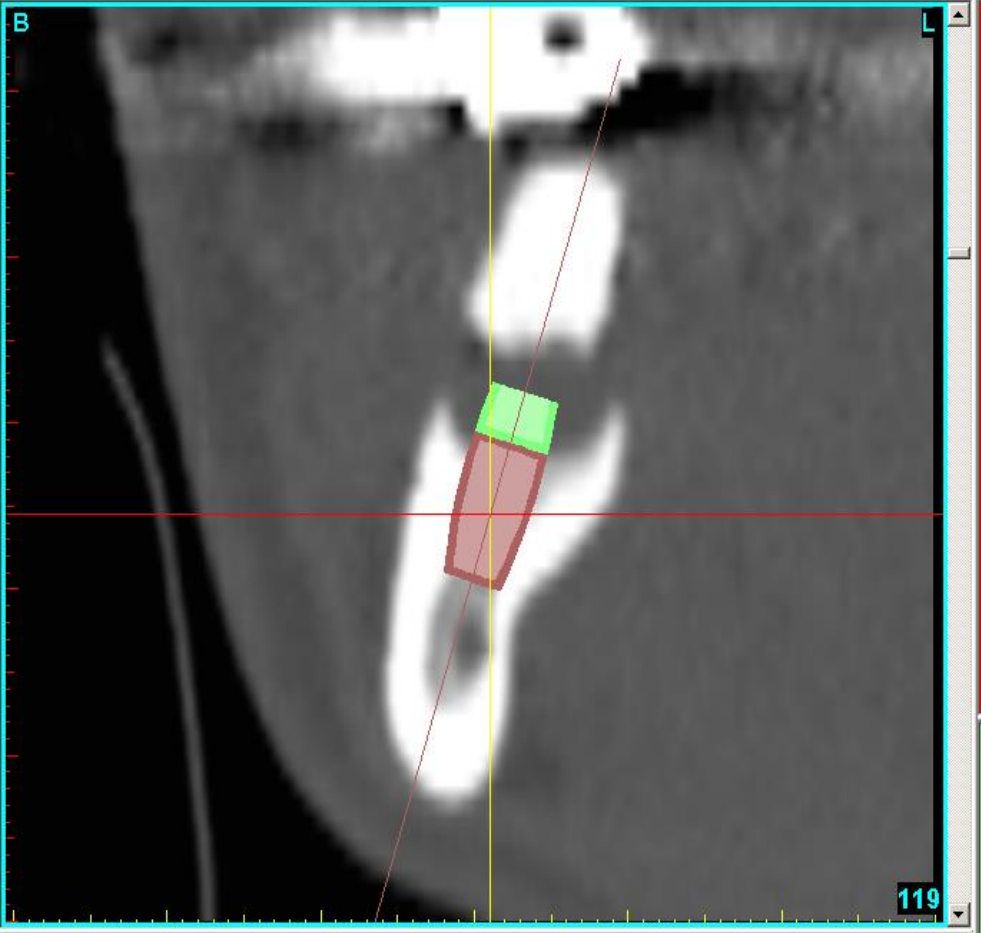
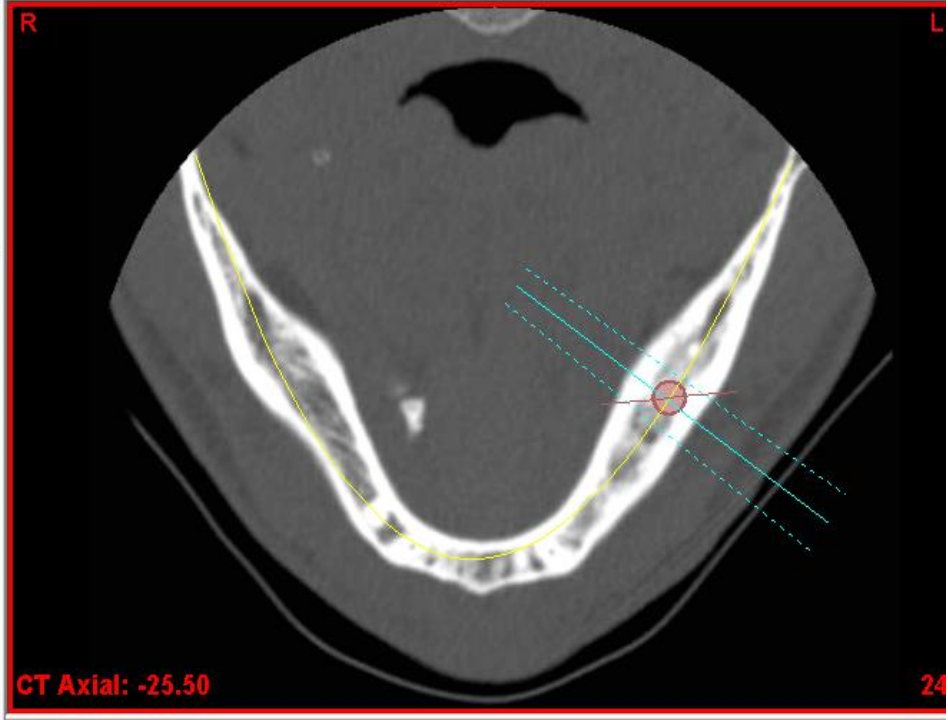
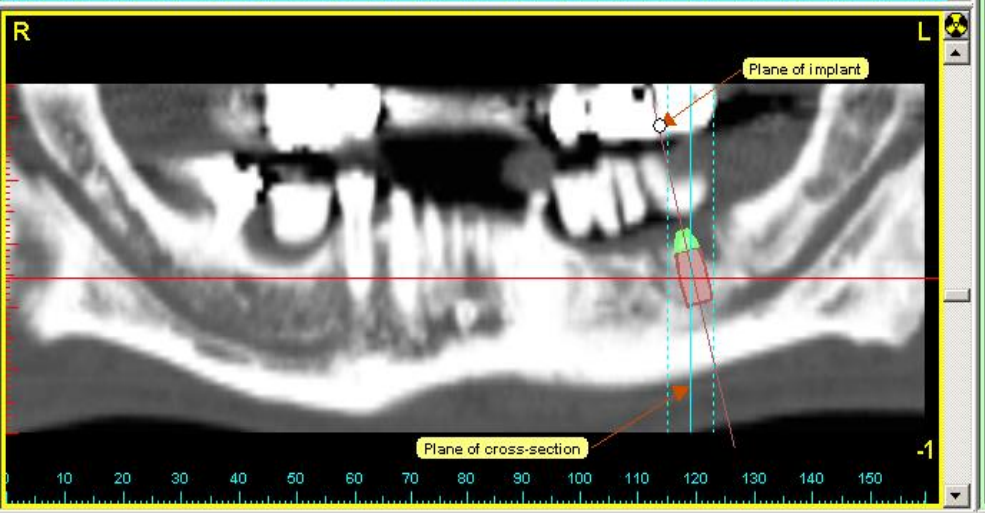
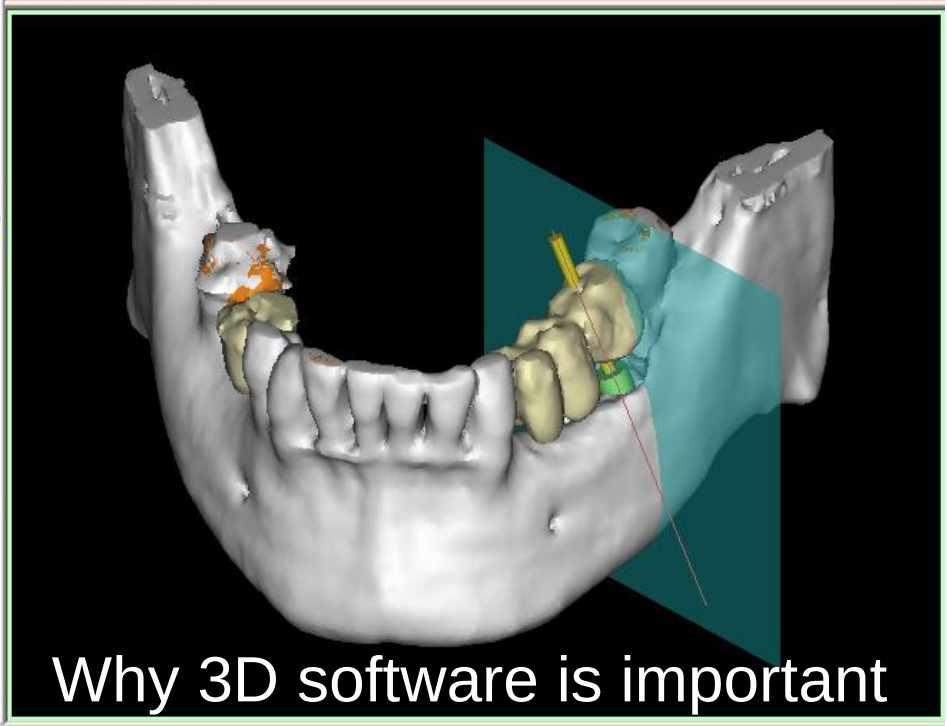

Panoramic
Transaxial
Cross-sectional

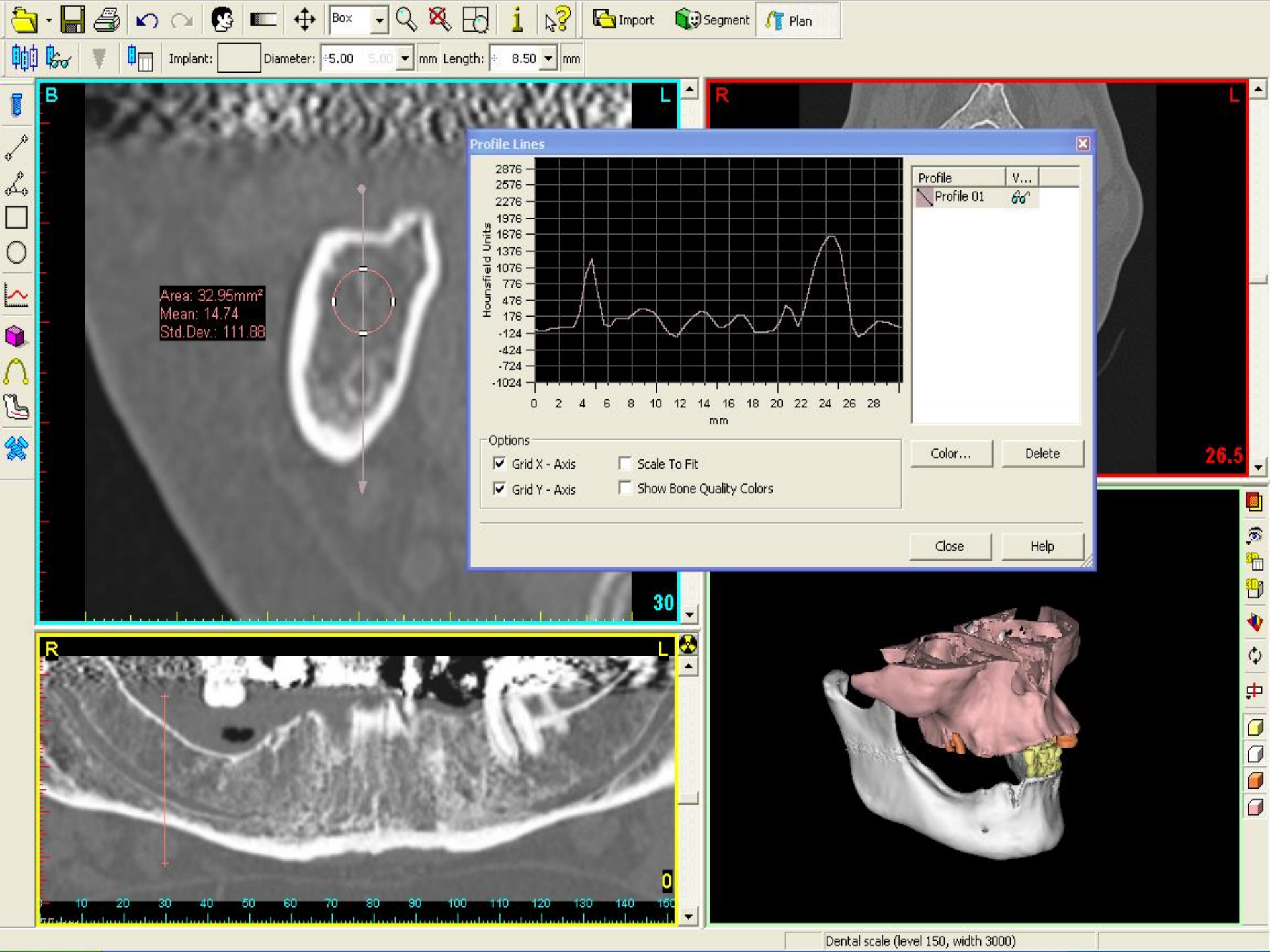








Why 3D software is important


Box
Import
Segment
Plan
Implant:
Diameter:
5.00
mm
Length:
8.50
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B
L
Area: 32.95mm²
Mean: 14.74
Std.Dev.: 111.88
30
R
L
26.5
Profile Lines
2876
2576
2276
1976
1676
1376
1076
776
476
176
-124
-424
-724
-1024
Hounsfield Units
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
mm
Profile
V...
Profile 01
Options
Grid X - Axis
Grid Y - Axis
Scale To Fit
Show Bone Quality Colors
Color...
Delete
Close
Help
R
L
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140
Dental scale (level 150, width 3000)

Restoration-Driven Implant Planning

"Create a model of the desired result, then work backwards to determine how it can be achieved"

- ***Radio-Opaque Scanning Stents***
- ***3D Implant Planning Software***
- ***Surgical Drill Guides***

The Ultimate Goal

Place implants so accurately that a (temporary) restoration can be fabricated before the surgery takes place

"The Immediate Smile" *– Materialise Dental*

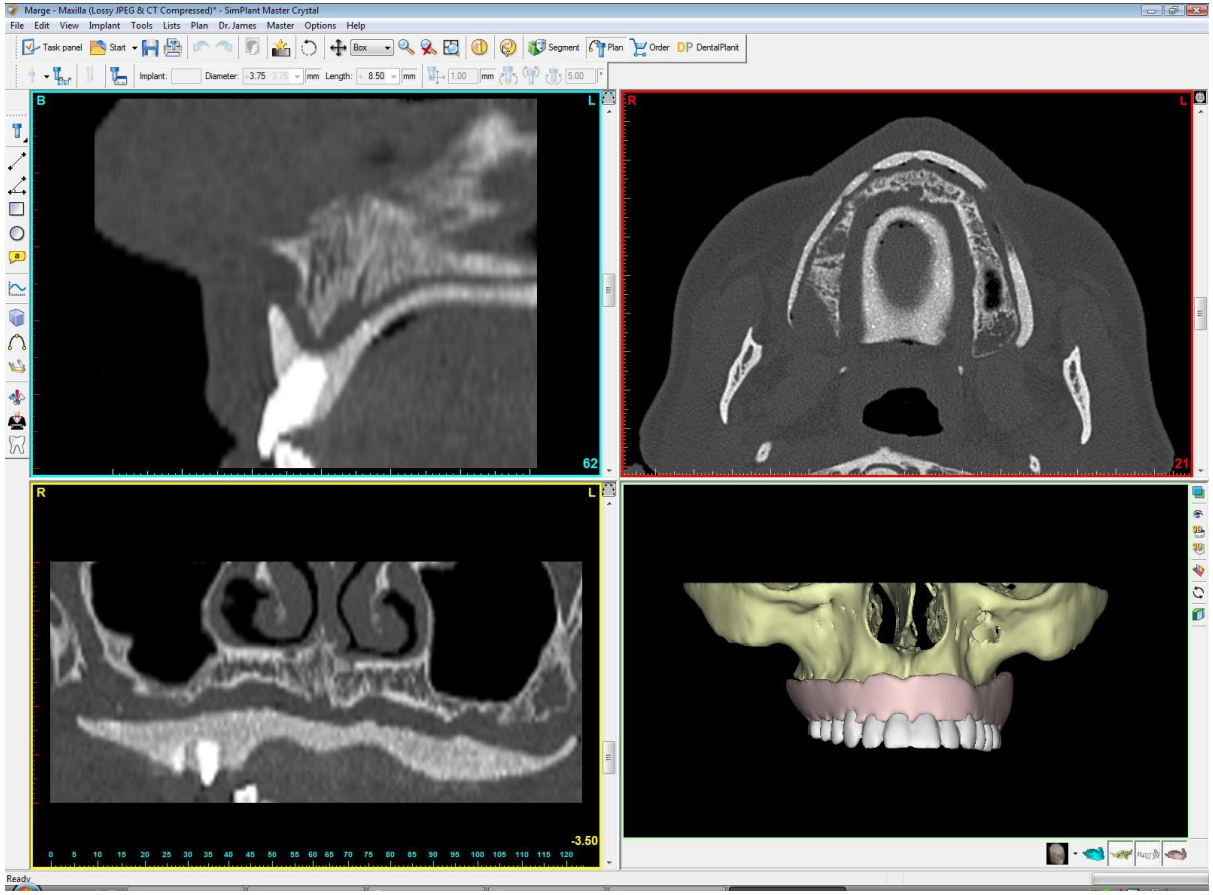
"Teeth in an Hour" *- Nobel Biocare*

"Smart Implants" *– Smart Implants UK Ltd*

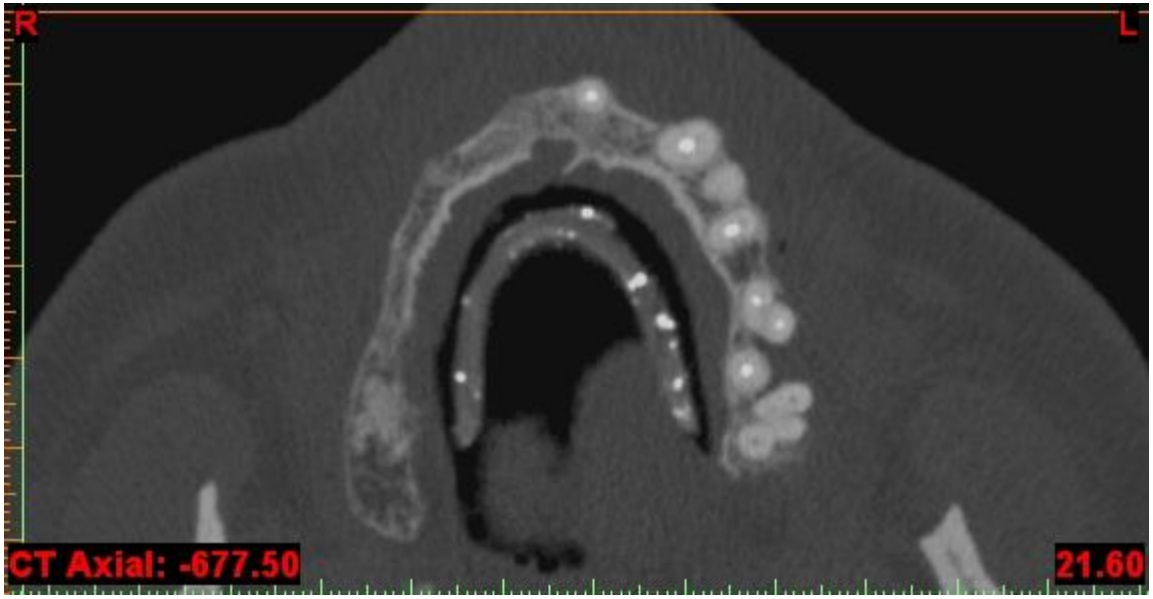
Advantages of using a Scanning Stent

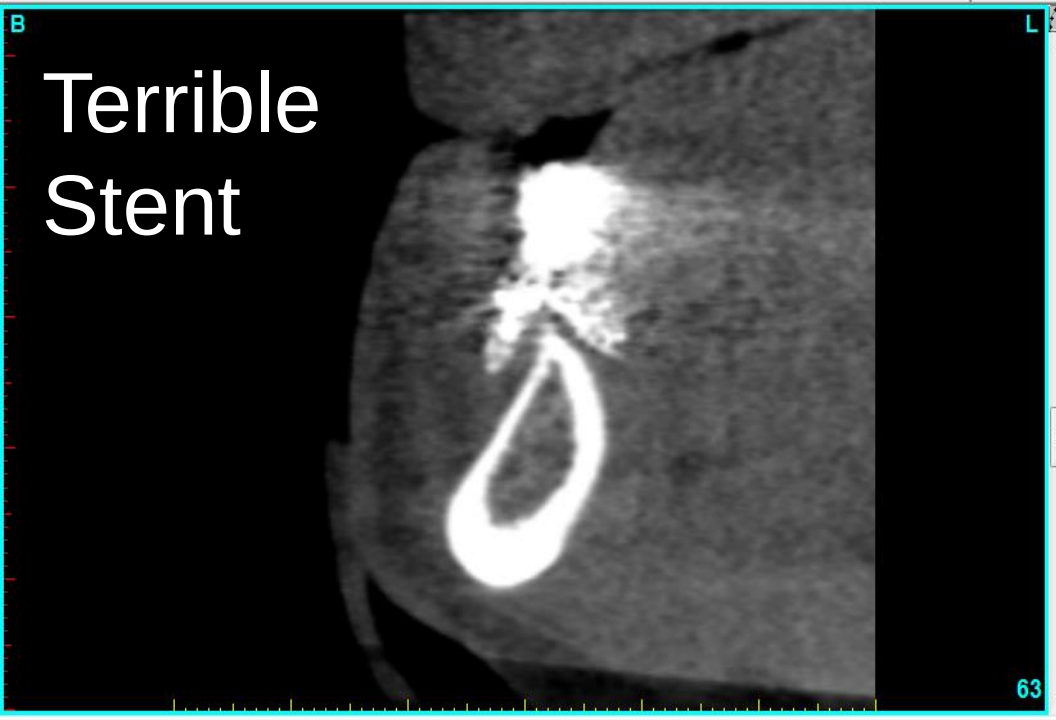
- **Gives inter-arch stability for the patient during the scan**
- **Opens the bite slightly (a few mm) using occlusal stops**
- **Position and size of the desired restoration can be visualised in the CT images**
- **If the maxilla and mandible are scanned together the 3D image will illustrate the inter-arch relationship.**

Good Stent

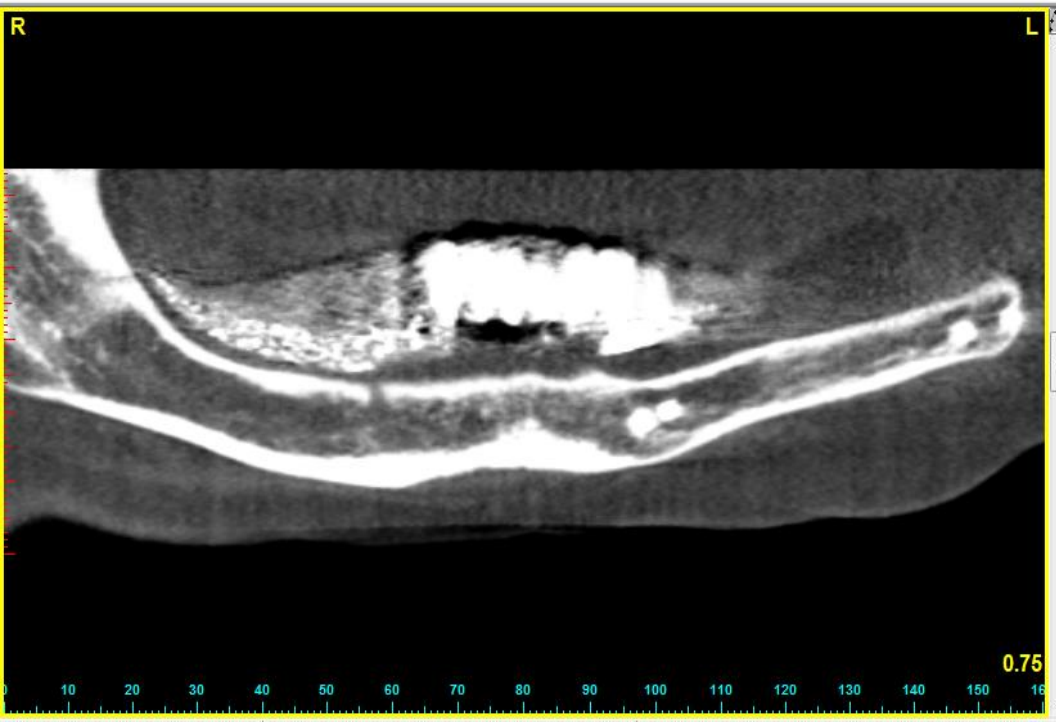

Marge - Maxilla (Lossy JPEG & CT Compressed)* - SimPlant Master Crystal
File Edit View Implant Tools Lists Plan Dr. James Master Options Help
Task panel Start Box Segment Plan Order DP DentalPlanit
Implant: Diameter: 3.75 mm Length: 8.50 mm
B L
62
ER L
21
R L
-3.50
Ready

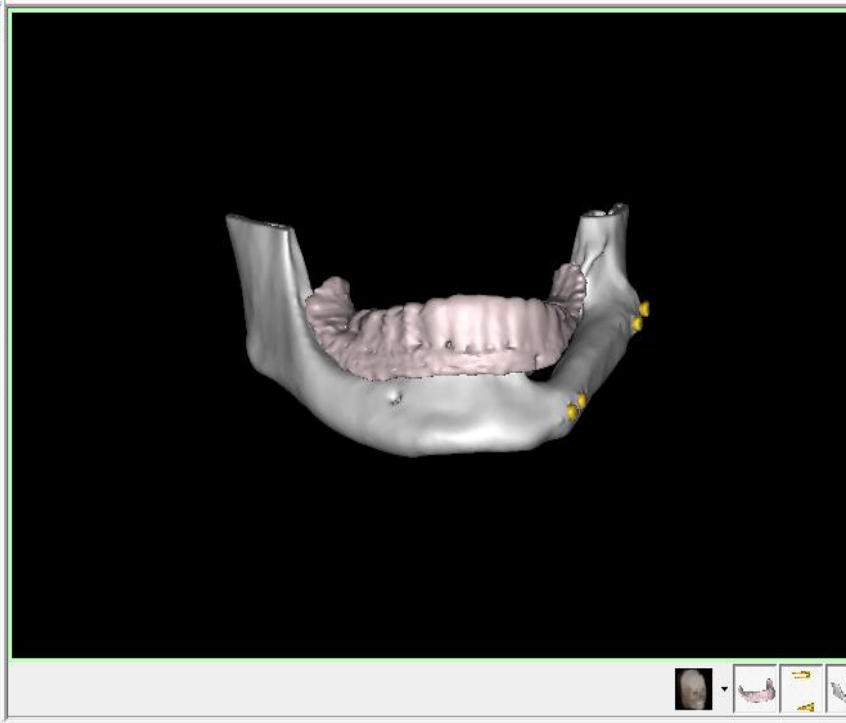
Bad Stent



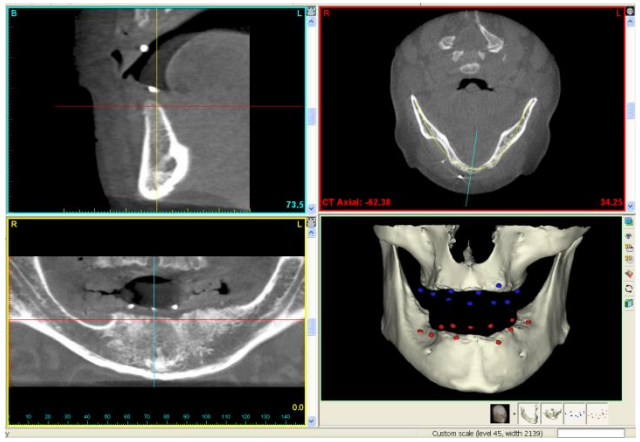


Terrible Stent





Dual Scan Technique



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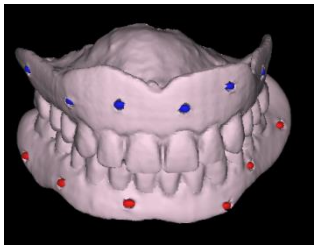

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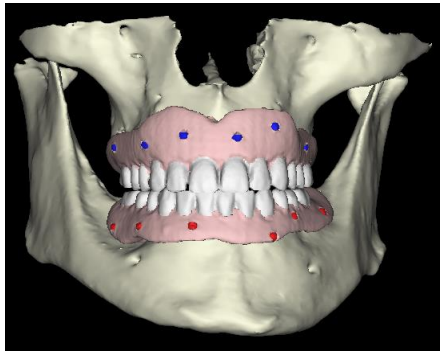


B
L
68


R
L
CT Axial: -50.25
50.10


R
L
0.00
0
10
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40
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80
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100
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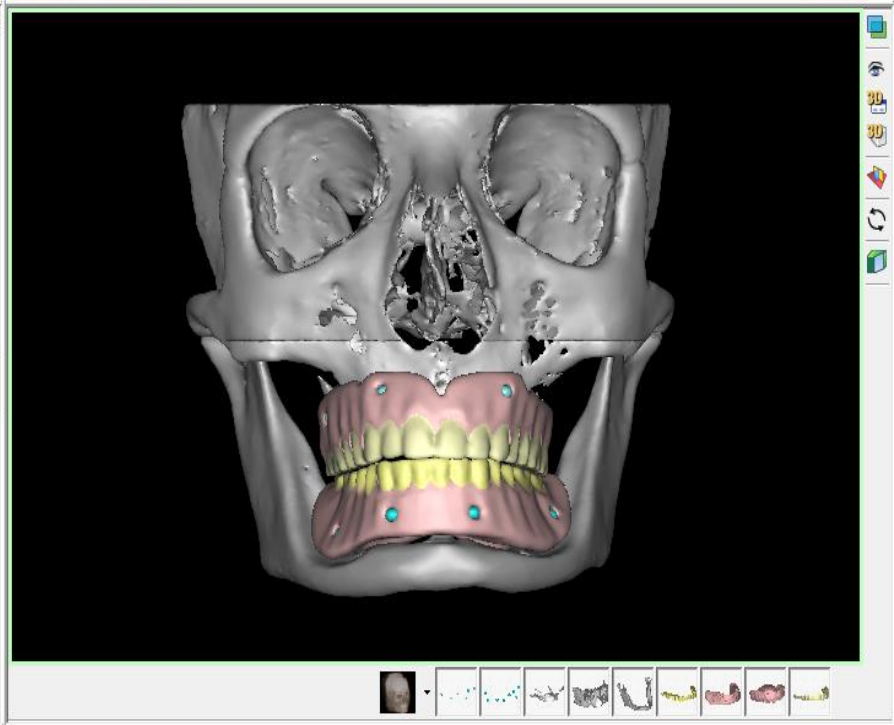
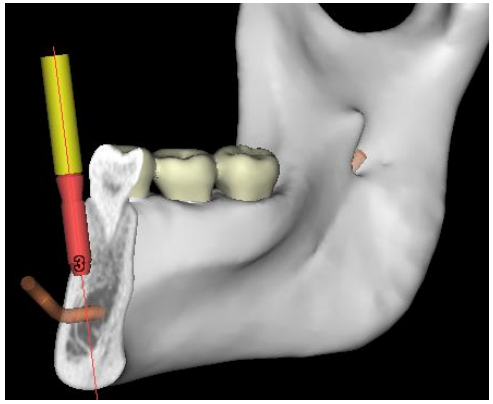
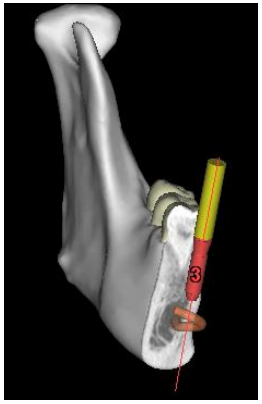
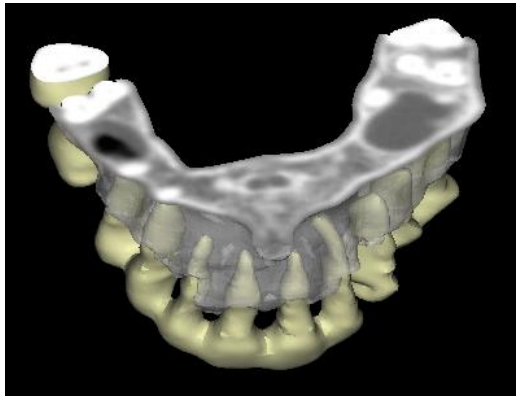
120
130

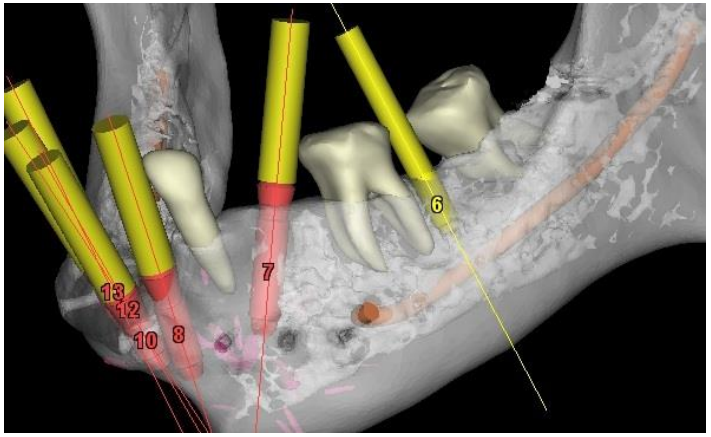


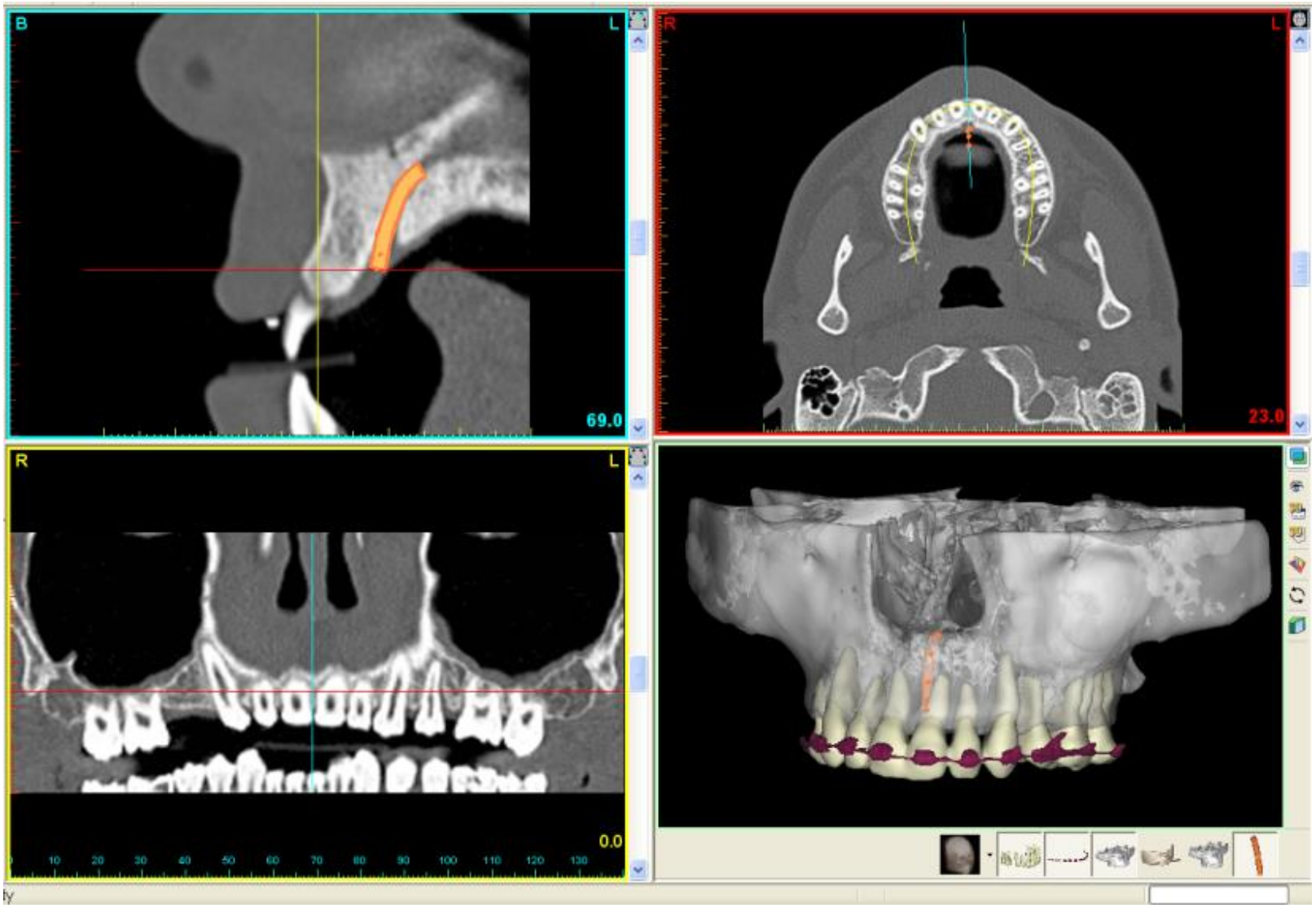
Segmentation and 3D Views










B
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69.0
R
L
23.0
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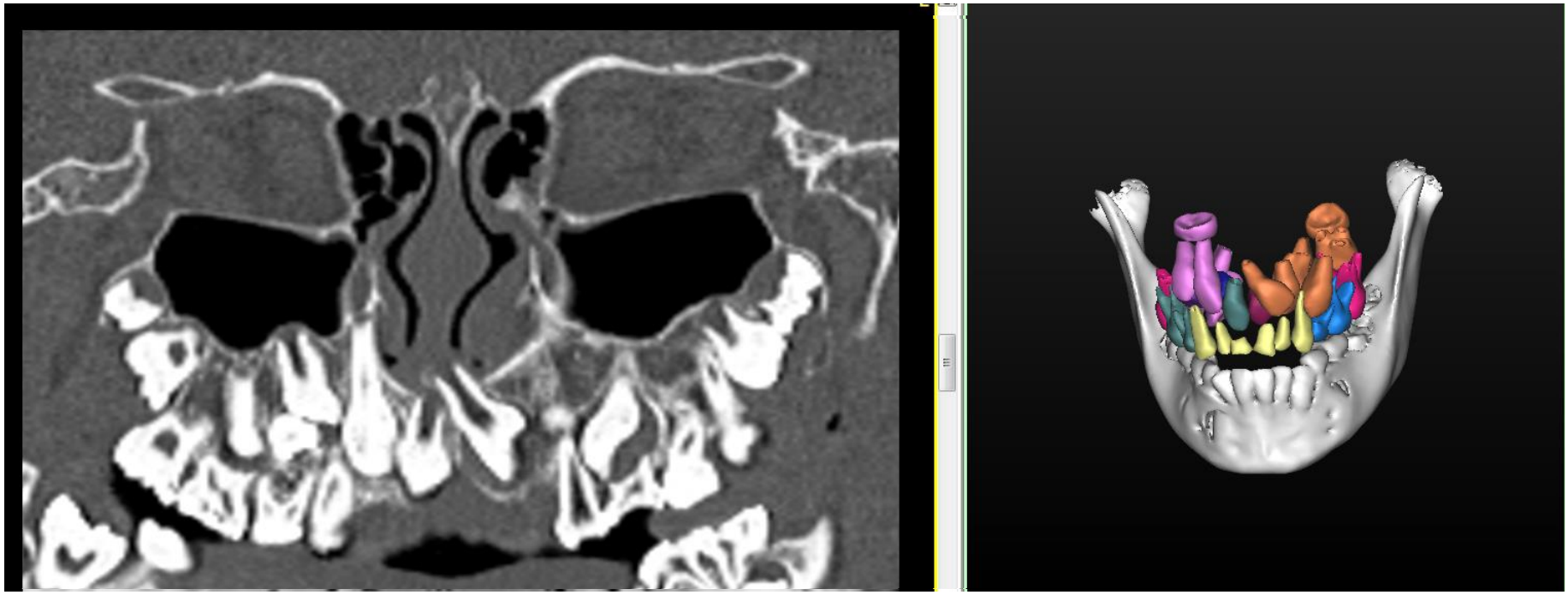
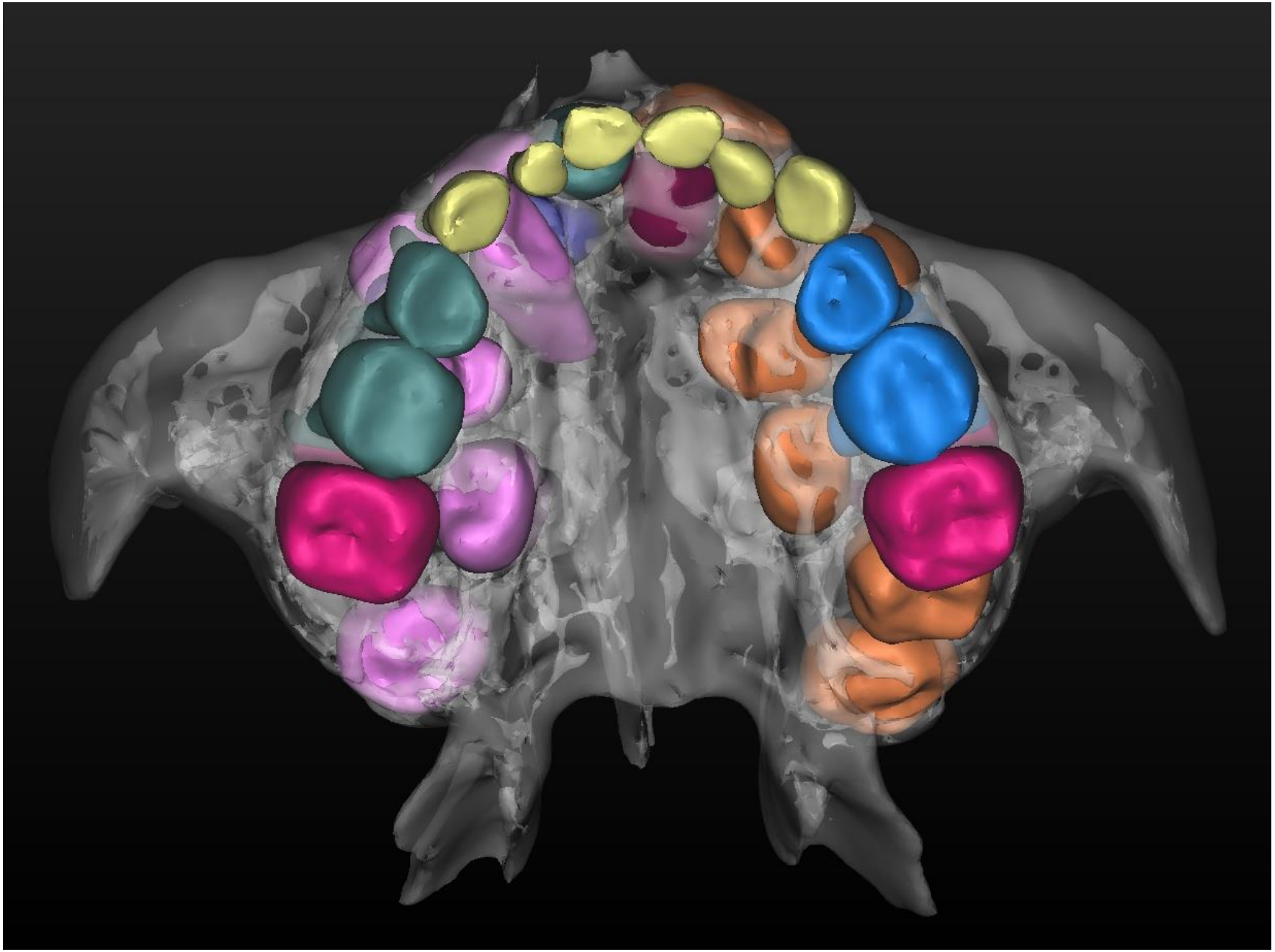
110
120
130

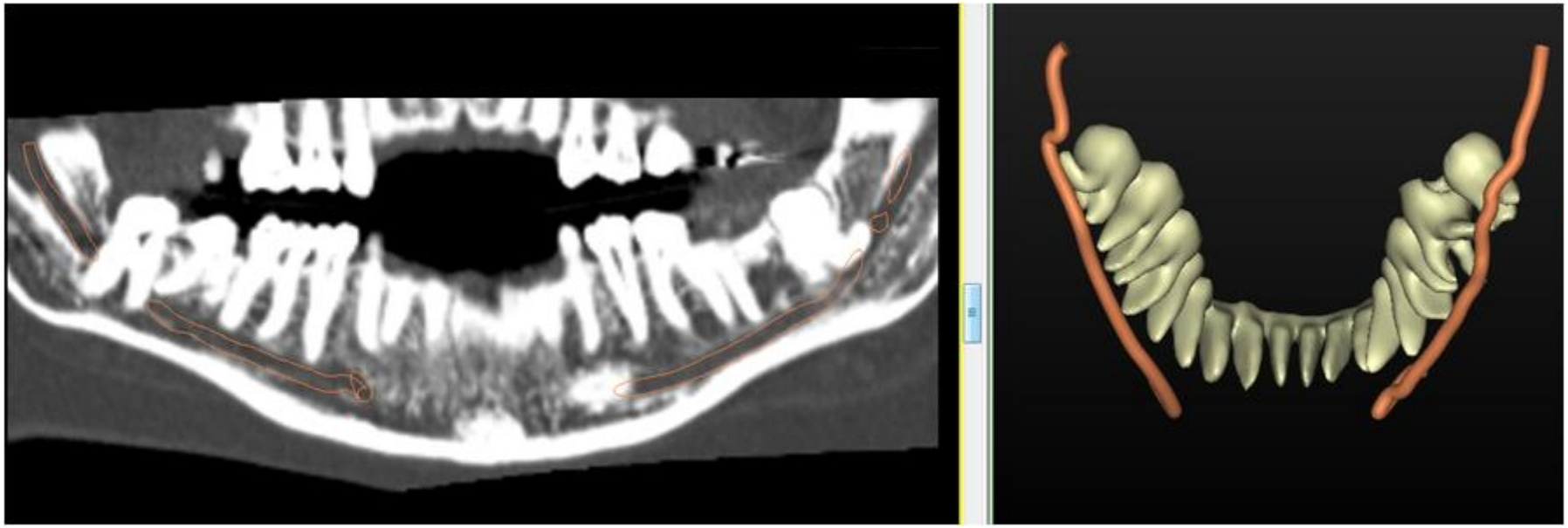
Hyperdontia



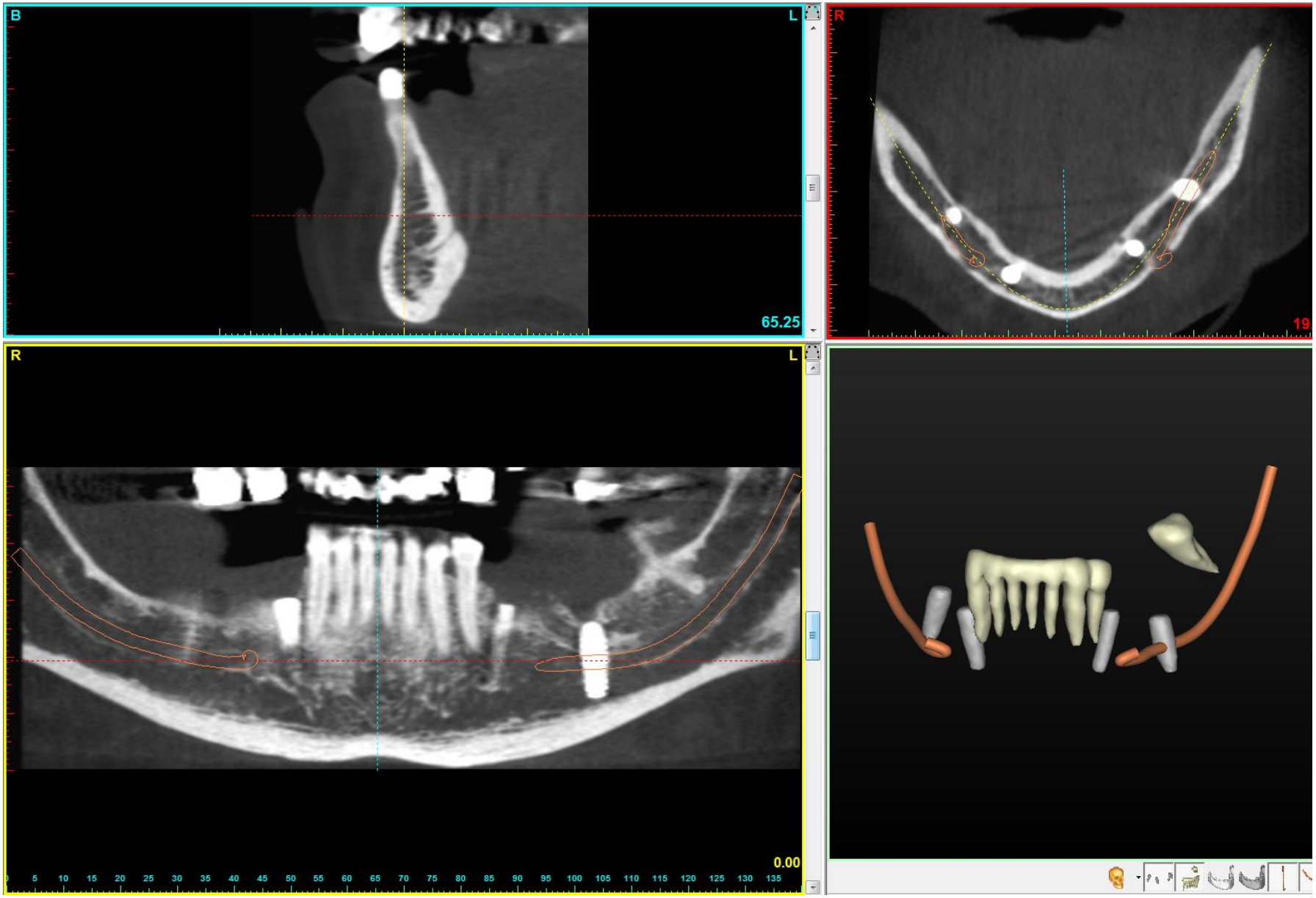
Courtesy of Nicolette Schroeder



Third Molars



Courtesy of Barry Dace



Take the CT Scan first, do the surgery second (not the other way around)!

IDT Scanning Protocols

- **Designed to produce the best image quality at the lowest radiation dose**
- **“Tested, Tried and True” at a number of Scanning Sites**

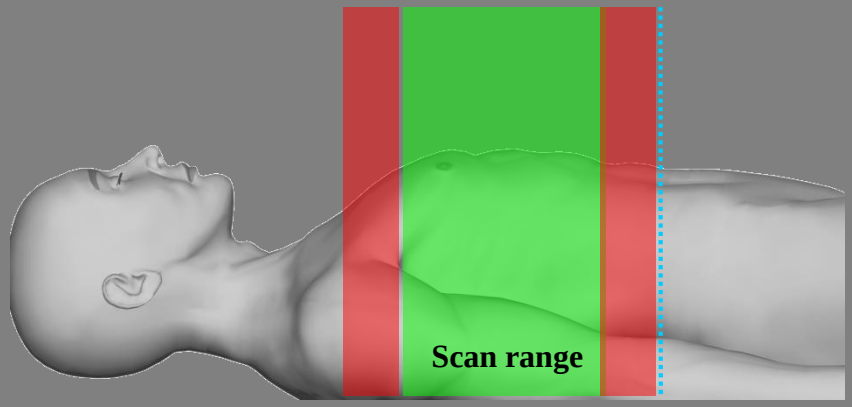
IDT Scanning Protocols

	Toshiba Aquilion 64	Philips Brilliance 64	Siemens Sensation 64	GE LightSpeed VCT	GE Optima CT660
kVp	120	120	120	120	120
Effective mAs	53	100	100	75	75
Time per Rotation	0.5 second	0.75	1	0.8	0.8
Collimation	32 x 0.5mm	40 x 0.625	20 x 0.6	32 x 0.625	32 x 0.625
Pitch	0.656	0.45	0.45	0.531	0.531
AEC	Sure Exposure = OFF	CAREDOSE = OFF	CAREDOSE = OFF	Smart mA = OFF	Smart mA OFF
Recon FOV	150 mm	150 mm	150 mm	150 mm	150 mm
Recon Algorithm	FC35	D (Bone)	H60s	Bone Plus	Bone Plus
Recon Slice Increment	0.25 mm	0.3 mm	0.3 mm	0.3 mm	0.3 mm
Recon Slice Thickness	0.5 mm	0.8 mm	0.75 mm	0.625 mm	0.625 mm
CTDIvol	11.2 mGy	13.85 mGy	14.1 mGy	12.3 mGy	13.2 mGy
Typical DLP	110 mGy.cm	130 mGy.cm	135 mGy.cm	121 mGy.cm	100 mGy.cm

Overrun

- **Overrun of about 1 rotation before and after imaged region (depending on scanner)**
- **Overrun very important in Dental CT as a large beam width can more than double the dose**
- **Important to use minimum collimation possible especially for scanners with 64 or more detector rows.**

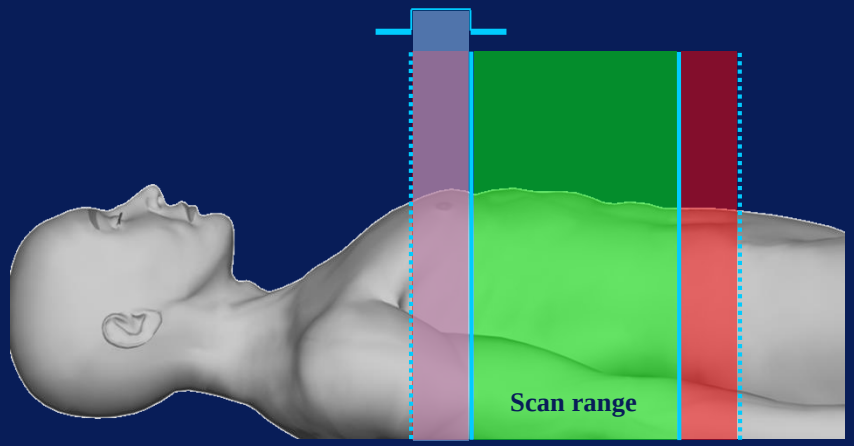
Overrun



Length irradiated = Length imaged + Overrun

Courtesy of Siemens

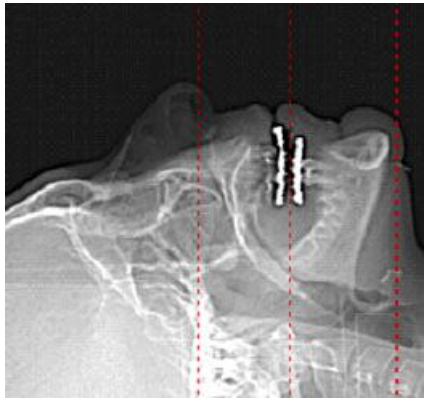
Siemens Definition has a solution



Technologie conventionnelle

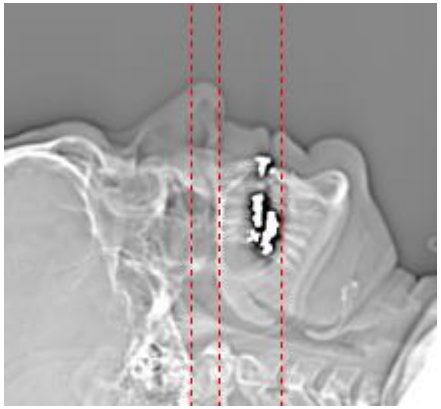
Courtesy of Siemens

Positioning the Patient



Occlusal Plane ✔
Mx or Mn

+ Minimise Artefact
+ Scan Both Jaws together
+ Most comfortable for patient



Hard Palate ✖
Maxilla only

- Artefact may be an issue
- Cannot Scan Both Jaws

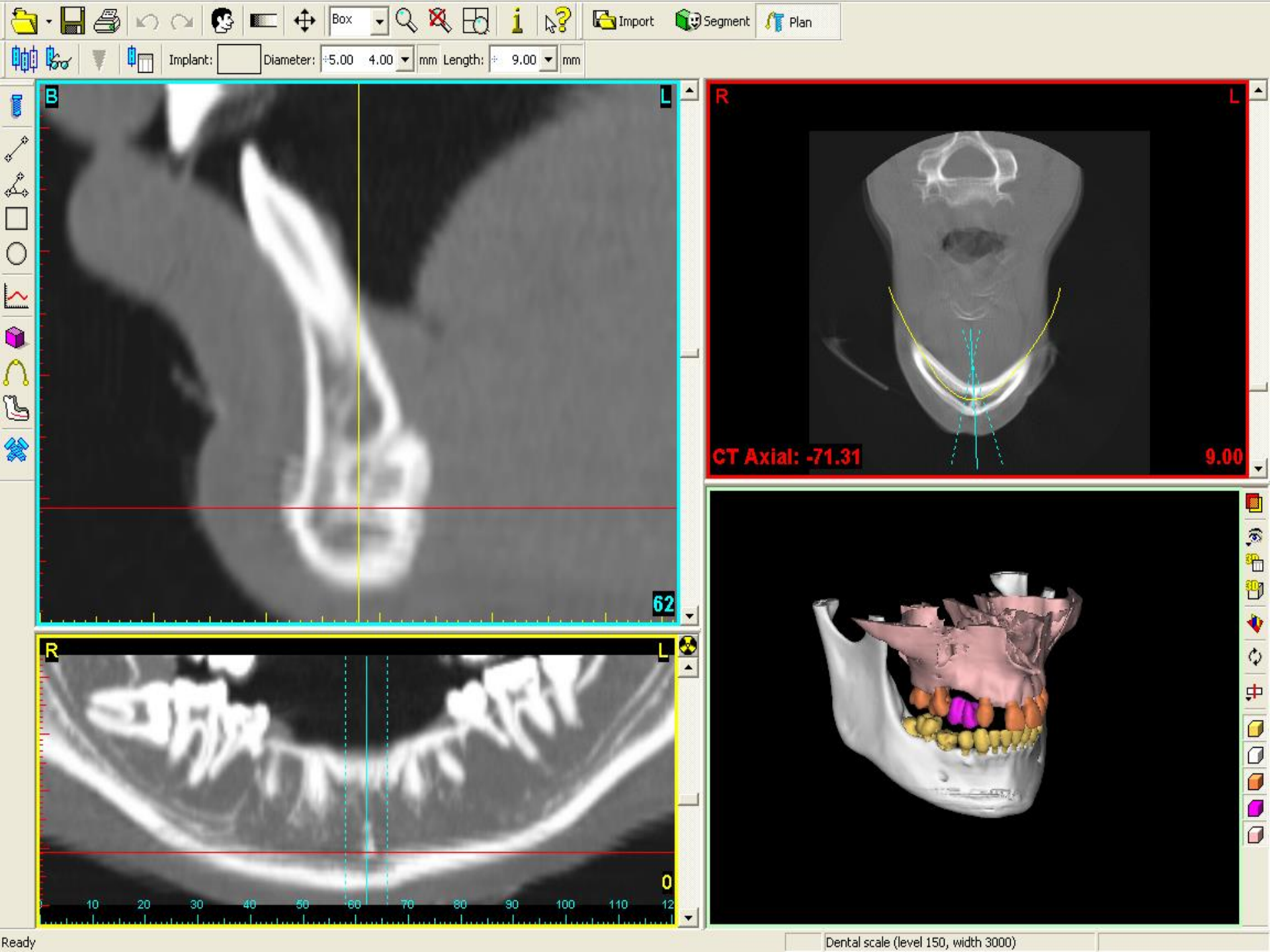
Lower Border ✖
Mandible only

- Artefact may be an issue
- Cannot Scan Both Jaws
- Uncomfortable for patient

Artefacts in CT images

Artefact = structured contribution to the image which has no counterpart in the object.

- **Motion artefact**
- **Spiral artefacts**
- **Starburst artefact**
- **Beam hardening**


Box
Import
Segment
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Implant:
Diameter:
5.00
4.00
mm
Length:
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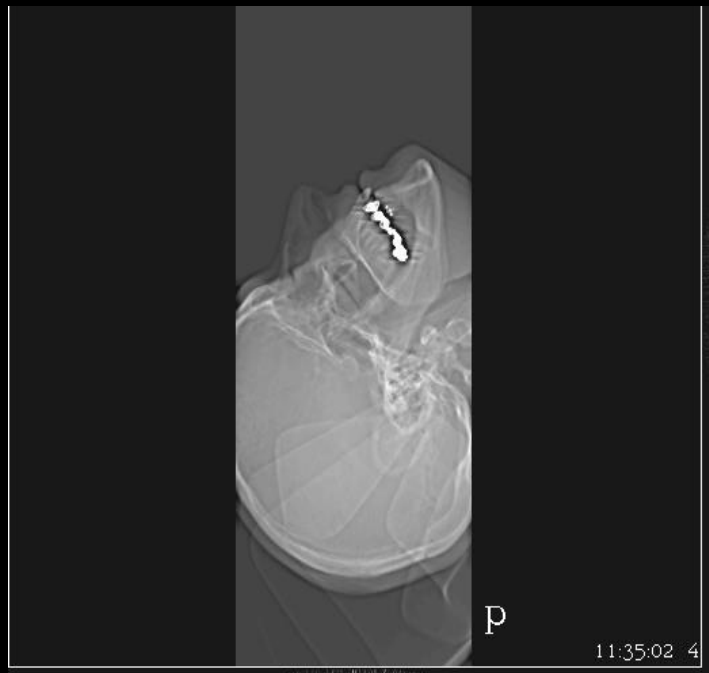
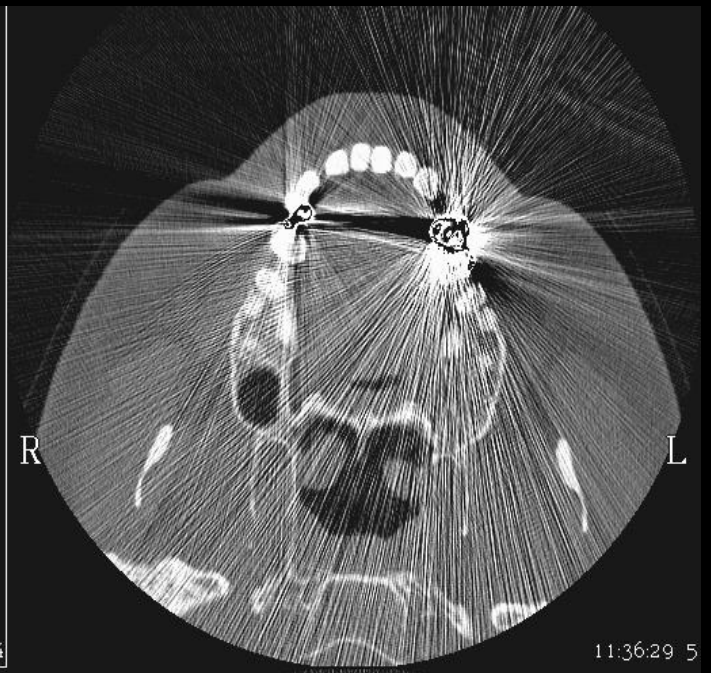
B
L
62
R
L
CT Axial: -71.31
9.00
R
L
0
10
20
30
40
50
60
70
80
90
100
110
Ready
Dental scale (level 150, width 3000)

STARBURST ARTEFACT

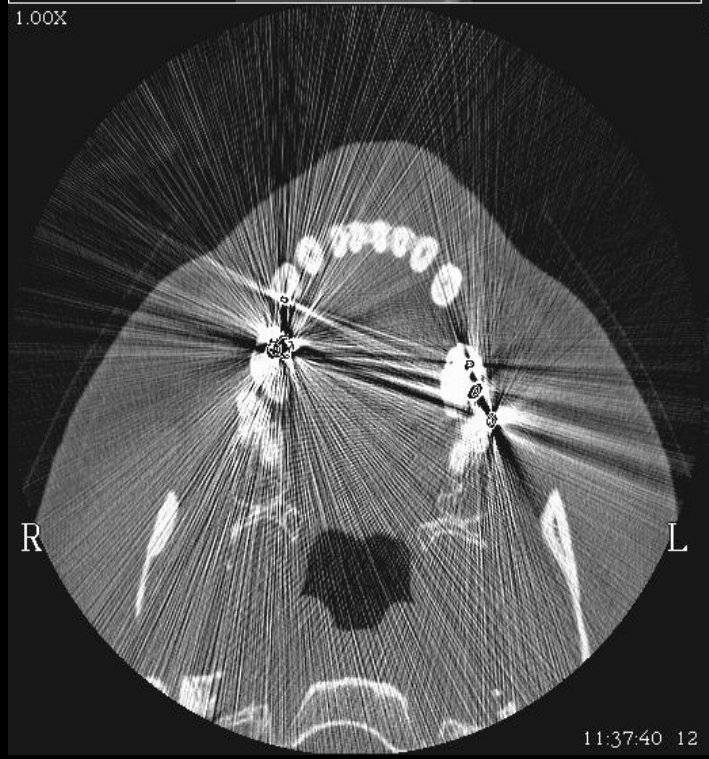
- **Starburst artefacts arise in CT scans when sharp changes in density are present, e.g. between air and bone or between bone and dense metals**
- **Starburst artefacts are caused by limitations in high frequency sampling**
- **Starburst artefacts are not caused by scattered radiation**

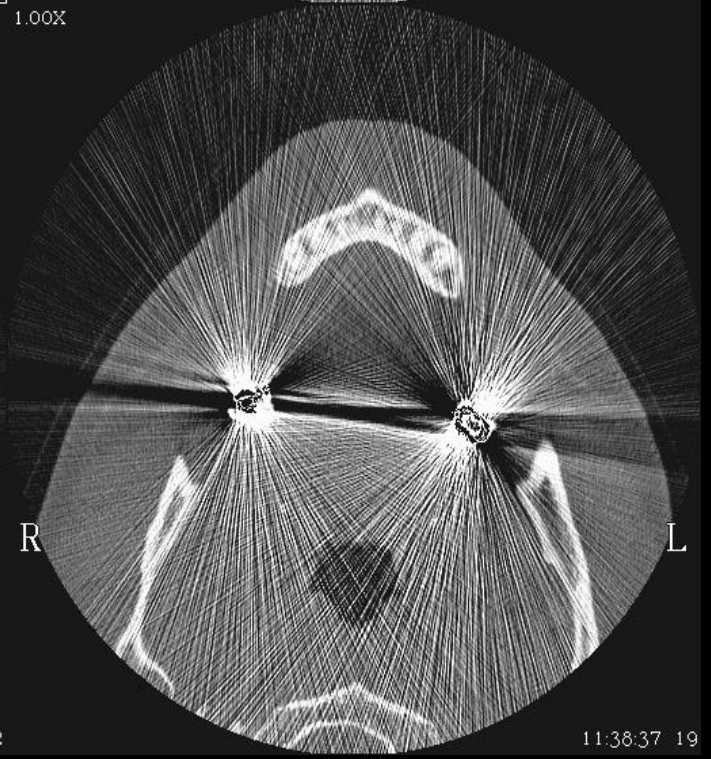


1.00X



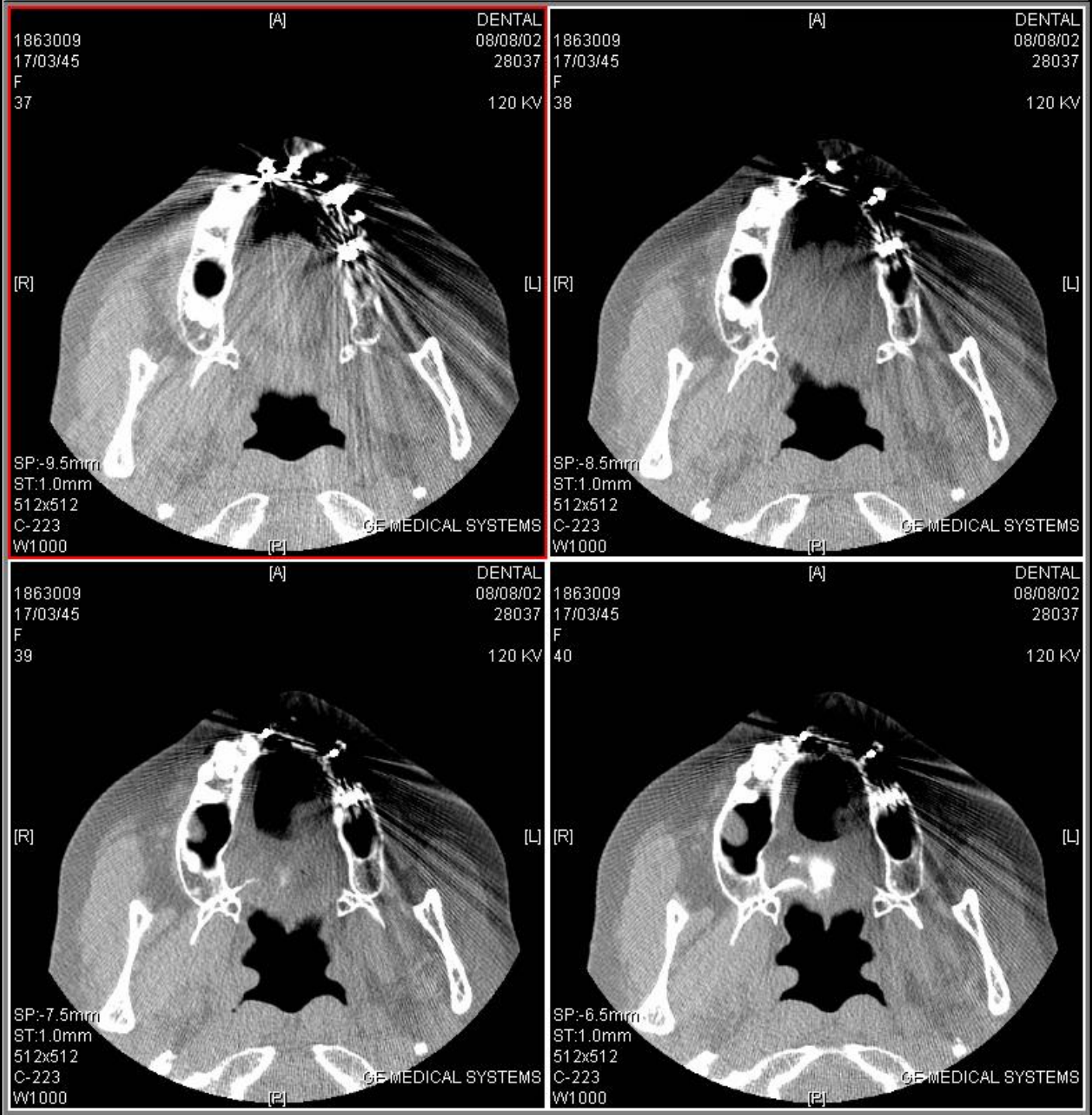
1.00X





BEAM HARDENING ARTEFACT

- **Beam Hardening artefacts also occur in CT scans when metals are present**
- **Metals cause the low energy x-rays to be filtered out of the x-ray beam**
- **The average energy becomes higher**
- **The CT numbers become lower**
- **Parts of the image appear black**

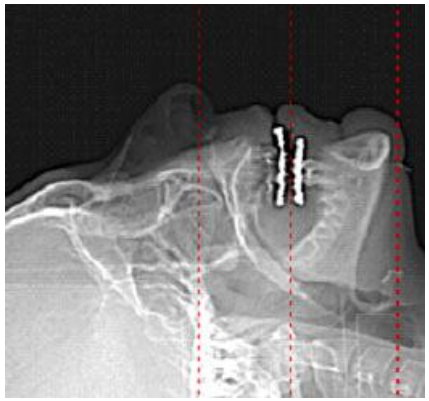

[A]
DENTAL
1863009
08/08/02
17/03/45
28037
F
37
120 KV
[R]
[L]
SP:-9.5mm
ST:1.0mm
512x512
C-223
W1000
GE MEDICAL SYSTEMS
[P]
[A]
DENTAL
1863009
08/08/02
17/03/45
28037
F
38
120 KV
[R]
[L]
SP:-8.5mm
ST:1.0mm
512x512
C-223
W1000
GE MEDICAL SYSTEMS
[P]
[A]
DENTAL
1863009
08/08/02
17/03/45
28037
F
39
120 KV
[R]
[L]
SP:-7.5mm
ST:1.0mm
512x512
C-223
W1000
GE MEDICAL SYSTEMS
[P]
[A]
DENTAL
1863009
08/08/02
17/03/45
28037
F
40
120 KV
[R]
[L]
SP:-6.5mm
ST:1.0mm
512x512
C-223
W1000
GE MEDICAL SYSTEMS
[P]

HOW TO AVOID ARTEFACTS

- **Remove jewellery and dentures that include metal**
  (leave plastic dentures in)

- **Careful patient positioning.**

How Many Slices?



Maxilla:

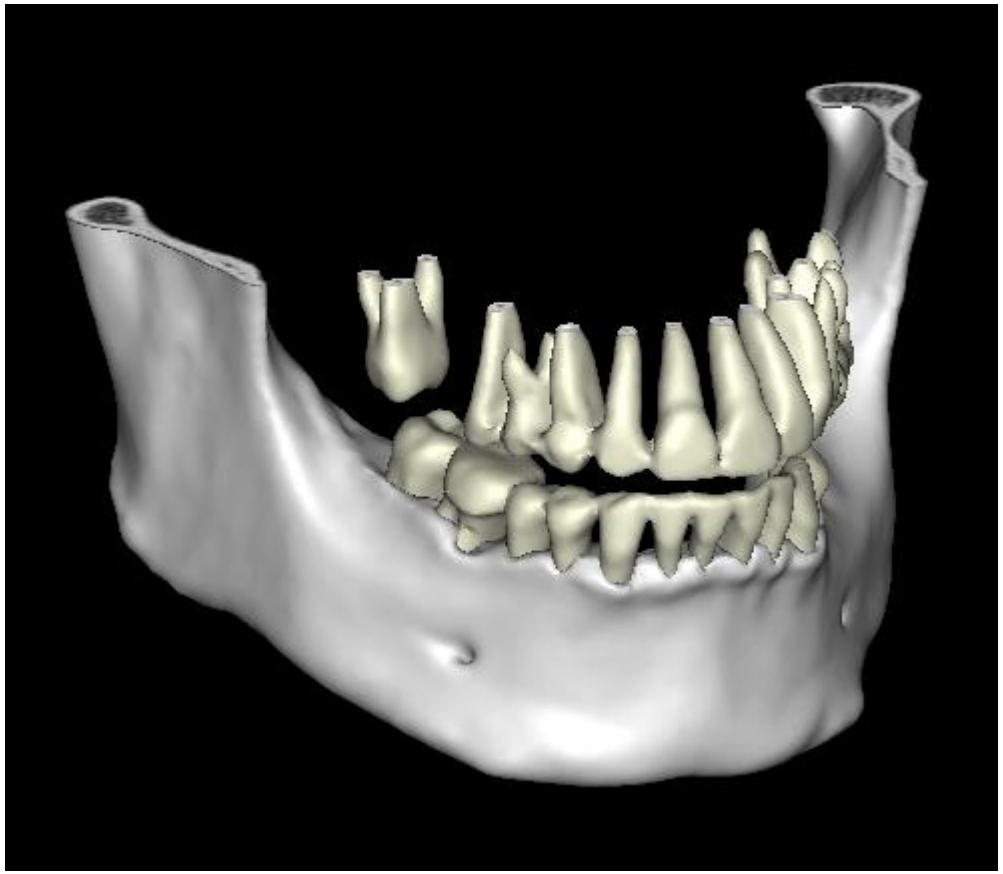
- Start halfway up the sinuses
  (about 20mm above hard palate)
- Scan towards the oral cavity
- Stop below all Mx teeth or markers in stent
- Do not scan orbits
  (unless explicitly requested and justified)

Mandible:

- Start just below the lower border
- Scan towards oral cavity
- Stop above all Mn teeth or markers in stent
- Do not scan thyroid
- Do not scan ascending rami up to TMJ
  (unless explicitly requested and justified)

Field Of View = 150mm is optimal

Include maxilla teeth but not TMJs



Sending the Data to IDT

We can receive the data:

- **via PACSmail or bbRad** ✔
- **on CD through the post** ✘

Please include the following with the data:

- **Dose Report**
- **ScoutViews**
- **Axial Slices**

Feedback Form

Hospital: IDTRef: *17546*

Patient: DOB: *?*

ScanDate: *2009-11-16* Time: *11:58* Rec'dVia: *CD*

Anatomy: *Maxilla*

Referrer: *Ms. M. Patel* Radiog.:

Scanner: *Siemens Sensation 16* DLP: *168 mGy.cm*

Scan Duration: *8 Seconds*

Effective Dose: *0.3 mSv (calculated from DLP)*

DENTAL CT SCAN REVIEW

1.	There was no lateral Scout View included with the data. Please include a "Scout View" or "Localizer" with every dataset.	◉ N/A ○ Minor ○ Major
2.	The axial slices do not correspond with the Scout View. Please ensure the patient doesn't move after the Scout View is taken.	◉ N/A ○ Minor ○ Major
3.	The patient was rotated / not straight with respect to the gantry. Please position the patient as straight as possible.	◉ N/A ○ Minor ○ Major
4.	An incorrect Slice Increment (interval) of mm was used. Please use an increment of 0.5 mm for future scans.	◉ N/A ○ Minor ○ Major
5.	An incorrect Slice Thickness of mm was used. Please use a Slice Thickness of 0.75 mm for future scans.	◉ N/A ○ Minor ○ Major
6.	An incorrect Gantry Tilt of degrees was used. Please use a Gantry Tilt of 0 degrees for future scans.	◉ N/A ○ Minor ○ Major
7.	An incorrect Field of View (FOV) of mm was used. Please use an FOV of 150 mm for future scans.	◉ N/A ○ Minor ○ Major
8.	An incorrect Reconstruction Kernel of was used. Please use H60s for future scans.	◉ N/A ○ Minor ○ Major
9.	An incorrect Scanning Plane was used. Please scan parallel to the Occlusal Plane unless otherwise specified.	◉ N/A ○ Minor ○ Major
10.	An excessive number of axial slices appears to have been acquired. This makes the Effective Dose higher than necessary. Please don't scan more than the Referrer has requested.	◉ N/A ○ Minor ○ Major
11.	The region scanned did not include all of the bony anatomy or landmarks required. Please include the full height of teeth and markers.	◉ N/A ○ Minor ○ Major
12.	The patient moved during the examination. Please encourage the patient to stay entirely still.	◉ N/A ○ Minor ○ Major

Remarks:

Nice scan - no probs - thank you :-)

◉ No Probs ○ Minor Probs ○ Major Probs ○ Training Required ○ Rescan Required

If you have any questions on the above - please phone IDT on +44 (0)20 8600 3540

Checked By: *RAR* Date: *2009-11-20*

IT IS NOW SAFE TO DELETE YOUR COPY OF THE PATIENT'S IMAGES

Thank You!

- **Any Questions?**