Orthopedic Applications of Stem Cell Therapy (Including Allografts and Bone Substitutes Used With Autologous Bone Marrow)

Policy # 00258
Original Effective Date: 06/16/2010
Current Effective Date: 05/15/2019

Applies to all products administered or underwritten by Blue Cross and Blue Shield of Louisiana and its subsidiary, HMO Louisiana, Inc. (collectively referred to as the “Company”), unless otherwise provided in the applicable contract. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.

Services Are Considered Investigational
Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.

Based on review of available data, the Company considers the use of mesenchymal stem cell therapy for all orthopedic applications, including use in repair or regeneration of musculoskeletal tissue to be investigational.*

Based on review of available data, the Company considers allograft bone products containing viable stem cells, including but not limited to demineralized bone matrix with stem cells, for all orthopedic applications to be investigational.*

Based on review of available data, the Company considers allograft or synthetic bone graft substitutes that must be combined with autologous blood or bone marrow for all orthopedic applications to be investigational.*

Policy Guidelines
This policy does not address unprocessed allograft bone.

Background/Overview
Mesenchymal Stem Cells
MSCs are multipotent cells (also called multipotent stromal cells) that can differentiate into various tissues including organs, trabecular bone, tendon, articular cartilage, ligaments, muscle, and fat.
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MSCs are associated with the blood vessels within the bone marrow, synovium, fat, and muscle, where they can be mobilized for endogenous repair as occurs with the healing of bone fractures. Tissues, such as muscle, cartilage, tendon, ligaments, and vertebral discs, show limited capacity for endogenous repair because of the limited presence of the triad of functional tissue components: vasculature, nerves, and lymphatics. Orthobiologics is a term introduced to describe interventions using cells and biomaterials to support healing and repair. Cell therapy is the application of MSCs directly to a musculoskeletal site. Tissue engineering techniques use MSCs and/or bioactive molecules such as growth factors and scaffold combinations to improve the efficiency of repair or regeneration of damaged musculoskeletal tissues.

Bone marrow aspirate is considered the most accessible source and, thus, the most common place to isolate MSCs for the treatment of musculoskeletal disease. However, harvesting MSCs from bone marrow requires a procedure that may result in donor-site morbidity. Also, the number of MSCs in bone marrow is low, and the number and differentiation capacity of bone marrow-derived MSCs decreases with age, limiting their efficiency when isolated from older patients.

In vivo, the fate of stem cells is regulated by signals in the local 3-dimensional microenvironment from the extracellular matrix and neighboring cells. It is believed the success of tissue engineering with MSCs will also require an appropriate 3-dimensional scaffold or matrix, culture conditions for tissue-specific induction, and implantation techniques that provide appropriate biomechanical forces and mechanical stimulation. The ability to induce cell division and differentiation without adverse effects, such as the formation of neoplasms, remains a significant concern. Given that each tissue type requires different culture conditions, induction factors (signaling proteins, cytokines, growth factors), and implantation techniques, each preparation must be individually examined.

**FDA or Other Governmental Regulatory Approval**

U.S. Food and Drug Administration (FDA)

The U.S. Food and Drug Administration (FDA) regulates human cells and tissues intended for implantation, transplantation, or infusion through the Center for Biologics Evaluation and Research,
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under Code of Federal Regulation, title 21, parts 1270 and 1271. MSCs are included in these regulations.

The regulatory status of the stem cell or stem cell containing products addressed in this review is summarized below.

Concentrated autologous MSCs do not require approval by the FDA. No products using engineered or expanded MSCs have been approved by the FDA for orthopedic applications.

The following products are examples of commercialized demineralized bone matrix (DBM) products. They are marketed as containing viable stem cells. In some instances, manufacturers have received communications and inquiries from the FDA related to the appropriateness of their marketing products that are dependent on living cells for their function. The following descriptions are from the product literature.

- **AlloStem®‡ (AlloSource)** is a partially demineralized allograft bone seeded with adipose-derived MSCs.
- **Map3®‡ (RTI Surgical)** contains cortical cancellous bone chips, DBM, and cryopreserved multipotent adult progenitor cells (MAPC®‡).
- **Osteocel Plus®‡ (NuVasive)** is a DBM combined with viable MSCs isolated from allogeneic bone marrow.
- **Trinity Evolution Matrix™‡ (Orthofix)** is a DBM combined with viable MSCs isolated from allogeneic bone marrow.
- **Other products contain DBM alone and are designed to be mixed with bone marrow aspirate:**
  - **Fusion Flex™‡ (Wright Medical)** is a dehydrated moldable DBM scaffold (strips and cubes) that will absorb autologous bone marrow aspirate;
  - **Ignite® (Wright Medical)** is an injectable graft with DBM that can be combined with autologous bone marrow aspirate.

A number of DBM combination products have been cleared for marketing by the FDA through the 510(k) process. FDA product code: MQV.
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Table 1 provides a representative sample of these products; some of which are specifically labeled for mixing with bone marrow aspirate.

<table>
<thead>
<tr>
<th>Product</th>
<th>Matrix Type</th>
<th>Mix With Autologous MSCs</th>
<th>Manufacturer or Sponsor</th>
<th>Date Cleared</th>
<th>510(k) No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitoss Bioactive Foam Bone Graft Substitute</td>
<td>Type I bovine collagen</td>
<td>X</td>
<td>Stryker</td>
<td>Nov 2008</td>
<td>K083033</td>
</tr>
<tr>
<td>NanOss BVF-E</td>
<td>Nanocrystalline hydroxyapatite</td>
<td></td>
<td>Pioneer Surgical</td>
<td>Aug 2008</td>
<td></td>
</tr>
<tr>
<td>OrthoBlast II Demineralized bone matrix putty and paste</td>
<td>Human cancellous bone chips</td>
<td></td>
<td>SeaSpine</td>
<td>Sep 2007</td>
<td>K070751</td>
</tr>
<tr>
<td>CopiOs Bone Void Filler (sponge and powder disc)</td>
<td>Type I bovine dermal collagen</td>
<td>X</td>
<td>Kensey Nash</td>
<td>May 2007</td>
<td>K071237</td>
</tr>
<tr>
<td>DBX Demineralized bone matrix putty, paste and mix</td>
<td>Processed human bone and sodium hyaluronate</td>
<td>X</td>
<td>Musculoskeletal Transplant Foundation</td>
<td>Dec 2006</td>
<td>K053218</td>
</tr>
<tr>
<td>Integra MOZAIK Osteoconductive Scaffold-Putty</td>
<td>Human cancellous bone</td>
<td>X</td>
<td>IsoTis Orthobiologics</td>
<td>Dec 2006</td>
<td>K062353</td>
</tr>
<tr>
<td>Formagraft ‡Collagen Bone Graft Matrix</td>
<td>Bovine fibrillary collagen</td>
<td>X</td>
<td>R and L Medical</td>
<td>May 2005</td>
<td>K050789</td>
</tr>
<tr>
<td>DynaGraft II Gel and Putty</td>
<td>Processed human bone particles</td>
<td></td>
<td>IsoTis Orthobiologics</td>
<td>Mar 2005</td>
<td>K040419</td>
</tr>
</tbody>
</table>
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**Rationale/Source**
Mesenchymal stem cells (MSCs) have the capability to differentiate into a variety of tissue types, including various musculoskeletal tissues. Potential uses of MSCs for orthopedic applications include treatment of damaged bone, cartilage, ligaments, tendons, and intervertebral discs.

For individuals who have cartilage defects, meniscal defects, joint fusion procedures, or osteonecrosis who receive stem cell therapy, the evidence includes small randomized controlled trials and nonrandomized comparative trials. The relevant outcomes are symptoms, morbid events, functional outcomes, quality of life, and treatment-related morbidity. Use of MSCs for orthopedic conditions is an active area of research. Despite continued research into the methods of harvesting and delivering treatment, there are uncertainties regarding the optimal source of cells and the delivery method. Studies have included MSCs from bone marrow, adipose tissue, peripheral blood, and synovial tissue. The largest body of evidence has evaluated the use of autologous MSCs, either concentrated or expanded in culture, for cartilage repair. This evidence includes small randomized and nonrandomized comparative trials with insufficient data to evaluate health outcomes. Also, expanded MSCs for orthopedic applications are not U.S. Food and Drug Administration–approved (concentrated autologous MSCs do not require agency approval). Overall, there is a lack of evidence that clinical outcomes are improved. The evidence is insufficient to determine the effects of the technology on health outcomes.

This medical policy was developed through consideration of peer-reviewed medical literature generally recognized by the relevant medical community, U.S. Food and Drug Administration approval status, nationally accepted standards of medical practice and accepted standards of medical practice in this community, Blue Cross and Blue Shield Association technology assessment program (TEC) and other non-affiliated technology evaluation centers, reference to federal regulations, other plan medical policies, and accredited national guidelines.
Supplemental Information

Practice Guidelines and Position Statements

American Association of Orthopaedic Surgeons
The 2013 and 2014 American Association of Orthopaedic Surgeons’ guidelines on the treatment of glenohumeral joint osteoarthritis have indicated that:
- Treatment using an allograft, autograft, biologic, and interpositional grafts in patients with glenohumeral joint osteoarthritis is inconclusive; and that
- Treatment using growth factor injections and/or platelet rich plasma for patients with symptomatic osteoarthritis of the knee is inconclusive.

American Association of Neurological Surgeons
The American Association of Neurological Surgeons (2014) guidelines on fusion procedures for degenerative disease of the lumbar spine relevant to this evidence review have indicated that “The use of demineralized bone matrix (DBM) as a bone graft extender is an option for 1- and 2-level instrumented posterolateral fusions. Demineralized Bone Matrix: Grade C (poor level of evidence).”

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 2. Many are observational studies with commercially available products (eg, Cartistem, AlloStem).
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Table 2. Summary of Key Trials

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpublished</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT01413061</td>
<td>Study of Subtalar Arthrodesis Using AlloStem® Versus Autologous Bone Graft</td>
<td>140</td>
<td>Mar 2018 (completed)</td>
</tr>
<tr>
<td>NCT01626677;</td>
<td>Long Term Follow-Up Study of CARTISTEM® Versus Microfracture for the</td>
<td>104</td>
<td>May 2015 (completed)</td>
</tr>
<tr>
<td>NCT01041001</td>
<td>Treatment of Knee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02291926</td>
<td>Phase I Study of Human Umbilical Cord Mesenchymal Stem Cell Implantation in</td>
<td>20</td>
<td>Dec 2016</td>
</tr>
<tr>
<td></td>
<td>the Treatment of Articular Cartilage Defect of Knee</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NCT: national clinical trial.
a Denotes industry-sponsored or cosponsored trial.

References

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Policy History
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Current Effective Date: 05/15/2019
05/06/2010 Medical Policy Committee approval
06/16/2010 Medical Policy Implementation Committee approval.
05/05/2011 Medical Policy Committee approval
05/18/2011 Medical Policy Implementation Committee approval. No change to coverage.
05/03/2012 Medical Policy Committee review
05/16/2012 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
03/04/2013 Coding updated
05/02/2013 Medical Policy Committee review
05/22/2013 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
05/01/2014 Medical Policy Committee review
05/21/2014 Medical Policy Implementation Committee approval. New investigational indication added.
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05/07/2015  Medical Policy Committee review
05/20/2015  Medical Policy Implementation Committee approval. No change to coverage.
05/05/2016  Medical Policy Committee review
05/18/2016  Medical Policy Implementation Committee approval. Investigational statement added on bone graft substitutes that must be used with autologous blood or bone marrow aspirate. Title changed.
01/01/2017  Coding update: Removing ICD-9 Diagnosis Codes
05/04/2017  Medical Policy Committee review
05/17/2017  Medical Policy Implementation Committee approval. No change to coverage.
12/01/2017  Coding update
05/03/2018  Medical Policy Committee review
05/16/2018  Medical Policy Implementation Committee approval. No change to coverage.
05/02/2019  Medical Policy Committee review
05/15/2019  Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
10/21/2019  Coding update
Next Scheduled Review Date:  05/2020

Coding

The five character codes included in the Blue Cross Blue Shield of Louisiana Medical Policy Coverage Guidelines are obtained from Current Procedural Terminology (CPT®), copyright 2018 by the American Medical Association (AMA). CPT is developed by the AMA as a listing of descriptive terms and five character identifying codes and modifiers for reporting medical services and procedures performed by physician.

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Codes used to identify services associated with this policy may include (but may not be limited to) the following:

<table>
<thead>
<tr>
<th>Code Type</th>
<th>Code</th>
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<tbody>
<tr>
<td>CPT</td>
<td>0263T, 0264T, 0265T, 0489T, 0490T, 20939, 38206, 38220, 38230, 38232, 38241</td>
</tr>
<tr>
<td>HCPCS</td>
<td>No codes</td>
</tr>
<tr>
<td>ICD-10 Diagnosis</td>
<td>All related diagnoses</td>
</tr>
</tbody>
</table>

*Investigational – A medical treatment, procedure, drug, device, or biological product is Investigational if the effectiveness has not been clearly tested and it has not been incorporated into standard medical practice. Any determination we make that a medical treatment, procedure, drug, device, or biological product is Investigational will be based on a consideration of the following:

A. Whether the medical treatment, procedure, drug, device, or biological product can be lawfully marketed without approval of the U.S. Food and Drug Administration (FDA) and whether such approval has been granted at the time the medical treatment, procedure, drug, device, or biological product is sought to be furnished; or

B. Whether the medical treatment, procedure, drug, device, or biological product requires further studies or clinical trials to determine its maximum tolerated dose, toxicity, safety, effectiveness, or effectiveness as compared with the standard means of treatment or diagnosis, must improve health outcomes, according to the consensus of opinion among experts as shown by reliable evidence, including:
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1. Consultation with the Blue Cross and Blue Shield Association technology assessment program (TEC) or other nonaffiliated technology evaluation center(s);
2. Credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community; or
3. Reference to federal regulations.

**Medically Necessary (or “Medical Necessity”) - Health care services, treatment, procedures, equipment, drugs, devices, items or supplies that a Provider, exercising prudent clinical judgment, would provide to a patient for the purpose of preventing, evaluating, diagnosing or treating an illness, injury, disease or its symptoms, and that are:
   A. In accordance with nationally accepted standards of medical practice;
   B. Clinically appropriate, in terms of type, frequency, extent, level of care, site and duration, and considered effective for the patient's illness, injury or disease; and
   C. Not primarily for the personal comfort or convenience of the patient, physician or other health care provider, and not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of that patient's illness, injury or disease.

For these purposes, “nationally accepted standards of medical practice” means standards that are based on credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community, Physician Specialty Society recommendations and the views of Physicians practicing in relevant clinical areas and any other relevant factors.

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