



CCOA Directive on Cone-Beam Computed Tomography (CBCT): Diagnostic Application of CBCT

Adopted June 23, 2023, and Effective July 3, 2023

Directive

Chiropractors may own and register CBCT equipment. Chiropractors are NOT authorized to operate CBCT to image or scan patients. Chiropractors are NOT authorized to interpret three-dimensional volumetric scans produced by CBCT. *

*Notice on the CBCT Directive

The Imaging and interpretation of CBCT in the chiropractic profession is a new consideration. Imaging and interpretation with a CBCT scan are a diagnostic procedure currently established in the dental profession. Chiropractic and dental practice applications of CBCT are not the same.

Council has authorized that the CCOA work to establish a standard of practice for future use of CBCT by chiropractors. The adoption of a CBCT standard of practice will include consultation with regulated members, subject matter experts, stakeholders, and the public through the Minister of Health.

This directive may be modified or amended as needed during the process of consideration and establishing a CBCT Standard of Practice.

The CCOA recommends that regulated members understand that CBCT use in practice is under review, and NOT authorized at this time. Currently, the CCOA advises regulated members NOT purchase or lease CBCT equipment. If you are a chiropractor who owns, or is considering purchasing this equipment, please pay close attention to this directive, as the directive defines your current regulatory requirements established by Council.

CBCT use in chiropractic practice has NOT been authorized by the CCOA Council. Until such authorization, any patient imaging with CBCT by chiropractors may be referred to the Complaints Director as a discipline complaint under Part 4 of the *Health Professions Act*.

Requirements under consideration

1. The CCOA must establish the registration requirements for CBCT equipment.
 - Chiropractors must have a radiation registration certificate issued by the CCOA for any CBCT equipment that they own or operate per Standard of Practice 8.4.
 - CBCT specific annual renewal and preventative maintenance considerations.
2. The CCOA must establish the parameters for CBCT in the Radiation Health and Safety program of the College.
3. The CCOA must establish the Standards of Practice for CBCT, including the following.
 - The indications for use of CBCT.
 - The operation of CBCT.
 - The interpretation and reporting of CBCT images.
 - The maintenance of CBCT.
 - Compliance with any required provincial licensing or approval.
4. The CCOA must establish what competencies and training are necessary for chiropractors to obtain for the operation of CBCT scans.
 - Chiropractors do not receive training in the operation of CBCT equipment as part of their Doctor of Chiropractic training.
 - CBCT has been shown to have a steep learning curve¹⁰ with a high rate of retakes, thus increasing radiation exposure to the patient.
5. The CCOA must establish the indications for utilization of CBCT in diagnostic imaging.
 - Evidence currently supports CBCT imaging for^{1,2}:
 - Scans of small joints or bones in the distal extremities.
 - Scans to assess for osseous TMJ abnormalities.
 - Scans to evaluate for the following in the cervical spine:
 - traumatic fractures and hairline fractures within the cervical spine,
 - evaluate cervical spine spondylosis,
 - intervertebral foraminal stenosis, and
 - facet joint arthrosis.
 - Evidence does not currently support CBCT imaging for:
 - Routine spinal screening, including the cranio-cervical junction^{3,11}.
6. The CCOA must establish the practice criteria for image selection:
 - CBCT must not be used if:
 - The radiation dosing will exceed standard radiographs, or
 - The imaging will not benefit the clinical outcomes, meaning the imaging will not increase the benefit to the patient over traditional imaging, or

- The imaging will not impact treatment selection, meaning the image will not result in the selection of a different intervention.
7. The CCOA must consider the competency for chiropractors to read and interpret three-dimensional volumetric scans.
 - Chiropractors must be able to identify pathology on these scans, the same as any professional that interprets diagnostic imaging.
 - This is not a competency taught in Doctor of Chiropractic Programs.
 - Based on preliminary consultation all CBCT scans must have a radiologist consultation to screen for pathology.
 8. The CCOA must develop the quality assurance and peer review that will apply to chiropractors who obtain and interpret CBCT studies.
 - Review of clinical decision to requisition a CBCT scan.
 - Review of the image quality.
 - Review of safety associated with operations.
 - Review of CBCT study interpretations and reports.

Key Considerations in this Directive

Rationale and summary of procedure

CBCT is a radiographic imaging method that, when utilized by properly trained individuals, allows accurate, three-dimensional imaging of hard tissue structures. Initially used by dental specialists to aid in surgical procedures, the use of CBCT is now being explored within other healthcare specialties,^{1,2} including chiropractic.³

CBCT uses a conical x-ray beam which falls on a flat panel detector. The X-ray tube and the detector synchronously rotate 360° around the patient and at certain degree intervals, single projection images are acquired. Software programs incorporating sophisticated algorithms are applied to these projection data to generate a volumetric data set, which can be used for reconstruction images in three orthogonal planes. CBCT can easily be installed in outpatient clinics because of their compact size.

CBCT is often promoted for its advantages in comparison to conventional CT imaging, which include lower radiation dose, higher spatial resolution, smaller size, and lower cost. The major drawbacks are the long acquisition time of 10 to 40 seconds, which can lead to motion artifacts and the limited range of potential applications due to the limited field of view.^{1,2}

Efficacy/potential applications

CBCT is a promising imaging modality that may be useful in musculoskeletal diagnosis for evaluation of small joints and bones. The primary musculoskeletal applications are the detection of occult fractures, verification of healing fractures and non-union, and assessment of benign tumors and degenerative changes of the bony structures.^{1,2} For example, CBCT has been shown to detect significantly more small bone and joint fractures, in particular complex fractures, than conventional radiography.⁴ In addition, CBCT has been found to be superior to conventional radiographic methods in the assessment of osseous TMJ abnormalities.⁵ The use of CBCT for these applications could potentially provide a benefit to chiropractors, such as those who primarily see traumatic cases, or those with a TMJ focus.

Chiropractic authors have suggested the application of CBCT in the upper cervical spine; most notably for Upper Cervical Chiropractic technique systems that concentrate on the craniocervical junction.³ It has been suggested that CBCT could lead to the better identification of structural anomalies and vertebral misalignments specific to this chiropractic approach. In addition, CBCT may be indicated to evaluate for traumatic fractures and hairline fractures within the cervical spine, evaluate cervical spine spondylosis, intervertebral foraminal stenosis, and facet joint arthrosis.

The potential applications of CBCT imaging technology within the chiropractic profession are currently limited due to the narrow field of view (depending on equipment, from 6x6 cm to 18x23 cm) and the lack of penetration power. For example, the limited field of view makes CBCT unsuitable for assessment of large joints. Moreover, even the latest and most powerful CBCT systems are unable to deliver X-rays which can visualize the lower cervical vertebra after passing through the shoulders.¹

Safety

A primary concern around the safety of imaging technologies (including CBCT) is the effective radiation dose received by a patient. Effective radiation dose is dependent on equipment type, exposure settings and especially the field of view selected. CBCT is praised for its high resolution with low effective dose, when compared to standard CT imaging. However, the radiation dose for CBCT can exceed that of conventional radiography (Table 1). Moreover, the actual patient dose with the use of CBCT may be higher than that expressed by the technical specifications. CBCT has an initial steep learning curve and a higher susceptibility to motion artifacts because of the long acquisition times, both of which bring an increased risk of retakes.² Current CBCT technology has also been suggested to be unable to adequately capture the lower cervical spine.¹ This limitation could result in chiropractors who use CBCT for cervical assessments having to use a combination of both CBCT and conventional radiography to get a complete diagnostic image of the full cervical spine, thereby increasing the cumulative dose to a patient with the possibility of adverse health effects for the patient.

Table 1. Comparative doses for CBCT, conventional radiography, and standard CT

	CBCT	Plain-film	Standard CT
Ankle ⁽⁶⁾	1.9 µSv to 14.3 µSv	1.5 µSv for ankle series including AP and Lateral	21.4 µSv
Cervical spine	50-250 µSv ^(3 & 7)	200 µSv for a 5 view Upper Cervical Chiropractic protocol ⁽³⁾ 122 µSv for a cervical AP and Lateral ⁽⁸⁾	16,700 µSv ⁽⁹⁾

Of perhaps even greater concern is whether chiropractors are competent to take or interpret CBCT images without advanced training. Thus far it appears that not even many chiropractors with specialist training are sufficiently trained in CBCT application and interpretation, let alone conventional field practitioners.

Regulatory Considerations

There is not currently any research that investigates the diagnostic or therapeutic utility of radiographs (in the absence of red flags) for the functional or structural evaluation of the spine.¹¹ In the absence of any documented evidence to support this application, CBCT scans must not be used as a routine screening device.

Training/Competency Considerations

Consideration must be given to whether chiropractors are competent to take or interpret CBCT images. To understand how CBCT can improve patient care, one must know its clinical indications and effective use. Moreover, CBCT has an initial steep learning curve, and with this, an increased risk of retakes.¹⁰ Therefore, the chiropractor must weigh the benefits to justify each decision to scan and ensure its clinical competence before exposing the patient.

Current CCOA Considerations on Obtaining Competence

The CCOA is researching requirements for training regarding the indications for, operations of, interpretation of, and reporting of CBCT scans. As this is new diagnostic procedure, the CCOA will establish approved courses for CBCT certification. The following are some of the considerations that must be addressed before chiropractors are authorized to operate CBCT.

- Fundamentals of CBCT technology and comparisons to conventional imaging devices.
- Radiation dosimetry and strategies to reduce effective dose to the patient during CBCT.
- 3D Radiographic anatomy and variations.
- Clinical indications for CBCT scan.
- Appropriate operational parameters for imaging.
- Interpretation and report of CBCT images.

Current CCOA Considerations on Quality Assurance for Competence

The CCOA must develop a quality assurance program relative to the use of CBCT. Quality Assurance Programs assess the following criteria:

- Was the imaging appropriately chosen?
- What is the quality of the image?
- Was the imaging including the report appropriately reported?

Current CCOA Consideration on Equipment Operations

The CCOA must establish a preventative maintenance program including the testing for operational parameters for all radiation equipment.

Current CCOA Considerations on Radiation Health and Safety

The CCOA must establish the parameters of the Radiation Health and Safety Program that applies to CBCT equipment.

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