Antibacterial, Osteoconductive and Osteostimulative Properties of Inion BioRestore™

Inion Oy

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Introduction

Traditionally, harvested autologous bone grafts have been considered the standard of care for skeletal reconstruction due to their osteogenic potential (Jones et al. 2007, Lobb et al. 2019). However, both autografts and allografts present notable limitations, including donor site morbidity, increased risk of infection, limited availability, and prolonged recovery times (Valtanen et al. 2020). The demand for more effective and less invasive alternatives has led to the development of bioactive materials (Fillingham & Jacobs 2016), such as Inion BioRestore™[1].

Inion BioRestore™ morsels and Inion BioRestore™ Plus blocks

Inion BioRestore™ is a bioactive and bioabsorbable synthetic bone graft substitute designed to fill, restore, or augment bony voids or gaps. The Inion BioRestore™ products are available both in morsels and blocks in different sizes and shapes. The porous, bioactive material of Inion BioRestore™ supports new bone formation through its osteoconductive and osteostimulative properties. Additionally, Inion BioRestore™ offers an added benefit over traditional bone graft materials through its antibacterial properties (Internal data on file, Inion Oy). In this paper, the key features and benefits of Inion BioRestore™ are presented in more detail.

Key Features

Antibacterial Properties: *Reducing the Risk of Infection*

Scientific evidence indicates that bioactive glass materials possess antibacterial properties, which may help inhibit bacterial contamination at the surgical site (Drago et al. 2018). Inion BioRestore™ has also demonstrated such properties in laboratory testing, supporting its potential to reduce the risk of postoperative infection. The antibacterial properties of Inion BioRestore™ were evaluated in vitro using the bacterial strains *Staphylococcus aureus* ATCC BAA-44, *Staphylococcus aureus* ATCC 49230, and *Staphylococcus epidermidis* ATCC 51625 (Inion test report T211R239/2016). The report indicates that bioactive glass slowed down the growth of *Staphylococcus aureus* ATCC BAA-44 and *Staphylococcus aureus* ATCC 49230. In addition, it was effective against the *Staphylococcus epidermidis* permanently decreasing the bacterial counts below the detection level (see figure 1.).

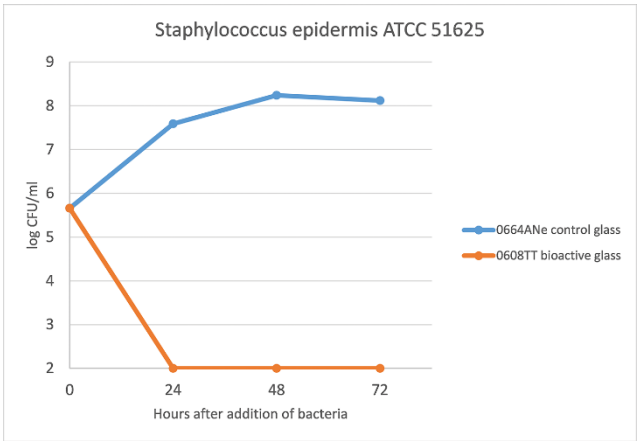

Figure 1. Antibacterial properties of Inion BioRestore™

[1] *In this paper, the term Inion BioRestore™ is used to refer to both Inion BioRestore™ and Inion BioRestore™ Plus, unless otherwise specified.*

Osteoconductive Properties: *Supporting Bone Formation*

Inion BioRestore™ supports bone healing by actively stimulating the proliferation and differentiation of osteoblasts, while simultaneously providing a scaffold for new bone formation. Its porous structure facilitates the ingrowth of bone tissue throughout the implant. As the material gradually resorbs, it is replaced by newly formed bone. In vitro cell culture tests (Inion test report TR-04446/2007) provide evidence of osteoconductivity demonstrated by successful cell attachment, growth and proliferation.

Osteostimulative Properties: *Accelerating Bone Regeneration*

In vitro cell culture test report (Inion test report TR-04446/2007) demonstrates that Inion BioRestore™ implants are not only osteoconductive but also osteostimulative. The in vitro cell culture tests with human adipose mesenchymal stem cells show the osteostimulative effect, defined as the active stimulation of osteoblast proliferation and differentiation as evidenced by alkaline phosphatase activity (Inion test report TR-04446/2007).

Key Benefits

Complete and Controlled Degradation

As a bioabsorbable material, Inion BioRestore™ gradually absorbs and remodels into new bone efficiently due to its porous fiber structure. The open structure enables flow of fluid into the implants enabling bone formation and vascularization throughout the implant. Based on preclinical testing and clinical data, Inion BioRestore™ material remodels into bone and degrades in vivo in six months. (Internal data on file, Inion Oy).

Antimicrobial and Biocompatible

In addition to the antibacterial properties of Inion BioRestore™, its fully synthetic composition eliminates the risk of disease transmission and contributes to a reduced overall risk of adverse events. Furthermore, the synthetic origin of the material shortens operative time and overcomes the limitations in quantity and quality of available bone grafts. (Inion Oy, 2025, Internal data on file, Inion Oy).

Osteoconductive and Osteostimulative

Inion BioRestore™ actively stimulates osteoblast proliferation and differentiation while providing a scaffold to support new bone formation. Inion BioRestore™ supports bone regeneration by acting as a porous scaffold that facilitates the attachment and ingrowth of bone-forming cells.

Indications for Use

Inion BioRestore™ and Inion BioRestore™ Plus products are indicated[2] for the filling, restoration, and/or augmentation of bony voids or gaps within the skeletal system. These voids may be surgically created or result from traumatic injury. Specific indications include:

Inion BioRestore™ morsels:

- Mandibular bone defects
- Maxillofacial bone defects
- Defects in extremities
- Defects in spine
- Defects in pelvis

Inion BioRestore™/ Inion BioRestore™ Plus blocks:

- Filling and/or restoration of bone defects in extremities

Conclusions

Inion BioRestore™ material offers antibacterial, osteoconductive and osteostimulative properties, enhancing the body's natural healing processes and offering a reliable and safe solution for bone regeneration. It supports effective bone healing and may reduce complications commonly associated with traditional bone grafting materials. Its synthetic and sterile composition eliminates the need for donor site surgery, thereby reducing related risks. Inion BioRestore™ is suitable for a range of clinical applications where effective and predictable bone healing is essential.

[2] *See the current Instructions for Use (IFU) for complete and up-to-date list of indications for any regional or regulatory variations.*

References

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INION OY
Lääkärinkatu 2
33520 Tampere
FINLAND
tel: +358-10-830 6600
email: info@inion.com

INION INC
Americas Corporate Office
37 North Orange Avenue, Suite 900C
Orlando, Florida 32801
USA
tel: +1 (954) 659-9224

Version 1: 10/2025