Spine

SPINE
Solutions

COLLAGEN MATRIX
SCIENCE • TECHNOLOGY • INNOVATION

Science • Technology • Innovation

At Collagen Matrix we are passionate about advancing the science of tissue repair and regeneration. That's why we're the driving force in the design, development and manufacturing of advanced collagen and mineral based medical devices that support the body's natural ability to regenerate.

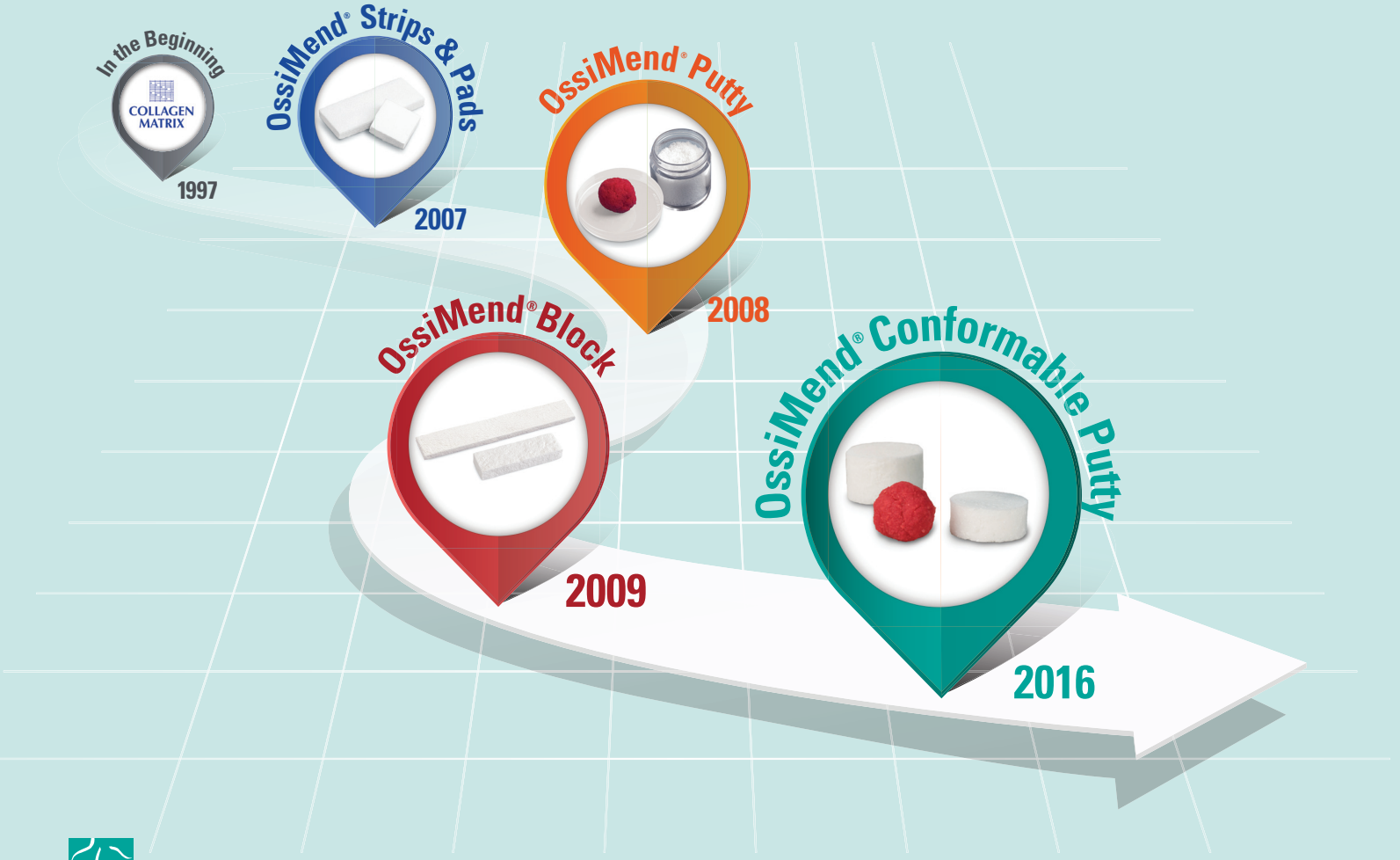
Over our 20 years of proven performance, we have focused our proprietary technologies and innovative products to meet clinical needs through five key business units – Dental, Spine, Orthopaedic, Dural Repair and Nerve Repair.

Proven Performance
Six Platform Technologies

We have developed six proprietary tissue engineering technologies to expand our broad line of collagen and mineral based medical device solutions.

T1 – Reconstituted Collagen
T2 – Intact Collagen
T3 – Natural Carbonate Apatite Mineral
T4 – Collagen and Mineral Composites
T5 – Collagen Coatings
T6 – Crosslinking

Evolution of **OssiMend®** Products



Why Use a Bone Graft Matrix?

Bone grafts provide a scaffold for the patient's body to grow new bone. A common use for bone grafts is in spinal fusion surgeries where two or more vertebrae are fused together. Spine surgeons also use bone grafts to stabilize a corrected spinal deformity or to repair spinal fractures.

7.5 million

Our products have helped patients worldwide with over 7.5 million medical devices that have been produced across all five key business units.

Innovative Biocomposite Solutions

We have developed a variety of collagen and mineral bone graft solutions that have a wide range of adjustable characteristics such as mineral-to-collagen ratios, pore structure, mineral size, handling and a diverse assortment of final product sizes, shapes and forms — from blocks, to strips, to putties that solve bone grafting challenges.

OssiMend® Portfolio of Bone Graft Products

Bone Graft Product	Composition	Form	BMA: Product Mixing Ratio	Handling Characteristics	Absorbency	Where to Use*
OssiMend® Block	80% Mineral 20% Collagen	Rectangular shaped blocks	1ml : 1cc	Compression Resistant, Flexible	Moderate	-Posterolateral gutters
OssiMend® Strips & Pads	55% Mineral 45% Collagen	Rectangular shaped strips & square shaped pads	1ml : 1cc	Conformable, Adaptable	High	-Posterolateral gutters
OssiMend® Putty	55% Mineral 45% Collagen	Granular powder	1ml : 1cc	Moldable	High	-Posterolateral gutters -Around surgical hardware -Vertebral body defects
OssiMend® Conformable Putty	55% Mineral 45% Collagen	Cylinder shaped pucks	1ml : 1cc	Moldable	High	-Posterolateral gutters -Around surgical hardware -Vertebral body defects

* See instructions for use of the products for specific indications.

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OssiMend® Biocomposites – Perfect Partnership

Our biocomposite bone graft matrices are a combination of two components that are derived from natural sources, highly purified bovine type I collagen and bovine anorganic carbonate apatite bone mineral.

When combined, they provide an optimal and successful scaffold to support the body's natural ability to regenerate new bone.

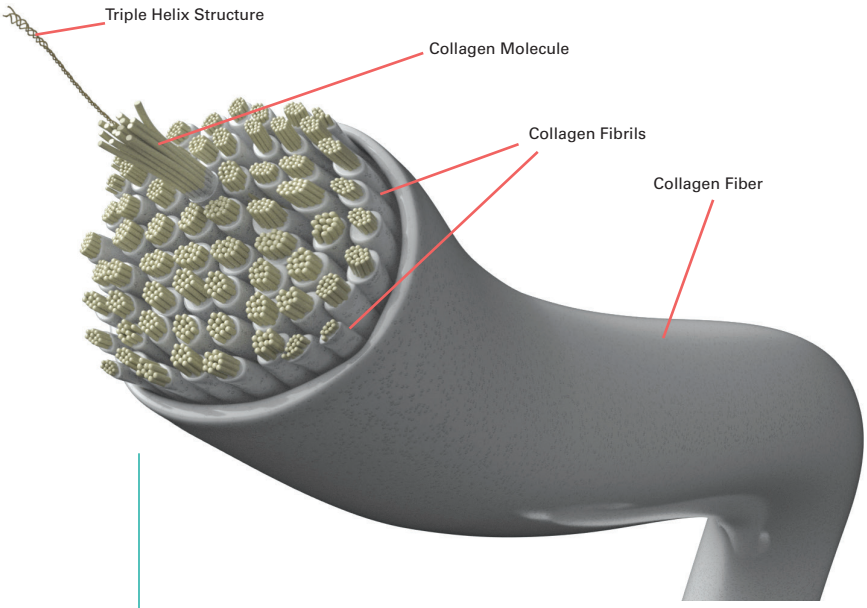
Collagen + **Mineral** = **Biocomposite Solutions**

OssiMend® Comprehensive Solutions

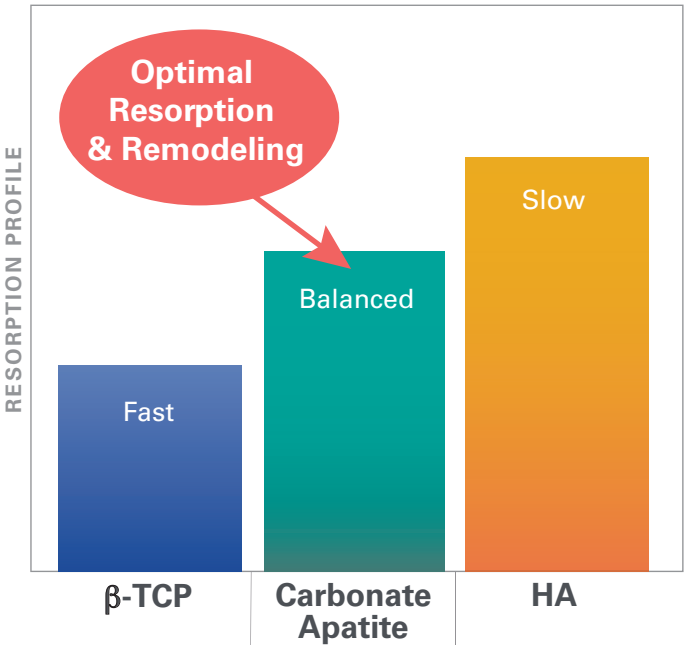
Why Type I Collagen?

Homologous Molecular Structure to Human Collagen[1]

- Highly purified for biocompatibility
- 100% resorbable through normal metabolic pathways[2]
- Easily absorbs and retains biological factors
- Intrinsic hemostatic properties control minor bleeding[2,3]
- Well-established long clinical history[2]
- Versatile for matrix engineering



Five Reasons Why Carbonate Apatite is Superior

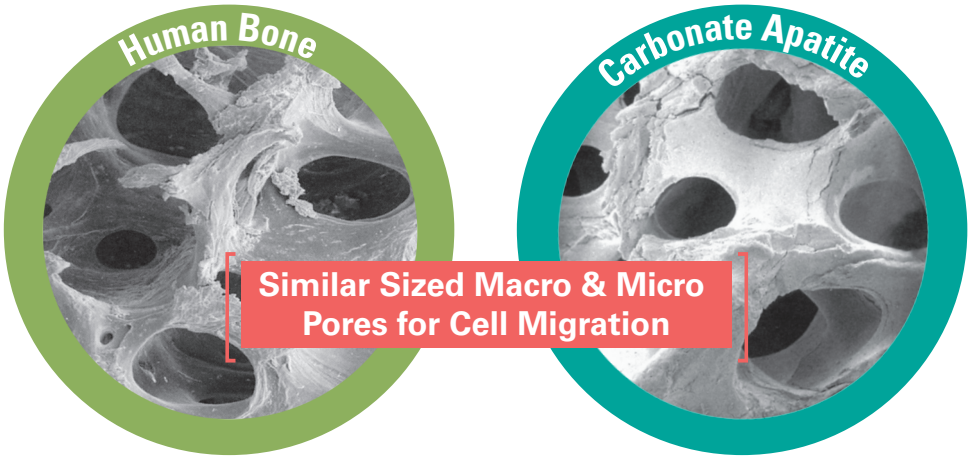


1 Optimal **Resorption & Remodeling**[5,6]

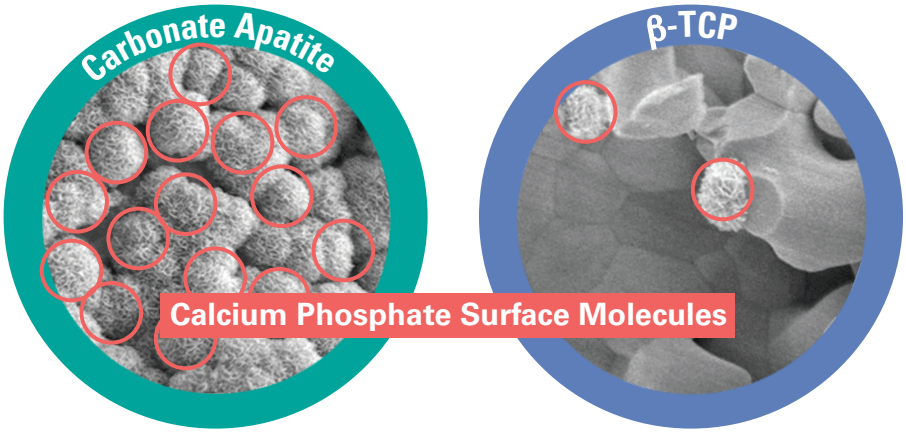
- Not fast like beta-tricalcium phosphate (β-TCP)
- Not slow like hydroxyapatite (HA)
- Ideally, the rate of the bone graft resorption is balanced to the rate of bone remodeling
- Carbonate apatite resorption and remodeling are similar to human bone[5,6]

2 **Natural Mineral Structure** Similar to Human Bone Mineral

- Pores provide pathways for cell migration and attachment to lay down new bone
- Carbonate apatite is a better osteoconductive material than HA[7]



3 More **Calcium Phosphate Deposition** than β-TCP[8]



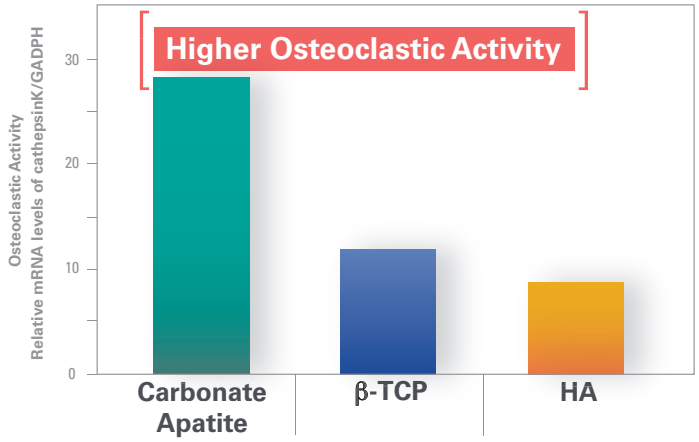
- More calcium phosphate molecules are deposited on a carbonate apatite surface than a β-TCP surface[8]
- Osteoblasts prefer attaching to calcium phosphate to lay down new bone

4 Half the Crystallinity than HA, **More Soluble**[9]

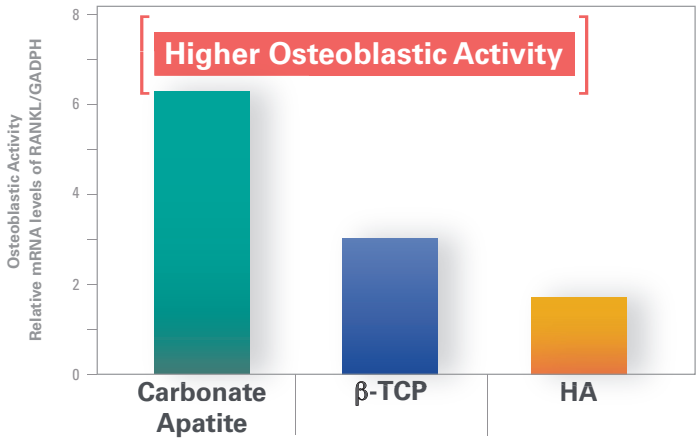
- Carbonate apatite has half the crystallinity than HA, which enables optimal resorption and remodeling because it more easily resorbs[9]

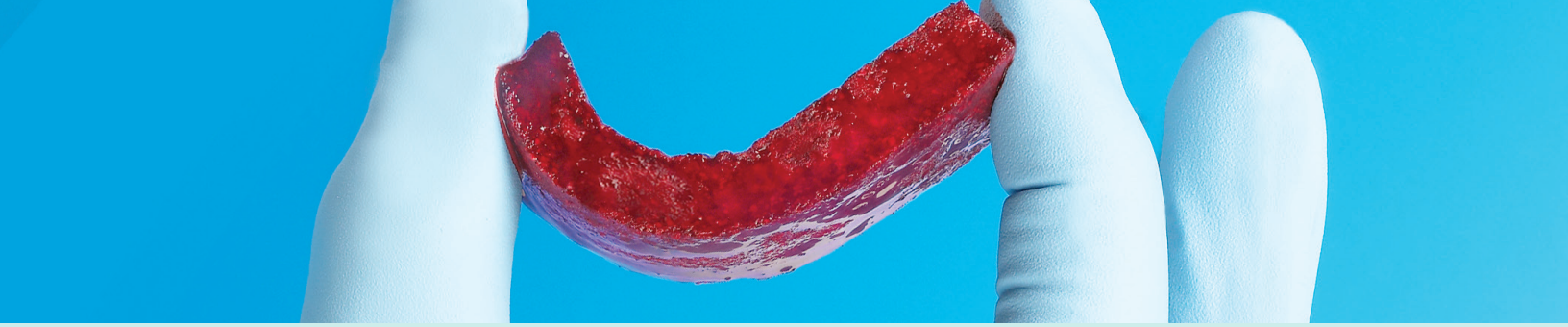
5 Independent Studies have shown Higher **Osteoclastic & Osteoblastic Activity** than β-TCP & HA[10]

- Osteoclasts break down bone
- Carbonate apatite shows higher levels of osteoclastic activity than β-TCP & HA[10]



- Osteoblasts secrete new bone
- Osteoblast proteins are most upregulated with carbonate apatite than β-TCP & HA[10]





OssiMend® Block

BONE GRAFT MATRIX

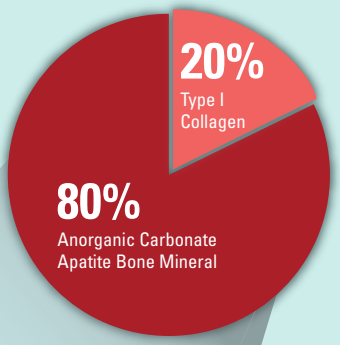
A mechanically strong, compression resistant biocomposite matrix that is easily cut and customized and is fully resorbed during bone remodeling. It is osteoconductive and when mixed with autogenous bone marrow becomes osteoinductive and osteogenic.

Compression resistant

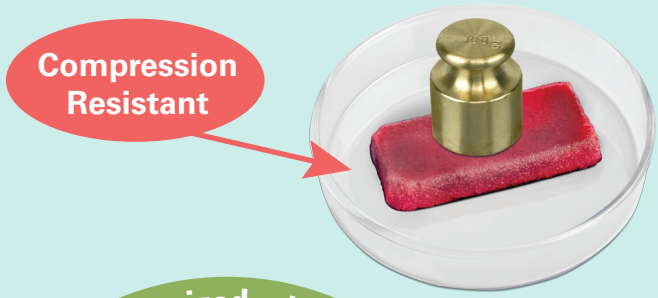
- High mechanical strength
- Retains integrity upon implantation

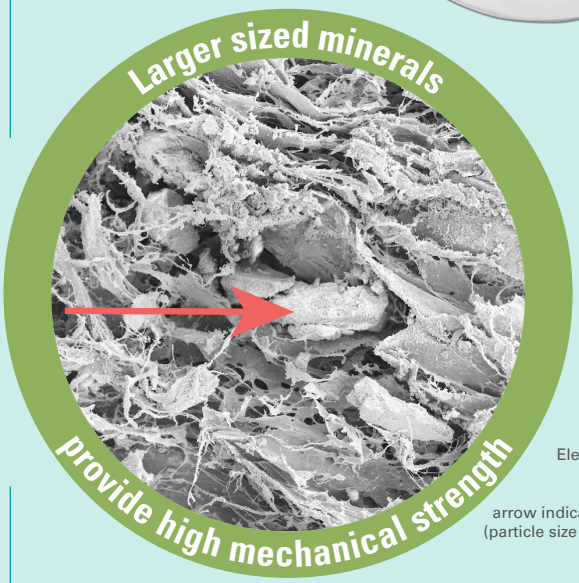
Optimal porosity

- 78% of pores are optimal size (100 - 400µm) for tissue regeneration[11]
- Retention of rich stem cells



See 5 Reasons Why Carbonate Apatite is Superior on Pages 6-7





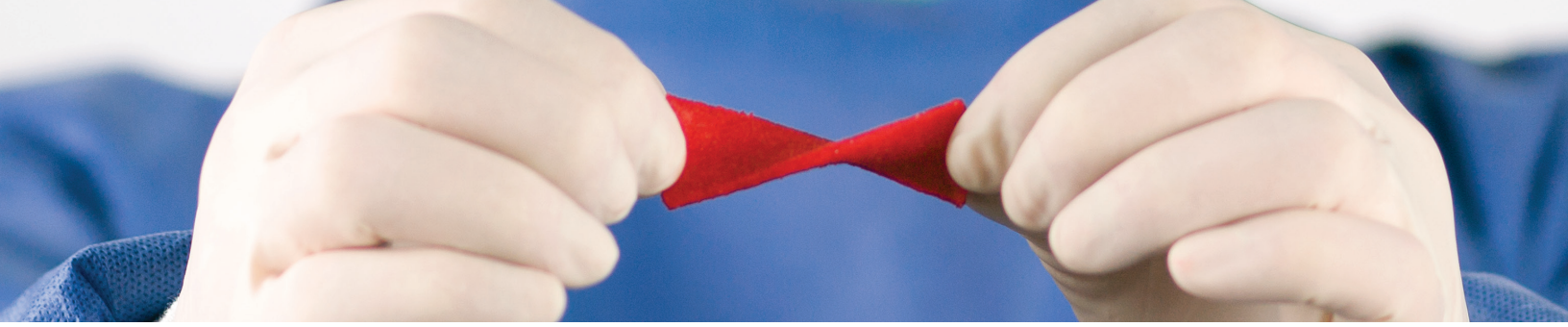
Scanning Electron Micrograph of OssiMend® Block magnification x50, arrow indicates mineral particle (particle size range 0.25-1.25mm)

Almost **2x more absorbent** than Vitoss® Foam Strip[11] –

- Delivers rich stem cells to injury site

	ABSORBENCY (ml/g)
OssiMend® Block	3.8 ± 0.2
Vitoss® Foam Strip	2.1 ± 0.1

Scan here to view product demo video



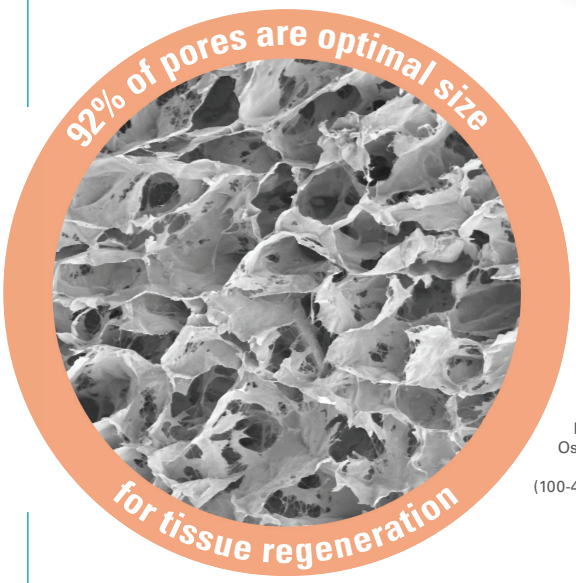
OssiMend® Strips & Pads

BONE GRAFT MATRIX

Highly absorbent and versatile biocomposite matrices that can be easily cut and sized in either the dry or hydrated state and are fully resorbed during bone remodeling. They are osteoconductive and when mixed with autogenous bone marrow become osteoinductive and osteogenic.

Excellent porosity & handling

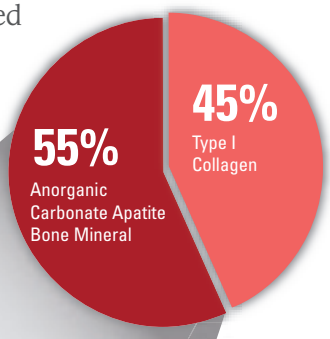
- 92% of pores are optimal size (100 - 400 µm) for tissue regeneration[11]
- Flexible when wet
- Retains integrity upon implantation



Scanning Electron Micrograph of OssiMend® Strips & Pads magnification x75 (100-400µm pore size range)

More than double the collagen than other leading brands

- 45% collagen, compared to 20% collagen which is typically found in other matrices
- Highly absorbent
- Retention of rich stem cells



See 5 Reasons Why Carbonate Apatite is Superior on Pages 6-7

Over **10x more absorbent** than Vitoss® Foam Strip[11] –

- Delivers rich stem cells to injury site

	ABSORBENCY (ml/g)
OssiMend® Strips & Pads	22.9 ± 1.7
Vitoss® Foam Strip	2.1 ± 0.1

Scan here to view product demo video

OssiMend® Putty

BONE GRAFT MATRIX

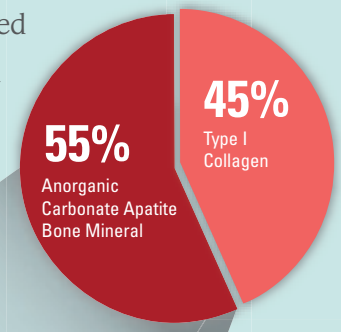
This highly absorbent and malleable biocomposite putty is available in a granular powder form and when hydrated with autogenous bone marrow is easily molded. It is fully resorbed during bone remodeling and is osteoconductive and when mixed with autogenous bone marrow becomes osteoinductive and osteogenic.

Versatile handling

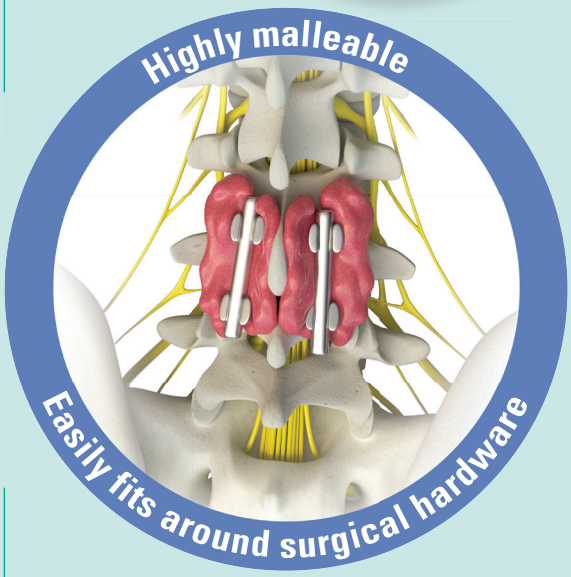
- Conveniently fills spine defects and can be used in conjunction with surgical hardware
- Molds into a paste, can be reshaped
- Easily mixes with stem cell rich osteoinductive components

More than double the collagen than other leading brands

- 45% collagen, compared to 20% collagen which is typically found in other matrices
- Highly absorbent
- Retention of rich stem cells



See 5 Reasons Why Carbonate Apatite is Superior on Pages 6-7



Almost **6x more absorbent** than Vitoss® Foam Strip[11] –

- Delivers rich stem cells to injury site

	ABSORBENCY (ml/g)
OssiMend® Putty	12.0 ± 0.1
Vitoss® Foam Strip	2.1 ± 0.1

Scan here to view product demo video

OssiMend® Conformable Putty

MOLDABLE BONE GRAFT MATRIX

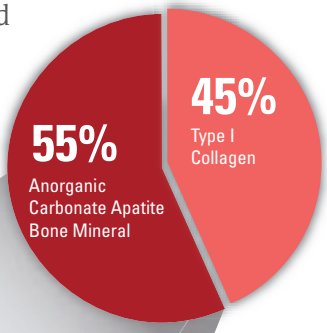
Offering more robust malleability than OssiMend® Putty, this highly absorbent moldable biocomposite putty is available in cylinder shaped pucks and when hydrated with autogenous bone marrow can be molded. It maintains its integrity upon post-surgical irrigation and is fully resorbed during bone formation and remodeling. It is osteoconductive and when mixed with autogenous bone marrow becomes osteoinductive and osteogenic.

Robust & cohesive handling

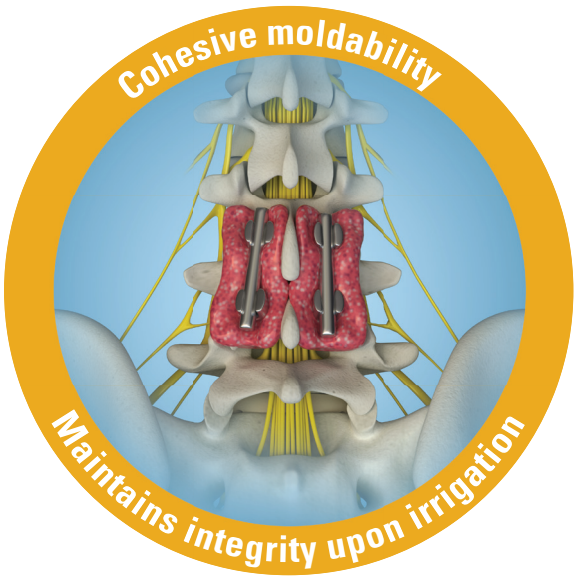
- Highly moldable to fit defect sites
- Larger mineral size provides stable handling
- Resistant to irrigation, does not wash away

More than double the collagen than other leading brands

- 45% collagen, compared to 20% collagen which is typically found in other matrices
- Highly absorbent
- Retention of rich stem cells



See 5 Reasons Why Carbonate Apatite is Superior on Pages 6-7



Over **4x more absorbent** than Vitoss® Foam Strip[11] –

- Delivers rich stem cells to injury site

	ABSORBENCY (ml/g)
OssiMend® Conformable Putty	9.1 ± 0.5
Vitoss® Foam Strip	2.1 ± 0.1

Scan here to view product demo video

OssiMend® Block

CATALOG NO.	DIMENSIONS			QUANTITY
	Length	Width	Thickness	
MCCB0524	6.25 cm	2 cm	0.4 cm	5 cc, 1 Block
MCCB10	6.25 cm	2 cm	0.8 cm	10 cc, 1 Block
MCCB20	6.25 cm	2 cm	0.8 cm	20 cc, 2 Blocks
MCCB0514	12.5 cm	1 cm	0.4 cm	5 cc, 1 Block
MCCB1004	12.5 cm	2 cm	0.4 cm	10 cc, 1 Block
MCCB2004	12.5 cm	2 cm	0.4 cm	20 cc, 2 Blocks

OssiMend® Strips & Pads

CATALOG NO.	DIMENSIONS			QUANTITY
	Length	Width	Thickness	
MCC2020-1	2 cm	2 cm	0.5 cm	2 cc, 1 Pad
MCC2020	2 cm	2 cm	0.5 cm	4 cc, 2 Pads
MCC2050	2 cm	5 cm	0.5 cm	10 cc, 2 Strips

OssiMend® Putty

CATALOG NO.	QUANTITY
MCCP02	2 cc Granular Powder
MCCP05	5 cc Granular Powder
MCCP10	10 cc Granular Powder

OssiMend® Conformable Putty

CATALOG NO.	QUANTITY
MCCPC25	2.5 cc Cylinder Shaped Puck
MCCPC50	5 cc Cylinder Shaped Puck

References:

1. Miller EJ. 1984. Chemistry of the Collagens and Their Distribution. Extracellular Matrix Biochemistry, KA Piez, AH Reddi (eds.). pp 41-82. Elsevier, New York, NY. 2. Li ST. 2000. Biologic Biomaterials: Tissue-Derived Biomaterials (Collagen). Biomedical Engineering Handbook, Second Edition. Vol. I, JD Bronzino (ed.), pp 42:1-23, CRC Press, Boca Raton, FL. 3. Jaffe R., Deykin DJ. 1974. Evidence for a Structural Requirement for the Aggregation of Platelet by Collagen. CI in Invest 53:875-883. 4. Ott S. (2003, October 21). *Collagen and Bone Matrix*. Retrieved from https://depts.washington.edu/ bonebio/ASBMRed/matrix.html 5. Matsuura A, Jubo T, Doi K, Hayashi K, Morita K, Toyota R, Hayashi H, Hirata I, Okazaki M, and Akagawa Y. 2009. Bone Formation Ability of Carbonate Apatite-Collagen Scaffolds with Different Carbonate Contents. Dental Materials Journal 28(2): 234-242. 6. Ellies LG, Carter JM, Natiella JR, Featherstone JDB, Nelson DGA. 1988. Quantitative Analysis of Early In Vivo Tissue Response to Synthetic Apatite Implants. J Biomed Mater Res 22:137-148. 7. Spense G., Patel N., Brooks R., Rushton N. 2009. Carbonate Substituted Hydroxyapatite: Resorption by Osteoclasts Modifies the Osteoblastic Response. Journal of Biomedical Materials Research Part A 217-224. 8. In vitro data on file at Collagen Matrix, Inc. 9. Li, S.T., Chen, H.C., Yuen, D, inventors; 2011 Sept. 29. Method of Preparing Porous Carbonate Apatite from Natural Bone. United States patent US 8,980,328. 10. Kanayama, K., Sriarj, W., Shimokawa, H., Ohya, K., Doi, Y., Shibutani, T. 2011. Osteoclast and Osteoblast Activities on Carbonate Apatite Plates in Cell Cultures. J Biomater Appl 2011 26:435-436. 11. Data on file at Collagen Matrix, Inc.

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