GUIDELINES FOR

DENTAL RADIOLOGY

Version 1

Issue Date: 10/06/2021

Effective Date: 10/08/2021

Health Policies and Standards Department

Health Regulation Sector (2021)

INTRODUCTION

Dubai Health Authority (DHA) is the responsible entity for regulating, licensing and monitoring health facilities and healthcare professionals in the Emirate of Dubai. The Health Regulation Sector (HRS) is an integral part of DHA and was founded to fulfil the following overarching strategic objectives and program:

Objective #1: Position Dubai as a global medical destination by introducing a value-based, comprehensive, integrated and high quality service delivery system.

Objective #2: Direct resources to ensure healthy and safe environment for Dubai population.

Strategic Program #5: Oral & Dental Care: This program focuses on improving the oral health outcomes and ensure that all individuals have access to high quality treatments and effective prevention programs for dental care.

ACKNOWLEDGMENT

This document was developed by Dental Services Department, Primary Healthcare Services Sector (PHCSS). It has further been reviewed by the Health Policy and Standards Department (HPSD), HRS.

HRS would like to acknowledge and thank all parties that participated and worked toward developing these guidelines to ensure improving the quality and safety of healthcare services.

The Health Regulation Sector

Dubai Health Authority

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EXECUTIVE SUMMARY

Clinical guidelines are increasingly becoming part of current practice and will become more common over the next decade. These Clinical Guidelines aim to improve the quality and the level of healthcare provided to the clients. Healthcare providers can use these guidelines to answer specific questions in day-to-day practice and as an information source for continuing professional education.

This document presents a framework for dental healthcare providers to:

- To raise awareness regarding the appropriate use of dental Cone Beam Computed Tomography (CBCT) in the clinical practice, to develop a comprehensive referral criteria, and provide recommendation on the use of CBCT.

DEFINITIONS

Cone Beam Computed Tomography: is a radiographic imaging method that allows accurate, three-dimensional (3D) imaging of hard tissue structures.

Radiographic Referral: is simply a means for a healthcare practitioner to obtain a radiograph by a referral sent to a radiology specialist, the referral should have adequate description of the history, clinical signs and symptoms of the patient to enable the CBCT practitioner to proceed with the justification process.

ABBREVIATIONS

2D	:	Two Dimensional
3D	:	Three Dimensional
ALARA	:	As Low As Reasonably Achievable
CBCT	:	Cone beam computed tomography
DHA	:	Dubai Health Authority
FANR	:	Federal Authority for Nuclear Regulation
HPSD	:	Health Policy and Standards Department
HRS	:	Health Regulation Sector
PHCSS	:	Primary Healthcare Services Sector
TMJ	:	Tempro Mandibular Joint

A. GUIDELINES FOR CLINICAL APPLICATION OF CONE-BEAM COMPUTED TOMOGRAPHY (CBCT) IN DENTISTRY

1. BACKGROUND

One of the fundamental tools that aids a clinician in diagnosis is the use of radiographs. Furthermore, it also plays a role in treatment planning, monitoring disease progression and assessing treatment efficacy. In dentistry, radiographical investigations are often essential in the management of patients for clinical examination alone can be misleading and insufficient. Dental radiographs are images of teeth and surrounding structures which is commonly used by dentists to evaluate your oral health. Dental x-rays can be in the form of bitewing, periapical, orthopantogram, and recently introduced Cone-Beam Computed Tomography (CBCT). Both the patient and the clinical staff are at risk of x-ray exposure; therefore, it should be utilized properly to maximize its diagnostic value and minimize its radiation dose.

2. SCOPE

2.1. To raise awareness regarding the appropriate use of dental CBCT in the clinical practice and to develop a comprehensive referral criteria.

3. PURPOSE

3.1. To raise awareness regarding the appropriate use of dental CBCT in the clinical practice and to develop a comprehensive referral criteria.

3.2. Provide recommendation on the use of CBCT.

3.3. Selecting the appropriate imaging pathway in regards to CBCT to improve patients care by reducing error and radiation dose.

3.4. To clarify the clinical situation in which CBCT investigation method would be found useful to both the clinician and patient.

4. APPLICABILITY

4.1. DHA licensed Dental Radiologist.

4.2. DHA licensed Dental Implantologists.

4.3. DHA licensed Oral Maxillofacial Surgeons.

4.4. DHA licensed Periodontist.

4.5. DHA licensed Endodontist.

4.6. DHA licensed Orthodontist.

4.7. DHA Licensed Dental Assistant.

5. RECOMMENDATION ONE: BASIC PRINCIPLES

5.1. CBCT examinations must not be carried out unless a history and clinical examination have been performed.

5.2. CBCT examinations must be justified for each patient to demonstrate that the benefits outweigh the risks.

5.3. CBCT examinations should potentially add new information to aid the patient's management.

5.4. CBCT should not be repeated 'routinely' on a patient without a new risk/benefit assessment having been performed.

5.5. When accepting referrals from other dentists for CBCT examinations, the referring dentist must supply sufficient clinical information (results of a history and examination) to allow the CBCT Practitioner to perform the Justification process.

5.6. CBCT should only be used when the question for which imaging is required cannot be answered adequately by lower dose conventional (traditional) radiography.

5.7. CBCT images must undergo a thorough clinical evaluation ('radiological report') of the entire image dataset.

5.8. Where it is likely that evaluation of soft tissues will be required as part of the patient's radiological assessment, the appropriate imaging should be conventional medical CT or MR, rather than CBCT.

5.9. CBCT equipment should offer a choice of volume sizes and examinations must use the smallest that is compatible with the clinical situation if this provides less radiation dose to the patient.

5.10. Where CBCT equipment offers a choice of resolution, the resolution compatible with adequate diagnosis and the lowest achievable dose should be used.

5.11. A quality assurance programme must be established and implemented for each CBCT facility, including equipment, techniques and quality control procedures.

5.12. Aids to accurate positioning (light beam markers) must always be used.

5.13. 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.

5.14. CBCT equipment should undergo regular routine tests to ensure that radiation protection, for both practice/facility users and patients, has not significantly deteriorated.

5.15. For staff protection from CBCT equipment, the guidelines detailed in the European Guidelines on Radiation Protection in Dental Radiology' should be followed.

5.16. All those involved with CBCT must have received adequate theoretical and practical training for the purpose of radiological practices and relevant competence in radiation protection.

5.17. Continuing education and training after qualification are required, particularly when new CBCT equipment or techniques are adopted.

5.18. Dentists responsible for CBCT facilities who have not previously received 'adequate theoretical and practical training' should undergo a period of additional theoretical and practical training that has been validated by an academic institution (University or equivalent).

5.19. For dento-alveolar CBCT images of the teeth, their supporting structures, the mandible and the maxilla up to the floor of the nose (e.g. 8cm x 8cm or smaller fields of view), clinical evaluation ('radiological report') should be made by a specially trained Dental Radiologist or, where this is impracticable, an adequately trained general dental practitioner.

5.20. For non-dento-alveolar small fields of view (e.g. temporal bone) and all craniofacial CBCT images (fields of view extending beyond the teeth, their supporting structures, the mandible, including the Tempro mandibular Joint (TMJ), and the maxilla up to the floor of the nose), clinical evaluation

('radiological report') should be made by a specially trained Dental Radiologist or by a Clinical Radiologist (Medical Radiologist).

6. **RECOMMENDATION TWO:** RADIATION PROTECTION IN DENTAL RADIOLOGY

6.1. Staff protection measurements should be carried out by the chief dental practitioner in order to guarantee that the requirements are following the country's law and in accordance with a qualified expert.

6.2. Staff exposure to radiation should not exceed 1mSv per year, additional safety measures are usually unnecessary for pregnant staff provided it follows this rule. The limitation of the dose is achieved by As Low As Reasonably Achievable (ALARA) principle.

6.3. ALARA principle is mainly attained by keeping adequate distance, in order to achieve that goal a designated area should be marked for staff not to enter during the x-ray exposure.

6.4. Dental practices involved with excessive workloads, using cephalometry, and requiring patient assistance should pursue guidance from a certified expert.

6.5. Written instructions on radiation safety should be provided to all the staff.

6.6. When planning new facilities or making significant changes it is essential to consult a qualified expert to ensure the protection of the dental x-ray facility and obtain appropriate Federal Authority for Nuclear Regulation (FANR) approvals.

6.7. Radiation awareness and protection training is required from all the staff in the dental practice.

7. **RECOMMENDATION THREE:** JUSTIFICATION AND REFERRAL CRITERIA

7.1. Any CBCT acquired must be justified to the patient to show that the benefits outweigh the risks. In order to go ahead with the selection of a radiograph it is crucial to take history and undergo clinical examination for the patient.

8. **RECOMMENDATION FOUR:** CLINICAL APPLICATION OF CBCT IN DENTISTRY

8.1. **Implantology:**

8.1.1. Preoperative

a. Cross sectional view CBCT is considered in the site of the potential implant, for assessment of the location and relationship to anatomical structures.

b. In cases that might require augmentation such as sinus augmentation, block grafting, ramus or symphysis grafting, assessment of site with previous traumatic injury or area involving impacted teeth

c. Sites that were previously treated with bone graft for bone reconstruction or ridge augmentation procedures.

8.1.2. Postoperative

a. In the presence of signs and symptoms; for example, implant mobility or altered sensation.

b. Implant retrieval.

8.2. **Oral and maxillofacial surgery:**

8.2.1. Third Molar Assessment

a. To evaluate the relationship between the lower third molar and inferior alveolar canal in case of an overlap CBCT may be taken.

8.2.2. Impacted Teeth

a. One of the common teeth impacted is the maxillary canine. CBCT is used to allow proper treatment planning by the oral surgeon and orthodontist.

8.2.3. Maxillofacial trauma

a. CBCT for zygomatic complex fracture, maxillary and mandibular bone fracture, dentoalveolar fracture is useful for both diagnosis and treatment planning.

b. Bone pathology

8.2.4. Bone graft assessment

a. Used to estimate the defects size and shape to determine the amount of graft needed.

8.2.5. Craniofacial surgery

a. CBCT may be used for cleft palate cases to assess the size of the cleft, dental age and arch segment positioning.

8.2.6. Orthognathic surgery

a. Used for orthodontic analysis to determine the treatment plan and prognosis.

8.2.7. Temporomandibular Joint (TMJ) Imaging.

8.3. **Periodontics:**

8.3.1. Patient in need of implants

a. " As previously mentioned above in the implantology section"

8.3.2. Periodontics diagnosis and treatment planning

a. Tooth with advanced furcation lesion and might be replaced with an implant.

b. Advanced bone loss involving anatomical structures such as the sinus and IAN canal.

c. Periodontal cases that did not favourably react to the repeated localized periodontal therapy.

d. Root fracture, root resorption, and periodontal -endodontic lesion not viewed in the 2D radiography or detected by examination.

e. Certain peri-implantitis cases for improved diagnosis and treatment.

8.4. **Endodontics:**

8.4.1. In the diagnosis of endodontically-involved teeth whether previously treated or untreated with opposing or nonspecific signs and symptoms.

8.4.2. Cases that may use limited field of vision CBCT are extra canals, complex morphology, dental anomalies (e.g. dens invaginatus), calcified canals, external and internal root resorption, or invasive cervical resorption.

8.4.3. Vertical root fracture that couldn't be identified by examination and 2D imaging.

8.4.4. Management of non-healing lesion in association with previously endodontically treated tooth to decide on the treatment modality.

8.4.5. Assessment for nonsurgical retreatment of the complication that resulted during or after endodontic treatment for example overextended root canal obturation material, separated endodontic instruments and localization of perforations.

8.4.6. Assessment of endodontic treatment complications (for example, post- perforations) for treatment planning purposes when existing conventional radiographic views have yielded insufficient information.

8.4.7. Assessment and/or management of root resorption, which clinically appears to be potentially amenable to treatment.

8.4.8. Considered when the patient needs to undergo surgical endodontic retreatment to pinpoint the location of the root apex and its relationship to the adjacent anatomical structure.

8.4.9. Management of dentoalveolar trauma resulting in root fracture, luxation, tooth displacement or alveolar fracture.

8.4.10. Confirmation of non-odontogenic causes of pathosis.

8.5. **Orthodontics:**

8.5.1. CBCT may be used to view the juxtaposition of impacted teeth to the vital structure that my obstruct tooth movement during active orthodontic treatment

8.5.2. Placement of mini implants used for anchorage CBCT may be taken to avoid injury to the dental roots.

8.5.3. Analysis prior to orthognathic surgery as mentioned previously.

9. RECOMMENDATION FIVE: CONTRAINDICATION FOR THE USE OF CBCT

9.1. Soft tissue involvement

9.2. Follow ups

9.2.1. Follow ups can be carried out by the means of intraoral radiograph, panoramic or cephalometric x-ray. However in certain cases, such as recurrence or unexpected outcome, CBCT can be requested.

9.3. Observation of the airway

9.3.1. Not indicated due to the fact that CBCT is usually taken in sitting position while airway observation requires the patient to be in supine position.

10. RECOMMENDATION SIX: ROLE AND RESPONSIBILITY

10.1. Every healthcare provider having a part with the process of CBCT should have the appropriate knowledge whether in theory or practice.

10.2. Responsible individuals who did not gain the knowledge or training must enrol in institutions or programs that are accredited in those aspects.

10.3. Continuous education will still be required for new and updated aspects regarding CBCT.

11. RECOMMENDATION SEVEN: CONCLUSION

11.1. CBCT is a tool that provides great advantages and applications in dentistry. However, It should not be the first selection of imaging over the day to day standard radiographs such as intraoral periapical, bitewings or panoramic X-rays. The role of a physician is to decide when a CBCT should be undertaken and that is basically in cases that 2D radiographs fail to provide sufficient details.

11.2. Appropriate documentation of X-ray forms plays a major criteria to a radiologist since it improves the image quality and reduces mishap which eventually aids in ALARA principle.

12. RECOMMENDATION EIGHT: RECOMMENDATIONS

12.1. 2D radiographs in most clinical scenarios are the x-rays selected, CBCT is chosen in the cases where 2D images cannot provide the details or answers required.

12.2. The link between a radiologist and managing physician is through a radiology request form. Filling a request form accurately is very crucial, since it helps in the following:

12.2.1. Reducing radiation dose and the investigation time.

12.2.2. Improve the quality of service offered to the patient.

12.2.3. Failure to properly complete these forms may therefore result in misdiagnosis.

12.3. To achieve ALARA, the field of view and area of interest should be mentioned within the request CBCT form to avoid error.

12.4. In order to request a CBCT, the following physician should be able to interpret CBCT thoroughly to avoid any mishaps or delay.

KEY PERFORMANCE INDICATORS (KPIs)

1. Patient Happiness: Overall Assessment	
DHA Pillar	Patient Happiness
Indicator Name	Overall Assessment
Measure Type	Outcome
Data Source	Survey data
Measure Description	People who had a very favorable overall assessment of the facility during measurement period
Measure Denominator	All survey respondents who meet inclusion criteria
Measure Numerator	Survey respondent whose overall assessment of the facility was very high - patients with the highest possible score (scale has 2-7 options) or the two highest options (scale has 8+ options)
Measure Inclusion Criteria	Total number of valid responses to surveys that ask a patient to give their overall assessment of a facility
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

2. Patient Happiness: Recommendation to Others	
DHA Pillar	Patient Happiness
Indicator Name	Recommendation to Others
Measure Type	Outcome
Data Source	Survey data
Measure Description	Percentage of patients who were very likely to recommend the facility to other people during measurement period
Measure Denominator	All survey respondents who meet inclusion criteria
Measure Numerator	Survey respondent whose recommendation was very high - patients with the highest possible score (scale has 2-7 options) or the two highest options (scale has 8+ options)
Measure Inclusion Criteria	Total number of valid responses to surveys that ask whether the patient would recommend the facility to others
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

3. Patient Happiness: Doctors Made Sure Patient Understood All Information	
DHA Pillar	Patient Happiness
Indicator Name	Doctors Made Sure Patient Understood All Information
Measure Type	Outcome
Data Source	Survey data
Measure Description	Percentage of patients who answered favorably ('yes') that doctors made sure he/she understood all information
Measure Denominator	All survey respondents who met inclusion criteria
Measure Numerator	Survey respondent indicated 'yes,' doctors made sure that the patient understood all information
Measure Inclusion Criteria	Valid response to the survey question ('yes' or 'no')
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

4. Patient Safety: Rate of Medication Error	
DHA Pillar	Patient Safety
Indicator Name	Rate of Medication Error
Measure Type	Outcome
Data Source	Internal facility records, reports, or survey data
Measure Description	Rate of prescriptions per 100,000 with a dispensing error during measurement period
Measure Denominator	Number of medication prescriptions during measurement period
Measure Numerator	Number of prescriptions in which a medication error occurs (e.g. dispensing error, prescribing error, administering and preparing error, patient compliance error, vaccine error, administering a medicine for a known allergy patient, dose-related adverse drug reaction)
Measure Inclusion Criteria	All filled prescriptions
Measure Exclusion Criteria	Unsafe condition and near miss incident, adverse drug reactions
Source	TEC required measures http://apps.who.int/iris/bitstream/10665/252274/1/9789241511643-eng.pdf
International Benchmark	2.28 Per 100,000 (in the U.S.) Source: https://www.nationwidechildrens.org/newsroom/news-releases/2017/07/study-finds-rate-of-medication-errors-resulting-in-serious-medical-outcomes-rising . One medication error occurs for every five doses given in US hospitals and 1-2% of patients admitted to US hospitals are harmed by medication errors. Source: http://stateclaims.ie/wp-content/uploads/2017/11/Medication-Incidents-Report-2016.pdf
Higher is Better	No
Risk Adjust This Measure	No

5. Patient Safety: Rate of Medical Error	
DHA Pillar	Patient Safety
Indicator Name	Rate of Medical Error
Measure Type	Outcome
Data Source	Internal facility records, reports, or survey data
Measure Description	Rate of medical errors (errors in diagnosis, medication, surgery, equipment use, lab findings interpretation) per 100,000 patients in measurement period
Measure Denominator	All qualifying patients in measurement period
Measure Numerator	Medical errors as defined through proven reports (e-medical systems) during measurement period
Measure Inclusion Criteria	All patients with at least one medical encounter in measurement year
Measure Exclusion Criteria	None
Source	TEC required measures http://apps.who.int/iris/bitstream/10665/252274/1/9789241511643-eng.pdf
International Benchmark	To be discussed with DHA
Higher is Better	No
Risk Adjust This Measure	No

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