Three-Dimensional Printed Orthopedic Implants

Policy
Blue Cross and Blue Shield of Kansas City (Blue KC) will provide coverage for Three-Dimensional Printed Orthopedic Implants when it is determined to be medically necessary because the criteria shown below are met.

When Policy Topic is covered
Custom 3D printed implants for patients with bone or joint deformity may be considered medically necessary when the devices are produced at a central manufacturing facility and meet FDA custom device exemption requirements.

When Policy Topic is not covered
Three-dimensional (3D) printed orthopedic implants that have a design that is approved or cleared by the Food and Drug Administration (FDA) and produced in standard sizes for patients with typical bone and joint anatomy are investigational.

Patient-matched 3D printed implants that are based on non-standard shapes and sizes for patients with typical bone and joint anatomy and do not qualify as custom devices according to FDA custom device exemption requirements are investigational.

Three-dimensional printed orthopedic implants produced outside of FDA-regulated manufacturing facilities are investigational.

Considerations
This policy does not address custom mandible or maxillofacial implants.

There are no specific codes for 3-dimensional printed orthopedic implants. It is possible that providers may use the following code:

L8699 Prosthetic implant, not otherwise specified.
Description of Procedure or Service

<table>
<thead>
<tr>
<th>Populations</th>
<th>Interventions</th>
<th>Comparators</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals:</td>
<td>Interventions of interest are:</td>
<td>Comparators of interest are:</td>
<td>Relevant outcomes include:</td>
</tr>
<tr>
<td>• Who have typical bone and joint anatomy and are undergoing standard</td>
<td>• Standard-sized 3-dimensional printed implant</td>
<td>• Standard implants produced by traditional manufacturing</td>
<td>• Symptoms</td>
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<tr>
<td>orthopedic procedures</td>
<td></td>
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<td>• Functional outcomes</td>
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<td></td>
<td></td>
<td></td>
<td>• Quality of life</td>
</tr>
<tr>
<td>Individuals:</td>
<td>Interventions of interest are:</td>
<td>Comparators of interest are:</td>
<td>Relevant outcomes include:</td>
</tr>
<tr>
<td>• Who have typical bone and joint anatomy and are undergoing standard</td>
<td>• Patient-matched 3-dimensional printed implant</td>
<td>• Patient-matched implants produced by traditional</td>
<td>• Symptoms</td>
</tr>
<tr>
<td>orthopedic procedures</td>
<td></td>
<td>manufacturing</td>
<td>• Functional outcomes</td>
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<tr>
<td></td>
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<td></td>
<td>• Quality of life</td>
</tr>
<tr>
<td>Individuals:</td>
<td>Interventions of interest are:</td>
<td>Comparators of interest are:</td>
<td>Relevant outcomes include:</td>
</tr>
<tr>
<td>• With bone or joint deformity requiring a custom orthopedic implant</td>
<td>• Custom 3-dimensional printed implant</td>
<td>• Custom implants produced by traditional manufacturing</td>
<td>• Symptoms</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Functional outcomes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Quality of life</td>
</tr>
</tbody>
</table>

Summary

This evidence review addresses orthopedic implants that are constructed by additive manufacturing, commonly known as 3-dimensional (3D) printing. Three situations are considered: 3D printing of standard-sized implants, 3D printing of patient-matched implants for individuals who have typical bone and joint anatomy, and custom 3D printed implants for patients who have bone or joint deformity.

For individuals who have typical bone and joint anatomy and are undergoing standard orthopedic procedures who receive a standard-sized 3D printed implant, the evidence includes a randomized controlled trial and systematic review. Relevant outcomes include symptoms, functional outcomes, and quality of life. Three-dimensional printed implants are often manufactured with titanium and allow greater porosity than can be achieved with traditional manufacturing techniques. Greater porosity is believed to facilitate bony in-growth and theoretically improve the stability of the implant. However, the effect of these devices on the adjacent bone, particularly subsidence and resorption, is unknown. Studies are needed that compare these newer devices with the established alternatives. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have typical bone and joint anatomy and are undergoing standard orthopedic procedures who receive a patient-matched 3D printed implant, the evidence includes no comparative studies. Relevant outcomes include symptoms, functional outcomes, and quality of life. Studies are needed to determine whether patient-matched implants improve outcomes compared with conventional implants. It is noted that other methods for the customization of orthopedic procedures, specifically patient-specific cutting guides and sex-specific implants, have failed to demonstrate improvements in health outcomes.
Demonstration of improvement in key outcome measures is needed to justify the greater resource utilization (eg, time, imaging) of patient-matched 3D printed devices. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have bone or joint deformity requiring a custom orthopedic implant who receive a custom 3D printed implant, the evidence includes case series. Relevant outcomes include symptoms, functional outcomes, and quality of life. The largest case series with the longest follow-up is from outside of the United States. The most commonly reported indications are for revision total hip arthroplasty with severe acetabular defects, reconstruction following orthopedic tumor resection, and spinal abnormalities. These cases would require a custom process for design and manufacturing, even with traditional manufacturing methods. Therefore, the design and manufacturing of a single implant with 3D printing is an advantage of this technology. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

**Background**

Three-dimensional (3D) printed implants are made by a process of additive manufacturing. Additive manufacturing uses a computer-aided process with a 3D printer to build devices 1 layer at a time. The most commonly used technologies in medical devices are powder bed fusion, stereolithography, fused filament fabrication, and liquid-based extrusion. Stereolithography systems use a vat of liquid that is cured by light. Fused filament fabrication melts a solid filament at the point of deposition, after which it solidifies, while liquid-based extrusion systems eject a liquid which then solidifies. Orthopedic implants are frequently made with cobalt-chromium or titanium powder bed fusion, which uses an energy source such as laser or electron beam to melt or sinter a layer of metal powder onto the layer below.

Additive manufacturing contrasts with the traditional methods of manufacturing, which include forging (shaped by hammering or bending), casting (formed by molten metal poured into a mold), and machining (removes material to create the desired geometry). Traditional manufacturing methods are frequently used with cobalt-chromium alloys for orthopedic implants. Titanium is also used for implants, including the femoral stems and acetabular cups used for total hip arthroplasty. The manufacturing of titanium and titanium alloys with traditional production methods is more difficult. Production of complex shapes is also limited with forging, casting, or machining.

Advantages of additive manufacturing include the ability to manufacture complex structures that traditional manufacturing processes cannot, and to create devices individually matched to the patient’s anatomy. Additive manufacturing also allows rough or porous surface textures that promote bone in-growth, and some have proposed that fully porous implants may reduce bone resorption around the implant. Three-dimensional printed models of a joint or spine can also be constructed to plan and practice complex surgeries. In addition to increased design
flexibility and potential improvements in function, additive manufacturing wastes less raw materials and may reduce processing costs.

Additive manufacturing may, however, introduce variability into the manufacturing process. A number of factors affect the production of patient-matched orthopedic implants. One factor is whether the device is based on a standard template or custom-designed. Another is if the design could be affected by image quality, rigidity of anatomic structures, or clarity of anatomic landmarks. Some patient-matched devices are based on a standard-sized template with specific features modified within a defined design or performance envelope. Patient-matched devices that follow the patient anatomy more precisely are more vulnerable to design errors.

Manufacturing processes that occur after printing can also affect device performance and material properties. Postprocessing may include removal of manufacturing residues, heat treatments, and final machining and polishing when needed and where surfaces are accessible. For devices made with additive manufacturing, the U.S. Food and Drug Administration (FDA) recommends process validation, revalidation if there are any changes to the device or process, and mechanical device testing in a manner similar to testing of devices made with a traditional manufacturing method. Three-dimensional printing of orthopedic implants at a central facility permits the manufacturer to regulate quality, biocompatibility of materials, and sterility.

**Regulatory Status**

In 2017, UFDA published guidance for industry and technical considerations for 3D printed medical devices. The recommendations in this guidance are intended to supplement any device-specific recommendations and represent FDA’s initial thinking and recommendations. The guidance does not apply to 3D printing at the point-of-care.

FDA expects “that AM [additive manufacturing] devices will follow the same regulatory requirements and submission expectations as the classification and/or regulation to which a non-AM device of the same type is subject.” The required information, characterization, and testing will depend on a variety of factors, such as whether it is an implant or instrument, and whether it is available in standard sizes or is patient-matched.

The FDA has noted that although patient-matched devices are sometimes referred to as customized devices, they are not custom devices meeting custom device exemption requirements under the U.S. Federal Food, Drug, and Cosmetic Act unless they comply with all of the criteria of section 520(b). FDA published guidance for industry and on the custom device exemption act in 2014. Custom devices are those created or modified to comply with the order of an individual physician or dentist, do not exceed 5 units per year, and are reported by the manufacturer to FDA for devices manufactured and distributed under section 520(b) of the Food, Drug, and Cosmetic Act.
Under Section 520(b) of the Food, Drug, and Cosmetic Act, custom devices are exempt from premarket approval (PMA) requirements and conformance to mandatory performance standards.

“A device not covered by an existing marketing approval would require either a PMA or a valid exemption from the requirements to obtain PMA approval in order to be introduced into interstate commerce. Examples of potential valid exemptions or alternatives from the PMA requirement include: (1) establishing the substantial equivalence of the new device to a valid predicate device, (2) approval of an Investigational Device Exemption (IDE) or (3) meeting all custom device exemption requirements.”

“Custom Devices are not exempt from any other requirements, including, but not limited to, the Quality System Regulation, including Design Controls (21 CFR Part 820); Medical Device Reporting (21 CFR Part 803); Labeling (21 CFR Part 801); Corrections and Removals (21 CFR Part 806); and Registration and Listing (21 CFR Part 807).”

A custom device may not be marketed to the general public.

FDA has also noted that most patient-matched devices will fall within the existing regulatory pathway for that device type. In addition to standard labeling, specific labeling information is recommended for AM devices that are patient-matched. FDA has stated that “modifications to a 510(k)-cleared device that maintain its original intended use and could be clinically studied do not appropriately qualify as a custom device.”

A number of titanium spinal interbody implants with increased roughness and porosity than traditional designs have received marketing clearance by FDA through the 510(k) process. They have a biomechanical stiffness similar to polyetheretherketone cages and less than solid titanium. They include:

- Cascadia™ Cervical and Cascadia ™AN Lordotic Oblique Interbody Systems (K2M)
- EIT (Emerging Implant Technologies)
- IB3D (Medicrea)
- Modulus XLIF (NuVasive)
- NanoHive interbodies (HD Lifesciences).

Porous 3D printed titanium implants for minimally invasive sacroiliac joint fusion have received 510(k) clearances.

- iFuse 3D (SI Bone).

Custom knee implants include:

- ConforMIS iTotal® Cruciate Retaining Knee Replacement System (ConforMIS)
- ConforMIS iTotal® Posterior Stabilized Knee Replacement System (ConforMIS)
- ConforMIS iUni® Unicondylar Knee Replacement System (ConforMIS)
- ConforMIS iTotal Hip system (ConforMIS).

**Rationale**

This evidence review was created in May 2018 with a search of the MEDLINE database through March 20, 2018.

Evidence reviews assess the clinical evidence to determine whether the use of a technology improves the net health outcome. Broadly defined, health outcomes are length of life, quality of life, and ability to function—including benefits and harms. Every clinical condition has specific outcomes that are important to patients and to managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of a technology, 2 domains are examined: the relevance and the quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

**Standard-Sized 3-Dimensional printed Orthopedic Implants**

There is limited data on the performance of orthopedic implants produced by additive manufacturing. Porosity can be increased with 3-dimensional (3D) printing, and basic research has suggested an increase in osteointegration with more porous surfaces. Although a number of spinal interbody spacers are currently manufactured with 3D printing, it is not clear at this time whether the titanium implants lead to improved health outcomes compared with standard polyetheretherketone (PEEK) cages. Recent evidence, described below, has suggested an increase in subsidence (sinking or settling into the adjacent bone) with titanium compared with PEEK cages. The movement of an implant into the adjacent vertebra can result in a loss of disc height.

One RCT found that use of solid titanium interbody cages for anterior cervical discectomy and fusion resulted in worse clinical and radiologic outcomes compared with PEEK interbody cages at a mean at 7-year follow-up. In this trial, 80 patients with cervical spondylotic myelopathy were randomized to multilevel anterior cervical discectomy and fusion with titanium or PEEK interbody cages. The group
who received anterior cervical discectomy and fusion with solid titanium implants had greater loss of Cobb angle and a greater proportion of patients showing loss of intervertebral height over 3 mm (34.5%), indicating cage subsidence, compared with the PEEK group (5.4%, p<0.05). Clinical outcome measures (Japanese Orthopaedic Association and Neck Disability Index) were significantly worse in the group with titanium cages.

A meta-analysis by Seaman et al (2017), which identified 6 studies (3 level IV evidence and 2 level III [all retrospective], and the level II prospective RCT described above), found no statistically significant difference between solid titanium and PEEK implants for spinal fusion rates, but there was a statistically significant increase in the rate of subsidence with titanium implants (odds ratio, 3.59; 95%, confidence interval, 1.28 to 10.07; p=0.015).\(^4\) Most studies used solid titanium implants and evaluated interbody devices of different designs. Comparison of porous 3D-printed titanium implants with PEEK implants has not been reported. The only RCT identified found significant differences in favor of the PEEK group for the patient-reported outcome measures.

The effect of titanium on bone resorption is unclear. The literature on femoral stems for hip arthroplasty indicated that osteolysis and long-term failure might increase with titanium compared with cobalt-chromium stems, which some authors have suggested is due to the increased flexibility of titanium compared with cobalt-chromium.\(^5\) Other investigators suggested that fully porous 3D printed titanium femoral stems may reduce bone resorption and loosening from stress-shielding.\(^6\) in addition to the choice of metal, the process of additive manufacturing may also result in more flexibility of the orthopedic implant than traditional manufacturing.

**Section Summary: Standard-Sized 3-Dimensional Printed Orthopedic Implants**
There is limited data on the performance of orthopedic implants produced by additive manufacturing. Three-dimensional printed implants are often manufactured with titanium and permit greater porosity than traditional manufacturing techniques. The literature on solid titanium implants has suggested greater subsidence compared with PEEK interbody spacers for spinal fusion and greater bone resorption compared with cobalt-chromium femoral stems in total hip arthroplasty. The effect on adjacent bone of porous titanium implants produced by 3D-printing is unknown. Due to these uncertainties, clinical trials are needed to evaluate how 3D-printed implants perform over the long-term compared with devices manufactured traditionally.

**Patient-Matched 3D printed Orthopedic Implants**
No published RCTs have been identified on patient-matched knee implants. Results from an RCT (NCT02494544) comparing the ConforMIS iTotal CR Knee Replacement System with off-the-shelf implants are expected in 2025 (see Ongoing and Unpublished Clinical Trials section).
It is notable that a number of RCTs have been performed with implants produced using traditional manufacturing and designed specifically for women. These studies with sex-specific implants have not shown improvements in clinical outcomes.\textsuperscript{7} Similarly, trials on patient-specific cutting guides have not shown improved clinical outcomes compared with standard cutting guides (see separate policy).

**Section Summary: Patient-Matched 3D Printed Orthopedic Implants**

Patient-matched implants refer to the production of orthopedic implants that are modified based on 3D images. No studies have been identified to evaluate whether matching orthopedic implants to individual patient anatomy improves the net health outcome.

**Custom 3D printed Orthopedic Implants**

Examples of custom implants are summarized in Table 1 and include implants for revision arthroplasty with severely compromised acetabulum, reconstruction following bone resection in orthopedic oncology, and complex spinal pathology. Most cases address severe acetabular defects with revision total hip arthroplasty that cannot be reconstructed using commercially available cages. In the report by Citak et al (2017), patients had undergone as many as 8 prior revision hip arthroplasties.\textsuperscript{8} The custom 3D printed implants are typically designed with flanges to attach the acetabular cup to the pelvis. Postoperative evaluations have shown 30- to 40-point improvements in the Harris Hip Score and up to 91% implant survival at 72 months.\textsuperscript{9}

The second most commonly reported indication for custom implants is pelvic or long bone reconstruction after tumor resection. Case series include up to 35 patients with a follow-up of approximately 2 years. Postoperative scores have ranged from 19 out of 30 on the Musculoskeletal Tumor Society Score (MSTS) for a tibial bone block to 25.8 on the International Society of Limb Salvage score for custom plate fixation or total joint (see Table 2). Liang et al (2017) have reported outcomes with the MSTS following pelvic tumor resection and reconstruction.\textsuperscript{10} The custom devices were designed with a hook, crest, and either flange or braids to attach the device to the adjacent bone. Mean MSTS scores at 20.5 months were 22.7 for an iliac prosthesis, 19.8 for a hemipelvic prosthesis, and 17.7 for a screw-rod connected prosthesis.

Three-dimensional printed spinal implants have also been used to treat complex spinal pathology.\textsuperscript{11} One case involved tumor resection and vertebral reconstruction, and another used a custom-designed titanium fusion cage for an unusual congenital deformity. The authors reported that the custom implants were easily placed in position, which reduced the surgical time and eliminated the need to harvest autograft bone to intraoperatively fit the defect.

| Table 1. Key Case Series Characteristics of Custom Orthopedic Implants |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Study**     | **Country** | **Participants** | **Treatment Delivery** | **Follow-Up, mo** |
| Acetabulum     | China         | 22 patients with revision | Customized acetabular | 82              |
Table 2. Key Case Series Results of Custom Orthopedic Implants

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Outcome</th>
<th>Outcome</th>
<th>Outcome</th>
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</thead>
<tbody>
<tr>
<td><strong>Acetabulum</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Mao et al (2015)</td>
<td>Revision THA with custom acetabular cages</td>
<td>HHS 39.6 preoperatively to 80.9 at follow-up (p&lt;0.01)</td>
<td>Implant survival of 91.2% (95% CI, 58.10% to 73.95%)</td>
<td></td>
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<tr>
<td>Li et al (2016)</td>
<td>Revision THA with custom acetabular cages</td>
<td>HHS 36 preoperatively to 82 at follow-up (p&lt;0.001)</td>
<td>75% of patients could walk unaided and 21% used a cane</td>
<td></td>
</tr>
<tr>
<td>Citak et al (2017)</td>
<td>Revision THA with custom acetabular cages</td>
<td>HHS 22.1 preoperatively to 58.7 at follow-up</td>
<td>89% implant survival</td>
<td></td>
</tr>
<tr>
<td><strong>Pelvis</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Liang et al (2017)</td>
<td>Modular titanium iliac or hemipelvic prostheses</td>
<td>MSTS of 22.7 for iliac prosthesis</td>
<td>MSTS of 19.8 for standard hemipelvic prosthesis</td>
<td>MSTS of 17.7 for screw-rod connected prosthesis</td>
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<tr>
<td><strong>Distal femur or proximal tibia</strong></td>
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<tr>
<td>Ding et al (2013)</td>
<td>Custom endoprosthesis</td>
<td>ISLS score of 25.8 (range, 18- 27)</td>
<td></td>
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<tr>
<td>Luo et al (2017)</td>
<td>Custom titanium tibial bone block with standard knee prosthesis</td>
<td>MSTS score, 19</td>
<td></td>
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</tr>
</tbody>
</table>

THA: total hip arthroplasty.
Section Summary: Custom 3D Printed Orthopedic Implants
The most effective use of 3D printing in orthopedics may be for custom implants, defined by FDA as devices created or modified to comply with the order of an individual physician or dentist, do not exceed 5 units per year, and are reported by the manufacturer to FDA. Potential benefits of 3D printed custom devices are flexibility in design, reduced cost, and faster production time in comparison with conventionally manufactured custom implants. Consistent with the limited number of implants that are considered custom, the literature consists of case reports and case series. The largest series with the longest follow-up are from China and the largest number of cases is for revision hip arthroplasty in patients with severe acetabular defects. Another reported use is for bone reconstruction following tumor resection. These cases require a custom process for design and manufacturing. The design and manufacturing of a single implant with 3D printing is an advantage of this technology.

Summary of Evidence
For individuals who have typical bone and joint anatomy and are undergoing standard orthopedic procedures who receive a standard-sized 3D printed implant, the evidence includes an RCT and systematic review. Relevant outcomes include symptoms, functional outcomes, and quality of life. Three-dimensional printed implants are often manufactured with titanium and allow greater porosity than can be achieved with traditional manufacturing techniques. Greater porosity is believed to facilitate bony in-growth and theoretically improve the stability of the implant. However, the effect of these devices on the adjacent bone, particularly subsidence and resorption, is unknown. Studies are needed that compare these newer devices with the established alternatives. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have typical bone and joint anatomy and are undergoing standard orthopedic procedures who receive a patient-matched 3D printed implant, the evidence includes no comparative studies. Relevant outcomes include symptoms, functional outcomes, and quality of life. Studies are needed to determine whether patient-matched implants improve outcomes compared with conventional implants. It is noted that other methods for the customization of orthopedic procedures, specifically patient-specific cutting guides and sex-specific implants, have failed to demonstrate improvements in health outcomes. Demonstration of improvement in key outcome measures is needed to justify the greater resource utilization (eg, time, imaging) of patient-matched 3D printed devices. The evidence is insufficient to determine the effects of the technology on health outcomes.
For individuals who have bone or joint deformity requiring a custom orthopedic implant who receive a custom 3D printed implant, the evidence includes case series. Relevant outcomes include symptoms, functional outcomes, and quality of life. The largest case series with the longest follow-up is from outside of the United States. The most commonly reported indications are for revision total hip arthroplasty with severe acetabular defects, reconstruction following orthopedic tumor resection, and spinal abnormalities. These cases would require a custom process for design and manufacturing, even with traditional manufacturing methods. Therefore, the design and manufacturing of a single implant with 3D printing is an advantage of this technology. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

**Supplemental Information**

**Practice Guidelines and Position Statements**

**American Society for Testing and Material**
The American Society for Testing and Material has drafted standards for additive manufacturing. The specification on Titanium-6 Aluminum-4 Vanadium with Powder Bed Fusion covers additively manufactured titanium-6aluminum-4vanadium components using full-melt powder bed fusion such as electron beam melting and laser melting. The Society states that “the components produced by these processes are used typically in applications that require mechanical properties similar to machined forgings and wrought products. Components manufactured to this specification are often, but not necessarily, post processed via machining, grinding, electrical discharge machining, polishing, and so forth to achieve desired surface finish and critical dimensions.”

**U.S. Preventive Services Task Force Recommendations**
Not applicable.

**Medicare National Coverage**
There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

**Ongoing and Unpublished Clinical Trials**
Some currently unpublished trials that might influence this review are listed in Table 3.

**Table 3. Summary of Key Trials**

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
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<th>Completion Date</th>
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<tr>
<td>NCT02494544a</td>
<td>A Prospective, Randomized, Multicenter Study to Evaluate the ConforMIS iTotal® (CR) Knee Replacement System Versus Off-the-Shelf Replacement</td>
<td>800</td>
<td>Aug 2025</td>
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NCT: national clinical trial

References

**Billing Coding/Physician Documentation Information**

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>C40.20</td>
<td>Malignant neoplasm of long bones lower limb, code range</td>
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<tr>
<td>C40.22</td>
<td>Malignant neoplasm of peripheral nerves of lower limb, including hip,</td>
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C47.22 code range
C49.20- Malignant neoplasm of connective and soft tissue of lower limb, including hip, code range
C49.22 Benign neoplasm of long bones of lower limb, code range
D16.20- Benign neoplasm of connective and soft tissue of lower limb, including hip, code range
D16.22
D21.20- Benign neoplasm of connective and soft tissue of lower limb, code range
D21.22
L40.50 Arthropathic psoriasis, unspecified
M05.051- Felty’s Syndrome, hip and knee, code range
M06.051- Rheumatoid myopathy with rheumatoid arthritis, hip and knee, code range
M05.469
M05.451- Rheumatoid polyneuropathy with rheumatoid arthritis, hip and knee, code range
M05.569
M05.551- Rheumatoid arthritis with rheumatoid factor without organ or systems involvement, hip and knee, code range
M05.769
M05.851- Other rheumatoid arthritis with rheumatoid factor, hip and knee, code range
M05.869
M06.051- Rheumatoid arthritis without rheumatoid factor, hip and knee, code range
M06.069
M06.251- Rheumatoid bursitis, hip and knee, code range
M06.269
M06.351- Rheumatoid nodule, hip and knee, code range
M06.369
M06.851- Other specified rheumatoid arthritis hip and knee, code range
M06.869
M07.651- Enteropathic arthropathies, hip and knee, code range
M07.669
M08.051- Unspecified juvenile rheumatoid arthritis, hip and knee, code range
M08.069
M08.251- Juvenile rheumatoid arthritis with systemic onset, hip and knee, code range
M08.269
M08.451- Pauciarticular juvenile rheumatoid arthritis, hip and knee, code range
M08.469
M08.851- Other juvenile arthritis, hip and knee, code range
M08.869
M08.951- Juvenile arthritis, unspecified, hip and knee, code range
M08.969
M12.051- Chronic postrheumatic arthropathy [Jaccoud], hip and knee, code range
M12.069
M12.451- Intermittent hydrarthrosis, hip and knee code range
M12.469
M12.551- Traumatic arthropathy, hip and knee, code range
M12.569
M12.851- Other specific arthropathies, not elsewhere classified, hip and knee, code range
M12.869
M13.0 Polyarthritis, unspecified
M16.0- Osteoarthritis, hip and knee, code range
<table>
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<td>M25.369</td>
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</tr>
<tr>
<td>M25.551</td>
<td>Pain; hip and knee, code range</td>
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<tr>
<td>M25.569</td>
<td>Pain; hip and knee, code range</td>
</tr>
<tr>
<td>M43.18</td>
<td>Spondylolisthesis, sacral and sacrococcygeal region</td>
</tr>
<tr>
<td>M43.28</td>
<td>Spondylolisthesis, sacral and sacrococcygeal region</td>
</tr>
<tr>
<td>M43.27</td>
<td>Fusion of spine, code range</td>
</tr>
<tr>
<td>M43.28</td>
<td>Spinal instabilities, code range</td>
</tr>
<tr>
<td>M46.1</td>
<td>Sacroiliitis, not elsewhere classified</td>
</tr>
<tr>
<td>M48.08</td>
<td>Sacroiliitis, not elsewhere classified</td>
</tr>
<tr>
<td>M51.17</td>
<td>Intervertebral disc disorders with radiculopathy, lumbosacral region</td>
</tr>
<tr>
<td>M53.2X7</td>
<td>Intervertebral disc disorders with radiculopathy, lumbosacral region</td>
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<tr>
<td>M53.2X8</td>
<td>Intervertebral disc disorders with radiculopathy, lumbosacral region</td>
</tr>
<tr>
<td>M53.3</td>
<td>Sacroccygeal disorders, not elsewhere classified</td>
</tr>
<tr>
<td>M53.88</td>
<td>Sacroccygeal disorders, not elsewhere classified</td>
</tr>
<tr>
<td>M80.051A</td>
<td>Age-related osteoporosis with current pathological fracture, initial</td>
</tr>
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<td>M80.052A</td>
<td>Age-related osteoporosis with current pathological fracture, initial</td>
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<tr>
<td>M80.059A</td>
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<td>M80.051K</td>
<td>Age-related osteoporosis with current pathological fracture, initial</td>
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<td>M80.052K</td>
<td>Age-related osteoporosis with current pathological fracture, initial</td>
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<td>M80.059K</td>
<td>Age-related osteoporosis with current pathological fracture, initial</td>
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<td>M80.051S</td>
<td>Age-related osteoporosis with current pathological fracture, sequela,</td>
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<tr>
<td>M80.052S</td>
<td>Age-related osteoporosis with current pathological fracture, sequela,</td>
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<td>M80.059S</td>
<td>Age-related osteoporosis with current pathological fracture, sequela,</td>
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<tr>
<td>M80.851A</td>
<td>Other osteoporosis with current pathological fracture, initial</td>
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<tr>
<td>M80.852A</td>
<td>Other osteoporosis with current pathological fracture, initial</td>
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<tr>
<td>M80.859A</td>
<td>Other osteoporosis with current pathological fracture, initial</td>
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<tr>
<td>M80.851G</td>
<td>Other osteoporosis with current pathological fracture, subsequent</td>
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<tr>
<td>M80.852G</td>
<td>Other osteoporosis with current pathological fracture, subsequent</td>
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<tr>
<td>M80.859G</td>
<td>Other osteoporosis with current pathological fracture, subsequent</td>
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<tr>
<td>M80.851K</td>
<td>Other osteoporosis with current pathological fracture, subsequent</td>
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<tr>
<td>M80.852K</td>
<td>Other osteoporosis with current pathological fracture, subsequent</td>
</tr>
<tr>
<td>M80.859K</td>
<td>Other osteoporosis with current pathological fracture, subsequent</td>
</tr>
<tr>
<td>M80.851S</td>
<td>Other osteoporosis with current pathological fracture, sequela femur</td>
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<tr>
<td>M80.852S</td>
<td>Other osteoporosis with current pathological fracture, sequela femur</td>
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<td>M80.859S</td>
<td>Other osteoporosis with current pathological fracture, sequela femur</td>
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<td>M84.461A</td>
<td>Pathological fracture, initial encounter for fracture, tibia code range</td>
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<tr>
<td>M84.462A</td>
<td>Pathological fracture, initial encounter for fracture, tibia code range</td>
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<tr>
<td>M84.461G</td>
<td>Pathological fracture, initial encounter for fracture, tibia code range</td>
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<td>M84.462G</td>
<td>Pathological fracture, initial encounter for fracture, tibia code range</td>
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<tr>
<td>M84.461K</td>
<td>Pathological fracture, initial encounter for fracture, tibia code range</td>
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M84.462K  non-union, tibia code range
M84.461S, Pathological fracture, sequela, tibia code range
M84.462S
M84.561A, Pathological fracture in neoplastic disease, initial encounter for
M84.562A fracture, tibia code range
M84.561G, Pathological fracture in neoplastic disease, subsequent encounter for
M84.562G fracture with delayed healing, tibia code range
M84.561K, Pathological fracture in neoplastic disease, subsequent encounter for
M84.562K fracture with delayed non-union, tibia code range
M84.561S, Pathological fracture in neoplastic disease, sequela, tibia code range
M84.562S
M84.661A, Pathological fracture in other disease, initial encounter for fracture,
M84.662A tibia code range
M84.661G, Pathological fracture in other disease, subsequent encounter for
M84.662G fracture with delayed healing, tibia code range
M84.661K, Pathological fracture in other disease, subsequent encounter for
M84.662K fracture with delayed non-union, tibia code range
M84.661S, Pathological fracture in other disease, sequela, tibia code range
M84.662S
M87.051- Idiopathic aseptic necrosis, femur code range
M87.059
M87.151- Osteonecrosis due to drugs, femur code range
M87.159
M87.251- Osteonecrosis due to previous trauma, femur code range
M87.256
M87.351- Other secondary osteonecrosis, femur code range
M87.353
M87.851- Other osteonecrosis, femur code range
M87.859
M96.661- Fracture following insertion of orthopedic implant, joint prosthesis, or
M96.679 bone plate, femur, tibia and fibula code range
M97.01XA, Periprosthetic fracture around internal prosthetic hip joint, initial
M97.02XA encounter, code range
M97.01XD, Periprosthetic fracture around internal prosthetic hip joint,
M97.02XD subsequent encounter, code range
M97.01XS, Periprosthetic fracture around internal prosthetic hip joint, sequela
M97.02XS code range
M97.11XA, Periprosthetic fracture around internal prosthetic knee joint, initial
M97.12XA encounter, code range
M97.11XD, Periprosthetic fracture around internal prosthetic knee joint,
M97.12XD subsequent encounter, code range
M97.11XS, Periprosthetic fracture around internal prosthetic knee joint, sequela
M97.12XS code range
Q74.2 Other congenital malformations of lower limb(s), including pelvic
girdle
S33.2XXA- Dislocation of sacroiliac and sacroccocygeal joint, code range
S33.2XXS
S72.401A, Unspecified fracture of lower end of femur, initial encounter for
S72.402A, S72.409A  
Closed fracture code range

S72.401G, S72.402G, S72.409G  
Unspecified fracture of lower end of femur, subsequent encounter for closed fracture with delayed healing code range

S72.401K, S72.402K, S72.409K  
Unspecified fracture of lower end of femur, subsequent encounter for closed fracture with nonunion code range

S72.401S, S72.402S, S72.409S  
Unspecified fracture of lower end of femur, sequela, code range

T84.010- T84.013  
Broken internal prosthesis, hip and knee code range

T84.020- T84.023  
Dislocation of internal prosthesis, hip and knee code range

T84.030- T84.033  
Mechanical loosening of internal prosthetic joint, hip and knee code range

T84.050- T84.053  
Periprosthetic osteolysis of internal prosthetic joint, hip and knee code range

T84.060- T84.063  
Wear of articular bearing surface of internal prosthetic joint, hip and knee code range

T84.090- T84.093  
Other mechanical complication of internal joint prosthesis, hip and knee code range

T84.51- T84.54  
Infection and inflammatory reaction due to internal prosthesis, hip and knee code range

Z96.641- Z96.659  
Presence of artificial joint, hip and knee code range

**Additional Policy Key Words**

N/A

**Policy Implementation/Update Information**

8/1/18 New Policy. Three-dimensional printed implants are considered medically necessary for custom implants for patients with bone or joint deformity and investigational for standard and patient-matched implants.

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