

Three-dimensional imaging and interpretation

Clinical Policy ID: CCP.1389

Recent review date: 11/2025

Next review date: 3/2027

Policy contains: Endoscopy; three-dimensional rendering or reconstruction; tomography; ultrasonography.

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Coverage policy

Three-dimensional imaging (also called three-dimensional reconstruction or rendering), interpretation, and reporting are clinically proven and, therefore, may be medically necessary when all of the following criteria are met (American Association of Endodontists/American Academy of Oral and Maxillofacial Radiology, 2015; Dong, 2025; Plana, 2014; Simpson, 2017; Tang, 2025; Virani, 2016):

- The additional imaging detail will impact the diagnosis or clinical course of the member.
- The service is consistent with accepted standards of medical practice.
- Sufficient clinical expertise is available to perform the procedure and interpret the results.
- A written order or referral documents the medical necessity for the additional three-dimensional imaging.
- The interpreting physician's report addresses the medical necessity identified by the ordering or referring health care provider.

Limitations

The interpreting physician shall maintain a copy of the test results and interpretation along with a copy of the ordering or referring health care provider's order for the study.

The use of three-dimensional imaging, interpretation, and reporting is investigational/not clinically proven and, therefore, not medically necessary when any of the following conditions are present:

- Equivalent information obtained from the test has already been provided by another procedure (such as ultrasound, magnetic resonance imaging, or angiography).
- Equivalent information obtained from the test could be provided by a standard (two-dimensional) imaging study without reconstruction.
- The procedure is performed routinely based on the internal protocols of the testing facility.
- The procedure is not consistent with accepted standards of medical practice.
- Documentation of medical necessity is lacking.

Alternative covered services

Standard of care patient evaluation and management by a network health care provider.

Background

The majority of medical imaging is presented as two-dimensional information. Advances in multi-detector computed tomographic imaging capture large volumes of information in digital form, which, in turn, allows data to be manipulated into other planes that were not acquired directly during the acquisition. Multidetector tomographic modalities (e.g., computed tomography, magnetic resonance tomography, and positron-emission tomography) and ultrasonography can create three-dimensional depictions of morphologic and physiological attributes characteristic of health and disease (Sarmah, 2023).

Many techniques may be used to produce and store three-dimensional imaging and improve the understanding of a pathological process. Pre-image processing is essential for clearing extraneous data and accurately depicting tissues and organs. It may require specialized algorithms for processing. Three-dimensional reconstruction is expensive, and its use is confined to specially designed medical devices that can accommodate higher-resolution images (Sarma, 2023).

Findings

Guidelines

A number of guidelines support three-dimensional imaging, when the additional information will impact diagnosis or treatment planning and when sufficient expertise is available to perform the procedure and interpret the results. Three-dimensional rendering and reconstruction represent important technological advancements that capture more anatomically accurate data sets and, in turn, provide additional detail and a dimension of depth of anatomy and pathology not found with standard two-dimensional modalities. Three-dimensional imaging can be justified on an individual basis based on clinical presentation taking into account specific use, optimization protocols, radiation dose, risk-assessment strategies, and current standards of practice (American Association of Endodontists/American Academy of Oral and Maxillofacial Radiology, 2015; Dong, 2025; Plana, 2014; Simpson, 2017; Tang, 2025; U.S. Preventive Services Task Force, 2024; Virani, 2016).

Evidence review

Low- to moderate-quality evidence from systematic reviews and meta-analyses demonstrates comparable to superior aspects of diagnostic accuracy of three-dimensional imaging versus two-dimensional imaging for many clinical applications. However, the impact of these technological advancements on diagnostic certainty, treatment planning, and clinical outcomes has not been quantified, and the clinical or cost effectiveness compared to less expensive and more readily available alternatives has not been established, lending ambiguity to the optimal choice of imaging. The intended clinical application will determine the degree of accuracy and precision required, along with the desire to reduce radiation exposure. The incremental value of three-

dimensional imaging over current imaging standards for many indications has not been determined, and justification for the additional information would be needed.

Several systematic reviews and meta-analyses have examined a range of clinical uses for three-dimensional imaging methods. Clinical applications include, but are not limited to:

- Assessment and treatment planning in craniofacial surgery (Werathammo, 2025).
- Assessment and treatment planning in dentistry and oral surgery (Awarun, 2019; Chen, 2021; Erum, 2025; Hartmann, 2019; Saini, 2025; Thierens, 2018; Wismeijer, 2018).
- Assessment and treatment planning in liver surgery (Banchini, 2024).
- Assessment and treatment planning in orthopedic surgery (Boudissa, 2024; Kosy, 2018; Kwan, 2025; Liu, 2025; Nevalainen, 2025; Suri, 2025).
- Breast cancer detection (specifically ultrasonography) (Bin, 2019).
- Detection of soft tissue defects of the knee (Shakoor, 2018) and rotator cuff (Teng, 2018).
- Diagnosis and classification of uterine abnormalities (Spagnol, 2022; Xydias, 2025).
- Facilitation of laparoscopic and thoracoscopic surgeries (Fergo, 2017; Liang, 2018; Sánchez-Margallo, 2021; Vettoretto, 2018).
- Guiding brachytherapy for cervical cancer (Kim, 2020).
- Guiding tubal sterilization microinsert positioning (Carretti, 2019).

In 2019, we updated the references and added several new systematic reviews and meta-analyses with no policy changes warranted.

In 2020, we updated the reference list. No policy changes are warranted.

In 2021, we updated the references with no policy changes warranted.

In 2022, we updated the reference list. No policy changes are warranted.

In 2023, we identified no newly published, relevant literature to add to the policy.

In 2024, we updated the references with no policy changes warranted.

In 2025, we reorganized the findings and updated the references with no policy changes.

References

On September 16, 2025, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “Imaging, Three-Dimensional” (MeSH), “three-dimensional imaging,” “three-dimensional rendering,” and “three-dimensional reconstruction.” We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

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Policy updates

6/2018: initial review date and clinical policy effective date: 10/2018

10/2019: Policy references updated.

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