

Electrical and Ultrasound Bone Growth Stimulators (for Nebraska Only)

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[Instructions for Use](#)

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Related Policies

None

Application

This Medical Policy only applies to the State of Nebraska.

Coverage Rationale

The use of an **invasive** spinal **Electrical Bone Growth Stimulator** is proven and medically necessary as an adjunct to lumbar spinal fusion surgery when the following criteria are met:

- Radiographic evidence of skeletal maturity; and
- Increased risk for fusion failure demonstrated by any of the following:
 - Previously failed fusion at the same site, when minimum of six months has elapsed since the last surgical procedure
 - Spinal fusion performed, or to be performed, at more than one level as part of a single surgery
 - Comorbid conditions associated with compromised bone healing (e.g., diabetes, obesity, osteoporosis, current tobacco use)
 - Spondylolisthesis grade II or greater

The use of an **invasive** spinal Electrical Bone Growth Stimulator is unproven and not medically necessary for the treatment of all other indications due to insufficient evidence of efficacy and/or safety.

For Non-Invasive Electrical or Ultrasound Bone Growth Stimulators, refer to the [Nebraska Department of Health and Human Services, Chapter 7-000 Durable Medical Equipment, Prosthetics, Orthotics and Medical Supplies \(DMEPOS\)](#).

Definitions

Delayed Union: A fracture that has not healed within the expected time period. The fact that a bone is delayed in its union does not mean that it will become a Nonunion (Mehmood, 2017).

Electrical Bone Growth Stimulator: A device (either implanted into the body or worn externally), that uses an electric field or current to stimulate the growth of bone tissue (Haglin 2017).

- **Invasive:** The implantable current generator is surgically placed in an intramuscular or subcutaneous space, while an electrode is implanted within the fragments of bone graft at the targeted fusion site. The implanted device is usually

functional for 6 to 9 months at which point the current generator is removed in a second surgical procedure, while the electrodes may or may not be removed. Implantable bone growth stimulators are used as an adjunct to spinal fusion surgery and implanted at the time of surgery.

- **Non-Invasive:** An external power source generates a weak electrical current to the target sites using either pulsed electromagnetic fields, capacitive coupling or combined magnetic fields.

Fracture Union: The point at which the fractured bone has regained sufficient strength and stiffness to function as a weightbearing structure without external support (Morshed, 2014).

Nonunion Fracture: The result of an arrest in the healing process and is defined by the following three findings (Thomas, 2022):

- Motion at the fracture site.
- Radiographic evidence showing the persistence of the fracture line without bridging callus.
- Incomplete progression toward radiographic healing in the expected length of time for the given bone and further healing not expected.

Applicable Codes

The following list(s) of procedure and/or diagnosis codes is provided for reference purposes only and may not be all inclusive. Listing of a code in this policy does not imply that the service described by the code is a covered or non-covered health service. Benefit coverage for health services is determined by federal, state, or contractual requirements and applicable laws that may require coverage for a specific service. The inclusion of a code does not imply any right to reimbursement or guarantee claim payment. Other Policies and Guidelines may apply.

CPT Code	Description
Electrical Bone Growth Stimulator: Non-Spinal (Invasive, Non-Invasive)	
20974	Electrical stimulation to aid bone healing; noninvasive (nonoperative)
20975	Electrical stimulation to aid bone healing; invasive (operative)
Ultrasound Bone Growth Stimulator	
20979	Low intensity ultrasound stimulation to aid bone healing, noninvasive (nonoperative)

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Coding Clarification: Utilize HCPCS code E0748 when reporting bone growth stimulation for all anatomical levels of the spine.

HCPCS Code	Description
E0747	Osteogenesis stimulator, electrical, noninvasive, other than spinal applications
E0748	Osteogenesis stimulator, electrical, noninvasive, spinal applications
E0749	Osteogenesis stimulator, electrical, surgically implanted
E0760	Osteogenesis stimulator, low intensity ultrasound, noninvasive

Description of Services

Bone healing is a complex process dependent on a variety of factors. The rate of bone repair and composition of tissue varies depending on type of bone fractured, the extent of the bone and soft tissue damage, the adequacy of the blood supply, and the degree of separation between bone ends. The individual's general health and nutritional status also play a significant role in bone healing. The presence of infection may adversely affect healing. Diminished blood flow to the fracture site will often suppress the healing response; factors that can cause diminished blood flow include heavy smoking, malnutrition, diabetes, alcoholism, peripheral vascular disease, increasing age, and the use of some medications such as steroids. Other characteristics such as high-grade trauma, high grade and open fractures, comminution of the fracture, vertical or oblique fracture pattern, and fracture displacement may also contribute to poor healing of bone [Agency for Healthcare Research and Quality (AHRQ), 2005].

Bone growth stimulation is utilized to promote bone healing in difficult to heal fractures or fusions by applying electrical or ultrasonic current to the fracture/fusion site. Ultrasonic stimulation is applied externally, while electrical stimulation can be applied either from the outside of the body (Non-Invasive) or from the inside of the body (Invasive) (ECRI, 2024).

Bone growth stimulators are only indicated for use in individuals who are skeletally mature. A person is said to be skeletally mature when all bone growth is complete; the cartilage cells of the growth plate cease to proliferate, the growth plate becomes thinner, is replaced by bone and disappears, and the epiphysis is “closed” or fused with the shaft [Agency for Healthcare Research and Quality (AHRQ), 2005].

Clinical Evidence

Electrical Bone Growth Stimulators (EBGS)

The evidence in peer-reviewed literature for EBGS is insufficient to evaluate health outcomes as a treatment for any condition, except as an adjunct to spinal fusion surgery. Evidence from randomized controlled trials (RCTs) are needed to establish safety and efficacy.

ECRI updated a published Clinical Evidence Assessment on noninvasive electrical bone growth stimulators for treating nonunion fractures. After extensive review ECRI determined that the evidence found is at high risk of bias due to one or more of the following: small sample size, single-center focus, retrospective design, and lack of control groups, randomization, or blinding. No studies reported on patients' quality of life and functional status using validated instruments. ECRI also found no published guidelines that discuss noninvasive electrical bone growth stimulators for treating nonunion fractures. Large randomized controlled trials (RCTs) comparing electrical stimulators with other noninvasive bone growth stimulators and those comparing noninvasive electrical stimulators from different manufacturers and reporting on pain, functional status, quality of life, and retreatment rates are needed to address evidence gaps.

A Hayes Evidence Analysis Research Brief (EARB) on noninvasive electrical bone growth stimulation for cervical spinal fusion found through a search of peer-reviewed published literature that there was one newly published study since they had archived their Health Technology Assessment (HTA) on this technology. The study they found performed two evaluations to compare fusion rates between pulsed electromagnetic field stimulation (PEMF) using a historical control group (160 subjects) from the FDA investigational device exemption (IDE) study with a post hoc analysis of high-risk subjects from the FDA study and a multicenter, open-label study consisting of 274 subjects treated with PEMF. Hayes has not published an updated HTA with any recommendations based on this one study (2022).

Another EARB by Hayes (2022) on noninvasive electric bone growth stimulation for non-spinal arthrodesis found no new studies that addressed noninvasive electrical bone growth stimulation (EBGS) as an adjunct to arthrodesis for foot, ankle, or other non-spinal indications. Their HTA on noninvasive EBGS that addressed foot and ankle indications was archived in October 2021.

ECRI published a Clinical Evidence Assessment for Cervical-Stim (Orthofix Medical, Inc.), a Food and Drug Administration (FDA)-approved device that provides noninvasive PEMF as an adjunctive treatment option for cervical fusion in patients at high-risk for non-fusion. In the assessment, ECRI determined that the evidence is inconclusive due to a very low-quality body of evidence which consisted of a post hoc analysis of a randomized controlled trial (RCT) and an additional retrospective cohort. The RCT included in the analysis was the Foley (2008) study cited below which ECRI found to be at high risk of bias because it reported subjective, patient-reported outcomes and because the patients were not blinded to their treatment allocation group. The retrospective study's findings involved *post hoc* subgroup analysis and were found to be at high risk of selection bias and confounding effects. ECRI also noted that the RCT and the comparison cohort study used the same patients as the control group which limited findings interpretation and generalizability (2021).

Caliogna et al. (2021) conducted an extensive review of the recent literature of the signaling pathways modulated by pulsed electromagnetic fields (PEMFs) and PEMFs clinical application for bone healing. A review of the literature was performed on two medical electronic databases (PubMed and Embase). Three authors performed the evaluation of the studies and the data extraction. All studies for this review were selected following these inclusion criteria: studies written in English, studies available in full text and studies published in peer-reviewed journal. The investigators concluded that the data reported in the literature give a solid base for the clinical application of PEMFs; unfortunately, the selected electromagnetic field parameters are very different (frequency, waveform, and amplitude), thus preventing the possibility to carry out accurate analysis. To date, there is a great heterogeneity of the PEMFs physical parameters used, both for in vitro and in vivo studies for bone healing. As a consequence of lack of standardized experimental guidelines, controlled trials resulted in non-comparable and inconclusive data. The investigators indicted that further biology studies and clinical trials with clear and standardized parameters (intensity, frequency, dose, duration, type of coil) are required to clarify the precise dose-response relationship and to understand the real applications in clinical practice of PEMFs for bone healing.

Peng et al. (2020) conducted a systematic review and meta-analysis to evaluate the effect of pulsed electromagnetic field (PEMF) on bone healing in patients with fractures. The investigators searched CNKI, Wan Fang, VIP, Embase, PubMed,

CENTRAL, Web of Science, Physiotherapy Evidence Database, and Open Grey websites for randomized controlled trials (published before July 2019 in English or Chinese) comparing any form of PEMF to sham. Reference lists were also searched. Related data were extracted by two investigators independently. The bias risk of the articles and the evidence strength of the outcomes were evaluated. Twenty-two studies were eligible and included in the analysis (n = 1,468 participants). The pooled results of 14 studies (n = 1,131 participants) demonstrated that healing rate in PEMF group was 79.7%, and that in the control group was 64.3%. PEMF increased healing rate by the Mantel-Haenszel analysis, relieved pain by the inverse variance analysis, and accelerated healing time by the inverse variance analysis. Moderate quality evidence suggested that PEMF increased healing rate and relieved pain of fracture, and very low-quality evidence showed that PEMF accelerated healing time. According to the investigators, a limitation of this systematic review and meta-analysis was that the literature was insufficient to analyze whether PEMF has an impact on bone mineral density (BMD) and functional outcome. Even for bone healing, different effects may be achieved by PEMF treatments with different parameters (frequency, intensity). Though the determination of effective intensity and frequency is important for each clinical application, there was not enough literature to analyze them, and it is difficult to discuss the dose-response relationship. In the future, more high-quality trials are needed to analyze the effectiveness of PEMF and to identify the best parameters, dose, and duration of PEMF.

Akhter et al. (2020) conducted a systematic review and meta-analysis to evaluate if postoperative electrical stimulation is more efficacious than no stimulation or placebo in promoting radiographic fusion in patients undergoing spinal fusion. The investigators searched the Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE, CINAHL and MEDLINE from date of inception to current. Ongoing clinical trials were also identified, and reference lists of included studies were manually searched for relevant articles. Two reviewers independently screened studies, extracted data, and assessed risk of bias. Data were pooled using the Mantel-Haenszel method. Trialists were contacted for any missing or incomplete data. Of 1,184 articles screened, 7 studies were eligible for final inclusion (n = 941). A total of 487 patients received postoperative electrical stimulation and 454 patients received control or sham stimulation. All evidence was of moderate quality. Electrical stimulation (pulsed electromagnetic fields, direct current, and capacitive coupling) increased the odds of a successful fusion by 2.5-fold relative to control. A test for subgroup interaction by stimulation type, smoking status, and number of levels fused was not significant. The investigators concluded that this systematic review and meta-analysis found moderate-level evidence supporting the use of postoperative electrical stimulation as an adjunct to spinal fusion surgery. When compared to sham, placebo-controlled, or no stimulation, patients treated with postoperative electrical stimulation have significantly greater rates of successful radiographically defined fusions. According to the investigators, these results are supported by a notably high statistically significant effect, a narrow confidence interval, and the inclusion of only high-quality randomized trials with human subjects.

Aleem et al. (2016) conducted a meta-analysis of randomized sham-controlled trials to assess the efficacy of electrical stimulation for bone healing. Outcomes were pain relief, functional improvement, and radiographic nonunion. Fifteen trials met the inclusion criteria. Four trials included patients undergoing spinal fusion, five trials evaluated fresh fracture treatment, five trials examined treatment of delayed or nonunion, and one study included patients undergoing surgical osteotomy. According to the investigators, this systematic review and meta-analysis showed that patients treated with electrical stimulation as an adjunct for bone healing experience lower rates of radiographic nonunion or persistent nonunion and have significantly less pain. The results related to pain reduction were mainly due to one trial that evaluated electrical stimulation for spinal fusion surgery. The trials that evaluated electrical stimulation for nonunion or delayed union of long bones did not show statistically significant pain reduction nor a statistically significant difference at the level of meta-analysis between treatment and control groups for the radiographic union outcome (risk ratio for persistent nonunion compared to sham: 0.55, 95% CI: 0.29 to 1.12). The investigators also indicated that no difference was seen in functional outcomes in a limited number of trials. According to the investigators, future trials focusing on functional outcomes are needed.

Ebrahim et al. (2014) performed a meta-analysis comparing low intensity pulsed ultrasonography (LIPUS) or electrical stimulation (ESTIM) to control fracture healing as well as a network meta-analysis to compare the two approaches indirectly. The investigators searched the reference lists of recent reviews evaluating LIPUS and ESTIM that included studies published up to 2011, from 4 electronic databases. Eligible trials were those that included patients with a fresh fracture or an existing delayed union or nonunion who were randomized to LIPUS or ESTIM. Standard and network meta-analytic techniques were used to synthesize the data. Seven trials evaluating ESTIM (3 fresh fracture and 5 nonunion populations) which reported union rates as one of their outcomes were included in the meta-analyses. The investigators found that in patients with a delayed union or nonunion, very low-quality evidence showed that ESTIM, when compared with standard care, had a suggested non statistically significant benefit on union rates at 3 months but no significant effect at 6 months or at 12 months. Further studies are needed to support the use of ESTIM for improving union rates of fractures.

Shi et al. (2013) reported a randomized sham-controlled trial that included 58 patients with delayed union of surgically reduced long-bone fractures (femur, tibia, humerus, radius, or ulna). Delayed union was defined as a failure to heal after at least 16 weeks and not more than 9 months following surgical reduction and fixation of the fracture. Patients with fracture nonunion, defined as failure to heal after more than 9 months, were excluded from the study. Treatment with 8 hours of pulsed electromagnetic field therapy (PEMF) per day was stopped when no radiographic progression was observed over 3 months or when union was achieved, with union defined as no pain during joint stressing or during motion at the fracture site and callus bridging for 3 out of 4 cortices on blinded assessment. Three months of treatment resulted in a slight, but not statistically significant, improvement in the rate of union between PEMF-treated patients and controls (38.7% vs. 22.2%). The success rate was significantly greater with PEMF (77.4% vs. 48.1%) after an average of 4.8 months of treatment. The time to union was not significantly different between PEMF (4.8 months; range, 2-12) and sham controls (4.4 months; range, 2-7).

A systematic review of electrical stimulation to enhance bone healing by Griffin and Bayat identified 105 clinical studies and 35 in vitro studies of the technology. Direct current was found to be effective in enhancing bone healing in spinal fusion, as supported by four studies at level of evidence 1 (randomized control trial). The authors found support for its use for nonunion fractures, but only based on level of evidence 4 (case series). Eleven studies were retrieved for capacitive coupling suggesting its effectiveness for spinal fusion but, for treating nonunions, the findings were conflicting. Studies of inductive coupling for long bones had conflicting findings. Overall, the studies, although in favor of electrical stimulation application in bone repair, displayed variability in treatment regime, primary outcome measures, follow-up times, and study design, making critical evaluation and assessment difficult (Griffin and Bayat, 2011).

A randomized controlled trial by Foley et al. (2008) tested the efficacy of PEMF stimulation to support cervical fusion in 323 participants with compressed cervical nerve root and symptomatic radiculopathy appropriate to the compressed root that had failed to respond to nonoperative management. While the group randomized to PEMF showed a significantly higher fusion rate than the control group (83.6% vs. 68.6%, $p = 0.0065$) at six months, the group difference disappeared at 12 months post-surgery (92.8% vs. 86.7%, $p = 0.1129$). Additionally, the study failed to show any group difference in patient-centered outcome such as pain scores, neck disability index, or functional status at 6 or 12 months. The authors concluded that although PEMF stimulation appeared to hasten bone healing in this randomized trial, it did not result in a significant advantage in terms of ultimate fusion rates or clinical outcomes for cervical fusion.

Clinical Practice Guidelines

Current specialty society guidelines support the use of noninvasive electrical bone growth stimulators following spinal fusion. They suggest that when choosing a device (capacitive coupling stimulation (CCS) versus pulsed electromagnetic field stimulation (PEMFS), the surgical approach and procedure should be taken into consideration.

American Association of Neurological Surgeons (AANS) and Congress of Neurological Surgeons (CNS)

A 2014 update to the (AANS) and (CNS) guidelines for bone growth stimulators as an adjunct for lumbar spinal fusion found no new evidence that conflicted with their original 2005 recommendations supporting the use of CCS to enhance fusion rates in patients at high risk of nonunion undergoing posterior lumbar fusion and PEMFS in high-risk patients following interbody fusion (Kaiser et al., 2014).

North American Spine Society (NASS)

NASS coverage policy recommendations agree with AANS recommendations for spinal indications. According to this document, the current evidence is insufficient to support a coverage recommendation for the use of low intensity pulsed ultrasound or combined magnetic field technology for spinal use, in their opinion, electrical stimulation for augmentation of spinal fusion is indicated for all regions of the spine in individuals at high risk for pseudoarthrosis with specific criteria [i.e., fusion of 3 or more vertebrae, revision spinal fusion, smokers who cannot stop smoking prior to fusion (e.g., trauma), and in the presence of comorbidities]. Electrical stimulation is not indicated for a primary spinal fusion without risk factors, spinal fusion of two vertebral levels without risk factors, presence of malignancy, as an adjunct for primary bone healing of a spinal fracture, and as nonsurgical treatment of an established pseudoarthrosis (NASS, 2016).

U.S. Food and Drug Administration (FDA)

This section is to be used for informational purposes only. FDA approval alone is not a basis for coverage.

The FDA regards bone growth stimulators as significant-risk (Class III) devices. Because the list of products used for bone growth stimulation is extensive, refer to the following website for more information and search by product name in the

Device Name field on either the 510(k) page or on the Premarket Approvals page using Product Codes LOE (for stimulator, invasive bone growth), LOF (for stimulator, bone growth, non-invasive), or LPQ (for ultrasound bone growth stimulators): <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMN/pmn.cfm>. (Accessed August 6, 2024)

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Policy History/Revision Information

Date	Summary of Changes
12/01/2024	Supporting Information <ul style="list-style-type: none">Updated <i>Clinical Evidence</i> and <i>References</i> sections to reflect the most current informationArchived previous policy version CS037NE.Q

Instructions for Use

This Medical Policy provides assistance in interpreting UnitedHealthcare standard benefit plans. When deciding coverage, the federal, state, or contractual requirements for benefit plan coverage must be referenced as the terms of the federal, state, or contractual requirements for benefit plan coverage may differ from the standard benefit plan. In the event of a

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