Cone Beam CT
of the (Upper) Cervical Spine

Cameron Bearder, DC, FABVR, FACFN-c, FABBIR-c, DACNB-c
In progress: DCCJP, FNORA
Soon: DIANM

March 2025, PostGradDC Virtual Grand Rounds

KEYSTONE
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DISCLAIMER

- ***NO*** disclosures (*full price, but welcome help*)
- ***NO*** "demands" (*give it a couple more years*)
- ***ALL*** references will be provided (*cited*)
- ***ALL*** CBCT images are from Keystone (*unless noted*)

I'm here to present compelling information, that's changed the way I practice and approach the evaluation and treatment of the Cervical Spine

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My HOPE for this presentation is that *you (the audience)*:

- Stay awake and limit private browser surfing during the presentation
- Gain insight into the capabilities for CBCT in Chiropractic
- Use the information to think critically, for simple and complex cases alike
- Think more like a student, as opposed to an “expert” who knows it all

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Presentation Itinerary

1. VERY Brief Intro
1. What’s CBCT?
1. CBCT v CT v X-ray
1. CBCT in the Research
1. CBCT in Chiro
1. The Goods

KEYSTONE
UPPER CERVICAL SPINE CLINIC

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Hi, I'm Cameron

- In Chiro since 2010

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  - (CA-

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UPPER CERVICAL SPINE CLINIC

6

Hi, I'm Cameron

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  - (CA-Student-

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7

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    - "*We know a thing or two, because we've seen a thing or two*"

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      - Clinical Research; focus on cervical biomechanics and …

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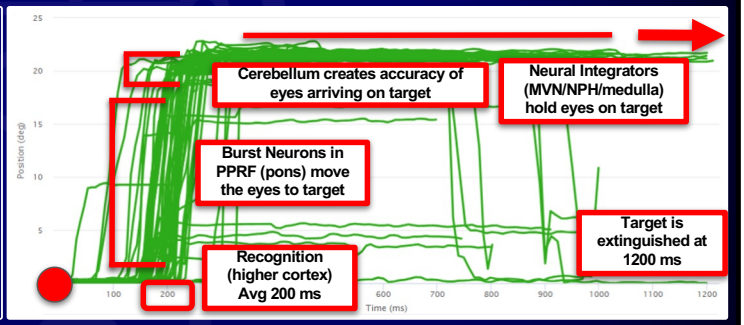

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https://pubmed.ncbi.nlm.nih.gov/18805225

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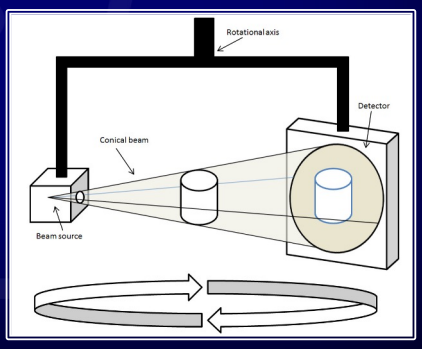

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https://pubmed.ncbi.nlm.nih.gov/18805225; https://commons.wikimedia.org/wiki/File:Cone_Beam_CT_principle.png

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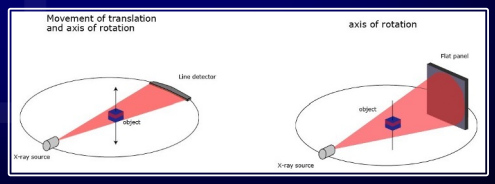

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  - Because CBCT exposure incorporates the entire FOV, only one rotational sequence of the gantry is necessary to acquire enough data for image reconstruction.

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CT : CBCT - Comparison

- Since we're discussing new and emerging …

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CT : CBCT - Comparison

Comparison: Conventional Multi-Slice CT (MSCT) vs. Cone Beam CT (CBCT)

Parameter	Conventional Multi-Slice CT (MSCT)	Cone Beam CT (CBCT)
Imaging Technology	Utilizes a **fan-shaped X-ray beam** coupled with multiple detector rows, acquiring helical or sequential axial slices	Employs a **cone-shaped X-ray beam** with a flat-panel detector, acquiring volumetric data in a single rotation
Radiation Dose	Generally **higher** due to continuous X-ray emission over multiple rotations	**Lower radiation exposure** (up to 10 times lower than MSCT) due to single-exposure acquisition
Image Acquisition	Produces **axial slices** that can be reconstructed into 3D images	Directly captures **volumetric data**, yielding high-resolution 3D reconstructions
Field of View (FOV)	**Extensive FOV**, capable of imaging entire organ systems or body regions	**Limited FOV**, optimized for localized anatomical regions (e.g., maxillofacial, cervical spine, extremities)
Acquisition Speed	Rapid acquisition (~1-10 seconds for full-body scans)	Faster single-rotation acquisition (~5-20 seconds for targeted regions)
Soft Tissue Contrast	**Superior** soft tissue differentiation (critical for neuro, thoracic, and abdominal imaging)	**Limited** soft tissue contrast (primarily optimized for osseous structures)
Bone Resolution	High-resolution bone imaging (~0.5–1 mm slice thickness)	**Superior spatial resolution** (~0.1–0.4 mm voxel size), ideal for detailed bony architecture assessment
Clinical Applications	Comprehensive imaging: **neurological, thoracic, abdominal, musculoskeletal, vascular, and trauma imaging**	Specialized imaging: **dentomaxillofacial, otolaryngology (ENT), temporomandibular joint (TMJ), orthopedic (weight-bearing joints, spine)**
Patient Positioning	Typically **supine** (prone or decubitus for specific protocols)	Typically **seated or standing**, accommodating weight-bearing and functional assessments
Availability	Standard in **hospitals, trauma centers, and diagnostic imaging centers**	Primarily found in **dental clinics, ENT practices, specialized orthopedic and research facilities**

Clinical Considerations

- **MSCT is preferred** for high-detail **soft tissue visualization, complex trauma, and systemic pathology evaluation.**
- **CBCT is ideal** for **localized high-resolution bony imaging with reduced radiation exposure,** particularly in dental, ENT, and weight-bearing orthopedic applications.

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CT : CBCT - Comparison

provide specific technical references

Certainly, here are specific technical references comparing conventional multi-slice computed tomography (MSCT) and cone-beam computed tomography (CBCT):

1. **Radiation Dose Comparison**:
   - A study published in *Skeletal Radiology* compared the diagnostic value of CBCT and conventional radiography after acute small bone or joint trauma. The findings indicated that while CBCT detected significantly more fractures, the radiation dose for CBCT substantially exceeded that of conventional radiography. PUBMED
2. **Image Quality Assessment**:
   - Research comparing fan-beam CT and on-board imaging (OBI) CBCT systems found that fan-beam CT produces superior images with better soft tissue differentiation, while CBCT offers superior spatial resolution. PMC
3. **Technological Differences**:
   - An article from Block Imaging highlights that traditional CT uses a high-output, rotating anode X-ray tube, whereas CBCT utilizes a low-power, medical fluoroscopy tube that provides continuous imaging throughout the scan. BLOCK IMAGING
4. **Clinical Applications**:
   - According to a publication by Cassling, both traditional CT and CBCT scanners produce images of internal body structures, but they differ in their applications. Traditional CT is often used for comprehensive imaging, while CBCT is tailored for specific areas such as dental and maxillofacial imaging. CASSLING
5. **Radiation Exposure in Dental Imaging**:
   - A review in *Physica Medica* discusses that CBCT has been developed specifically for dental and maxillofacial areas to overcome the limitations of 2D imaging, offering adequate imaging with a tenfold reduction in radiation compared to traditional CT. WIKIPEDIA, THE FREE ENCYCLOPEDIA

These references provide detailed insights into the distinctions between MSCT and CBCT in terms of radiation exposure, image quality, technological differences, and clinical applications.

Sources

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About Ionizing Radiation

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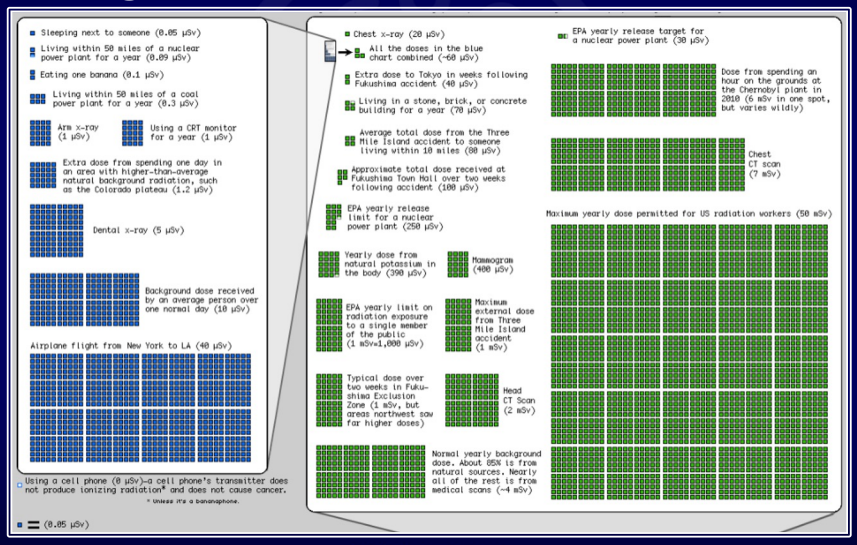
About Ionizing Radiation



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https://xkcd.com/radiation/

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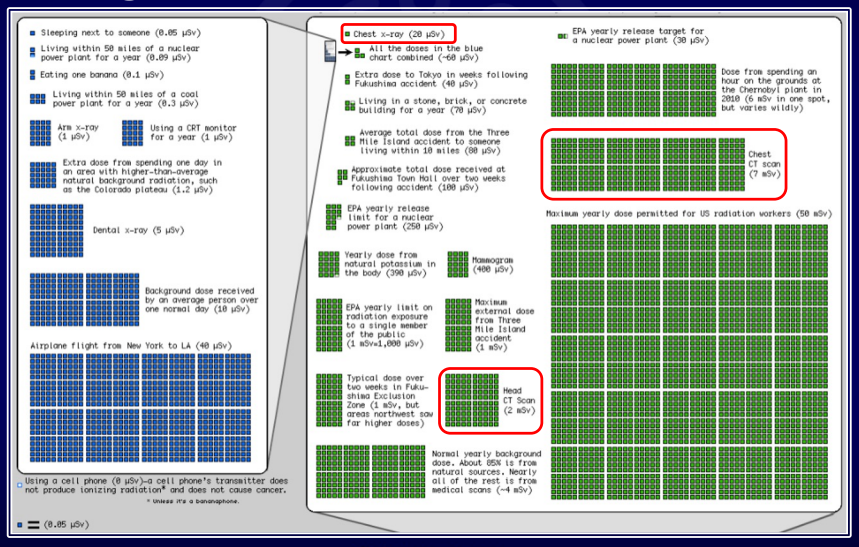
About Ionizing Radiation



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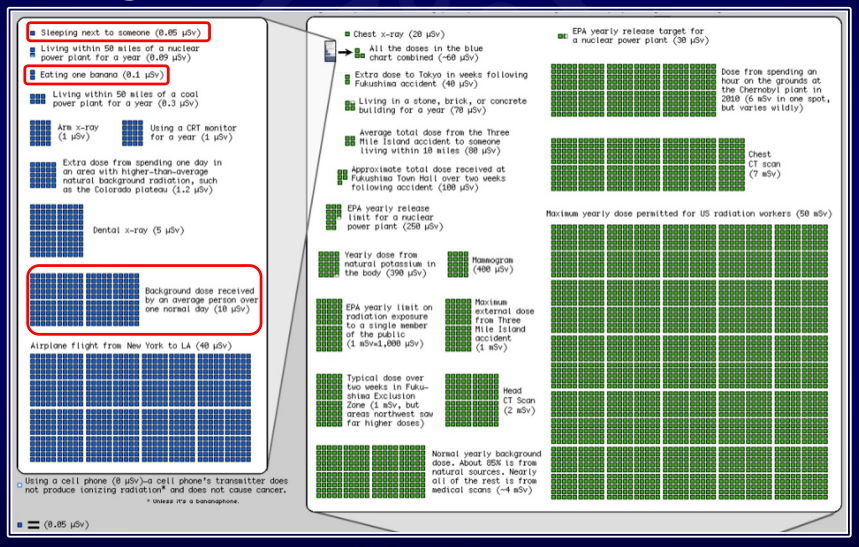

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https://xkcd.com/radiation/

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About Ionizing Radiation - CT Scans

CT protocol	$CTDI_{vol}$ (mGy)	DLP (mGy × cm)	Effective dose (mSv)
Cranium	53	740	1.6
Sinus	9	114	0.3
Carotid CTA	14	487	4,8
Neck	13	312	3.3
Chest	12	279	5.1
Pulmonary angiography	12	240	4.3
Chest low dose	2.6	87.9	1.7
Trunk (chest + abdomen)	11	686	11
Upper abdomen	11	251	4.8
Abdomen	11	496	7.9
Complete aorta	10	641	10
Lumbar spine bone	19	347	6.5
Calcium scoring	5.8	90.3	1.9
Prospective ECG-triggered coronary CTA	19	270	5.7
Polytrauma – head	64	1 105	4.6
Polytrauma – trunk	14	1 037	15

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https://www.aerzteblatt.de/callback/image.asp?id=130650

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About Ionizing Radiation - CBCT Scans

Table 3 - uploaded by Flavio Ricardo Manzi
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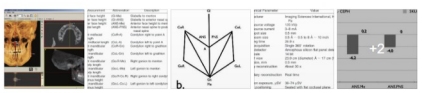
Technical Parameter	Value
Manufacturer	Imaging Sciences International, Hatfield, Pa
X-ray source voltage	120 kVp
X-ray source current	3–8 mA
Focal spot size	0.5 mm
X-ray beam size	0.5 Å ~ 0.5 to 8 Å ~ 10 inch
Scanning time	26.9 s
Image acquisition	Single 360° rotation
Image detector	Amorphous silicon flat panel detector
Gray scale	14 bit
Field of view	23.0 cm (diameter) Å ~ 17 cm (height)
Voxel size, mm	0.3 mm
Primary reconstruction time	About 30 s
Secondary reconstruction time	Real time
Radiation exposure, µSV	36–74 µSV
Patient positioning	Seated with flat occlusal plane

iCAT CBCT Unit: Technical Parameters and Settings at the Time of the Study

Source publication



Accuracy and reliability of craniometric measurements on lateral cephalometry and 3D measurements on CBCT scans

https://www.researchgate.net/figure/CAT-CBCT-Unit-Technical-Parameters-and-Settings-at-the-Time-of-the-Study_tbl2_47394784

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About Ionizing Radiation - Comparison

- What do we now know?

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  - Effective dose for iCAT CBCT = 74 ***MICRO***sieverts

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- What do we now know?
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  - Let's compare apples to apples:

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https://www.translatorscafe.com/unit-converter/en-US/radiation-absorbed-dose/26-25/microsievert-millisievert/

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About Ionizing Radiation - Comparison

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  - 3.3 ***MILLI***sieverts = 3300 microsieverts …

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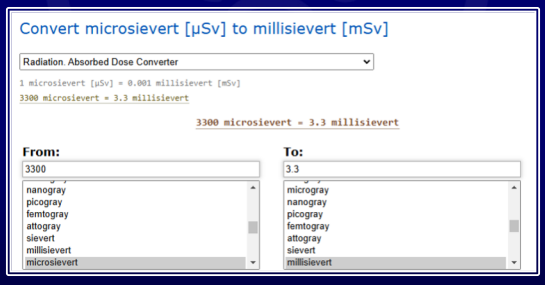
  - Effective dose for iCAT CBCT = 74 ***MICRO***sieverts
  - 3.3 ***MILLI***sieverts = 3300 microsieverts / 74 microsieverts = 44.5 scans



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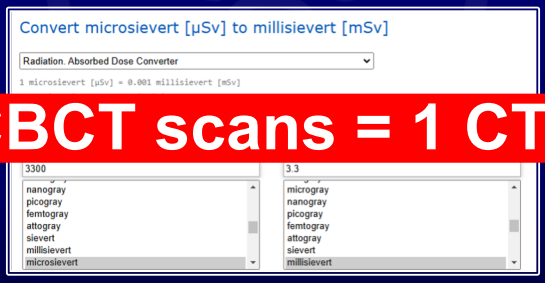

~45 CBCT scans = 1 CT scan

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XR : CBCT - Comparison

- What about when we compared the tried-and-true to the fancy-and-new?

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XR : CBCT - Comparison

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- Is CBCT any better than XR?

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- Is CBCT any better than XR?
- Well …

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XR : CBCT - Comparison

- What about when we compared the tried-and-true to the fancy-and-new?
- Is CBCT any better than XR?
- Well …
  - Effective dose for iCAT CBCT = 74 ***MICRO***sieverts
  - Effective dose for Cervical XR (A-P & Lateral) = 140 ***MICRO***sieverts

The radiation exposure associated with cervical and lumbar spine radiographs

Andrew K Simpson [1], Peter G Whang, Ari Jonisch, Andrew Haims, Jonathan N Grauer

Affiliations + expand

PMID: 18679095 DOI: 10.1097/BSD.0b013e3181568656

Abstract

Study design: Cross-sectional study.

Objective: To calculate the effective radiation doses of routine anteroposterior (AP) and lateral radiographs of the cervical and lumbar spines.

Summary of background data: Although plain radiographs are generally used as the initial imaging modality for the evaluation of patients with spinal complaints, the radiation that patients receive during these studies has not been well quantified. The effective radiation dose represents a functional measure of exposure that takes into account the amount of radiation delivered and the radiosensitivity of the exposed organs. Consequently, the effective dose is important to consider from a radiation safety perspective.

Methods: The imaging practices of our radiology department were reviewed and the effective radiation doses for AP and lateral radiographs of the cervical and lumbar spines were calculated using the following variables: emitted radiation dose, source-to-object distance (SOD), film area, and patient tissue dimensions. Values were obtained from both direct measurements and an examination of the established protocols employed at our institution.

Results: The effective doses for AP and lateral cervical radiographs were 0.12 and 0.02 mSv, respectively. Whereas the corresponding values for AP and lateral lumbar films were much larger (2.20 and 1.50 mSv, respectively). For comparative purposes, a typical chest x-ray results in a radiation dose between 0.06 and 0.25 mSv.

Conclusions: In this investigation, cervical spine films gave rise to radiation doses that are similar to those of chest x-rays. However, lumbar spine radiographs generated effective radiation doses that were approximately an order of magnitude greater than these other studies. In both the cervical and lumbar regions, AP views resulted in significantly greater radiation exposure than corresponding lateral images. The effective radiation doses reported here may prove to be valuable for assessing the relative risks and benefits of spine radiographs to establish appropriate guidelines for their use.

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https://pubmed.ncbi.nlm.nih.gov/18679095/; https://www.translatorscafe.com/unit-converter/en-US/radiation-absorbed-dose/25-26/millisievert-microsievert

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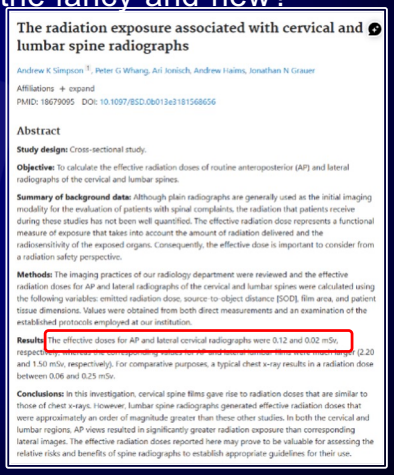
XR : CBCT - Comparison

- What about when we compared the tried-and-true to the fancy-and-new?
- Is CBCT any better than XR?
- Well …
  - Effective dose for iCAT CBCT = 74 ***MICRO***sieverts
  - Effective dose for Cervical XR (A-P & Lateral) = 140 ***MICRO***sieverts
  - ***2 images - 140 microsieverts or 575 images - 74 microsieverts***



The radiation exposure associated with cervical and lumbar spine radiographs

Andrew K Simpson [1], Peter G Whang, Ari Jonisch, Andrew Haims, Jonathan N Grauer

Affiliations + expand

PMID: 18679095 DOI: 10.1097/BSD.0b013e3181568656

Abstract

Study design: Cross-sectional study.

Objective: To calculate the effective radiation doses of routine anteroposterior (AP) and lateral radiographs of the cervical and lumbar spines.

Summary of background data: Although plain radiographs are generally used as the initial imaging modality for the evaluation of patients with spinal complaints, the radiation that patients receive during these studies has not been well quantified. The effective radiation dose represents a functional measure of exposure that takes into account the amount of radiation delivered and the radiosensitivity of the exposed organs. Consequently, the effective dose is important to consider from a radiation safety perspective.

Methods: The imaging practices of our radiology department were reviewed and the effective radiation doses for AP and lateral radiographs of the cervical and lumbar spines were calculated using the following variables: emitted radiation dose, source-to-object distance (SOD), film area, and patient tissue dimensions. Values were obtained from both direct measurements and an examination of the established protocols employed at our institution.

Results: The effective doses for AP and lateral cervical radiographs were 0.12 and 0.02 mSv, respectively, whereas corresponding values for AP and lateral lumbar views were markedly (2.20 and 1.50 mSv, respectively). For comparative purposes, a typical chest x-ray results in a radiation dose between 0.06 and 0.25 mSv.

Conclusions: In this investigation, cervical spine films gave rise to radiation doses that are similar to those of chest x-rays. However, lumbar spine radiographs generated effective radiation doses that were approximately an order of magnitude greater than these other studies. In both the cervical and lumbar regions, AP views resulted in significantly greater radiation exposure than corresponding lateral images. The effective radiation doses reported here may prove to be valuable for assessing the relative risks and benefits of spine radiographs to establish appropriate guidelines for their use.

KEYSTONE UPPER CERVICAL SPINE CLINIC

https://pubmed.ncbi.nlm.nih.gov/18679095/; https://www.translatorscafe.com/unit-converter/en-US/radiation-absorbed-dose/25-26/millisievert-microsievert

49

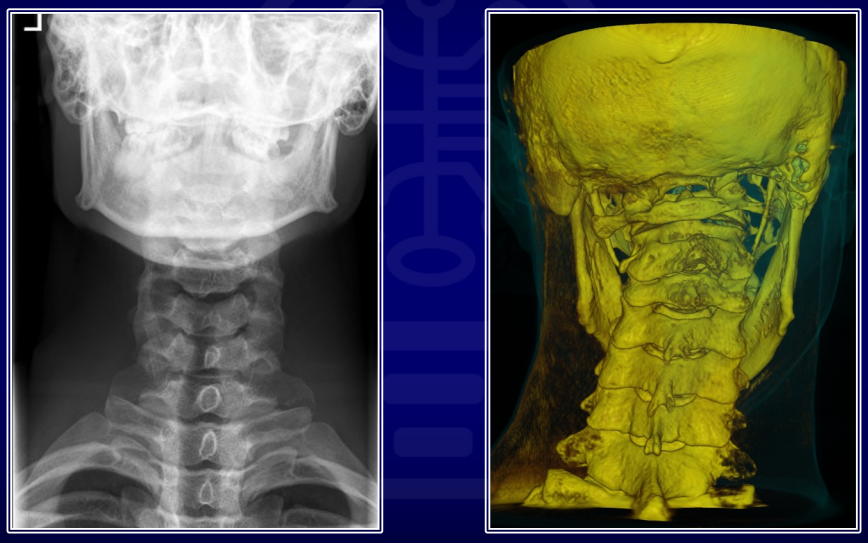
XR : CBCT - Comparison

KEYSTONE UPPER CERVICAL SPINE CLINIC

https://radiopaedia.org/articles/cervical-spine-ap-view

50

XR : CBCT - Comparison

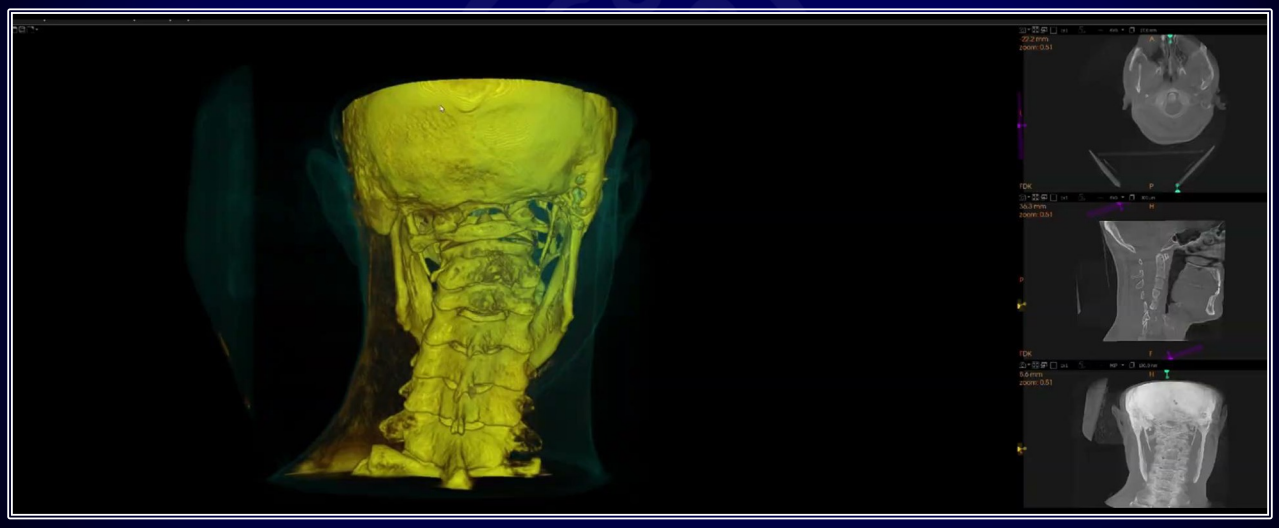


KEYSTONE UPPER CERVICAL SPINE CLINIC

https://radiopaedia.org/articles/cervical-spine-ap-view

51

XR : CBCT - Comparison



KEYSTONE UPPER CERVICAL SPINE CLINIC

https://radiopaedia.org/articles/cervical-spine-ap-view

52

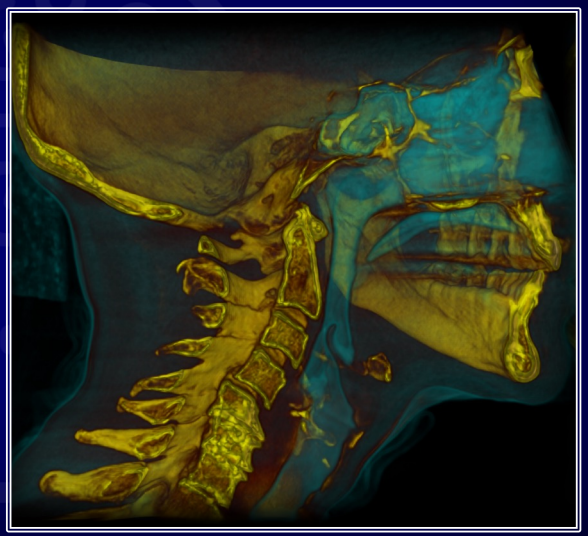
XR : CBCT - Comparison

KEYSTONE
UPPER CERVICAL SPINE CLINIC

https://www.researchgate.net/figure/Lateral-view-X-ray-of-the-cervical-spine-illustrating-cervical-spondylosis-degenerative_fig1_365437404

53

XR : CBCT - Comparison

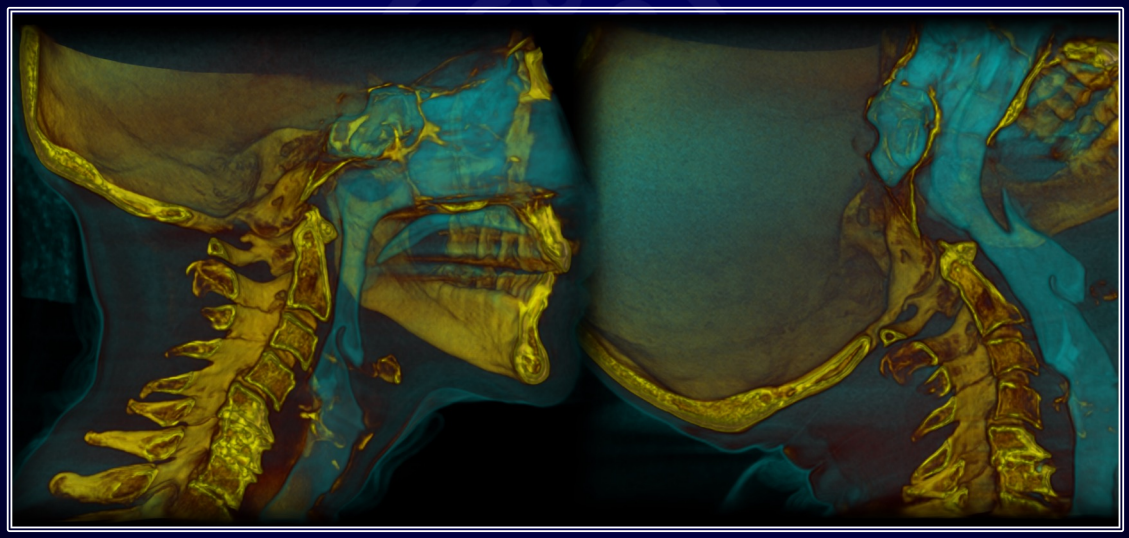


KEYSTONE
UPPER CERVICAL SPINE CLINIC

https://www.researchgate.net/figure/Lateral-view-X-ray-of-the-cervical-spine-illustrating-cervical-spondylosis-degenerative_fig1_365437404

54

XR : CBCT - Comparison



KEYSTONE UPPER CERVICAL SPINE CLINIC

55

Compare-Contrast: CBCT v DMI v Xray

	Time	Exposure	Source
CBCT (6DOF + Neutral)	~20 minutes	0.518 mSv	Tang et al *(PMID: 34593735)*
DMX (5 Studies)	~10 minutes	Similar to DAVIS or 5.500 mSv	Katz et al *(PMID: 32150926)* Hauser *(caringmedical.com)*
DDR (3 Studies)	~10 minutes	1.800 mSv	Konica Minolta *(healthcare.konicaminolta.us)*
Xray (Davis Series)	~25 minutes	0.540 mSv	Simpson et al *(PMID: 18679095)*
Cervical CT Scan		3.300 mSv	(slide 10)
Flight from NY - LA		0.040 mSv	(slide 10)

KEYSTONE UPPER CERVICAL SPINE CLINIC

56

Presentation Itinerary

1. ~~VERY Brief Intro~~
1. ~~What's CBCT?~~
1. **CBCT in the Research**
1. CBCT in Chiro
1. The Goods

KEYSTONE UPPER CERVICAL SPINE CLINIC

57

CBCT in "The Research"

- Spoiler alert … not much relative to usage in biomechanics and/or chiro

KEYSTONE UPPER CERVICAL SPINE CLINIC

58

CBCT in "The Research"

- Spoiler alert … not much relative to usage in biomechanics and/or chiro
  - 3 biomechanics studies, 2 chiro practice studies

KEYSTONE UPPER CERVICAL SPINE CLINIC

59

CBCT in "The Research"

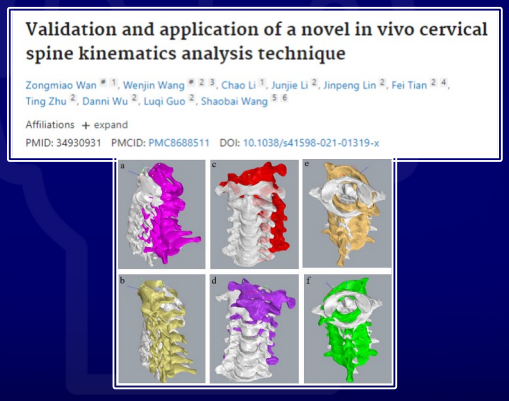
- 3 biomechanics studies


In vivo 3-Dimensional Kinematics Study of the Healthy Cervical Spine Based on CBCT Combined with 3D-3D Registration Technology

Benyu Tang [1], Haoqun Yao [1], Shaobai Wang [2], Yanlong Zhong [1], Kai Cao [1], Zongmiao Wan [1]

Affiliations + expand

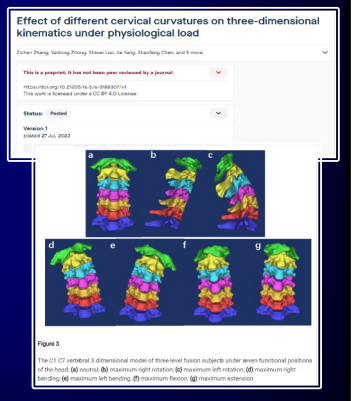
PMID: 34593735 DOI: 10.1097/BRS.0000000000004231


Validation and application of a novel in vivo cervical spine kinematics analysis technique

Zongmiao Wan [#1], Wenjin Wang [#2,3], Chao Li [1], Junjie Li [2], Jinpeng Lin [2], Fei Tian [2,4], Ting Zhu [2], Danni Wu [2], Luqi Guo [2], Shaobai Wang [5,6]

Affiliations + expand

PMID: 34930931 PMCID: PMC8688511 DOI: 10.1038/s41598-021-01319-x


Effect of different cervical curvatures on three-dimensional kinematics under physiological load

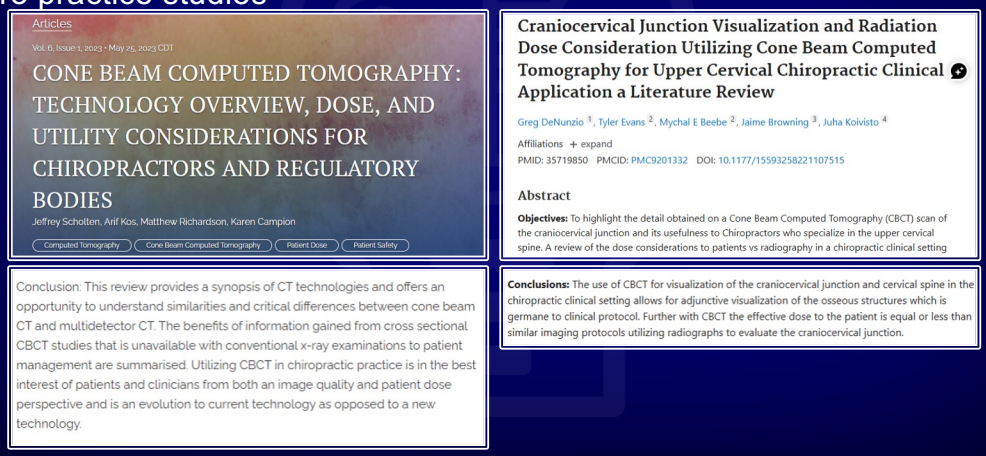
KEYSTONE UPPER CERVICAL SPINE CLINIC

https://pubmed.ncbi.nlm.nih.gov/34593735/; https://www.nature.com/articles/s41598-021-01319-x; https://www.researchgate.net/publication/372696647

60

CBCT in "The Research"

- 2 chiro practice studies



Articles

Vol. 6, Issue 1, 2023 • May 25, 2023 CDT

CONE BEAM COMPUTED TOMOGRAPHY: TECHNOLOGY OVERVIEW, DOSE, AND UTILITY CONSIDERATIONS FOR CHIROPRACTORS AND REGULATORY BODIES

Jeffrey Scholten, Arif Kos, Matthew Richardson, Karen Campion

Computed Tomography | Cone Beam Computed Tomography | Patient Dose | Patient Safety

Conclusion: This review provides a synopsis of CT technologies and offers an opportunity to understand similarities and critical differences between cone beam CT and multidetector CT. The benefits of information gained from cross sectional CBCT studies that is unavailable with conventional x-ray examinations to patient management are summarised. Utilizing CBCT in chiropractic practice is in the best interest of patients and clinicians from both an image quality and patient dose perspective and is an evolution to current technology as opposed to a new technology.

Craniocervical Junction Visualization and Radiation Dose Consideration Utilizing Cone Beam Computed Tomography for Upper Cervical Chiropractic Clinical Application a Literature Review

Greg DeNunzio [1], Tyler Evans [2], Mychal E Beebe [2], Jaime Browning [3], Juha Koivisto [4]

Affiliations + expand

PMID: 35719850 PMCID: PMC9201332 DOI: 10.1177/15593258221107515

Abstract

Objectives: To highlight the detail obtained on a Cone Beam Computed Tomography (CBCT) scan of the craniocervical junction and its usefulness to Chiropractors who specialize in the upper cervical spine. A review of the dose considerations to patients vs radiography in a chiropractic clinical setting

Conclusions: The use of CBCT for visualization of the craniocervical junction and cervical spine in the chiropractic clinical setting allows for adjunctive visualization of the osseous structures which is germane to clinical protocol. Further with CBCT the effective dose to the patient is equal or less than similar imaging protocols utilizing radiographs to evaluate the craniocervical junction.

KEYSTONE UPPER CERVICAL SPINE CLINIC

https://journal.parker.edu/article/78105; https://pmc.ncbi.nlm.nih.gov/articles/PMC9201332/

61

Presentation Itinerary

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KEYSTONE UPPER CERVICAL SPINE CLINIC

62

CBCT in Chiro … *UNOFFICIAL*

- From the ancient Facebook Threads … likely circa 2010; *Ciao, Italia!*

KEYSTONE UPPER CERVICAL SPINE CLINIC

63

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KEYSTONE UPPER CERVICAL SPINE CLINIC

64

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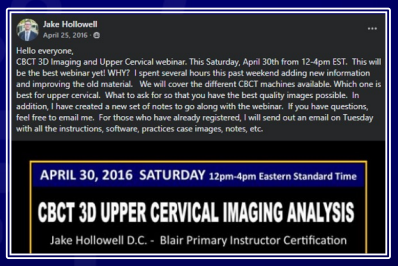
- Now, 2016(ish) → Dr. Hollowell offers multiple webinars for UC Blair CBCT



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- Anecdotally, 2017-18 seems to be when CBCTs start popping up frequently
  - Post-CV19, its commonplace for a new UC Chiro to START with CBCT

KEYSTONE UPPER CERVICAL SPINE CLINIC

67

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- Rumors of a CBP Chiro … cannot confirm nor deny

KEYSTONE UPPER CERVICAL SPINE CLINIC

68

CBCT in Chiro … *Official-ish*

- Each state is “unique” regarding it’s approval
  - **Red**-**Green**-***Gray***

KEYSTONE UPPER CERVICAL SPINE CLINIC

69

CBCT in Chiro … *Official-ish*

- Each state is “unique” regarding it’s approval
  - **Red**-**Green**-***Gray***
- Current efforts are through the **ICA Upper Cervical Council**

ICA COUNCIL ON UPPER CERVICAL CARE

KEYSTONE UPPER CERVICAL SPINE CLINIC

70

CBCT in Chiro … *Official-ish*

- Each state is “unique” regarding it’s approval
  - Red-Green-*Gray*
- Current efforts are through the **ICA Upper Cervical Council**
- A winning strategy …
  - Speak with Dr. Tyler Evans ***BEFORE*** approaching a State Chiro Board

KEYSTONE UPPER CERVICAL SPINE CLINIC

71

CBCT in Chiro … *More Official*

- CBCT On-Campus
  - Sherman

Sherman Becomes First Chiropractic College to Install CBCT Imaging

Home › Blog › Post › Sherman Becomes First Chiropractic College to Install CBCT Imaging

April 9, 2020 Post

True to its commitment to leading chiropractic education and improving patient care, Sherman College in Spartanburg, SC, has become the first chiropractic college to introduce cone beam computed tomography (CBCT) to its radiology department.

KEYSTONE UPPER CERVICAL SPINE CLINIC

72

CBCT in Chiro … *More Official*

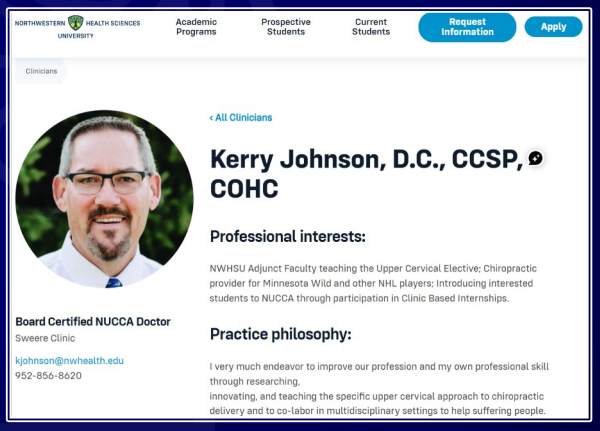
- CBCT On-Campus
  - Sherman
  - Life West

KEYSTONE UPPER CERVICAL SPINE CLINIC

73

CBCT in Chiro … *More Official*

- CBCT On-Campus
  - Sherman
  - Life West
  - Northwestern

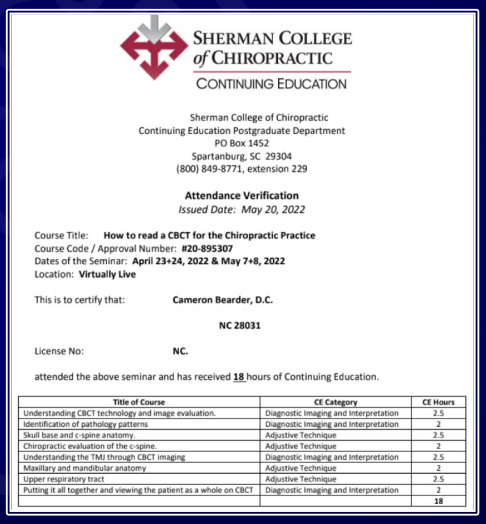


KEYSTONE UPPER CERVICAL SPINE CLINIC

74

CBCT in Chiro … *More Official*

- CBCT On-Campus
  - Sherman
  - Life West
  - Northwestern
- CCE Accredited Courses
  - Sherman - Live Virtual



SHERMAN COLLEGE *of* CHIROPRACTIC
CONTINUING EDUCATION

Sherman College of Chiropractic
Continuing Education Postgraduate Department
PO Box 1452
Spartanburg, SC 29304
(800) 849-8771, extension 229

Attendance Verification
Issued Date: May 20, 2022

Course Title: **How to read a CBCT for the Chiropractic Practice**
Course Code / Approval Number: **#20-895307**
Dates of the Seminar: **April 23+24, 2022 & May 7+8, 2022**
Location: **Virtually Live**

This is to certify that: **Cameron Bearder, D.C.**

NC 28031

License No: **NC.**

attended the above seminar and has received **18** hours of Continuing Education.

Title of Course	CE Category	CE Hours
Understanding CBCT technology and image evaluation.	Diagnostic Imaging and Interpretation	2.5
Identification of pathology patterns	Diagnostic Imaging and Interpretation	2
Skull base and c-spine anatomy.	Adjustive Technique	2.5
Chiropractic evaluation of the c-spine.	Adjustive Technique	2
Understanding the TMJ through CBCT imaging	Diagnostic Imaging and Interpretation	2.5
Maxillary and mandibular anatomy	Adjustive Technique	2
Upper respiratory tract	Adjustive Technique	2.5
Putting it all together and viewing the patient as a whole on CBCT	Diagnostic Imaging and Interpretation	2
		18

KEYSTONE
UPPER CERVICAL SPINE CLINIC

75

CBCT in Chiro … *More Official*

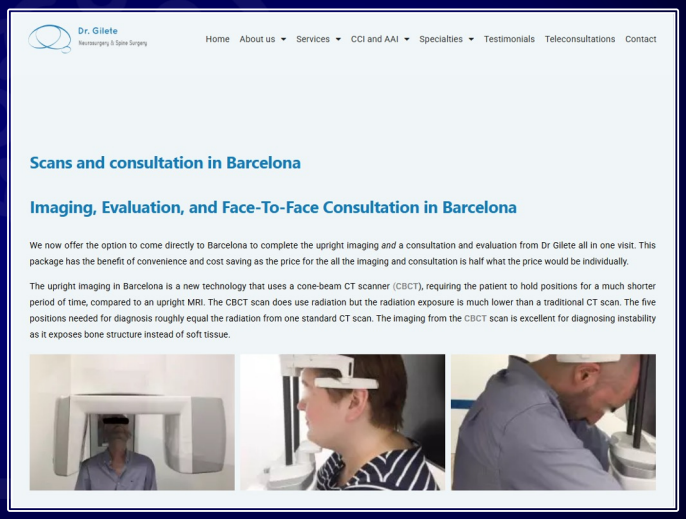
- CBCT On-Campus
  - Sherman
  - Life West
  - Northwestern
- CCE Accredited Courses
  - Sherman - Live Virtual
- ***State boards are coming around, but not all 50 are saluting the CBCT flag***

KEYSTONE
UPPER CERVICAL SPINE CLINIC

76

CBCT in Chiro-*sphere*

- CBCT for CCI/AAI
  - Dr. Gillette in Spain

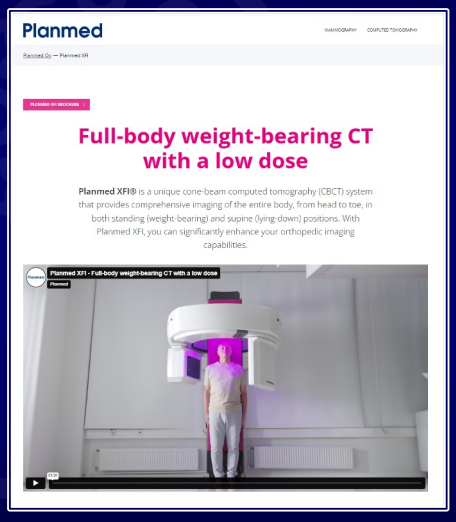


KEYSTONE
UPPER CERVICAL SPINE CLINIC

77

CBCT in Chiro-*sphere*

- CBCT for CCI/AAI
  - Dr. Gillette in Spain
- Full-body CBCT by Planmed
  - Not for purchase in USA .. yet
  - $500,000 +



KEYSTONE
UPPER CERVICAL SPINE CLINIC

78

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~~1. VERY Brief Intro~~

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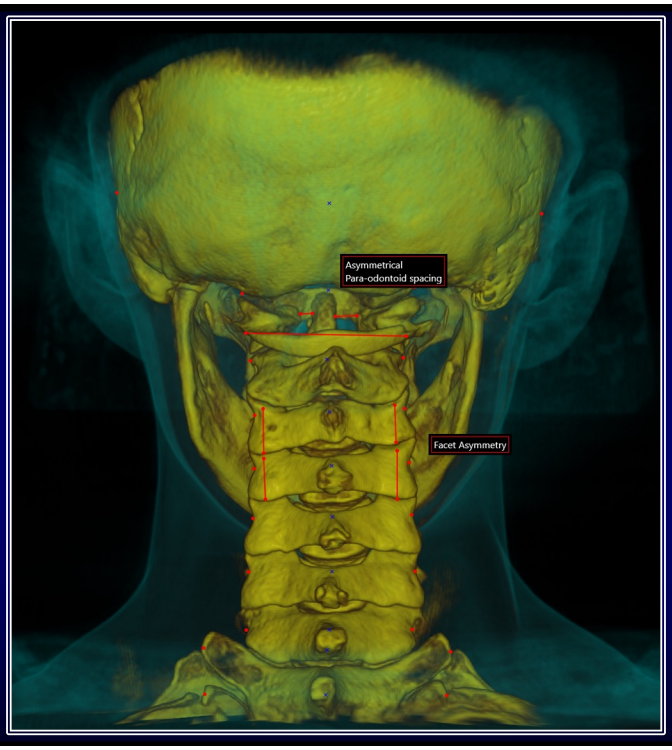
~~1. CBCT in Chiro~~

1. **The Goods**

KEYSTONE
UPPER CERVICAL SPINE CLINIC

79

The Goods



80

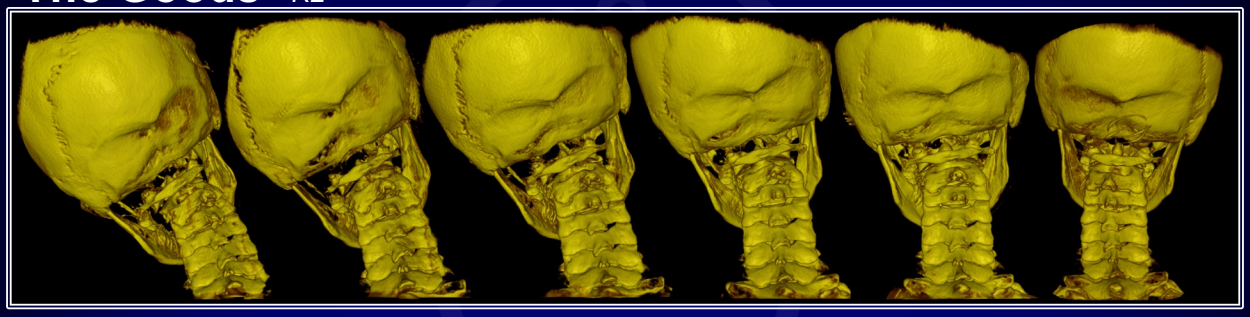
The Goods

81

The Goods

82

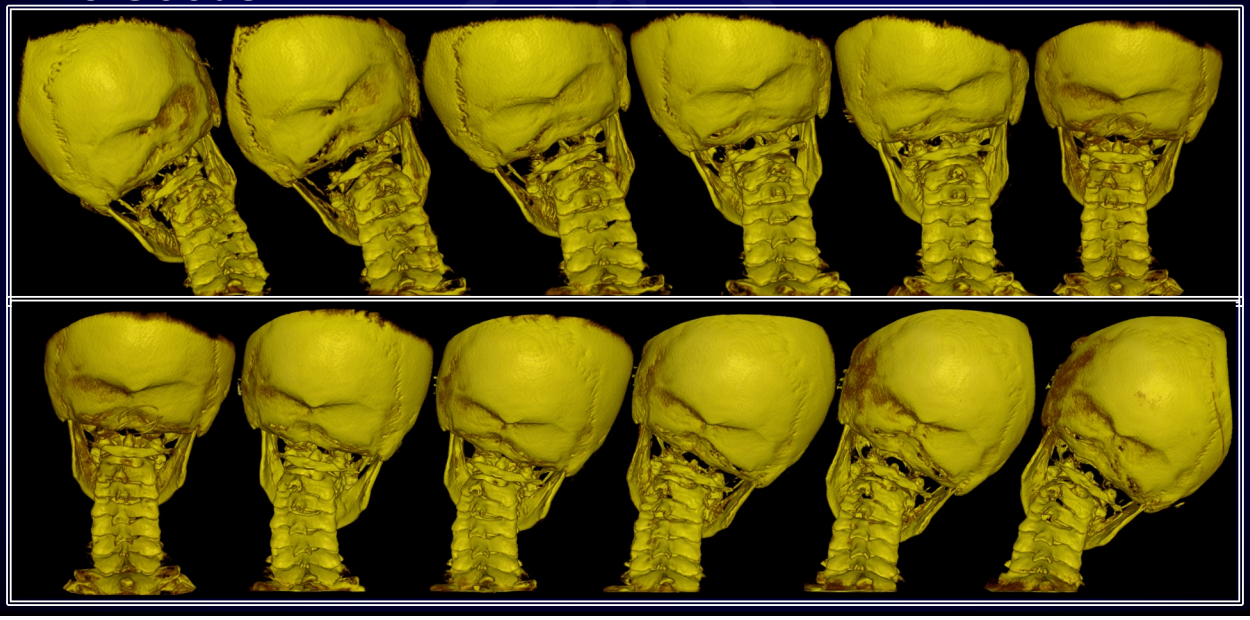
The Goods - *KL*



KEYSTONE
UPPER CERVICAL SPINE CLINIC

83

The Goods - *KL*



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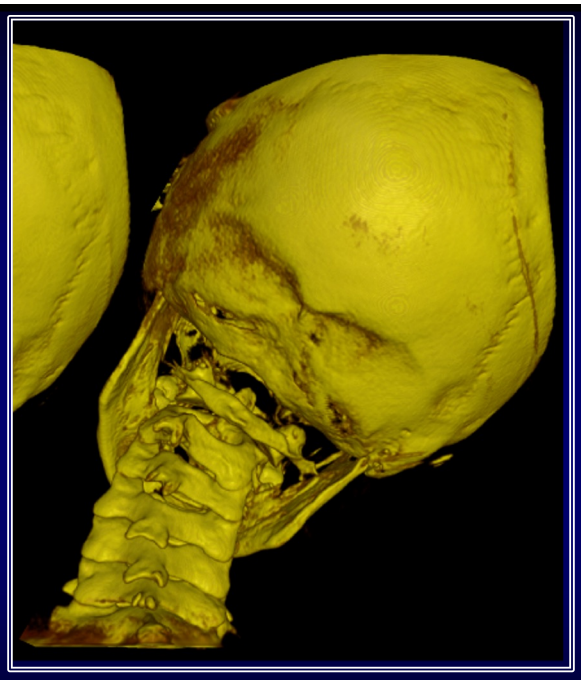
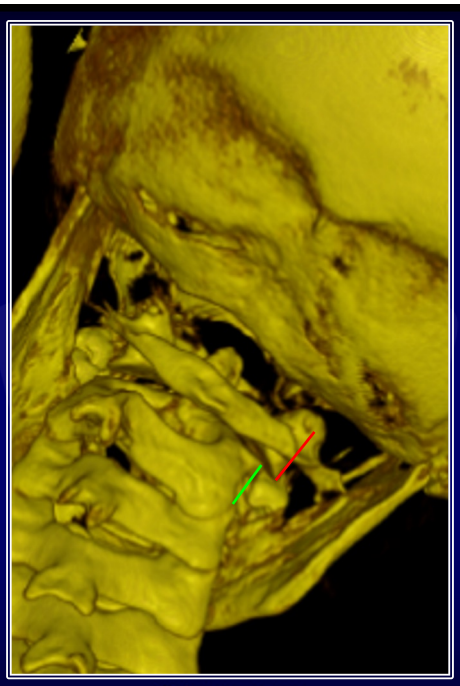
The Goods - *KL*



KEYSTONE
UPPER CERVICAL SPINE CLINIC

85

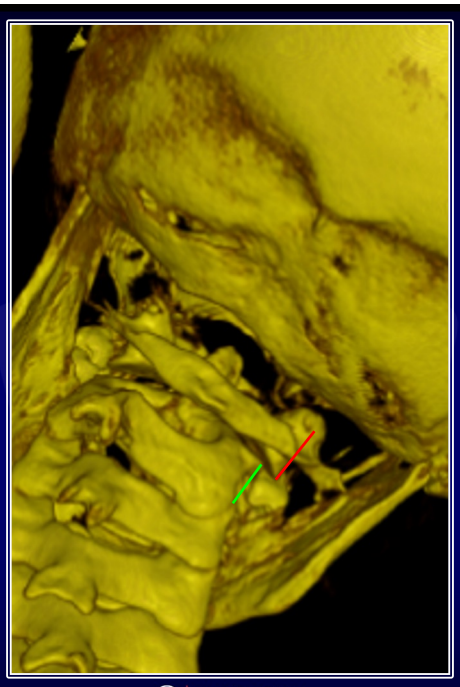
The Goods - *KL*



KEYSTONE
UPPER CERVICAL SPINE CLINIC

86

The Goods - *KL*



Yeah, ***BUT*** …

APOM Lateral Flexion XR

&

APOM Lateral Flexion DMX

KEYSTONE UPPER CERVICAL SPINE CLINIC

87

The Goods - Tangent

> Clin Imaging. 2010 Sep-Oct;34(5):375-8. doi: 10.1016/j.clinimag.2009.08.027.

Dynamic close-mouth view radiograph method for the diagnosis of lateral dynamic instability of the atlantoaxial joint

Susumu Fujiwara [1], Daisaku Tokunaga, Ryo Oda, Shogo Toyama, Kan Imai, Atushi Doi, Toshikazu Kubo

Affiliations + expand

PMID: 20813302 DOI: 10.1016/j.clinimag.2009.08.027

KEYSTONE UPPER CERVICAL SPINE CLINIC

https://pubmed.ncbi.nlm.nih.gov/20813302/

88

The Goods - Tangent

Results comparing an APOM to APCM

According to the results,
the OLMI in the CLOSED mouth view showed 0.5mm +/- 0.7 ***MORE*** *shift,*
with the ALDS in the CLOSED mouth view showing a 4.1% +/- 3 ***GREATER*** *shift.*

KEYSTONE UPPER CERVICAL SPINE CLINIC

https://pubmed.ncbi.nlm.nih.gov/20813302/

89

The Goods - Tangent

Results comparing an APOM to APCM

the open-mouth view. The results of current study demonstrate that the measurement of the OLMI was easily obtained by the close-mouth view, showing similar data with that obtained via the open-mouth view. Furthermore, the ADLS was able to measure dynamic views during right and left bending of the neck.

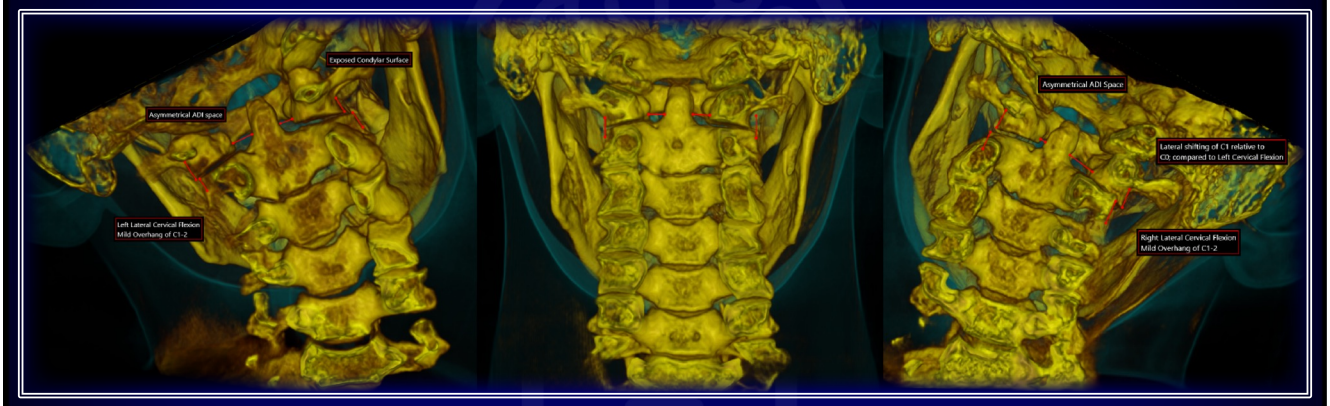
Atlantodental lateral shift showed a significantly higher percentage in the dynamic close-mouth view than that of the dynamic open-mouth view. The difference may be because in the positioning of the dynamic close-mouth view, the neck is more flexed in comparison to the position of the dynamic open-mouth view. Relative flexion of C1/C2 makes the odontoid process sit closer to the transverse ligament, where lateral motion of the odontoid process is emphasized. Therefore, the dynamic close-mouth view can be more useful for diagnosis of atlantoaxial lateral instability in the presence of mechanical deficiency, the transverse ligament (i.e., RA). The influence of temporomandibular joint should also be considered.

KEYSTONE UPPER CERVICAL SPINE CLINIC

https://pubmed.ncbi.nlm.nih.gov/20813302/

90

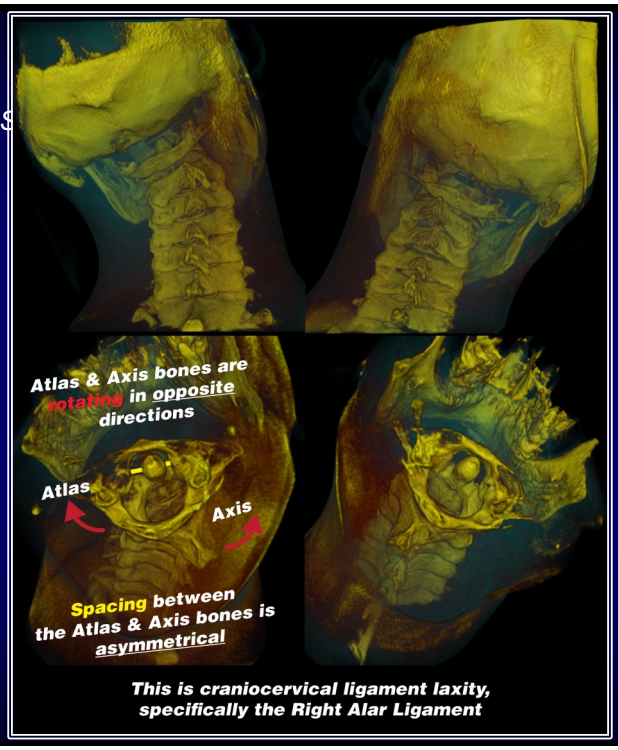
The Goods - *GP*



KEYSTONE
UPPER CERVICAL SPINE CLINIC

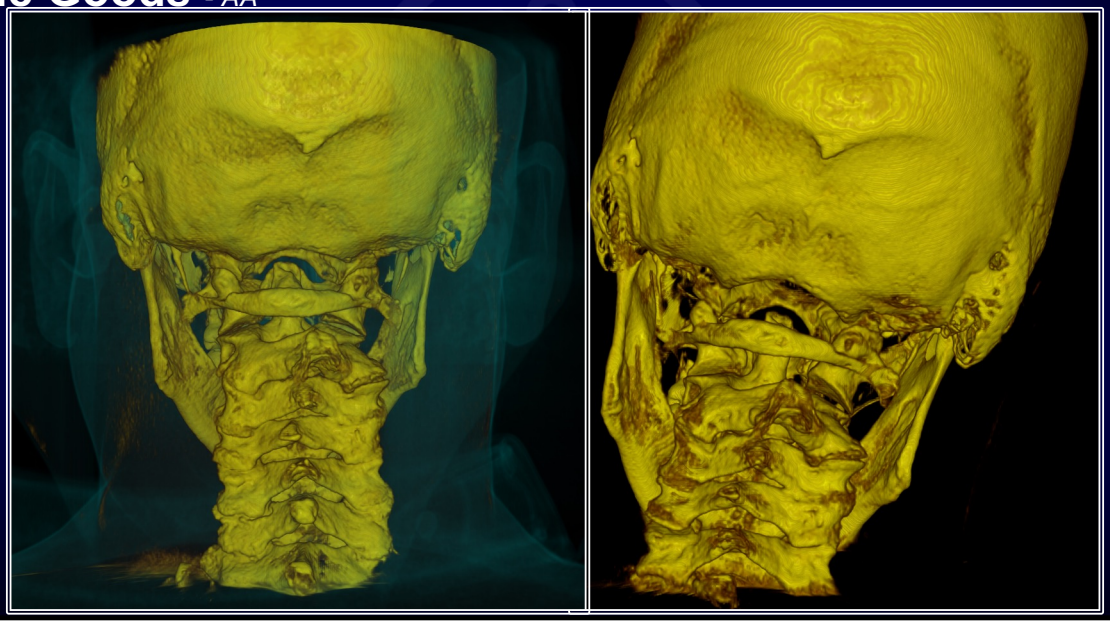
91

The Goods - *MS*



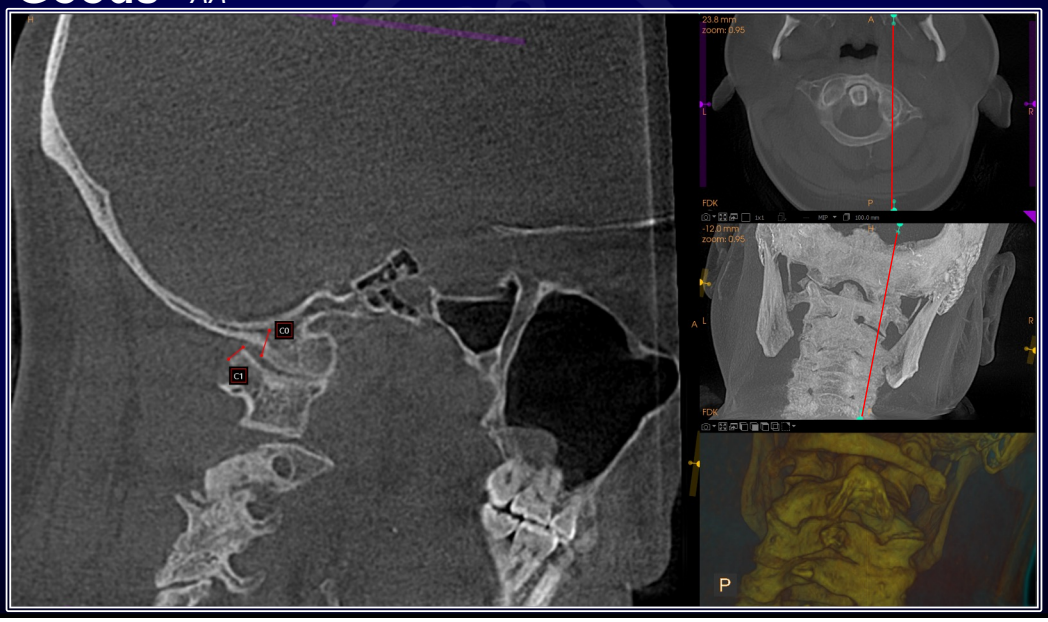
92

The Goods - *AA*



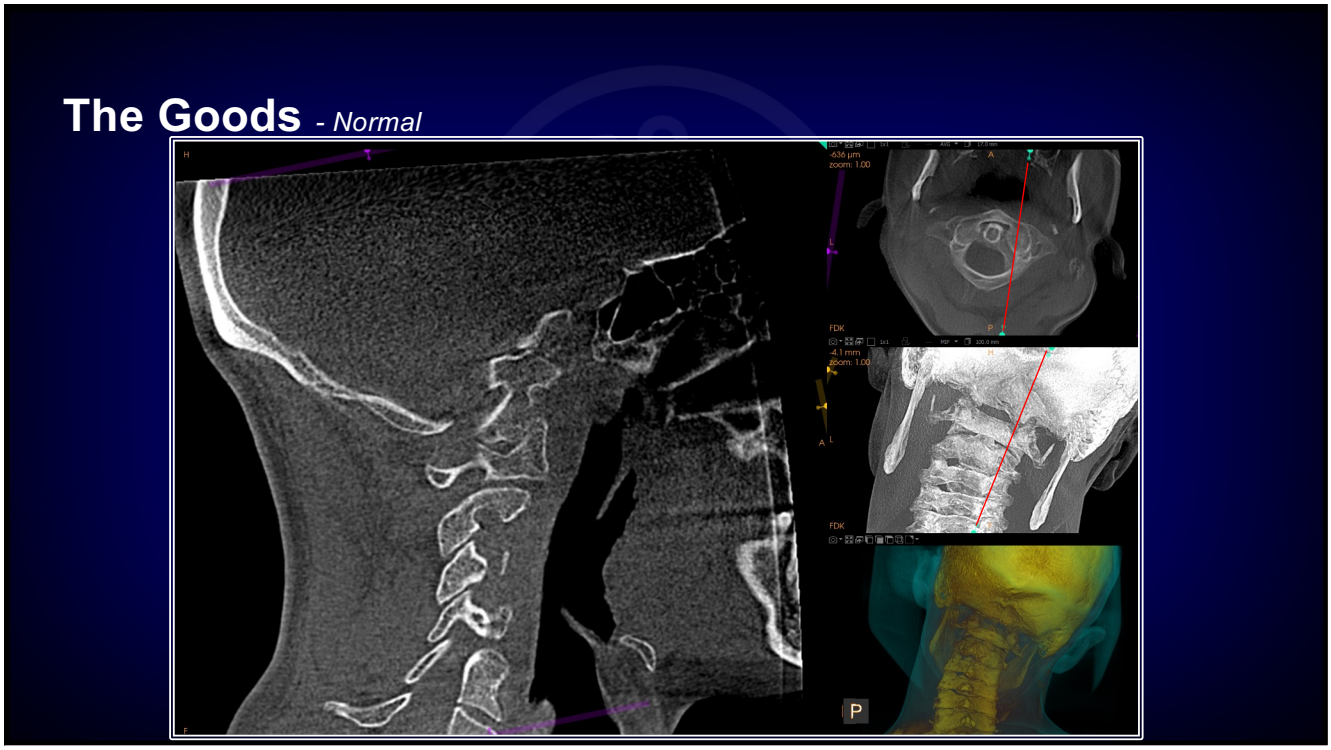
93

The Goods - *AA*



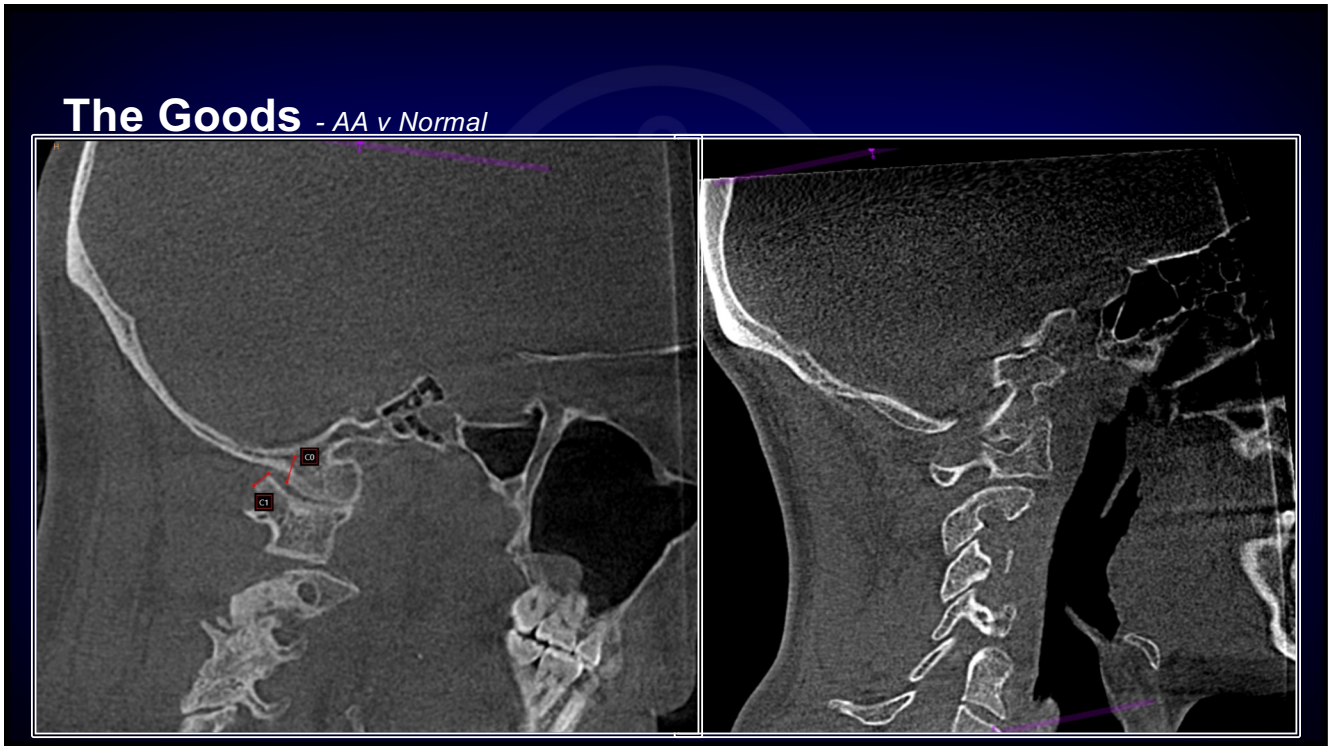
94

The Goods *- Normal*



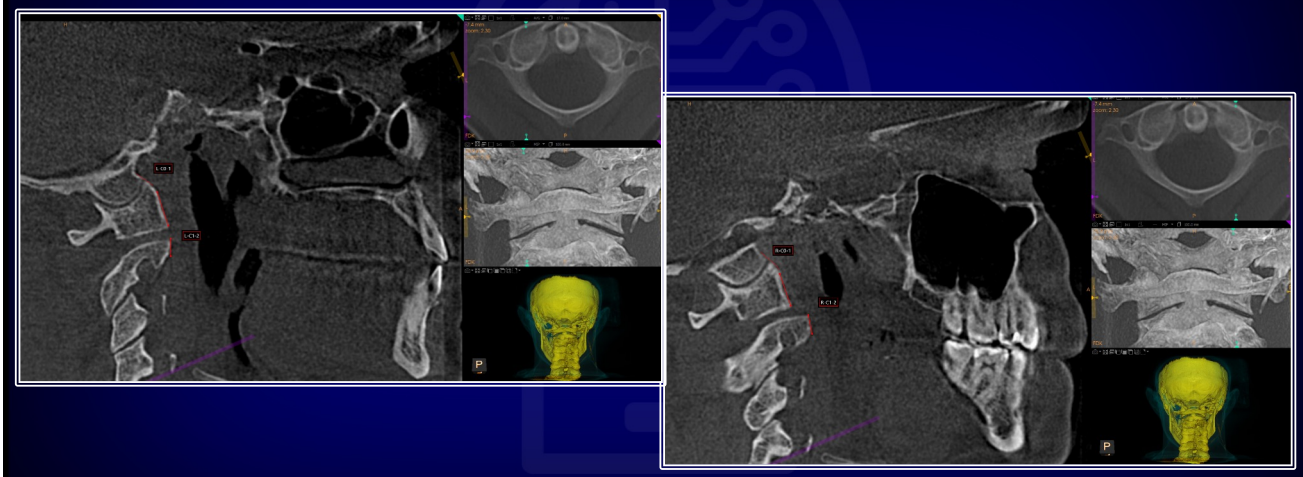
95

The Goods *- AA v Normal*



96

The Goods - *RC*



KEYSTONE
UPPER CERVICAL SPINE CLINIC

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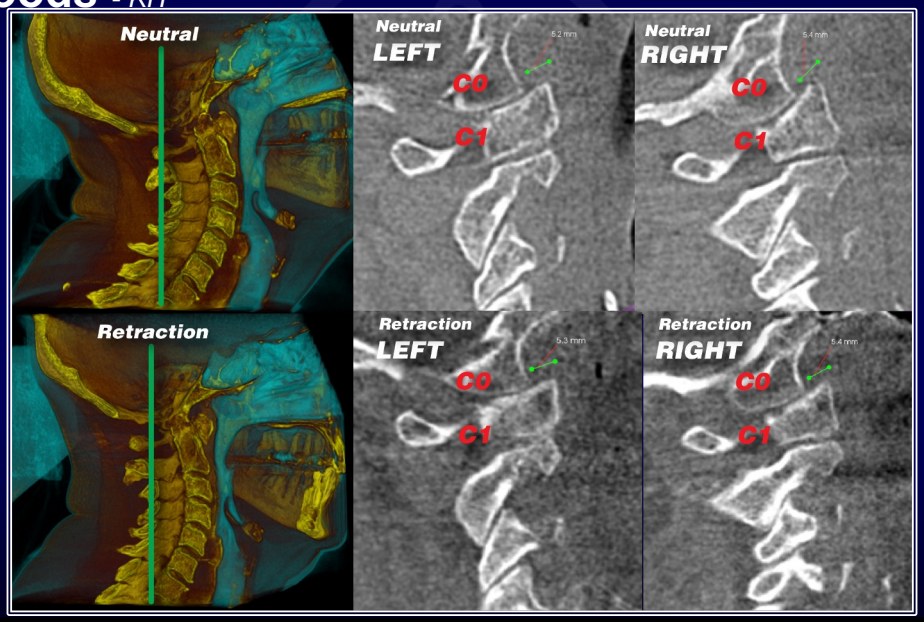
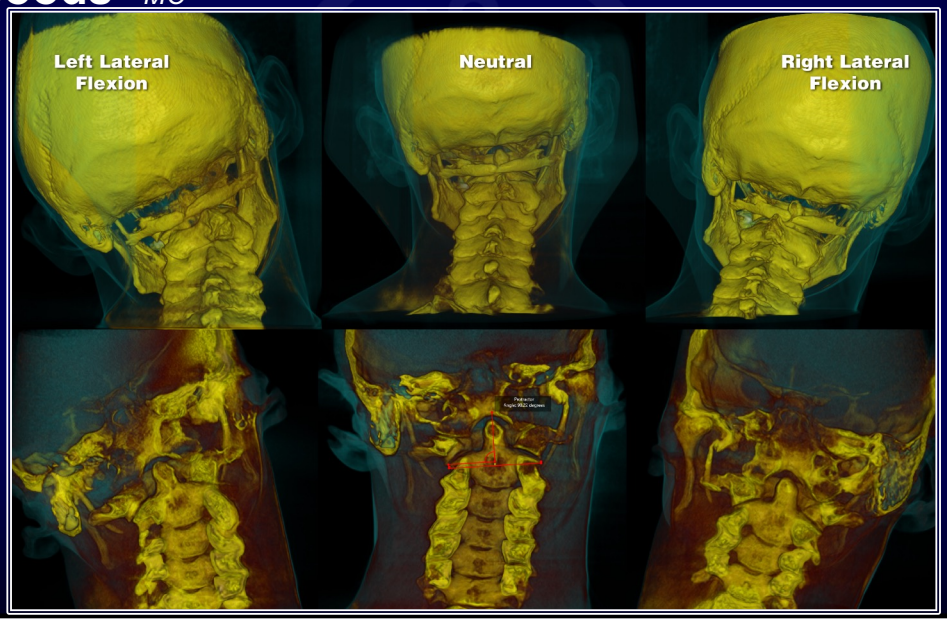
The Goods - *KH*



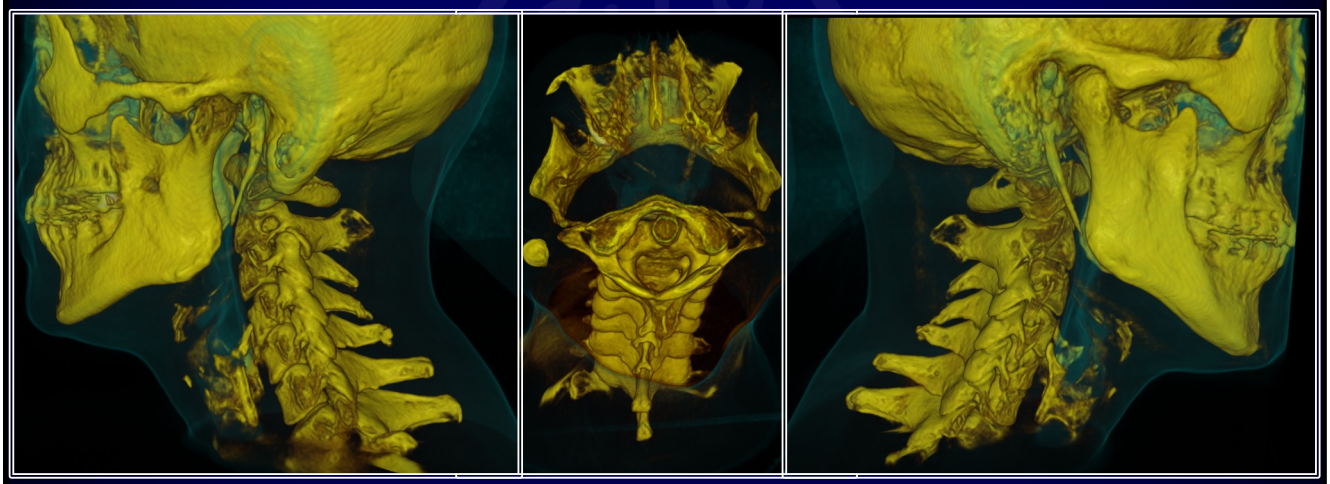
98

The Goods *- MC*



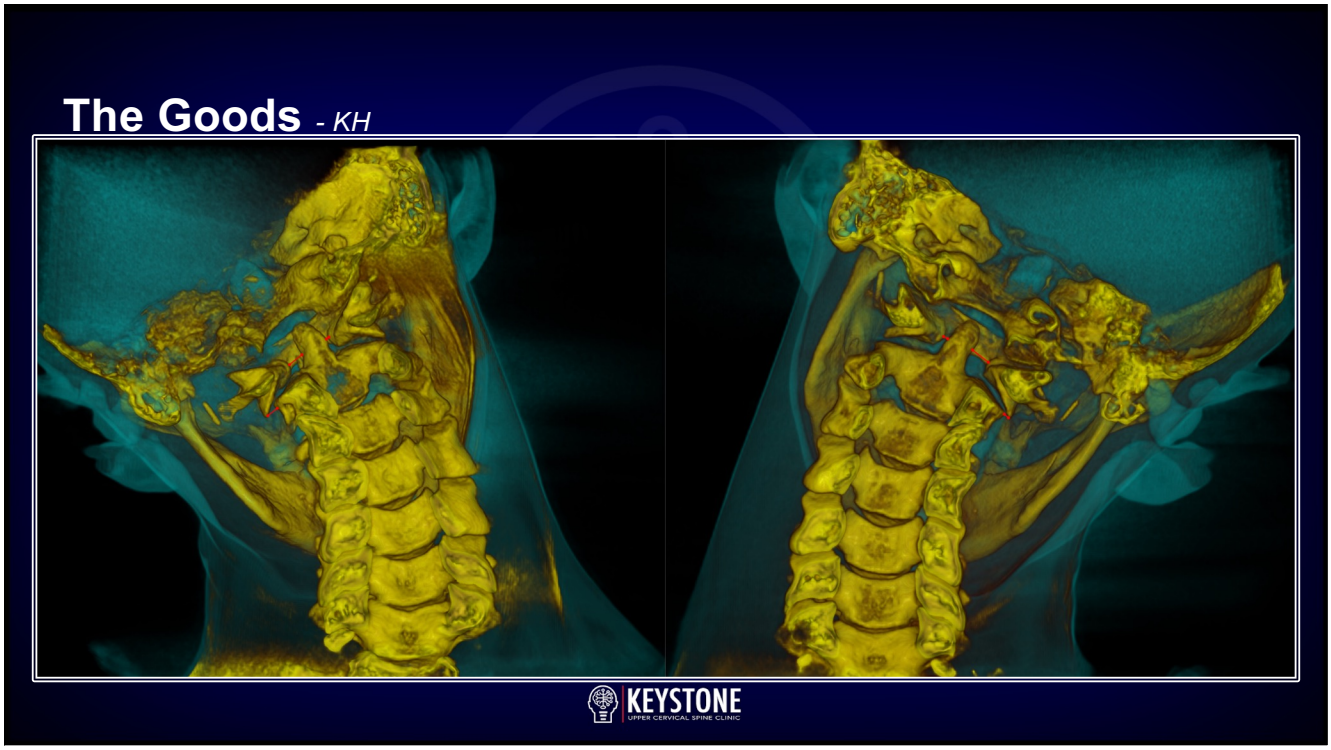
99

The Goods *- MC*

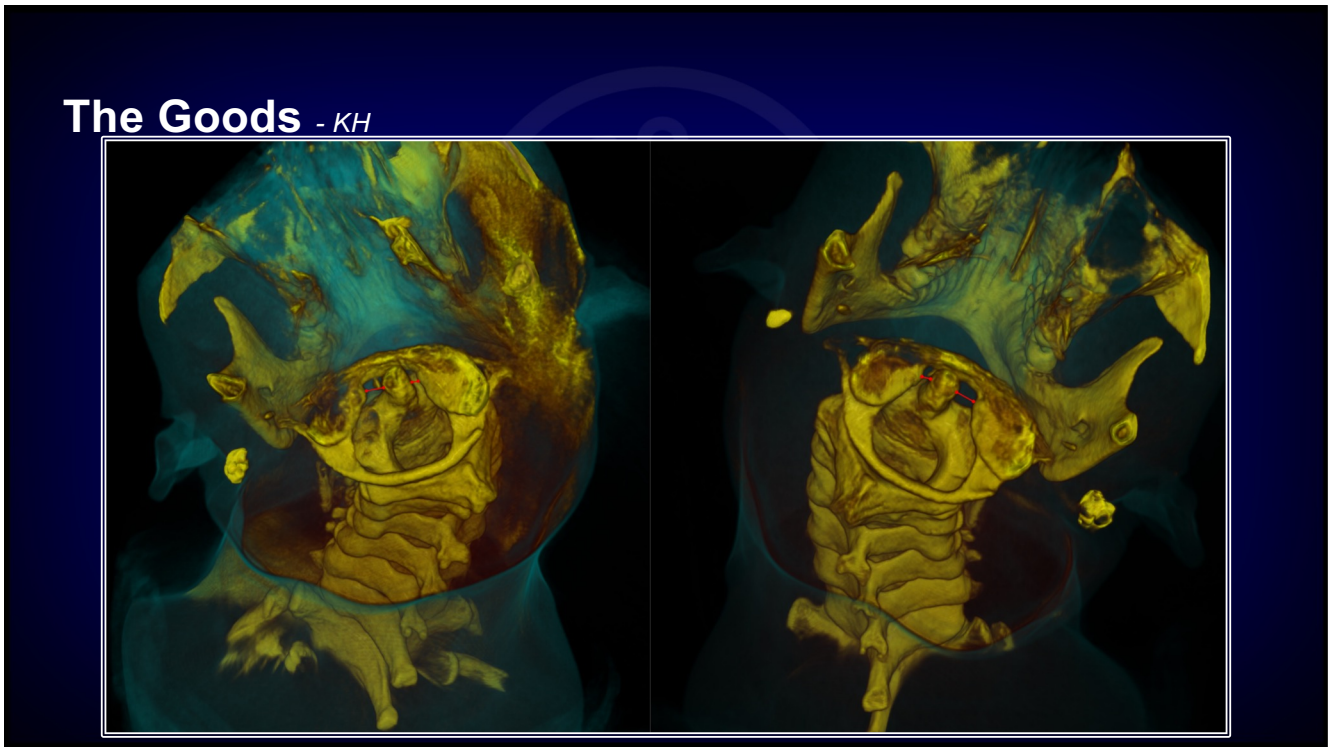


KEYSTONE
UPPER CERVICAL SPINE CLINIC

100

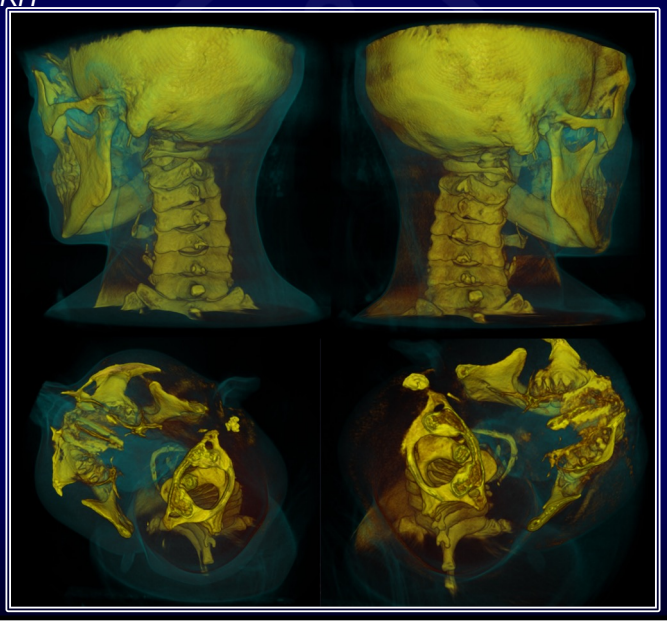

The Goods - KH
KEYSTONE
UPPER CERVICAL SPINE CLINIC

101


The Goods - KH

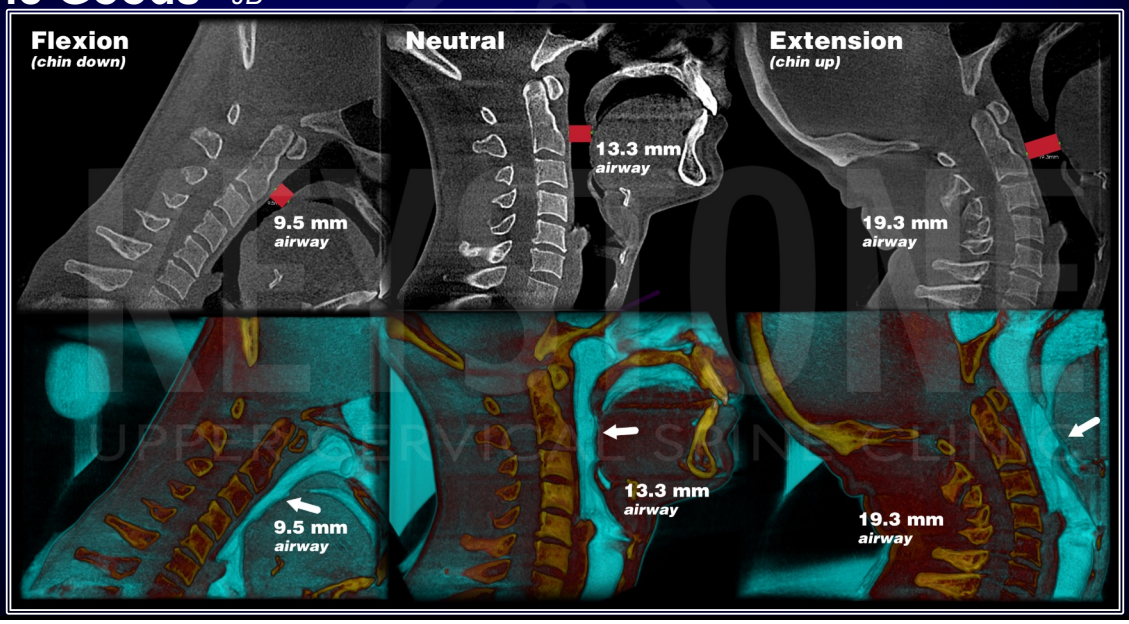
102

The Goods - *KH*



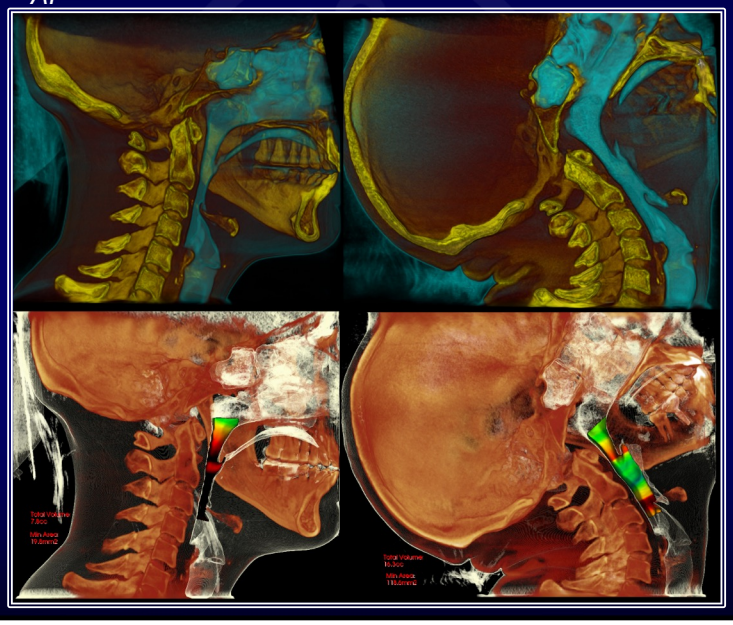
103

The Goods - *JB*



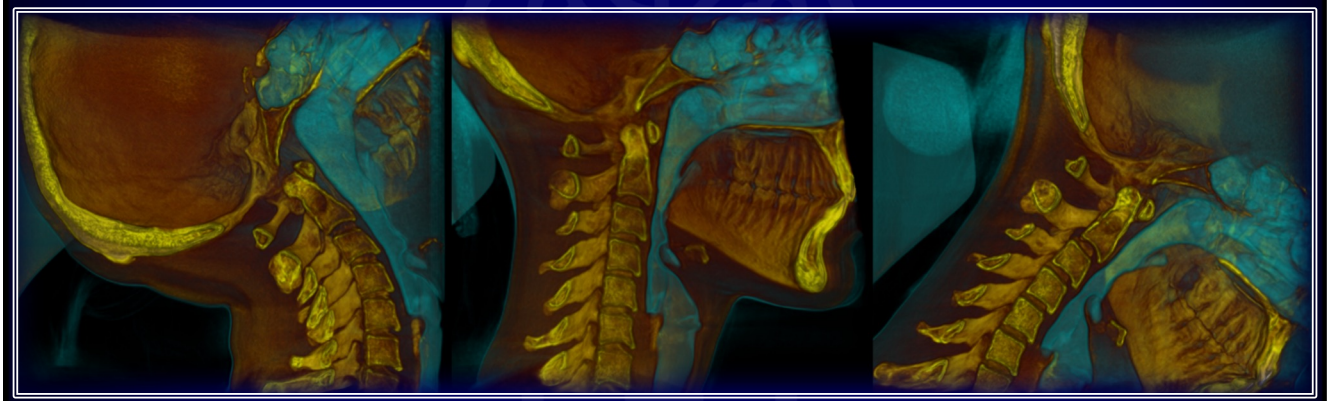
104

The Goods *- AP*



105

The Goods *- VF*



KEYSTONE
UPPER CERVICAL SPINE CLINIC

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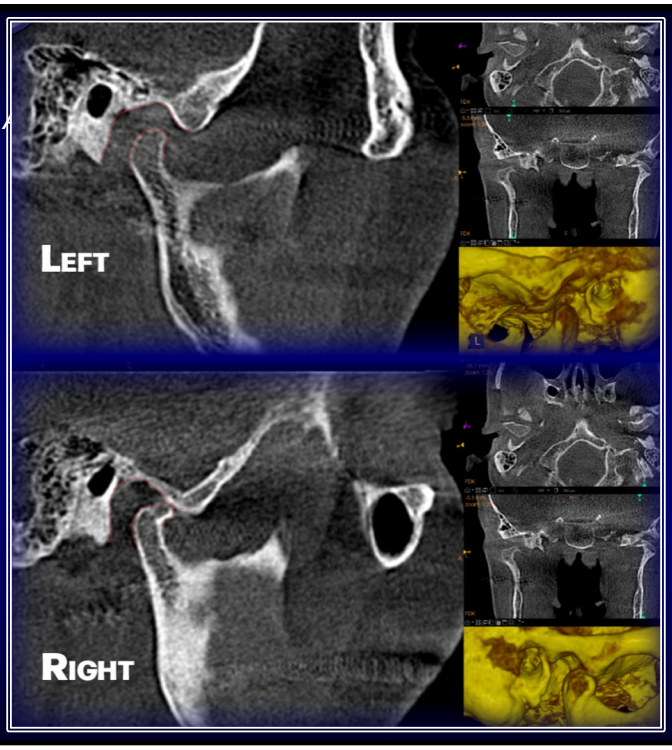
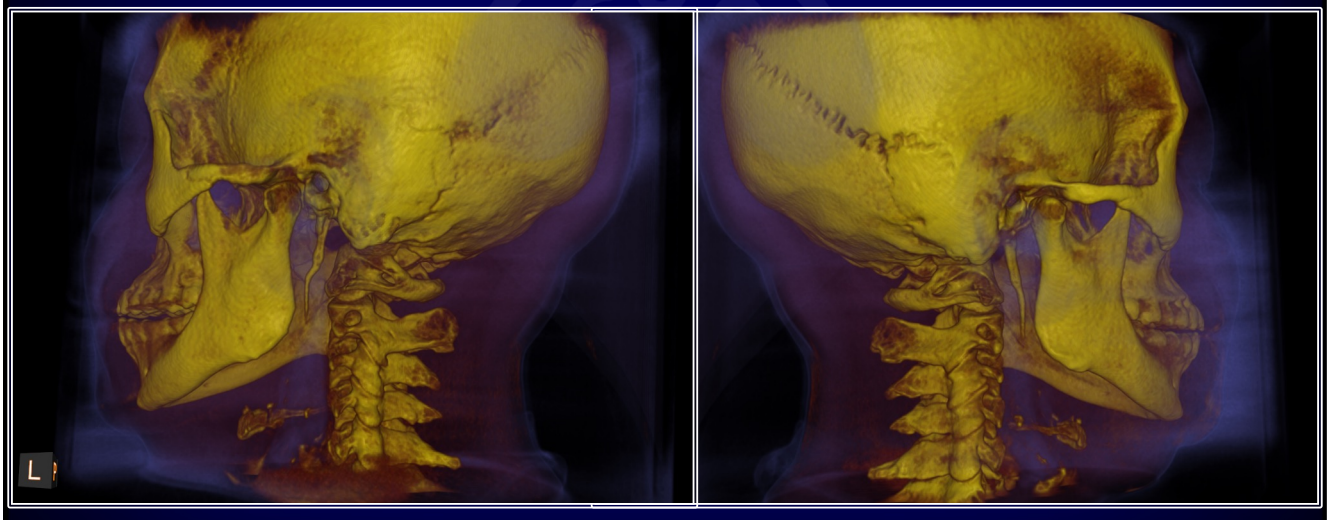
The Goods - A



107

The Goods - IS



KEYSTONE
UPPER CERVICAL SPINE CLINIC

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Presentation Itinerary

~~1. VERY Brief Intro~~

~~1. What's CBCT?~~

~~1. CBCT in the Research~~

~~1. CBCT in Chiro~~

~~1. The Goods~~

Thank you!!!

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keystonespineclinic@**gmail.com**

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