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Positional Magnetic Resonance Imaging (MRI) and Standing or Portable Ultrasound for Scoliosis

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Related Policies (if applicable)
None

Disclaimer

Carefully check state regulations and/or the member contract.
Each benefit plan, summary plan description or contract defines which services are covered, which services are excluded, and which services are subject to dollar caps or other limitations, conditions or exclusions. Members and their providers have the responsibility for consulting the member's benefit plan, summary plan description or contract to determine if there are any exclusions or other benefit limitations applicable to this service or supply. **If there is a discrepancy between a Medical Policy and a member's benefit plan, summary plan description or contract, the benefit plan, summary plan description or contract will govern.**

Coverage

This medical policy has become inactive as of the end date above. There is no current active version and this policy is not to be used for current claims adjudication or business purposes.

Positional (non-recumbent) magnetic resonance imaging **is considered experimental, investigational, and/or unproven** including its use in the evaluation of individuals with cervical, thoracic, or lumbosacral back pain.

Standing or portable ultrasound imaging (e.g., Scloioscan, Scolioscan Air) **is considered experimental, investigational and/or unproven** for the evaluation of individuals with scoliosis.

Policy Guidelines

There are no specific codes for either positional magnetic resonance imaging (MRI) or Scolioscan/Scolioscan Air. Positional MRI may be reported using the CPT code for the MRI scan. CPT code 76498 should not be used to report Scolioscan, since it is not an MRI service; an unlisted ultrasound code would be more appropriate.

Description

Back Pain

Determining the cause of back pain is a complex task. In some individuals, extensive evaluation with various imaging modalities does not lead to a definitive diagnosis. Some studies have suggested that imaging the body in various positions with "loading" of the spine may lead to more accurate diagnoses. This loading can be accomplished by having the individual sit or stand upright. Also, imaging can be completed with the individual in the position that causes the symptom(s). This theory is being evaluated in suspected nerve root compression and in some cases of spondylolisthesis.

Diagnosis

An open (non-recumbent) magnetic resonance imaging (MRI) system has been developed that allows imaging of a patient in various positions. Imaging can be conducted with partial or full weight-bearing. Dynamic-kinetic imaging (images obtained during movement) can also be obtained with this system. Conventional MRI of the spine is typically completed with an individual in a recumbent position. Weight-bearing can be simulated by imaging in the supine position with a special axial loading device.

One concern with positional MRI is the field strength of the scanners. Today's clinical MRI scanners may operate at a field strength between 0.1 to 3 tesla (T), and are classified as either low-field (<0.5 T), mid-field (0.5 to 1.0 T), or high-field (>1.0 T). Low-field MRI is typically used in open scanners. Open scanners are designed for use during interventional or intraoperative procedures, when a conventional design is contraindicated (e.g., an obese or claustrophobic individual), or for changes in individual positioning.

In general, higher field strength results in an increase in signal-to-noise ratio, spatial resolution, contrast, and speed. Thus, low-field scanners produce poorer quality images compared with high-field scanners, and longer acquisition times with low-field scanners increases the possibility of image degradation due to patient movement. However, field strength has less of an effect on the contrast-to-noise ratio, which determines the extent to which adjacent structures can be distinguished from one another.

Positional Magnetic Resonance Imaging

Positional (non-recumbent) magnetic resonance imaging (MRI) permits imaging of an individual in various positions, including sitting and standing. This technology is being evaluated as a diagnostic tool for individuals with position-dependent back pain.

Scoliosis

Scoliosis is an abnormal lateral curvature of the spine, most often diagnosed in childhood or early adolescence. It affects 2-3% of the population, or an estimated six to nine million people in the United. States. The primary age of onset is 10-15 years old occurring equally among genders. Females are eight times more likely to progress to a curve magnitude that requires treatment.

Diagnosis and Treatment

Scoliosis is usually confirmed through a physical examination, an x-ray, spinal radiography, CT scan or MRI. The curve is measured by the Cobb Method and is diagnosed in terms of severity by the number of degrees. A positive diagnosis of scoliosis is made based on a coronal curvature measured on a posterior-anterior radiograph of greater than 10 degrees. In general, a curve is considered significant if it is greater than 25 to 30 degrees. Curves exceeding 45 to 50 degrees are considered severe and often require more aggressive treatment.

Treatment for scoliosis is dependent upon the spinal curve. If mild enough, no treatment is warranted. Braces are effective in patients who have not reached skeletal maturity. Surgery may be recommended if the spinal curve is greater than 40 degrees and there are signs of progression.

Scolioscan System

Scolioscan (Telefield Medical Imaging Ltd, Hong Kong) is a 3D ultrasound imaging system for scoliosis assessment. The system includes a rigid frame with two movable supporting boards and four supporters to support patients to maintain a stable posture during a test. The chest and hip boards and the four supporters can be adjusted, and the information can be used for follow-up assessments for the same patient. The 3D ultrasound imaging of the spine is achieved through freehand scanning of the ultrasound probe, a custom-designed linear probe with frequency of 4-10 MHz and a width of 10 cm. An electromagnetic spatial sensor is installed inside to detect the position and orientation of the probe.

The Scolioscan system has two LCD screens. A touch screen is used by the operator to enter patient data, set parameters for screening, control image collection, perform measurements, and generate reports. The other screen provides information to patients, keeping them informed of the process, and includes a green eyespot with the location set according to the patients height to help the patient keep their head and neck posture stable during scanning.

After scanning, the collected B-mode image data along with the corresponding position and orientation information are used for 3D image reconstruction; volume project imaging is used to form coronal views of the spine for further analysis.

Scolioscan Air System

The Scolioscan Air System is a portable 3D ultrasound system developed by the research team of the Hong Kong Polytechnic University Department of Biomedical Engineering. Weighing 5 kg, the Scolioscan Air consists of a palm-sized wireless ultrasound probe with an optical marker

mounted on the bottom; a depth camera, and a laptop or table computer with dedicated software. The compact optical marker and depth camera replace the spatial sensor used in Scolioscan and thus help dramatically downsize the device. In addition, the technology for 3D ultrasound image reconstruction, visualization, and measurement, including a fully automatic curvature measurement method and 3D spinal deformity analysis software, can also be applied to Scolioscan Air.

Regulatory Status

Positional MRI

Several MRI systems have been cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process as open or total body systems for positional imaging. One such system is FONAR's Upright® MRI. FDA product code: LNH.

Refer to the FDA website for a complete list of open or total body systems for positional imaging.

Scolioscan and Scolioscan Air

A search of the FDA website on January 30, 2025, yielded no results for Scolioscan, Scolioscan Air or Telefield Medical Imaging.

Rationale

Positional Magnetic Resonance Imaging

Imaging Under Loading Stress

Dahabreh et al. (2011) conducted a systematic review for the Agency for Healthcare Research and Quality that assessed emerging magnetic resonance imaging (MRI) technologies for musculoskeletal imaging under loading stress. (1) Included were 36 studies that used positional weight-bearing MRI in patients with musculoskeletal conditions. Also included were studies evaluating axial compression devices. Most studies were cross-sectional or had case-control designs. The most commonly imaged body region was the lumbar spine. Four identified studies of lumbar spine imaging compared positional weight-bearing MRI with conventional MRI, myelography, or non-weight-bearing imaging in the same MRI device; however, these studies did not report the effect of the technology on patient outcomes. Two studies of foot imaging that compared weight-bearing MRI with MRI in the supine position with the same MRI device found that the 2 techniques provided similar information. Two studies of knee joint imaging found differences between weight-bearing MRI and non-weight-bearing MRI using the same device; no functional outcomes were reported. The potential effect on image quality of low magnetic field strengths (≤ 0.6 tesla [T]) in weight-bearing MRI scanners was not assessed. Key studies not included in the systematic review are described next.

Positional Magnetic Resonance Imaging in Neutral, Flexion, and Extension (Kinetic Magnetic Resonance Imaging)

Lao et al. (2014) and Lord et al. (2014) both published systematic reviews assessing the literature on positional (kinetic) MRI, which consists primarily of examining anatomic changes in neutral, flexion, extension, and axial rotation. (2, 3) Kinetic MRI studies in healthy and symptomatic individuals identified changes in neuroforaminal size, cord compression, cord length, cross-sectional area, ligamentum flavum thickness, and motion at the index and adjacent levels.

Seated Magnetic Resonance Imaging versus Supine Magnetic Resonance Imaging

Ferreiro Perez et al. (2007) compared recumbent with upright sitting positions in 89 patients who had disc herniation or spondylolisthesis (cervical or lumbar spine). (4) Using a 0.6-T Upright MRI system for both positions, pathology (disc herniation or spondylolisthesis) was identified in 68 (76%) patients. Images from 18 (20%) patients were not interpretable due to motion artifact. Pathologic features were better identified (i.e., either only evident or seen to be enlarged) in 52 (76%) of the 68 patients when in the sitting position; 10 of these were only observed in the sitting position. Pathologic features were better identified in the recumbent position in 11 (16%) of the 68 patients. The overall underestimation rate was calculated to be 62% for patients in the recumbent position and 16% for those in the upright-seated position. This research would suggest that there may be advantages when the position during imaging is matched with the positional symptoms of the patient. However, a more appropriate comparison group would be a standard recumbent clinical MRI system (e.g., field strength >0.6 T). In addition, technical problems with motion artifact were due to poor stabilization in an upright sitting position.

Standing Magnetic Resonance Imaging versus Supine Magnetic Resonance Imaging

In a study by Tarantino et al. (2013), 57 patients with low back pain when standing (50% also had back pain in the supine position) received an MRI in both upright and recumbent positions using a 0.25-T tilting system. (5) A table tilt of 82° was used to reproduce the orthostatic position without the patient instability associated with standing at 90°. Compared with the supine position, there was a significant decrease in intervertebral disc thickness (11.2 mm vs. 12.9 mm) along with changes in other measures and a qualitative increase in the volume of disc protrusions and/or spondylolisthesis in the upright position.

Standing Magnetic Resonance Imaging versus Axial Loaded Supine Magnetic Resonance Imaging

In a study by Charoensuk et al. (2021), 54 patients suspected of having spinal stenosis underwent both standing MRI and MRI plus axial loading using a compression device. (6) Primary outcome measures included measures of the intervertebral disc (i.e., cross-sectional area [DA], disc height [DH], and anteroposterior distance [DAP]), dural sac (cross-sectional area [DCSA]), spinal curvature (i.e., lumbar lordosis [LL] and L1-L3-L5 angle [LA]), and total lumbar spine height (LH). Results showed that there was a major difference observed with LL, but minor differences observed in DCSA, DAP, DA, LA, and LH. This suggests that the standing position might be adequately simulated while recumbent by utilizing an axial-loaded MRI using a compression device.

A study by Madsen et al. (2008) compared vertical (standing) MRI with recumbent MRI plus axial loading in patients who had lumbar spinal stenosis. (7) Sixteen patients with neurogenic claudication, experienced mainly during walking or in an erect position, were recruited for this phase of the study. Each patient underwent 4 scans with a 0.6-T Upright MRI system, consisting of vertical, horizontal with compression at a load of 40% of body weight, horizontal with no load, and horizontal with a 50% axial load. All horizontal scans were conducted with a cushion placed below the lower back to induce the extension of the lumbar spine. Results showed a similar dural sac cross-sectional area between the 2 positions, suggesting that the standing position might be adequately simulated while recumbent by axial loading and lordosis. Results were not correlated with patient symptoms in this study.

No evidence from RCTs was identified to support the use of positional MRI for position-dependent back or neck pain. Moreover, the systematic review by Dahabreh et al. (2011) concluded that, despite a large number of available studies, considerable uncertainty remained about the utility of this technique for the clinical management of musculoskeletal conditions. (1)

Scolioscan

In 2016, Zheng et al. published a prospective reliability and validity study for Scolioscan, aimed at testing the reliability of spine deformity measurement of Scolioscan and its validity compared to the gold standard Cobb angle measurements from radiography in adolescent idiopathic scoliosis (AIS) patients. (8) Twenty patients were included in the first stage of intra-/inter-operator and intra-/inter-raters reliabilities study. For the second study stage examining correlation between Scolioscan and X-ray measurements, additional patients were recruited, making the total patient number of 49.

The authors concluded, as this was the first study to report on the development and human application of Scolioscan in assessing its reliability and validity for scoliosis assessment, the measurement using Scolioscan was demonstrated to be very reliable and good to excellent correlation noted in comparison with the conventional radiographic Cobb's method. Since Scolioscan is radiation free and readily accessible, it has the potential to be used to screen large numbers of patients with AIS to monitor progress and outcome of treatment, and with prognostic implications. Further studies are required to demonstrate its clinical values with a larger number of scoliosis patients with different types of curvature and the feasibility of automatic Scolioscan angles measurement.

Brink et al. (2018) published results of a cross-sectional study of 33 patients with AIS, testing the reliability and validity of several ultrasound angle measurements in the coronal plane as compared with the radiographic coronal Cobb angle. (9) They concluded that coronal ultrasound angles are based on different landmarks than the traditional Cobb angle measurement and cannot represent the same angle values. They found excellent correlations between the ultrasound and Cobb measurements, without differences in the reliability and validity between the ultrasound angles based on the spinous processes and transverse processes. Therefore, the severity of the deformity in patients with AIS can be assessed by

ultrasound imaging, avoiding hazardous ionizing radiation, and enabling more individualized patient care. It also opens possibilities for screening.

Trzcińska et al. published preliminary results in 2022 from an analysis of posture parameters in patients with idiopathic scoliosis with the use of 3D ultrasound diagnostics. (10) The study included 20 girls, aged 10 to 16 years, with double-curve idiopathic scoliosis (the value of primary curve ranged from 25–50°), types I and II according to King–Moe classification. On the basis of an X-ray scan, the Cobb angle of primary and secondary curves was assessed, the skeletal maturity was evaluated with the Risser test, and the type of scoliosis was determined. The girls participated in a 3-week rehabilitation program. The examinations were performed before and after therapy. A scoliometer was used for measurements. Each of the participants underwent individual therapy. The three-plane approach to asymmetric exercises was based largely on positions that included primary curve correction with hypercorrection of the secondary curve. After the therapy, values of trunk rotation angles and the angle of scoliotic curvature of secondary curve were significantly lower than before the therapy, except for the value of the primary curve angle. The parameters measured by X-ray were significantly and positively related to the results obtained with the scoliometer and the scolioscan. Three-dimension ultrasound diagnostics offers new diagnostic possibilities; however, it requires further analyses supplemented with long-term follow-up in a larger group of patients.

Scolioscan Air

A study by Lai et al. investigated the reliability of a newly developed portable 3D ultrasound imaging system, Scolioscan Air, for scoliosis assessment using coronal images it produced. (11) A total of 19 patients with different severity of scoliosis were assessed. Each patient underwent scanning by a commercially available 3D ultrasound imaging system, Scolioscan, and the portable 3D ultrasound imaging system, with the same posture on the same date. The spinal process angles (SPA) were measured in the coronal images formed by both systems and compared with each other. Scolioscan Air was sufficiently comparable to Scolioscan in scoliosis assessment, overcoming the space limitation of Scolioscan and thus providing wider applications. Further studies involving a larger number of subjects are worthwhile to demonstrate its potential clinical values for the management of scoliosis.

Summary of Evidence

For individuals who have position-dependent back or neck pain who receive positional magnetic resonance imaging (MRI), the evidence includes comparative studies. Relevant outcomes are test accuracy, symptoms, functional outcomes, and quality of life. Comparisons of results from positional MRI with results from supine MRI or standing x-ray have indicated that positional MRI provides additional diagnostic data. However, no studies have been identified describing clinical outcomes of patients whose treatments were selected based on these new data. The clinical benefit of basing treatment decisions, including surgery, on these additional findings needs to be established. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Studies are limited for Scolioscan and Scolioscan Air, consisting of reliability and validity studies. Approval or clearance by the U. S. Food and Drug Administration is lacking. Based on limited information and lack of government approval, the use of Scolioscan and Scolioscan Air for assessing scoliosis is considered experimental, investigational and/or unproven.

Coding

Procedure codes on Medical Policy documents are included **only** as a general reference tool for each policy. **They may not be all-inclusive.**

The presence or absence of procedure, service, supply, or device codes in a Medical Policy document has no relevance for determination of benefit coverage for members or reimbursement for providers. **Only the written coverage position in a Medical Policy should be used for such determinations.**

Benefit coverage determinations based on written Medical Policy coverage positions must include review of the member's benefit contract or Summary Plan Description (SPD) for defined coverage vs. non-coverage, benefit exclusions, and benefit limitations such as dollar or duration caps.

CPT Codes	76498, 76499, 76999
HCPCS Codes	None

*Current Procedural Terminology (CPT®) ©2024 American Medical Association: Chicago, IL.

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Centers for Medicare and Medicaid Services (CMS)

The information contained in this section is for informational purposes only. HCSC makes no representation as to the accuracy of this information. It is not to be used for claims adjudication for HCSC Plans.

The Centers for Medicare and Medicaid Services (CMS) does not have a national Medicare coverage position. Coverage may be subject to local carrier discretion.

A national coverage position for Medicare may have been developed since this medical policy document was written. See Medicare's National Coverage at <https://www.cms.hhs.gov>.

Policy History/Revision

Date	Description of Change
12/31/2025	Document became inactive.
03/15/2025	Document updated with literature review. Coverage unchanged. No new references.
04/01/2024	Reviewed. No changes.
06/01/2023	Document updated with literature review. Coverage unchanged. References 6 and 10 added.
10/01/2022	Document reactivated. Positional (non-recumbent) magnetic resonance imaging is considered experimental, investigational, and/or unproven including its use in the evaluation of patients with cervical, thoracic, or lumbosacral back pain. Standing or portable ultrasound imaging (e.g., Scloioscan, Scolioscan Air) is considered experimental, investigational and/or unproven for the evaluation of patients with scoliosis.
08/31/2017	Document became inactive.
07/15/2017	Document updated with literature review. Coverage unchanged.
02/15/2016	Reviewed. No changes.
07/01/2015	Document updated with literature review. Coverage unchanged.

07/01/2014	Reviewed. No changes.
01/01/2013	Document updated with literature review. Coverage unchanged. This medical document is no longer scheduled for routine literature review and update.
07/01/2010	Policy updated with literature review. Coverage unchanged.
11/15/2008	New medical document.