Guideline on Justification and Referral Criteria for Selection of Patients for Dental Cone Beam CT Imaging

Public Health Services – Radiation Protection Unit

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Disclaimer: The Guideline summarizes recommendations from national and international organisations and publications. Examples of clinical indications for which CBCT imaging may be prescribed is listed in Table 1. These "Referral Criteria" are not rigid constraints rather they provide clinical guidelines to assess individual patient for CBCT imaging. There would be many more clinical situations outside of this 'Referral Criteria', which will require professional judgment by referring practitioner. The ultimate responsibility to justify and prescribe any radiographic imaging falls on the referring practitioner.

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Justification Principles

- When dental radiographic procedures are to be conducted on a patient, the procedure must be generically justified by using accepted radiographic modalities to assess the nature and extent of an actual or suspected dental condition, its early detection, treatment and response to treatment. Additionally, individual justification for the radiographic procedure must also occur and should be based on the dental and general health needs of each individual patient as assessed by a dental practitioner.
- CBCT imaging should potentially add new information to aid the patient's management.
- CBCT imaging must not be prescribed unless patient's history and clinical examination has been undertaken by Medical or Dental Practitioner or Specialist.
- The use of Medical Diagnostic Computed Tomography (CT) should be avoided if Dental CBCT equipment is readily available, considering clinical condition of the patient.
- When accepting referrals from other Dental or Medical Practitioner for CBCT examinations, the referring practitioner must supply sufficient clinical information (patient history and examination) to allow the CBCT operator (dental or medical radiation practitioner) to perform the Justification process.
- Record of the Justification process must be maintained for each patient.
- Routine CBCT exposure without adequate justification is unacceptable and must not be performed.
- CBCT imaging must not be prescribed by Dental Assistants, Dental Hygienist or Dental Therapist.
- When acting as a referrer, the Dental or Medical Practitioner or specialist should ensure that adequate clinical information derived from the patient's signs, symptoms and history is provided to the person taking responsibility to take radiographic exposure.

Optimisation Principles

- CBCT imaging must be avoided in clinical situations where OPG and Intra oral imaging is expected to provide adequate diagnostic information.
- CBCT examinations should use the smallest FOV depending on the area of interest. Large FOV must be avoided unless deemed necessary by the referrer.
- CBCT examination should be carried out with image resolution compatible with adequate diagnosis to optimize radiation dose to the patient.
- A quality assurance programme must be established and implemented for each CBCT facility, including equipment, techniques and quality control procedures.
- Aids to accurate positioning (light beam markers) must always be used.
- All new installations of CBCT equipment should undergo a critical examination and detailed acceptance tests before use to ensure that radiation protection for staff, members of the public and patient are optimal
- CBCT equipment should undergo routine tests to ensure that radiation protection, for both practice/facility users and patients, has not significantly deteriorated.
- CBCT operator and user (except Medical Radiation Practitioner such as Diagnostic Radiographer) must receive adequate theoretical and practical training in safe operation of the equipment. This should include but not limited to patient set up and positioning, selecting appropriate exposure factors, image reporting (i.e., Dental and Medical practitioner), routine Quality Assurance testing etc.

Table 1: Clinical Indications or Referral Criteria[1] to prescribe CBCT imaging

Clinical Indications /Referral Criteria	Recommendation
Unerupted tooth localisation: Assessment of the position of an unerupted tooth where the tooth is impacted and accurate identification of any resorption of adjacent teeth	• CBCT imaging technique with acceptable measurement accuracy and contrast resolution may identify position of teeth with high diagnostic accuracy. However, radiation dose to the patient will be higher when compared with OPG and intra oral, and the higher cost of CBCT examinations should also be considered. In such instances, OPG or Intra oral imaging may be considered. • Radiological examination of maxillary canines is not usually necessary before 10 years of age.
Assessment of an impacted tooth due to external resorption in relation to unerupted teeth	• CBCT imaging should not be used for the assessment of impacted maxillary canine or supernumerary teeth in the context of root resorption diagnosis, unless the intraoral radiography did not supply adequate diagnostic information. In such instances, smallest FOV consistent with diagnostic information should be used to reduce patient dose.
Endodontic Indications	• CBCT imaging should not be used as a standard method for demonstration of root-canal anatomy. • Limited volume, high-resolution CBCT may be used when conventional intraoral imaging provides inadequate diagnostic information; contradictory clinical signs and symptoms are present; or there is evidence of inflammatory root resorption, internal resorption, suspected root fracture, combined periodontal-endodontic lesions, perforations, or atypical pulp anatomy soft tissue structures
Caries Diagnosis	• CBCT is not an acceptable diagnostic examination for occlusal or proximal carious lesions.
Sinonasal Evaluation	• The spatial and contrast resolution of CBCT is acceptable for evaluating osseous and gross soft tissue changes in the sinusonasal complex.

[1] These "Referral Criteria" are not rigid constraints rather it intends to provide clinical guidelines to assess individual patient for CBCT imaging. There would be many more clinical situations outside of this 'Referral Criteria', which will require professional judgment by referring practitioner. The ultimate responsibility to justify and prescribe any radiographic imaging falls on the referring practitioner.

Clinical Indications /Referral Criteria	Recommendation
	• Comparing to OPG, CBCT provides better information about the relationship of the sinus floor to the roots of the molars. Inflammatory diseases of the sinus can also be evaluated with CBCT. • Sinusitis related to apical periodontitis can be identified with CBCT. However, soft tissue tumours, fluid, or blood cannot be differentiated on CBCT.
Obstructive Sleep Apnea	• CBCT may be useful in the management of obstructive sleep apnea. Upper airway volumes determined from CBCT may provide useful information to assess dimensional and morphologic changes in the upper airway, as well as to assess changes in these parameters after appliance or surgical therapy.
Diagnosis and treatment planning in orthodontic practice	• CBCT may be justified for complex cases of skeletal abnormality, particularly those requiring combined orthodontic/surgical management. • CBCT imaging may be prescribed for assessment of patients with complex craniofacial deformity requiring surgical or combined surgical/orthodontic intervention at 16 years or over as part of planning for the definitive procedure. • Large FOV CBCT should not be used routinely for orthodontic diagnosis. • Special care must be taken while imaging children and young adolescent as most orthodontic CBCT imaging involves large FOV, which may include skull base and neck.
Diagnosis of dental periapical pathosis	CBCT imaging may be prescribed for: • Contradictory or nonspecific clinical signs and symptoms. • Poorly localized symptoms associated with no evidence of pathosis by conventional Imaging. • Clinical situations where anatomical superimposition of roots or areas of the maxillofacial skeleton are needed for task-specific procedures. • Diagnose pathosis of non-endodontic origin to determine the extent of a lesion and its effect on surrounding structures.
Assessment of Intra or postoperative endodontic treatment complications when patients complain of irritation, pain, tissue necrosis or neurological disturbances after root canal treatment	• CBCT may be used for assessment of accidental overextension of filling material into the surrounding tissues and to determine the specific location of the overfilled materials, such as the mandibular canal, bone marrow, and submucosal layer. • FOV should be limited to the area of concern.

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Diagnosis and management of dentoalveolar trauma	• CBCT examination may be prescribed for diagnosis and assessment of injuries regarding injuries affecting the root portion of the tooth, periodontal ligaments, and status of the bone. • CBCT examination may also provide adequate diagnostic information on root fracture, root infraction, and root dislocation. • CBCT examination may also provide additional diagnostic information on pre-existing periapical disease; presence of jaw fracture; degree of extrusion or intrusion; and presence of tooth, tooth fragment, or foreign bodies lodged in the soft tissue.
Pre surgical planning of Dental Implant CBCT technology may improve presurgical planning as well as surgical execution through three-dimensional (3D) presurgical anatomic measurement and virtual implant placement simulation CBCT should be used as an adjunct to 2D dental radiology when, in the reasonable judgment of the clinician, the specific benefits to the patient as outlined above outweigh the risks	CBCT imaging may be prescribed to obtain relevant information in implant dentistry such as: • To determine the exact location of root apex/apices to evaluate proximity to adjacent anatomical structures • Location of relevant anatomic structures and their relation to implant placement • When there Is a clinical need for augmentation procedures or site development before Implant placement. • If bone reconstruction and augmentation procedures (i.e., ridge preservation or bone grafting) have been performed to treat bone volume deficiencies before Implant placement. • When there is a question regarding selection of implant sites, number, diameter, length, or loading strategy. • When the patient presents with a thin phenotype or there are esthetic concerns (risk for bone or soft tissue deformities) • Construction of computer-generated static surgical guides via 3D printing or stereolithography
Post operative assessment of dental implants • intraoral periapical radiography should be used in the absence of clinical signs or symptoms • Panoramic radiographs may be used for extensive implant cases	• CBCT must not be prescribed for periodic review of clinically asymptomatic Implants. • CBCT may be prescribed if implant retrieval is anticipated. • CBCT may be used postoperatively, only If the patient presents with Implant mobility or altered sensation, especially If fixture in the posterior mandible.
Complications with previously placed implants	• Limited FOV CBCT may be prescribed for nonsurgical treatment to assess endodontic treatment complications such as over extended root canal

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Evaluation of the non-healing of previous endodontic treatment to help determine the need for further treatment nonsurgical, surgical, or extraction	obturation material, separated endodontic Instruments, localization of perforations.
Determining risk to periodontal structures in patients requiring tooth movement. Patients presents with a malocclusion requiring fixed orthodontic appliances for decompensation	CBCT should not be used as a routine part of periodontal orthodontic Treatment. CBCT may be prescribed for following clinical situations: • When the adult patient presents with dentoalveolar deficiencies (i.e., dental crowding) and/or transverse maxillary deficiencies that might require surgical intervention to help ensure orthodontic boundary conditions are respected. • When the orthodontic patient presents with concomitant mucogingival deformities (recession). • When the patient presents with temporomandibular joint disorders, dentofacial disharmonies, congenitally missing teeth, or requirement for skeletal anchorage. • When the patient presents with impacted third molars requiring extraction with or without potential pathologies. • When the patient presents with impacted teeth requiring surgical exposure and bonding of an orthodontic bracket for eruption. • When the cleft palate patient presents for periodontal orthodontic therapy requiring decompensation and/ or more extensive collaborative interdisciplinary management.
Diagnostic assessment and treatment planning for the management of periodontitis OPG may provide adequate diagnostic information for comprehensively evaluating periodontal structures	Current available evidence does not support the routine use of CBCT in managing periodontitis. CBCT with limited FOV may be useful in the management of patients with periodontitis according to the following scenarios: • When an advanced furcation lesion has been detected and dental implants are being considered as an alternative treatment option • When advanced bone loss has encroached on anatomic structures, such as sinus cavities or the inferior alveolar nerve • When there is a questionable root fracture, root resorption, or periodontal-endodontic lesion present that could not be identified by OPG and/or clinical evaluation

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	• In the retreatment of cases that don't respond favourably to localized periodontal therapy • to enhance the diagnosis and management of peri-implantitis when determined necessary.
Assessment of mandibular third molars for extraction or coronectomy	• OPG imaging in most cases may provide adequate diagnostic information. CBCT imaging of the mandibular third molar should not be applied as a routine method before removal of mandibular third molars. • CBCT imaging should only be applied when the surgeon has a very specific clinical question in an individual patient case that cannot be answered by conventional (panoramic and/or intraoral) imaging.

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