



FEP Medical Policy Manual

FEP 1.01.05 Low Intensity Pulsed Ultrasound Fracture Healing Device

Effective Policy Date: July 1, 2022

Original Policy Date: March 2012

Related Policies:

- 7.01.07 - Electrical Bone Growth Stimulation of the Appendicular Skeleton
- 7.01.85 - Electrical Stimulation of the Spine as an Adjunct to Spinal Fusion Procedures

Low Intensity Pulsed Ultrasound Fracture Healing Device

Description

Description

Low-intensity pulsed ultrasound has been investigated as a technique to accelerate healing of fresh fractures, surgically treated closed fractures, delayed unions, nonunions, stress fractures, osteotomy sites, and distraction osteogenesis. Low-intensity pulsed ultrasound is administered using a transducer applied to the skin surface overlying the fracture site.

OBJECTIVE

The objective of this evidence review is to evaluate whether, compared with routine care without low-intensity pulsed ultrasound, low-intensity pulsed ultrasound improves the net health outcome when used as an adjunct to routine care to treat fractures (including fresh fractures, surgically treated closed fractures, delayed unions, nonunions, stress fractures, osteotomy sites, and distraction osteogenesis).

POLICY STATEMENT

Low-intensity pulsed ultrasound is considered **not medically necessary** as a treatment of fresh fractures (surgically managed or nonsurgically managed).

Low-intensity pulsed ultrasound is considered **not medically necessary** as a treatment of fracture nonunion and delayed union fractures.

Low-intensity pulsed ultrasound is considered **not medically necessary** as a treatment of stress fractures, osteotomy, and distraction osteogenesis.

POLICY GUIDELINES

Fresh (Acute) Fracture

There is no standard definition for a "fresh" fracture. A fracture is most commonly defined as fresh for 7 days after the fracture occurs, but there is definitional variability. For example, one study defined fresh as less than 5 days after fracture, while another defined fresh as up to 10 days post-fracture. Most fresh closed fractures heal without complications using standard fracture care (ie, closed reduction and cast immobilization).

Nonunion

There is no consensus on the definition of nonunion. One definition is a failure of progression of fracture healing for at least 3 consecutive months (and at least 6 months post-fracture) accompanied by clinical symptoms of delayed/nonunion (pain, difficulty weight-bearing).

The definition of nonunion used in U.S. Food and Drug Administration (FDA) labeling suggests that nonunion is considered established when the fracture site shows no visibly progressive signs of healing, without providing guidance on the timeframe of observation. The following patient selection criteria are consistent with those proposed for electrical stimulation as a treatment of nonunions (see evidence review 7.01.07):

- at least 3 months have passed since the date of the fracture, and
- serial radiographs have confirmed that no progressive signs of healing have occurred, and
- the fracture gap is 1 cm or less, and
- the patient can be adequately immobilized and, based on age, is likely to comply with non-weight bearing.

Delayed Union

Delayed union is defined as a decelerating healing process as determined by serial radiographs, together with a lack of clinical and radiologic evidence of union, bony continuity, or bone reaction at the fracture site for no less than 3 months from the index injury or the most recent intervention.

BENEFIT APPLICATION

Experimental or investigational procedures, treatments, drugs, or devices are not covered (See General Exclusion Section of brochure).

The transducer used for ultrasound treatment is categorized as durable medical equipment.

FDA REGULATORY STATUS

In 1994, the Sonic Accelerated Fracture Healing System (SAFHS; renamed Exogen 2000 and since 2006, Exogen 4000+; Bioventus) was approved by the FDA through the premarket approval process for treatment of fresh, closed, posteriorly displaced distal radius (Colles) fractures and fresh, closed, or grade 1 open tibial diaphysis fractures in skeletally mature individuals when these fractures are orthopedically managed by closed reduction and cast immobilization. In February 2000, the labeled indication was expanded to include the treatment of established nonunions, excluding skull and vertebra. FDA product code: LPQ.

RATIONALE

Summary of Evidence

For individuals who have fresh fractures (surgically or nonsurgically managed) who receive low-intensity pulsed ultrasound as an adjunct to routine care, the evidence includes randomized controlled trials (RCTs) and several meta-analyses. Relevant outcomes are symptoms, morbid events, functional outcomes, and quality of life. The evidence base has evolved with the publication of a large RCT and meta-analysis significantly shifting the weight of the evidence. Conclusions based on several earlier and small RCTs, rated at high-risk of bias, showed a potential benefit; however, the large RCT published in 2016, rated at low-risk of bias, showed no benefit. A 2017 meta-analysis including only trials with low-risk of bias found no difference in days to full weight-bearing, pain reduction, or days to radiographic healing. Similarly, the overall results of the meta-analysis found no significant difference in return to work, subsequent operations, or adverse events. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have fracture nonunion or delayed union fracture who receive low-intensity pulsed ultrasound as an adjunct to routine care including surgery, if appropriate, the evidence includes only lower quality studies consisting of a small systematic review in scaphoid nonunions, a meta-analysis of nonunion in various locations, 2 low-quality RCTs, and 1 observational comparative study. Relevant outcomes are symptoms, morbid events, functional outcomes, and quality of life. Of the 2 RCTs, one did not include functional outcomes. The second RCT had a small sample size and did not describe the randomization procedure. The observational study reported similar healing rates with low-intensity pulsed ultrasound and surgery, although the retrospective nature of the study, limits meaningful interpretation of these results. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have stress fractures, osteotomy sites, or distraction osteogenesis who receive low-intensity pulsed ultrasound as an adjunct to routine care, the evidence includes only lower quality studies consisting of small RCTs, a retrospective comparative observational study, and one meta-analysis for distraction osteogenesis. Relevant outcomes are symptoms, morbid events, functional outcomes, and quality of life. Results do not generally include functional outcomes and results across various outcomes, primarily time to radiographic healing, are inconsistent. The meta-analysis of 3 trials using low-intensity pulsed ultrasound for distraction osteogenesis reported no statistically significant differences in physiological or functional outcomes. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

SUPPLEMENTAL INFORMATION

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

National Institute for Health and Care Excellence

In 2013, the National Institute for Health and Care Excellence (NICE) published guidance on Exogen for the treatment of long-bone fractures with nonunion and delayed fracture healing.²⁸ The NICE concluded that use of the Exogen bone healing system to treat long-bone fractures with nonunion is supported by "clinical evidence" and "cost savings ... through avoiding surgery." For long-bone fractures with delayed healing, defined as no radiologic evidence of healing after 3 months, there was "some radiologic evidence of improved healing." However, due to "substantial uncertainties about the rate at which bone healing progresses without adjunctive treatment between 3 and 9 months after fracture" and need for surgery, "cost consequences" were uncertain. In 2019, the Exogen guidance was updated with a review of studies published after June 2012.²⁸ The review decision stated, "Overall the additional clinical evidence identified since the guidance was published in 2013 supports the current recommendations." The reviewers did not consider the Schandelmaier et al (2017) systematic review because it pooled fresh fractures and distraction osteogenesis alongside non-unions.

In 2018, NICE published guidance on the use of low-intensity pulsed ultrasound in 3 clinical circumstances, The guidance made the following conclusions:

- To promote healing of fresh fractures at low-risk of non-healing: "Current evidence does not show efficacy. Therefore, this procedure should not be used for this indication."²⁹,
- To promote healing of fresh fractures at high-risk of non-healing: "Current evidence on efficacy is very limited in quantity and quality. Therefore, this procedure should only be used in the context of research."³⁰,
- To promote healing of delayed and nonunion fractures: "Current evidence on efficacy is inadequate in quality. Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research."³¹,

American Academy of Orthopaedic Surgeons

In 2020, the American Academy of Orthopaedic Surgeons published updated guidelines on the treatment of distal radius fractures.³² Although the Academy issued a limited recommendation for the use of low-intensity pulsed ultrasound for adjuvant treatment of distal radius fractures in its prior 2009 guidelines, low-intensity pulsed ultrasound was not mentioned in the updated guidelines.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Medicare National Coverage

Effective 2001, ultrasonic osteogenic stimulators were covered as medically reasonable and necessary for the treatment of nonunion fractures.³³ Nonunion fractures of the skull, vertebrae, and those that are tumor-related are excluded from coverage. Ultrasonic osteogenic stimulators may not be used concurrently with other noninvasive osteogenic devices. Ultrasonic osteogenic stimulators for fresh fractures and delayed unions are not covered.

REFERENCES

1. Buza JA, Einhorn T. Bone healing in 2016. *Clin Cases Miner Bone Metab.* May-Aug 2016; 13(2): 101-105. PMID 27920804
2. Bhandari M, Fong K, Sprague S, et al. Variability in the definition and perceived causes of delayed unions and nonunions: a cross-sectional, multinational survey of orthopaedic surgeons. *J Bone Joint Surg Am.* Aug 01 2012; 94(15): e1091-6. PMID 22854998
3. Schandelmaier S, Kaushal A, Lytvyn L, et al. Low intensity pulsed ultrasound for bone healing: systematic review of randomized controlled trials. *BMJ.* Feb 22 2017; 356: j656. PMID 28348110
4. Seger EW, Jauregui JJ, Horton SA, et al. Low-Intensity Pulsed Ultrasound for Nonoperative Treatment of Scaphoid Nonunions: A Meta-Analysis. *Hand (N Y).* May 2018; 13(3): 275-280. PMID 28391752
5. Lou S, Lv H, Li Z, et al. The effects of low-intensity pulsed ultrasound on fresh fracture: A meta-analysis. *Medicine (Baltimore).* Sep 2017; 96(39): e8181. PMID 28953676
6. Leighton R, Watson JT, Giannoudis P, et al. Healing of fracture nonunions treated with low-intensity pulsed ultrasound (LIPUS): A systematic review and meta-analysis. *Injury.* Jul 2017; 48(7): 1339-1347. PMID 28532896
7. Griffin XL, Parsons N, Costa ML, et al. Ultrasound and shockwave therapy for acute fractures in adults. *Cochrane Database Syst Rev.* Jun 23 2014; (6): CD008579. PMID 24956457
8. Busse JW, Kaur J, Mollon B, et al. Low intensity pulsed ultrasonography for fractures: systematic review of randomised controlled trials. *BMJ.* Feb 27 2009; 338: b351. PMID 19251751

9. Schortinghuis J, Bronckers AL, Stegenga B, et al. Ultrasound to stimulate early bone formation in a distraction gap: a double blind randomised clinical pilot trial in the edentulous mandible. *Arch Oral Biol*. Apr 2005; 50(4): 411-20. PMID 15748694
10. Schortinghuis J, Bronckers AL, Gravendeel J, et al. The effect of ultrasound on osteogenesis in the vertically distracted edentulous mandible: a double-blind trial. *Int J Oral Maxillofac Surg*. Nov 2008; 37(11): 1014-21. PMID 18757179
11. Strauss E, Ryaby JP, McCabe J. Treatment of Jones' fractures of the foot with adjunctive use of low-pulsed ultrasound stimulation. *J Orthop Trauma*. 1999;13(4):310. https://journals.lww.com/jorthotrauma/Citation/1999/05000/Treatment_of_Jones_fractures_of_the_foot_with.76.aspx. Accessed February 2, 2022.
12. Busse JW, Bhandari M, Einhorn TA, et al. Re-evaluation of low intensity pulsed ultrasound in treatment of tibial fractures (TRUST): randomized clinical trial. *BMJ*. Oct 25 2016; 355: i5351. PMID 27797787
13. Tarride JE, Hopkins RB, Blackhouse G, et al. Low-intensity pulsed ultrasound for treatment of tibial fractures: an economic evaluation of the TRUST study. *Bone Joint J*. Nov 2017; 99-B(11): 1526-1532. PMID 29092994
14. Emami A, Petren-Mallmin M, Larsson S. No effect of low-intensity ultrasound on healing time of intramedullary fixed tibial fractures. *J Orthop Trauma*. May 1999; 13(4): 252-7. PMID 10342350
15. Gopalan A, Panneerselvam E, Doss GT, et al. Evaluation of Efficacy of Low Intensity Pulsed Ultrasound in Facilitating Mandibular Fracture Healing-A Blinded Randomized Controlled Clinical Trial. *J Oral Maxillofac Surg*. Jun 2020; 78(6): 997.e1-997.e7. PMID 32145206
16. Lubbert PH, van der Rijt RH, Hoorntje LE, et al. Low-intensity pulsed ultrasound (LIPUS) in fresh clavicle fractures: a multi-centre double blind randomised controlled trial. *Injury*. Dec 2008; 39(12): 1444-52. PMID 18656872
17. Schofer MD, Block JE, Aigner J, et al. Improved healing response in delayed unions of the tibia with low-intensity pulsed ultrasound: results of a randomized sham-controlled trial. *BMC Musculoskelet Disord*. Oct 08 2010; 11: 229. PMID 20932272
18. Ricardo M. The effect of ultrasound on the healing of muscle-pediculated bone graft in scaphoid non-union. *Int Orthop*. Apr 2006; 30(2): 123-7. PMID 16474939
19. Nolte P, Anderson R, Strauss E, et al. Heal rate of metatarsal fractures: A propensity-matching study of patients treated with low-intensity pulsed ultrasound (LIPUS) vs. surgical and other treatments. *Injury*. Nov 2016; 47(11): 2584-2590. PMID 27641221
20. Rue JP, Armstrong DW, Frassica FJ, et al. The effect of pulsed ultrasound in the treatment of tibial stress fractures. *Orthopedics*. Nov 2004; 27(11): 1192-5. PMID 15566133
21. Urita A, Iwasaki N, Kondo M, et al. Effect of low-intensity pulsed ultrasound on bone healing at osteotomy sites after forearm bone shortening. *J Hand Surg Am*. Mar 2013; 38(3): 498-503. PMID 23375786
22. Dudda M, Hauser J, Muhr G, et al. Low-intensity pulsed ultrasound as a useful adjuvant during distraction osteogenesis: a prospective, randomized controlled trial. *J Trauma*. Nov 2011; 71(5): 1376-80. PMID 22071933
23. Salem KH, Schmelz A. Low-intensity pulsed ultrasound shortens the treatment time in tibial distraction osteogenesis. *Int Orthop*. Jul 2014; 38(7): 1477-82. PMID 24390009
24. El-Mowafi H, Mohsen M. The effect of low-intensity pulsed ultrasound on callus maturation in tibial distraction osteogenesis. *Int Orthop*. Apr 2005; 29(2): 121-4. PMID 15685456
25. Tsumaki N, Kakiuchi M, Sasaki J, et al. Low-intensity pulsed ultrasound accelerates maturation of callus in patients treated with opening-wedge high tibial osteotomy by hemicallotaxis. *J Bone Joint Surg Am*. Nov 2004; 86(11): 2399-405. PMID 15523009
26. Lou S, Lv H, Li Z, et al. Effect of low-intensity pulsed ultrasound on distraction osteogenesis: a systematic review and meta-analysis of randomized controlled trials. *J Orthop Surg Res*. Aug 17 2018; 13(1): 205. PMID 30119631
27. Song MH, Kim TJ, Kang SH, et al. Low-intensity pulsed ultrasound enhances callus consolidation in distraction osteogenesis of the tibia by the technique of lengthening over the nail procedure. *BMC Musculoskelet Disord*. Mar 14 2019; 20(1): 108. PMID 30871538
28. National Institute for Health and Care Excellence (NICE). EXOGEN ultrasound bone healing system for long bone fractures with non-union or delayed healing [MTG12]. 2013 (Updated 2019); <https://www.nice.org.uk/guidance/mtg12>. Accessed February 3, 2022
29. National Institute for Health and Care Excellence (NICE). Low-intensity pulsed ultrasound to promote healing of fresh fractures at low risk of non-healing [IPG621]. 2018; <https://www.nice.org.uk/guidance/ipg621>. Accessed February 4, 2022.
30. National Institute for Health and Care Excellence (NICE). Low-intensity pulsed ultrasound to promote healing of fresh fractures at high risk of non-healing [IPG622]. 2018; <https://www.nice.org.uk/guidance/ipg622>. Accessed February 5, 2022.
31. National Institute for Health and Care Excellence (NICE). Low-intensity pulsed ultrasound to promote healing of delayed-union and non-union fractures [IPG623]. 2018; <https://www.nice.org.uk/guidance/ipg623>. Accessed February 6, 2022.
32. American Academy of Orthopaedic Surgeons. The treatment of distal radius fractures. 2009; <https://www.aaos.org/quality/quality-programs/upper-extremity-programs/distal-radius-fractures/>. Accessed February 7, 2022.
33. Centers for Medicare & Medicaid Services. National Coverage Decision for Osteogenic Stimulators (150.2). 2005; <https://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=65&ncdver=2&DocID=150.2&bc=gAAAABAAAA&>. Accessed February 8, 2022.

POLICY HISTORY - THIS POLICY WAS APPROVED BY THE FEP® PHARMACY AND MEDICAL POLICY COMMITTEE ACCORDING TO THE HISTORY BELOW:

Date	Action	Description
March 2012	New policy	
December 2012	Replace policy	Policy rationale and references updated; arthrodesis added to investigational statement; definition of delayed unions revised to 3 months for consistency with definition of nonunion.
March 2014	Replace policy	Policy updated with literature review. References 12, 16, and 18 added; clarification of non-union of previously surgically-treated fractures; fresh surgically-treated closed fractures added to Investigational statement.
March 2015	Replace policy	Policy updated with literature review; references 11 and 20 added. Information added to Policy Guidelines to clarify definition of "fresh fracture". Policy statements unchanged.
December 2016	Replace policy	Policy updated with literature review through July 1, 2016; references 14 and 16 added. Policy statements unchanged.
September 2017	Replace policy	Policy updated with literature review through January 25, 2017; references 3-4, 7, 17, and 25-26 were added. The following indications were changed from medically necessary to not medically necessary: fresh fractures (surgically and nonsurgically managed) and nonunion/delayed union fractures.
June 2018	Replace policy	Policy updated with literature review through January 8, 2018; references 5-6 and 16-17 added. Policy statements are unchanged.
June 2019	Replace policy	Policy updated with literature review through February 27, 2019; references added. Policy statements unchanged.
June 2020	Replace policy	Policy updated with literature review through January 30, 2020; references updated. Policy statements unchanged. Title changed to "Low Intensity Pulsed Ultrasound Fracture Healing Device" to more accurately reflect the expanded labeled indications as per the Regulatory Status section.
June 2021	Replace policy	Policy updated with literature review through February 18, 2021; references added. Slightly revised practice guidelines section for clarity. Policy statements unchanged.
June 2022	Replace policy	Policy updated with literature review through February 3, 2022; no references added. Not medically necessary policy statements updated to investigational for policy standardization purposes; intent unchanged. Policy statements unchanged.

The policies contained in the FEP Medical Policy Manual are developed to assist in administering contractual benefits and do not constitute medical advice. They are not intended to replace or substitute for the independent medical judgment of a practitioner or other health care professional in the treatment of an individual member. The Blue Cross and Blue Shield Association does not intend by the FEP Medical Policy Manual, or by any particular medical policy, to recommend, advocate, encourage or discourage any particular medical technologies. Medical decisions relative to medical technologies are to be made strictly by members/patients in consultation with their health care providers. The conclusion that a particular service or supply is medically necessary does not constitute a representation or warranty that the Blue Cross and Blue Shield Service Benefit Plan covers (or pays for) this service or supply for a particular member.