



⦿ Mechanism of Action

Activating bone healing at every stage



exogen[®]
ultrasound bone healing system

 bioventus[®]

EXOGEN Ultrasound Bone Healing System

The EXOGEN Bone Healing System is a unique fracture healing device that uses low-intensity pulsed ultrasound (LIPUS) technology to stimulate the body's natural bone healing process.¹

EXOGEN is osteoinductive, stimulating cells to differentiate into osteoblasts that begin the formation of new bone. EXOGEN is safe and effective for non-union fractures with metal fixation or implants² (see EXOGEN User Guide).



exogen[®]
ultrasound bone healing system

EXOGEN Mechanism of Action

1. Stimulation

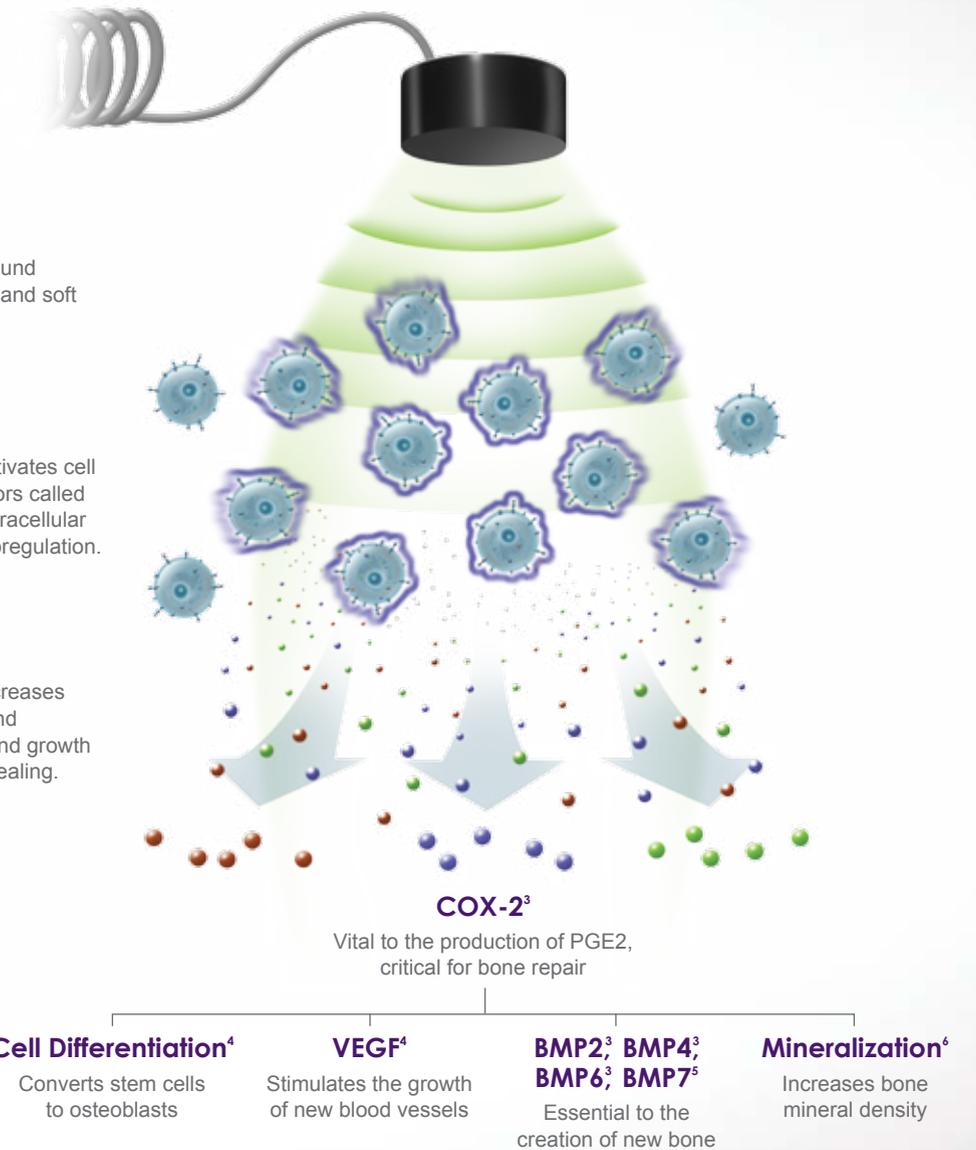
EXOGEN sends ultrasound waves through the skin and soft tissue to the fracture.

2. Activation

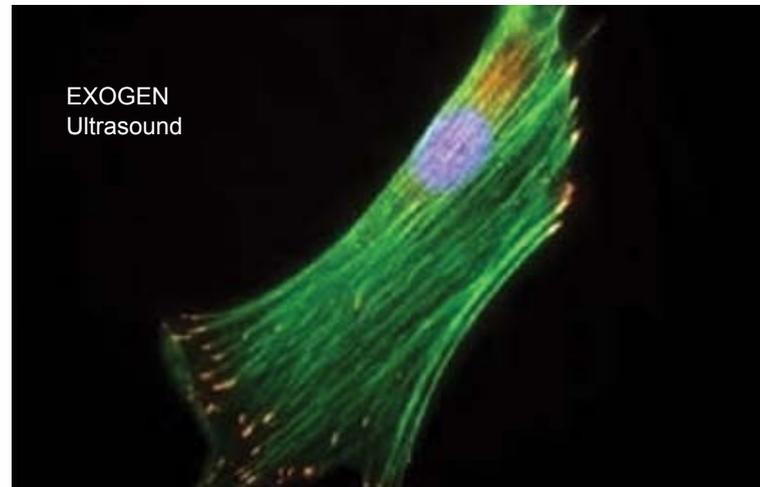
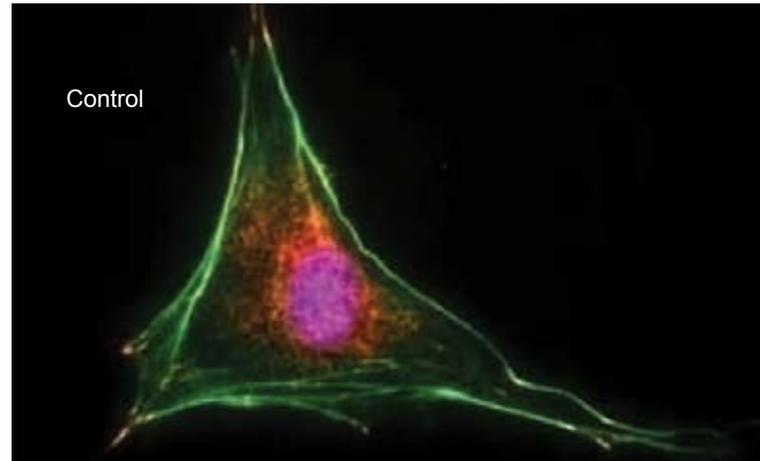
EXOGEN ultrasound activates cell surface mechanoreceptors called integrins, initiating an intracellular cascade that leads to upregulation.

3. Upregulation

EXOGEN ultrasound increases upregulation of genes and expression of proteins and growth factors critical to bone healing.

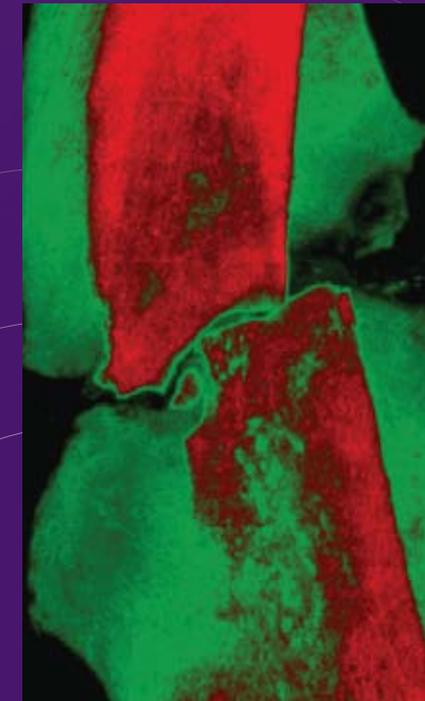


A clear biological response

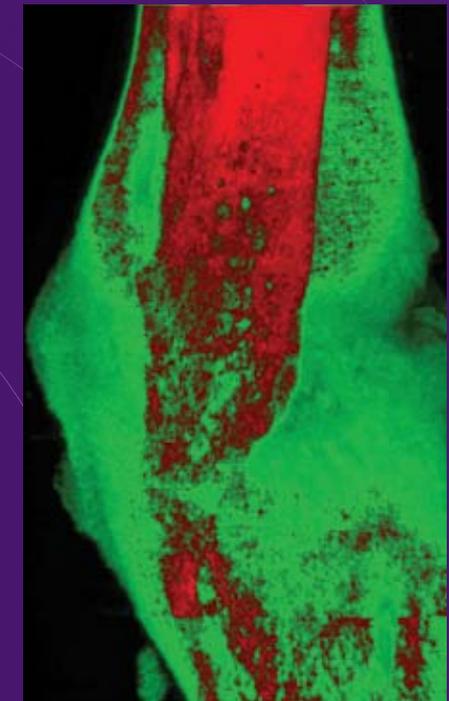


The lower image shows EXOGEN's impact on the formation of the cytoskeleton (in green) and focal adhesions (orange dots) in osteoblasts in vitro, caused by the clustering of integrins.⁷

Bridging the fracture gap



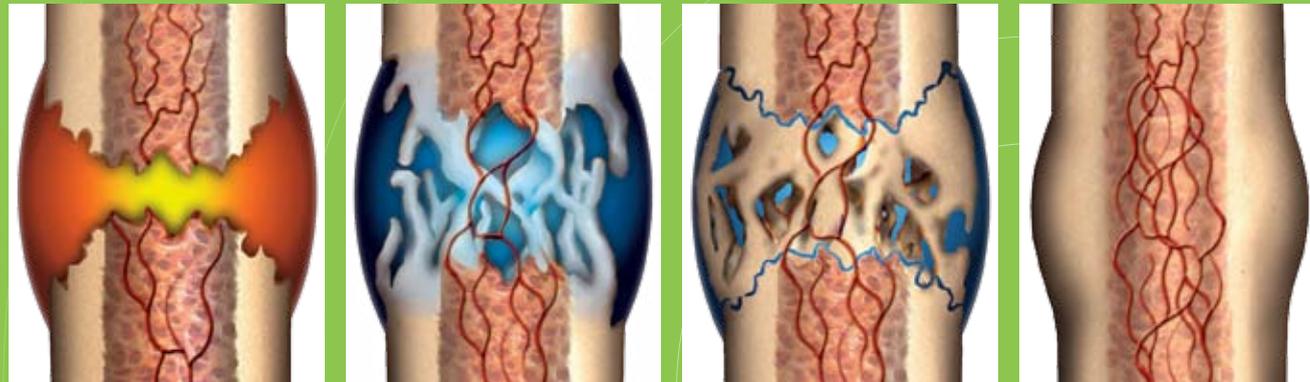
Control



EXOGEN Ultrasound

Micro-computed tomography shows that EXOGEN treatment increases the removal of original cortical bone and enhances endochondral ossification. The image on the right shows the growth of new, less-dense bone (in green) bridging the fracture gap of older, denser bone (in red).⁸

EXOGEN at every stage of the fracture healing process



Inflammation

EXOGEN's ultrasound signal increases cell division among periosteal cells in culture and upregulates growth factors that trigger the formation of new blood vessels.⁴

Soft Callus

The ultrasonic treatment enhances the TGFβ-triggered differentiation of chondrocytes in culture and accelerates the formation of extracellular matrix.^{9,10}

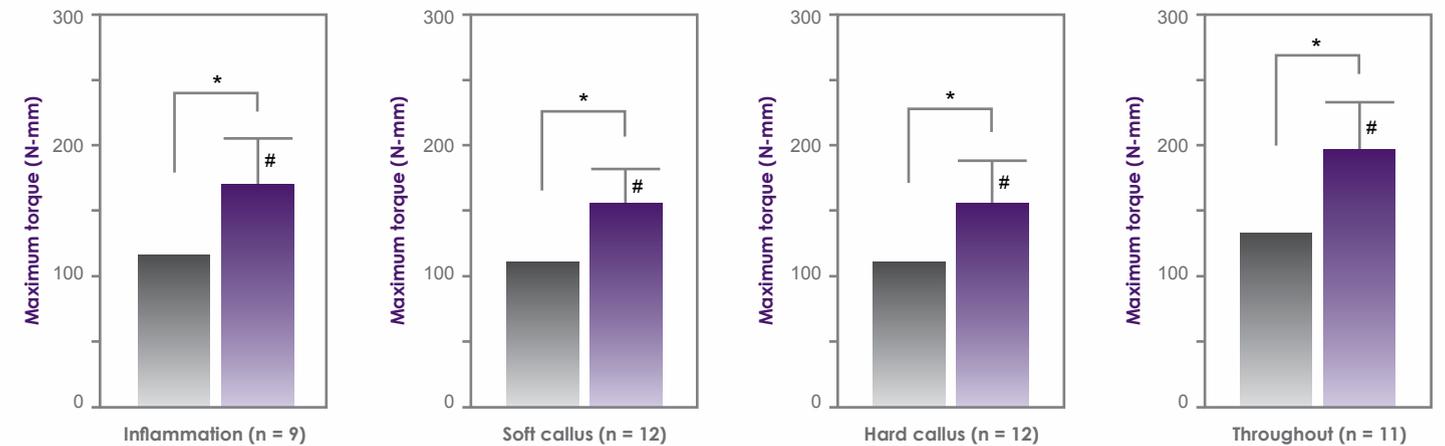
Hard Callus

EXOGEN upregulates endochondral ossification^{11,12} and enhances osteoblast differentiation¹³ and mineralisation.⁴

Bone Remodeling

Accelerating both the formation and resorption of bone, EXOGEN ultrasound treatment yields faster remodeling of the mineralised callus.⁸

EXOGEN accelerates healing throughout the fracture healing process¹



■ EXOGEN treatment ■ Control
 **p* < 0.01 treatment compared to contralateral control
 #*p* < 0.05 treatment compared to treatment throughout

Maximum torsional torque of the EXOGEN-treated femurs was significantly greater than the placebo controls at each phase of fracture healing in an animal model.

EXOGEN can easily penetrate soft tissue to reach both deep and superficial fractures

The depth and breadth of the EXOGEN signal enable it to treat superficial and deep indicated fractures, as well as non-union fractures with metal fixation or implants.^{2,14} Because the ultrasound waves travel easily through adipose tissue, it is suggested that EXOGEN therapy is effective for normally weighted and obese patients.¹⁵

Depth and breadth of penetration:¹⁵

- Beam reaches a depth of more than 260 mm
- Effective diameter of the ultrasound beam is more than 5 cm
- Therapeutic span is 3.4 cm, even after passing through 20 cm of soft tissue

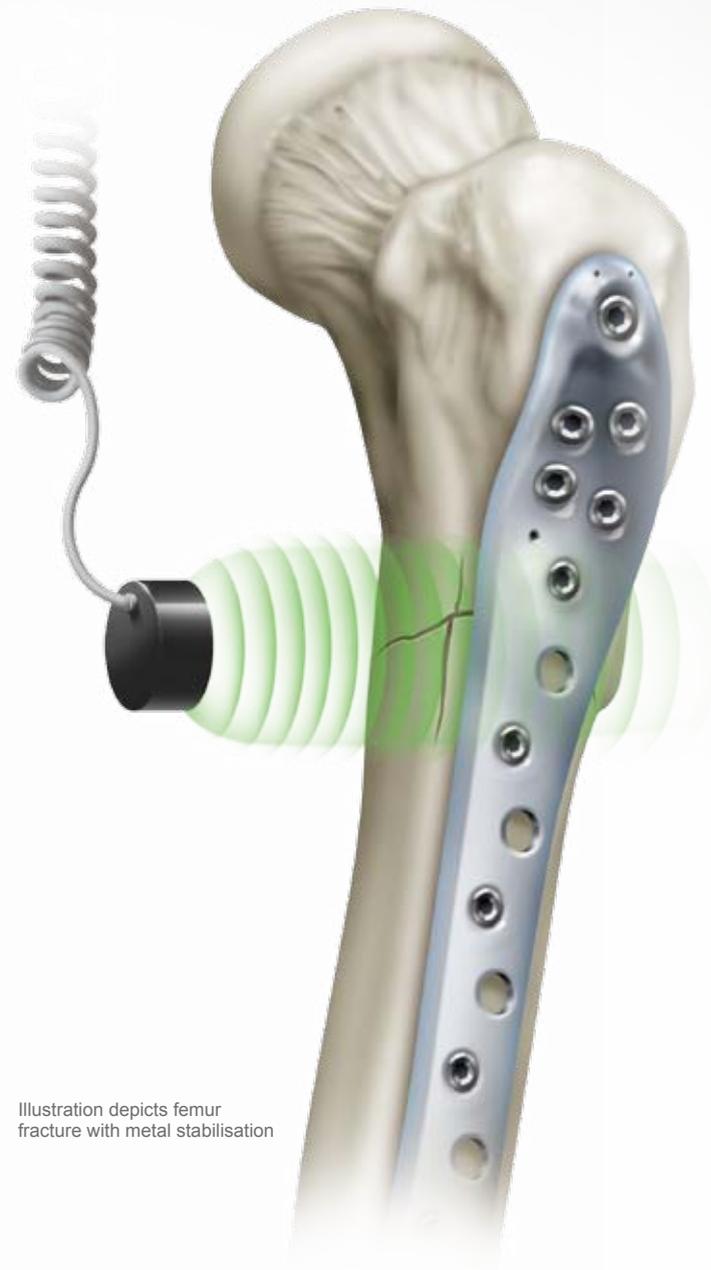


Illustration depicts femur fracture with metal stabilisation

Effective in a wide range of patients and fractures

EXOGEN shows results in special patient populations:

- Smokers¹⁶
- Infected non-union¹⁷
- Deep or superficial fractures¹⁴
- Atrophic non-union¹⁴
- Hypertrophic non-union¹⁴

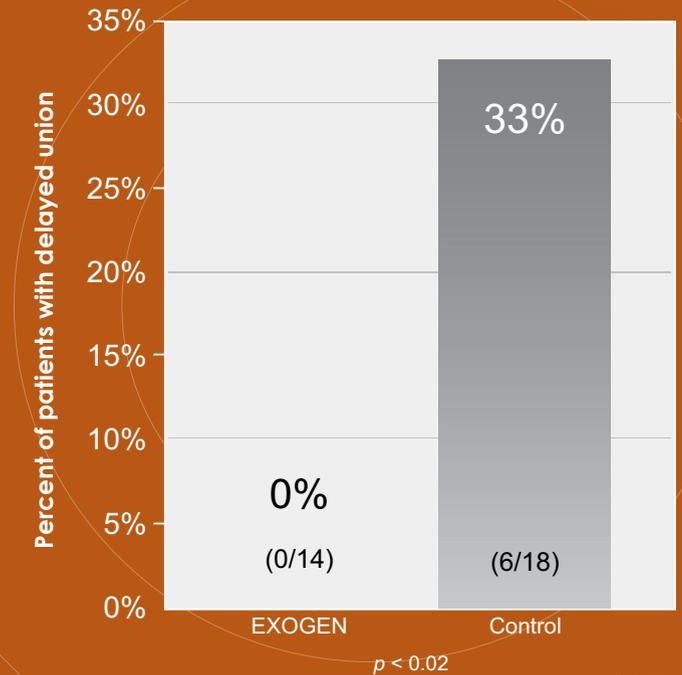
EXOGEN is effective on non-unions with metal implants:¹⁴

- Cells respond even if the fracture is fixed with metal implants

EXOGEN used on animal models with metal fixation has been shown to be:

- Safe²
- Non-cavitating¹⁸
- Non-thermal¹⁹

0% of EXOGEN-treated smokers developed a delayed union¹⁶

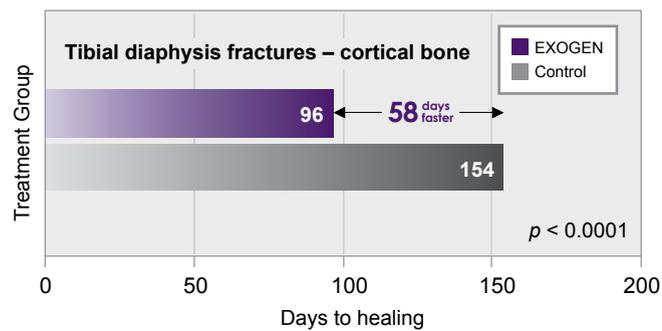


38% faster healing of fresh fractures^{20,21}

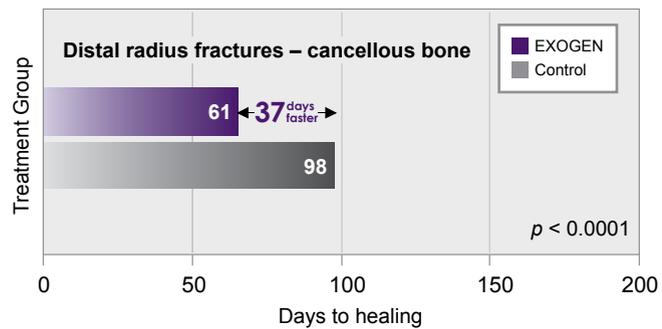
EXOGEN treatment accelerates healing in both cortical and cancellous bone

Analysis of these studies showed an 83% reduction in delayed unions.¹⁶

EXOGEN ultrasound is a unique fracture healing device that has demonstrated the ability to accelerate fresh fracture healing.



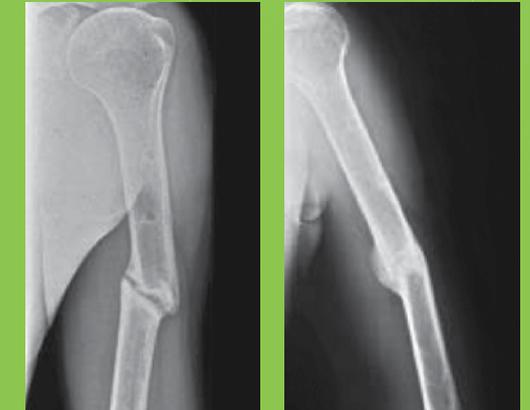
In a prospective, randomised, double-blind, placebo-controlled (Level I) study of 67 tibial fractures, EXOGEN treatment accelerated healing by 38%²⁰ – a difference of more than 8 weeks.



A separate Level I trial of 61 distal radius fractures also reported a 38% acceleration of healing, as well as significantly greater fracture alignment.²¹

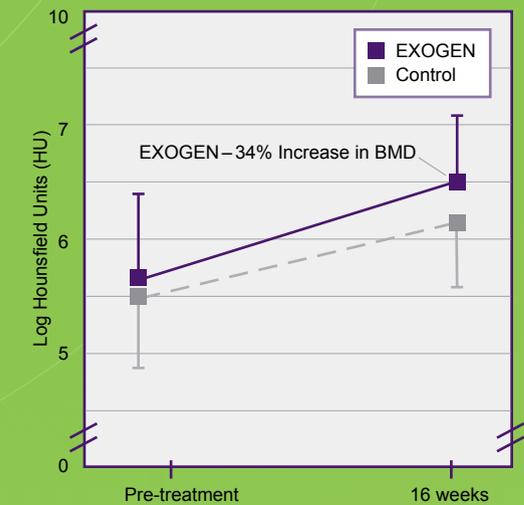
86% non-union[†] heal rate²⁰

EXOGEN has been shown to successfully resolve 86% of non-union fractures.²² The EXOGEN ultrasound signal is safe and effective as an adjunct to conservative treatment or surgical management, including metal fixation and implants.^{2,14}



Radiograph depicting humeral non-union fracture healing.

In a study on non-union fracture healing, bone mineral density showed an estimated 34% increase in subjects treated with EXOGEN for 20 minutes a day. EXOGEN also demonstrated a significant benefit in fracture gap reduction compared to the control group.⁶



Line graph illustrating improvement in bone mineral density for each treatment group separately through 16 weeks of follow-up.

High treatment compliance.⁶ Proven effectiveness.²⁰⁻²² Successful outcomes.

Backed by a full suite of patient support tools, EXOGEN is the only bone healing device with documented 91% treatment compliance.⁶

20-Minute Treatment

With treatments lasting just 20 minutes, EXOGEN can fit easily into the patient's daily routine.

Customer Support

EXOGEN Customer Support is available to answer questions and help maintain continuity of treatment.

Treatment Reminders

EXOGEN CONNECTS* sends automatic treatment reminders via phone, text message or email, based on the patient's preference.

exogen
connects



1. Enrol

EXOGEN CONNECTS is easy to join and use, and comes with an opt-out option.



2. Receive

Patients get treatment reminders and tips for healthy living.



3. Treat

Daily automated reminders prompt patients to use their device as prescribed.



4. Heal

Using EXOGEN consistently may put patients on the road to faster healing.



Treatment Tracking Log

EXOGEN's built-in treatment tracking log tracks device usage, making treatment compliance convenient for patients and verifiable for physicians.

Indications for Use

EXOGEN is indicated for the non-invasive treatment of osseous defects (excluding vertebra and skull) that includes the treatment of delayed unions, non-unions[†], stress fractures and joint fusion. EXOGEN is also indicated for the acceleration of fresh fracture heal time, repair following osteotomy, repair in bone transport procedures and repair in distraction osteogenesis procedures.

[†] A non-union is considered to be established when the fracture site shows no visibly progressive signs of healing.

There are no known contraindications for the EXOGEN device. Safety and effectiveness have not been established for individuals lacking skeletal maturity, pregnant or nursing women, patients with cardiac pacemakers, on fractures due to bone cancer, or on patients with poor blood circulation or clotting problems. Some patients may be sensitive to the ultrasound gel. Full prescribing information can be found in product labeling, at www.exogen.com, or by calling customer service at 800 12192.

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High treatment compliance⁶

Proven effectiveness^{20–22}

Successful outcomes

Count on EXOGEN.

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