Dental Policy

BlueCross BlueShield Kansas
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Title: Cone Beam Computed Tomography (CBCT)

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DESCRIPTION

A computed tomography (CT) scan is a diagnostic imaging method in which a computer is used to generate a three-dimensional image of an object using a series of two-dimensional X-ray image slices taken around a single axis of rotation. Cone beam refers to the type of x-ray projection which allows users to image a small well defined volume such as the lower face and mouth at a low radiation dosage.

Radiology is essential to dentists for determining the presence and extent of disease in patients for whom a thorough patient history and examination has been performed. It also has roles in treatment planning, monitoring disease progression, and in assessing treatment efficacy.

An application of CT, designed to meet the needs of dental practice, is the use of Cone Beam Computed Tomography (CBCT).

POLICY

A. Cone beam computed tomography (CBCT) is considered **medically necessary** for the following conditions:

1. Diagnosing temporomandibular joint disorder (TMJ)

2. Surgical planning for extraction or exposure of impacted teeth

3. Treatment planning for dental implants

4. Evaluation and/or treatment of tumors or cysts

5. Endodontics
   a. Multi-rooted teeth (i.e., 1-3, 14-16, 17-19, 30-32, and maxillary premolars #5 and #12)
   b. Endodontic retreatment
   c. Any apical surgery

6. Evaluation of resorption lesions

7. Orthodontic work up

B. Cone beam computed tomography (CBCT) is considered **not medically necessary** for general dental screenings, unless narrative provides supporting medical necessary.

Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

RATIONALE

All CBCT examinations must be justified on an individual basis by demonstrating that the potential benefits to the patients outweigh the potential risks. CBCT examinations should add new information to aid the patient's management.

Selection of dental CBCT is based on the individual patient's history and a clinical examination. The "routine" use of dental CBCT on patients based on a generalized approach rather than individual prescription is unacceptable. A "routine" or "screening" examination is defined as one in which a radiograph is taken regardless of the presence or absence of clinical signs and symptoms. CBCT should not be selected unless a history and clinical examination have been performed. "Routine" or "screening" imaging is unacceptable practice.

Choosing dental CBCT for a patient should also be based upon consideration of the prevalence of diseases, their rates of progression, and the diagnostic accuracy of CBCT (compared with traditional techniques) for the application in question.

Unerupted Tooth Localization

CBCT for assessment of the position of an unerupted tooth, particularly where the tooth is impacted. In these cases, an integral aspect of the assessment is often the accurate identification of any resorption of adjacent teeth. Such a situation is most often seen where maxillary canines are ectopic and incisor roots are suspected of having undergone resorption.[71] Traditional radiological assessment relies upon the use of parallax movement between images taken with different perspectives. In some specialized centers, multi-slice computed tomography (MSCT) has been used for this purpose, so some studies have concentrated on this comparison of performance.

Teeth are relatively large objects, having good contrast with the surrounding bone. It is obvious that a three-dimensional imaging technique with acceptable measurement accuracy and little distortion will identify position of teeth with high diagnostic accuracy. A recent systematic review[24] identified only four studies in which diagnostic accuracy had been determined for CBCT in relation to impacted teeth against a reference standard, all of which related to mandibular third molars.

Haney et al[25] in a clinical study of impacted maxillary canine teeth, showed that there were differences in diagnosis of tooth position between those made using conventional radiography and those made using CBCT, although this was only in a minority of observations. There were larger differences in treatment plans when the two imaging methods were compared, while confidence in diagnosis and treatment plans was greater when CBCT was used. Botticelli et al[7] showed that the understanding of canine position was different when CBCT was used compared with conventional imaging and that, in a minority of cases, treatment decisions were different. Similar findings for defining canine and supernumerary tooth position were reported by Katheria et al,[33] while observers in their study scored a significantly higher proportion of CBCT examinations as "very useful" in treatment planning than for conventional radiographic examinations. While there is a message here that the availability of CBCT changes diagnosis and treatment plans for a proportion of cases, it must be remembered that this may not be translated into better outcomes for patients.

Despite the expected advantage of CBCT in tooth localization, it is important to consider the impact upon management of patients, the increased radiation dose and the likely higher cost of CBCT examinations. Conventional radiography has served dentists and specialist orthodontists well over many years. In some cases, CBCT is likely to be preferred over MSCT if radiation exposure is lower. Radiological examination of maxillary canines is not usually necessary before 10 years of age.

For the localized assessment of an impacted tooth (including consideration of resorption of an adjacent tooth) where the current imaging method of choice is MSCT, CBCT may be preferred because of reduced radiation dose.

External Resorption in Relation to Unerupted Teeth

Assessment of impacted tooth position also involves assessment of the presence or absence of resorption in adjacent teeth. CBCT has been considered in several case series and non-systematic reviews.

Studies on impacted maxillary canines[3,26] reported that there was agreement between conventional and CBCT imaging on diagnosis of root resorption in the majority of assessments, while intra-rater reliability was lower for CBCT based assessments. Katheria et al[33] found a significantly greater proportion of cases were scored by observers as showing resorption, although there was no consideration of the possibility of false positive scores. Alqerban et al[2] compared observers' detection of root resorption in relation to impacted canine teeth in a clinical study with no reference standard. They reported a higher detection rate of "slight" resorption and a lower detection rate of "no resorption" using CBCT than when using panoramic radiographs, although they did not use intraoral radiographs for comparison.

The results of these studies should stimulate a note of caution. While it seems likely that the three-dimensional information of CBCT will identify resorption of roots more effectively than conventional intraoral radiographs, particularly on the facial and palatal surfaces, there is no research evidence to suggest that this information or any changes in treatment would alter the eventual outcomes. CBCT as a "first line" imaging method for assessment of impacted maxillary canine or supernumerary teeth in the context of root resorption diagnosis is not supported by evidence, but that it may be indicated when conventional intraoral radiograph did not supply adequate information.

CBCT may be indicated for the localized assessment of an impacted tooth (including consideration of resorption of an adjacent tooth) where the current imaging method of choice is conventional dental radiography and when the information cannot be obtained adequately by lower dose conventional (traditional) radiography.

Caries Detection and Diagnosis

The evidence does not support the clinical use of CBCT for caries detection and diagnosis. Nonetheless, CBCT examinations performed for other purposes should be carefully examined for caries lesions shown fortuitously when performing a clinical evaluation (report).

Periodontal Assessment

CBCT is not indicated as a routine method of imaging periodontal bone support. The diagnosis of periodontal diseases depends on a clinical examination. This may be supplemented by radiological

examination if this is likely to provide additional information that could potentially change patient management or prognosis. Radiographs do not have a role in diagnosis of periodontal disease, but are used as a means of demonstrating the hard tissue effects of periodontal disease, particularly the bony attachment loss. There is no clear evidence to support any robust recommendations on selection of radiological examinations.

Conventional two-dimensional radiographs have significant limitations in demonstrating the periodontal attachment of teeth. Two-dimensional images do not show irregular bone defects or buccal/lingual attachments clearly. The attraction of a three-dimensional image is, therefore, considerable. The scientific literature on periodontal uses of CBCT is small with only two *in vitro* studies suitable for systematic review of diagnostic accuracy.[42,51]

Overall, the literature related to use of CBCT in periodontal imaging is small, mainly laboratory-based and involves a limited number of CBCT systems. In terms of detection of periodontal bone loss, laboratory studies do not permit a comparison of CBCT with the primary diagnostic method, i.e., probing of pockets. Furthermore, the impact of three-dimensional images upon management decisions and treatment impact in clinical practice has not been considered. Nonetheless, the general direction of the case series in the literature suggests that CBCT may have a role to play in the management of complex periodontal defects for which surgery is the treatment option.

Assessment of Periapical Disease

Diagnosis of periapical inflammatory pathosis is a common and important task for dentists. A number of case reports and non-systematic reviews have highlighted the value of CBCT for identification of periapical lesions in selected cases.[48,10,55] The research studies addressing this aspect of use of CBCT are limited by the extreme, probably insurmountable, difficulty of obtaining a true reference standard in human clinical studies. A subsequent study showed that CBCT identified more, and larger, periapical bone defects following apicectomy than did conventional radiography.[9] Özen et al[52] found improved observer agreement values when artificial periapical lesions were assessed with CBCT compared with conventional imaging.

The current evidence suggests that high resolution CBCT may have higher sensitivity for detection of periapical lesions than conventional radiography in laboratory studies and that this is achieved without loss of specificity. In practice, clinical signs and symptoms add significantly to the diagnostic process and radiological evidence is not always of critical importance. Furthermore, the relatively high economic cost of CBCT compared with intraoral radiography should not be ignored.

CBCT is not indicated as standard method for identification of periapical pathosis. When conventional radiographs give a negative finding when there are contradictory positive clinical signs and symptoms, CBCT may be appropriate.

Evaluation and Treatment of Tumors or Cysts

CBCT is very useful for evaluation of intra-osseous lesions that are in close proximity to vital organs or vasculature in the head and neck region.[78] Although the reliability of CBCT to detect the invasion or erosion of oral malignancy such as Oral Squamous Cell Carcinoma (OSCC) is still under investigation, a study has suggested that combination of Magnetic Resonance Imaging (MRI) and CBCT may be a useful tool to delineate tumor boundary and develop appropriate surgical intervention.[79]

Studies have shown that CBCT exams enable the surgeon to produce a more conservative treatment approach, which reduces iatrogenic damages and is more acceptable to patients.[76,77]

Endodontics

Conventional endodontic imaging relies on intraoral radiography. In multi-rooted teeth and more complex cases (e.g., suspected root perforations; resorptions and atypical canal systems) intraoral radiographs at different beam angulations are used to achieve a range of perspectives and allow parallax localization. MSCT is impracticable for dentists and hard to justify on the basis of radiation dose. Endodontic treatment requires images in three phases of management: diagnosis, during treatment (working length estimation, master cone check image) and in post-treatment review. Endodontic treatment itself includes orthograde treatment and surgical endodontic procedures.

The three-dimensional images from CBCT offer a valuable new method of imaging root canal systems, and there are several non-systematic reviews in the literature that give a favorable perspective.[10,44,55] Endodontics requires, however, a high level of image detail, and it is important to remember that available dental CBCT systems offer resolutions far lower (by approximately one order of magnitude) than those of modern intraoral radiography. Furthermore, because endodontic treatment is a single tooth procedure, CBCT systems incapable of reducing the field of view to suitable dimensions will expose areas to radiation without patient benefit. A few studies report superior performance of CBCT in identifying root canals but there was no independent reference standard.[36,37,39] The impact of CBCT on management decisions had not been addressed in any detail, although one study on posterior teeth[38] reported that CBCT added additional clinically relevant information in 70% of cases. Research is needed to establish objectively the diagnostic accuracy of CBCT in identifying root canal anatomy and to quantify its impact on management decisions.

CBCT is not indicated as a standard method for demonstration of root canal anatomy. Limited volume, high resolution CBCT may be indicated, for selected cases where conventional intraoral radiographs provide information on root canal anatomy, which is equivocal or inadequate for planning treatment, most probably in multi-rooted teeth.

External resorption is sometimes idiopathic and unexpected, but there are sub-groups of patients and teeth in which there is increased risk, notably after severe dental luxation and avulsion injuries. As pointed out by Durack et al[13] resorption may progress rapidly and early treatment is advantageous. In such cases, the use of CBCT may be justified, but the timing of the imaging is unclear. The unpredictability of the condition means that a negative finding on one occasion would not exclude resorption at a later date. Repeated CBCT examinations would be hard to justify without research evidence of its value, particularly in children. Internal resorption is usually identified by chance on radiographs, so it seems likely that the role of CBCT would be reserved for cases where the resorption was extensive, where perforation of the root surface was in question and where three-dimensional information could help in decision-making on extraction or retention.

Exodontia

There is no literature related to the use of CBCT as part of the pre-extraction assessment of erupted teeth and there seems no good reason to suggest its use for this purpose. The literature

concentrates on unerupted teeth, principally lower third molars, as demonstrated in the systematic review performed by Guerrero et al.[24]

A number of clinical studies, case series and non-systematic reviews have been published on the use of CBCT for pre-surgical assessment of impacted third molars including Heurich et al,[29] Nakagawa et al,[47] Danforth et al,[11] Nakagawa et al,[46] Friedland et al,[16] Neugebauer et al,[52] Nakayama et al,[49] Tantanapornkul et al,[66] Lübbers et al,[38] Suomalainen et al[64] and Yamada et al.[73] CBCT may offer advantages for the surgeon in showing the anatomical position and relationships of mandibular third molars where there is a close inter-relationship between the third molar root and the mandibular canal (inferior dental canal), but that CBCT should not be used routinely for all third molar pre-surgical assessments.

Two studies satisfied the inclusion criteria for the review of diagnostic accuracy,[67,22] both of which considered the relationship between the mandibular third molar root and the mandibular canal and a reference standard of intra-surgical direct visualization. Cone-beam CT was significantly superior to panoramic images in predicting neurovascular bundle exposure during extraction of impacted mandibular third molar teeth, with impressive sensitivity.[67] The more recent study by Ghaeminia et al,[22] however, provided apparently contradictory findings. They found no significant difference in sensitivity and specificity between panoramic radiography and CBCT in predicting exposure of the mandibular canal. The difference in results of the two studies probably reflects different case selection. Direct exposure of the canal during surgery is, however, not a prerequisite for post-operative nerve damage. Injury may occur by pressure effects through thin intervening bone. As pointed out by Ghaeminia et al,[22] CBCT offers the advantage of identifying bucco-lingual position of the canal. Other factors, such as complex root morphology, may also favor the use of a cross-sectional imaging technique.

Where conventional radiographs suggest a direct inter-relationship between a mandibular third molar and the mandibular canal, and when a decision to perform surgical removal has been made, CBCT may be indicated.

CBCT may be indicated for pre-surgical assessment of an unerupted tooth in selected cases where conventional radiographs fail to provide the information required.

Implants

In investigating an implant site, a surgeon requires information on bone volume and quality, topography and the relationship to important anatomical structures, such as nerves, vessels, roots, nasal floor, and sinus cavities.[27]

In 2002, a Working Group of the European Association of Osseointegration (EAO) devised consensus guidelines on imaging for implant dentistry.[27] They did not include any comment on CBCT. They did, however, describe criteria for use of "cross-sectional imaging" (at that time, spiral tomography and MSCT).

The EAO guidelines made the following key points:

- Clinicians should decide if a patient requires cross-sectional imaging on the basis of the clinical examination, the treatment requirements and on information obtained from conventional radiographs.

- The technique chosen should provide the required diagnostic information with the least radiation exposure to the patient.
- "Standard" imaging modalities are combinations of conventional radiographs.
- Cross-sectional imaging is applied to those cases where more information is required after appropriate clinical examination and standard radiographic techniques have been performed.

The EAO guidelines presented valuable information on the special clinical situations in implant dentistry when cross-sectional imaging is required. The guidelines go on to explain that cross-sectional imaging is of principal value in pre-operative assessment and treatment planning, but that it is not part of a "routine protocol" for post-operative examinations "unless there is a need for assessments in situations where some kind of complications have occurred, such as nerve damage, postoperative infections in relation to nasal and/or sinus cavities close to implants".[27]

While these criteria for cross-sectional imaging are subjective in nature, relying heavily on subjective "clinical doubt", they do offer useful guidance. The primary question for clinicians is whether or not cross-sectional imaging is required for implant planning, rather than whether CBCT is required. Nonetheless, CBCT has different radiation dose implications and different capabilities.

There are a large number of publications (case studies; non-systematic reviews; descriptive studies) that illustrate the use of CBCT in implant dentistry.[1,4,6,8,15,17-21,24,28,43,56,60] These publications make it clear that CBCT is being used widely for implant dentistry.

For cross-sectional imaging prior to implant placement, the advantage of CBCT with adjustable fields of view, compared with MSCT, becomes greater where the region of interest is a localized part of the jaws.

Temporomandibular Joint (TMJ)

The overwhelming majority of patients with symptoms and signs related to the temporomandibular joint (TMJ) are suffering from myofascial pain/dysfunction or internal disc derangements. Bony abnormality is not seen in the former and only occasionally in the latter. In such cases, radiographs do not add information of relevance to management. Where imaging of the TMJ disc is needed, Magnetic Resonance Imaging (MR) is the method of choice.

Other pathoses encountered in the TMJ include osteoarthrosis and rheumatoid arthritis. In both these conditions, there are often bony changes that may be detectable on conventional radiographs and CBCT. When considering the justification for CBCT, however, the clinician should consider whether the information obtained will alter the management of the patient. The identification of bony erosions, remodeling or deformity may be purely documentary and have no impact on treatment strategy.

As stated by Petersson,[57] according to the current version of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC /TMD), imaging of the TMJ is not required for a diagnosis. Furthermore, there is no clear evidence for when TMD patients should be examined with imaging methods.

REVISIONS	
05-14-2013	Policy added to the bcbsks.com web site.
12-31-2013	In Coding section: ▪ Removed CDT code D0363 *(Deleted code, effective December 31, 2013)* ▪ Added CDT codes: D0393, D0394, D0395 *(New code, effective January 1, 2014)* ▪ Added ICD-10 Diagnosis codes *(Effective October 1, 2014)*
05-13-2015	In Coding section: ▪ Updated effective date of ICD-10 diagnosis codes to October 1, 2015
04-27-2016	Policy reviewed; no revisions made.
01-18-2017	Updated Description section.
	Remainder of policy reviewed; no other revisions made.
02-15-2018	In Coding section: ▪ Removed ICD-9 codes.
	Remainder of policy reviewed; no other revisions made.
07-03-2019	Policy reviewed; no changes made.
10-01-2020	In Coding Section: Added: M26.641, N26.642, M26.643, M26.649, M26.651, M26.652, M26.653, M26.659
05-21-2021	In Policy section ▪ Added Item A.5.c
06-15-2022	Medical Policy reviewed; with no revisions
08-08-2023	Updated Coding Section ▪ Removed ICD-10 Codes
12-10-2024	Medical Policy reviewed; with no revisions
01-13-2026	Medical Policy reviewed; with no revisions

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