



**CopiOs[®]
Bone Void
Filler**



Providing an environment conducive to bone growth

An Environment Conducive to Bone Growth¹



CopiOs Sponge and
CopiOs Paste Compressed
Powder Disc

Clinically Proven Technology

In a prospective, randomized, multi-center study of 213 patients (249 long bone fractures) that compared autogenous iliac crest bone graft (ICBG) to calcium phosphate (CaP)-collagen graft (Collagraft[®] Matrix) the authors concluded that composite grafts of CaP-collagen material and bone marrow aspirate are as effective and as safe as autogenous bone graft in the treatment of fracture defects of long bones.²

Synthetic Carrier Delivers Biologic Elements

CopiOs[®] Bone Void Filler alone is an osteoconductive scaffold; the addition of autologous bone marrow aspirate (BMA) provides osteogenic cells and osteoinductive proteins necessary for bone growth.

CopiOs Bone Void Filler is Formulated to Provide Physical and Chemical Characteristics to Optimize Bone Healing

- An abundance of localized calcium and phosphate ions promotes bone formation.³
- Acidic conditions for bone healing may preserve the solubility of osteoinductive proteins for bone healing.⁴
- A high porosity collagen sponge scaffold or a high void volume paste provides the 3-D structure, which plays a key osteoconductive role in bone regeneration.
- Resorption concurrent with bone growth.
- Biocompatibility and safety.
- Excellent handling and ease-of-use.

QUALITY
biocompatibility
performance

An Effective Autograft Alternative

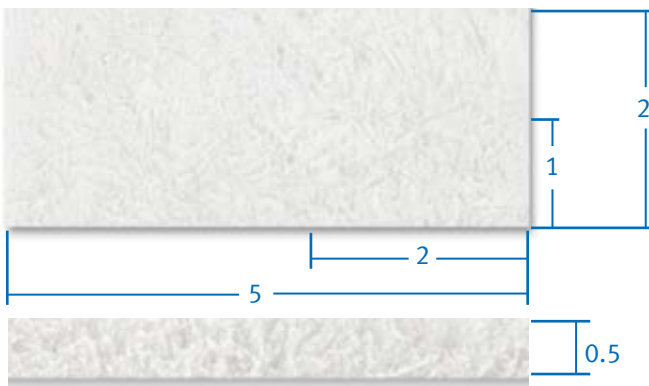
CopiOs Bone Void Filler

- *CopiOs* Bone Void Filler combined with bone marrow aspirate provides the three requisite properties for bone healing.
- Pre-clinical studies with *CopiOs* Sponge plus bone marrow aspirate show bone healing performance equivalent to autograft.
- Eliminates the need for a second surgical harvest procedure and associated complications including donor site morbidity.
- Readily available with consistent quality.

Autograft is widely regarded as the ideal construct for graft procedures, supplying osteoinductive growth factors, osteogenic cells, and a structural scaffold.⁵ However, autograft has its limitations:^{1, 5}

- Requires a second surgical procedure which increases costs and is associated with:
 - Longer OR and recovery times.
 - Greater blood loss.
 - Extended hospital stays.
- Limited bone supply and often issues with bone quality, especially in the elderly.
- Donor site morbidity.
- Major complications (25%-29%)¹ have been reported including disabling chronic pain at the donor site.

Two Convenient Forms for Intraoperative Flexibility



Part Number	Sponge Size
00-1103-010-01	1cc (1cm x 2cm x 0.5 cm)
00-1103-010-05	5cc (2cm x 5cm x 0.5 cm)
00-1103-010-10	10cc (2cm x 5cm x 0.5 cm) x 2

Part Number	Paste Volumes (when hydrated)
00-1103-020-01	1cc
00-1103-020-05	5cc
00-1103-020-10	10cc

Part Number	Description
00-1103-007-00	Bone Marrow Aspiration Needle



The Next Generation in Synthetic Bone Graft Materials

Abundance of Localized Mineral Promotes Bone Formation

- *CopiOs* Bone Void Filler is comprised of dibasic calcium phosphate and highly purified Type I bovine collagen.
- A unique mineral chemistry that is moderately soluble.
- Dibasic calcium phosphate provides 300 times more calcium and phosphate ions at equilibrium than either tricalcium phosphate (TCP) or hydroxyapatite. (HA) (Fig. 1)⁴

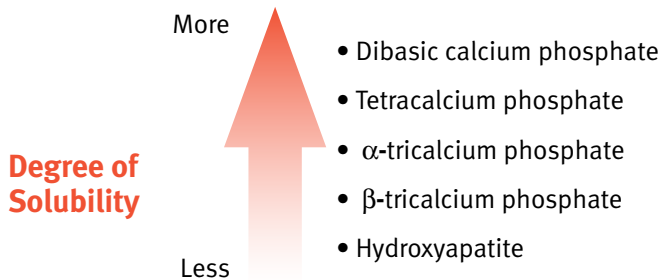


Fig. 1: Relative solubility of calcium phosphates⁴

Acidic Conditions for Bone Healing

- *CopiOs* Bone Void Filler provides a moderately acidic environment that promotes solubility of endogenous bone morphogenic proteins (BMPs). (Fig. 2)
- More soluble BMPs may remain available to bone healing processes in the early stages of bone growth.
- The concentration of BMPs in solution decreases substantially when HA or TCP is present. (Fig. 2)

	% BMPs Left in Solution
Control (No Mineral)	100%
CaHPO ₄ (DICAL)	76%
Ca ₃ (PO ₄) ₂ (TCP)	23%
Ca ₅ (PO ₄) ₃ (OH) (HA)	15%

Fig. 2: Concentration of BMP in a calcium salt solution⁴

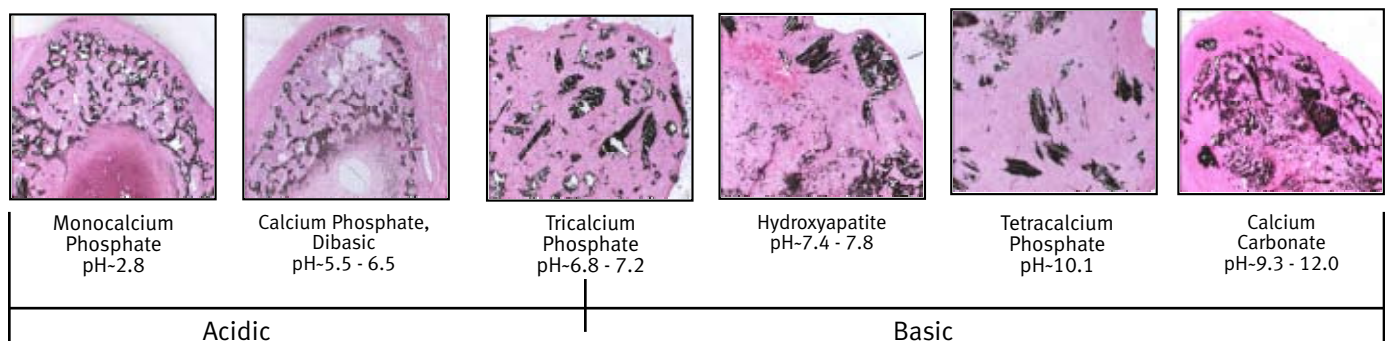
Optimized Chemistry

Study model:

- Female, Long Evans rats (60-130 g).
- Bilateral subcutaneous ectopic implantations (diameter approximately 7mm).
- Mineral compositions with different pH values were implanted (using a collagen scaffold and osteoinductive protein mixture).
- Histology was compared to assess bone growth and healing potential.

Conclusion:

Comparatively, the acidic mineral compositions show more mature, higher quality bone formation and a greater quantity of bone at this time period in this particular study.⁴ Note: cortical rim formation in dibasic calcium phosphate histology slide (mineralization-dark spots, development of marrow-white spots, preliminary signs of vascularization-light pink spots).



Osteoconductive Scaffolds Provide Key Role in Bone Regeneration

- Three-dimensional collagen scaffold sponge resembles human cancellous bone for guided bone regeneration.
- Sponge structure is approximately 93% porous with interconnecting, multi-directional pores ranging in size between 5-1000µm, which allow cell penetration and rapid, complete absorption of autologous fluids. (Fig. 3)
- Paste structure has high void volume. (Fig. 4)
- These osteoconductive attributes allow cellular attachment, nutrient and oxygen infiltration and vascularization throughout the graft material for bone healing.
- Sponge carrier technology wicks 7X its weight in autologous blood or bone marrow, localizing and retaining necessary cells and proteins at the defect for bone healing.

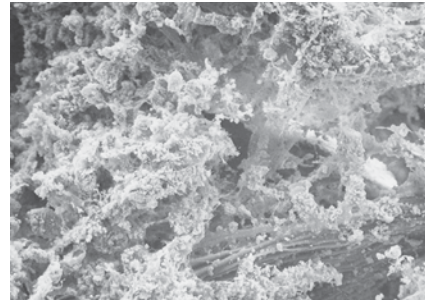


Fig. 3: Microscopic view of collagen in *CapiOs* Sponge (Magnification: 200X)⁴

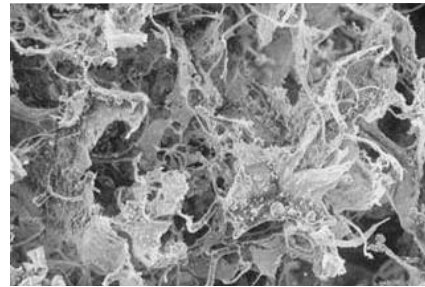


Fig. 4: Microscopic view of collagen in *CapiOs* Paste (Magnification: 100X)⁴

Timely Resorption Concurrent with Bone Growth

- Non-chemically cross-linked collagen provides strength and durability for the scaffold to persist until replaced by bone ingrowth.
- Rapidly incorporates into new bone and remodels by cell-mediated processes throughout the graft (as opposed to creeping substitution).
- As new bone growth occurs, the scaffold is resorbed. (Fig. 5)
- It resorbs more quickly than hydroxyapatite which is virtually insoluble.

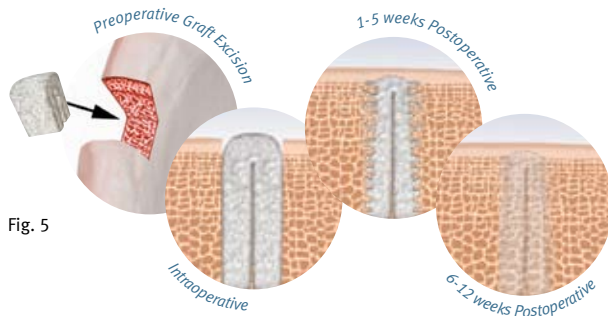


Fig. 5

Biocompatible and Safe

- Pre-clinical studies show *CapiOs* Bone Void Filler to be biocompatible and non-toxic.
- *CapiOs* Bone Void Filler was nonimmunogenic in animal studies.



CapiOs Sponge



CapiOs Paste

Excellent Handling and Easy-To-Use

- Pliant when hydrated, so it can be easily molded into irregularly-shaped defects.
- *CapiOs* Sponge is easy to shape and cut.
- *CapiOs* Paste provides ease of graft placement in difficult to reach defects and for surgeons who prefer the handling properties of a putty/paste formulation.
- Stable in a fluid environment.
- *CapiOs* Sponge is radiolucent allowing for better imaging and less interference with visualization of the healing process than hydroxyapatite.

Pre-Clinical Performance

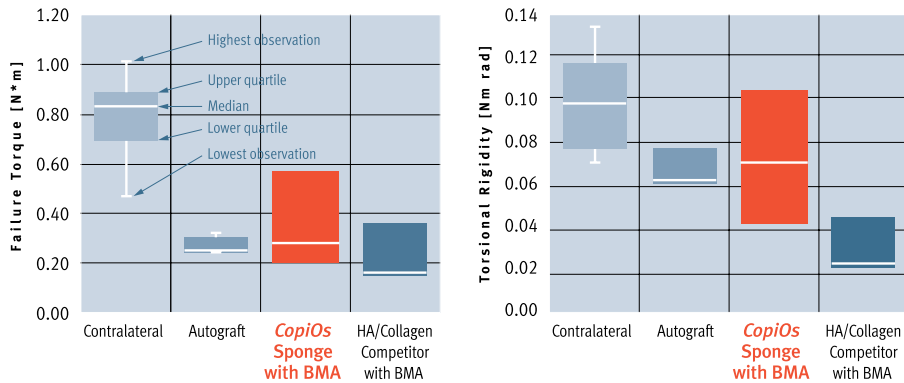
Study model:

- Skeletally mature New Zealand White rabbits (approximately 6 mos. old, 3-5 kg).
- Radial critical size segmental defect model (15mm).
- Evaluated use of autograft, *CopiOs* Sponge with bone marrow aspirate (BMA), and DePuy's Healos Bone Graft Replacement with bone marrow aspirate. An unfilled defect was the negative control, and the contralateral limb was the control for mechanical strength.
- Mechanical, radiographic and histologic evaluations were completed.

Conclusion:

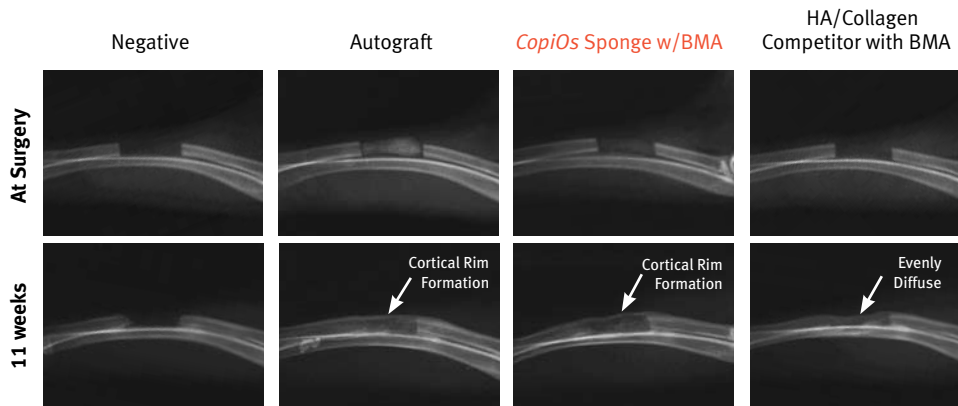
Pre-clinical studies with *CopiOs* Sponge plus bone marrow aspirate show bone healing performance equivalent to autograft.⁴

CopiOs Sponge with BMA was equivalent to autograft in failure torque and torsional rigidity testing.



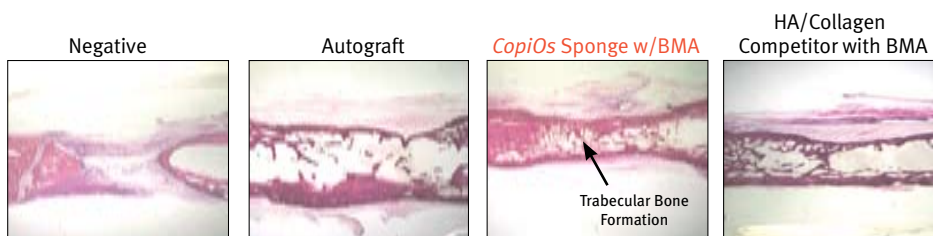
Mechanical performance at 11 weeks⁴

CopiOs Sponge with BMA was equivalent to autograft showing cortical rim formation at 11 weeks.



Radiographic Analysis: 11 weeks⁴

CopiOs Sponge with BMA shows trabecular bone formation at 12 weeks equivalent to autograft.



Histologic Analysis: at 12 weeks, 6x magnification⁴

Clinical Performance

Case 1

Post-op calcaneal osteotomy with subtalar fusion. Subtalar nonunion treated with *CopiOs* Sponge. Clinical union achieved 3-months post-op.⁴



Immediate post-op lateral ankle



3-months post-op standing lateral ankle

Case 2

Failed plafond fixation. Resulted in nonunion. Revised ankle arthrodesis and grafted with *CopiOs* Sponge.⁴



Pre-op standing lateral view



Pre-op standing oblique and AP



4-months post-op revision lateral



4-months post-op AP view

Case 3

Periprosthetic fracture with failure of fixation. Fixation revised and nonunion treated with *CopiOs* Sponge.⁴ Callus seen at 4 weeks.



Post-op across table



Post-op AP view



4-weeks post-op AP view



4-weeks post-op lateral

Intended Use

CopiOs Bone Void Filler, in combination with autologous blood products such as bone marrow, is intended for use only for filling bone voids or gaps of the skeletal system (i.e., extremities, pelvis, and spine, i.e., posterolateral spine fusion procedures with appropriate stabilizing hardware) that are not intrinsic to the stability of the bone structure. These voids may be a result of trauma or creation by surgeon. *CopiOs* Bone Void Filler is intended to be gently packed into the void or gap and will resorb during the course of the healing process.

Surgical Technique

CopiOs Sponge and *CopiOs* Paste should be used in the OR in an aseptic surgical field. The bone void site should be adequately prepared to expose healthy bleeding bone to help promote future bone growth.

- ① Determine the volume of the bone defect.
- ② Select and open appropriate number of packages of *CopiOs* Bone Void Filler based on product volume/size to best fill the defect providing maximum contact with the bone surface. *CopiOs* Sponges may be cut to size with surgical scissors or a scalpel.
- ③ Aspirate or obtain locally autologous blood, bone marrow or other blood product in the following volume recommendations.

For *CopiOs* Sponge obtain a volume of blood or bone marrow equal to the volume of the defect.

For *CopiOs* Paste use the volumes in the table below to achieve a putty-like consistency.

Product Size	Fluid Volume
1cc	0.6cc
5cc	4.0cc
10cc	8.5cc

- ④ Hydrate *CopiOs* Bone Void Filler with the blood product obtained.

For *CopiOs* Sponge, place sponge(s) into a sterile mixing bowl and add the blood product to saturate.

For *CopiOs* Paste, transfer the compressed powder disc into the bowl and add the blood product. Add slightly more or less fluid to achieve desired putty handling characteristics. Mix thoroughly for 1-2 minutes until there are no dry spots.

- ⑤ Thoroughly irrigate the site of the bone defect.
- ⑥ Gently mold *CopiOs* Bone Void Filler into the defect. Avoid compressing the structure of the graft. As an alternative *CopiOs* Paste may be loaded into the barrel of an appropriate size sterile syringe and then extruded.
- ⑦ Secure filled defect with surrounding soft tissue and perform rigid fixation of bone void as needed. Optimal management of fractures or defects requires adequate alignment and stability.

CopiOs Bone Void Filler will resorb during the course of the healing process.



Zimmer® Periarticular Locking Plate System and Periarticular Plating System

Zimmer Revision Hip & Knee Products



Zimmer NCB® Non-Contact Bridging Plating System



Zimmer Femoral Nailing Solutions



Zimmer Osteonecrosis Intervention Implant

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- 2 Chapman MW, Bucholz R, Cornell C. Treatment of acute fractures with a collagen-calcium phosphate graft material: a randomized clinical trial. *J Bone Joint Surg (Am)*. 1997; 79:495-502.
- 3 LeGeros R. Biodegradation and bioresorption of calcium phosphate ceramics. *Clin Mater*, 1993; 14(1):65-88.
- 4 Data on file at Zimmer, Inc.
- 5 Betz RR. Limitations of autograft and allograft: new synthetic solutions. *Orthopedics*. May 2002; 25(5 Supp):S561-S570.

Manufacturer: Kensey Nash Corporation · Distributor: Zimmer, Inc.

Contact your Zimmer representative or visit us at www.zimmer.com

