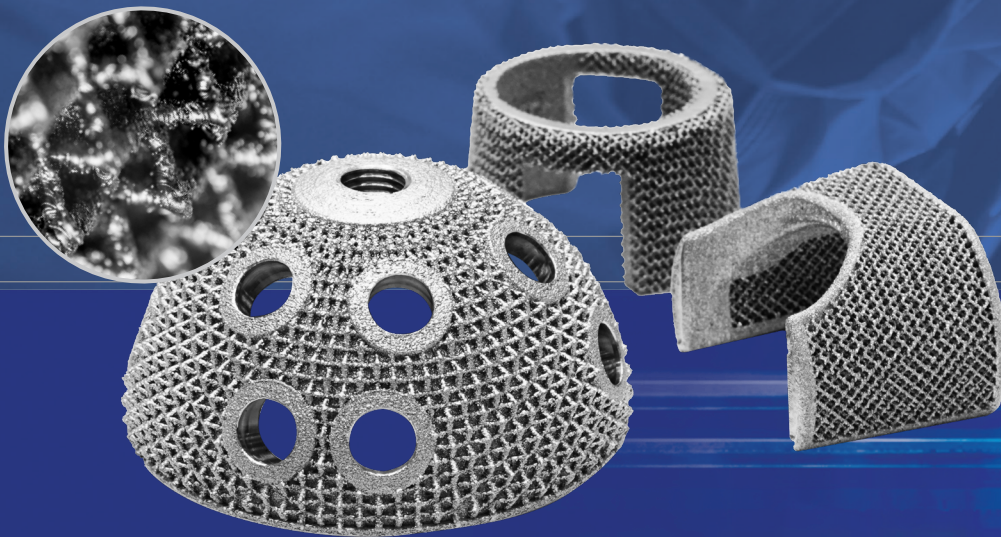


3D Metal

FINELY ENGINEERED FOR BONE



Brochure

Joint

Spine

Sports Med

3D Metal

3D Metal is a state-of-the-art **advanced biomaterial structure** that is **finely engineered for the bone**. It is made of Titanium alloy (Ti6Al4V), and it is obtained by means of 3D printing technology, an innovative **one-step layer-by-layer** additive manufacturing process (not a coating). This advanced technology allows for designing **engineered 3D structures** starting from a **CAD model** in a **precise, predictable** and **reproducible** manner.

3D Metal can be particularly useful for optimizing implant performance, thus allowing for **effectively managing challenging clinical scenarios**, such as **demanding bone conditions, active patients** and cases of **bone defects or bone loss**.

1

**MAXIMIZED
INITIAL
STABILITY**

2

**STRUCTURAL
AND FUNCTIONAL
CONNECTION
WITH THE BONE**

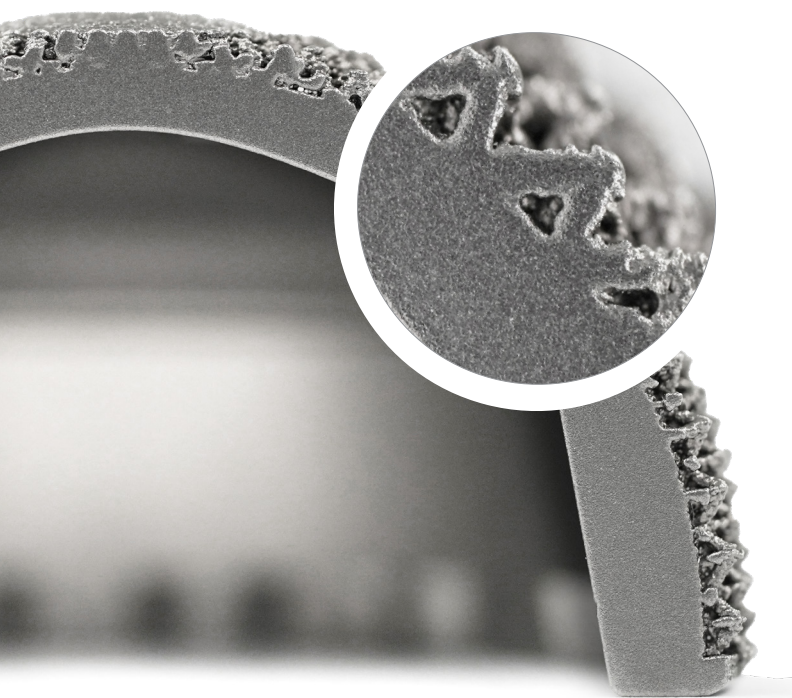
3

**UNPARALLELED
VERSATILITY**

1

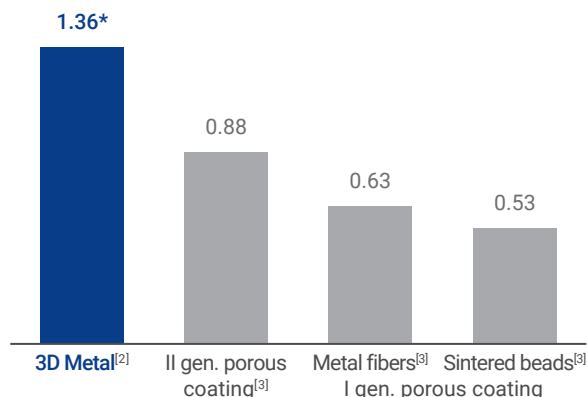
MAXIMIZED INITIAL STABILITY

Primary stability is crucial for implant performance following a joint replacement procedure. 3D Metal implants are characterized by an outer surface with **intrinsic high friction** and scratch-fit to obtain **superior primary stability**. A significant measure of the initial stability is the **coefficient of friction**.^[1]



3D Metal®

Friction coefficient: **1.36*** ^[2]

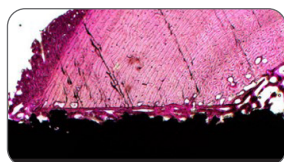


* Tests performed on the reinforced pyramid structure.

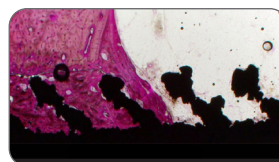
FINELY ENGINEERED FOR BONE

2 STRUCTURAL AND FUNCTIONAL CONNECTION WITH BONE

Specific parameters of the **3D Metal porous structure** can be designed and controlled, such as **pore size** and **porosity**. These two parameters are crucial to obtaining an efficient biological fixation.^[1]



**ROUGHENED SURFACES:
BONE ON-GROWTH**
Cells grow on the device's **outer surface only**.



**POROUS STRUCTURES:
BONE IN-GROWTH**
Cells **penetrate** the 3D structure. The more pores are **interconnected**, the more **cell penetration** is effective.

3D Metal features porous structure parameters in line with the **commonly accepted parameters**.^[4]

	Pore size	Porosity
For effective bone in-growth ^[4]	100 - 1000µm	50 - 90%
3D Metal	450 - 900µm*	65 - 80%*

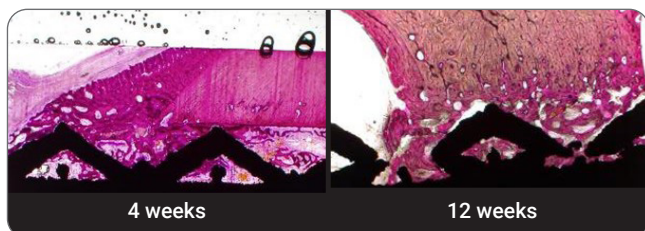
*depending on specific net structure and device analyzed region

ANIMAL STUDY EVALUATION

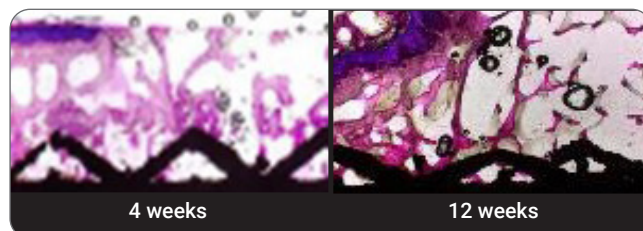
The **efficient connection with the bone** of the 3D Metal structures has been validated by means of an **animal study in young sheep**.^[2]

Histological analysis (both from cortical and cancellous sites) showed **both on-growth and in-growth** starting from the first time-point (4 weeks) with no fibrous tissue interposition, demonstrating an **early and effective bone integration**.

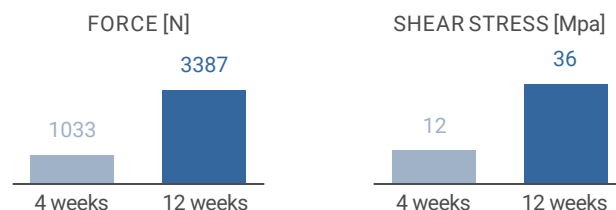
CORTICAL SITES



CANCELLOUS SITES



Mechanical parameters at the 3D Metal samples-bone interface during the extraction phase were recorded. The performed mechanical tests showed a **strong sample connection to the bone** already at 4 weeks, further increasing at 12 weeks after implantation.



Mechanical parameters related to 3D Metal samples (as an example)

Sample topographical characterization has been performed through optical microscopy and SEM. **Precision** and **reproducibility** are clear in the registered images for both **pyramid** and **honeycomb** structures.

PYRAMID STRUCTURE



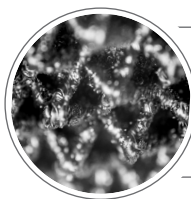
HONEYCOMB STRUCTURE



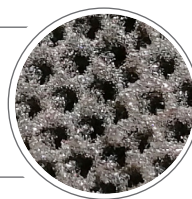
3D Metal

3 UNPARALLELED VERSATILITY: ONE TECHNOLOGY, MULTIPLE OPTIONS

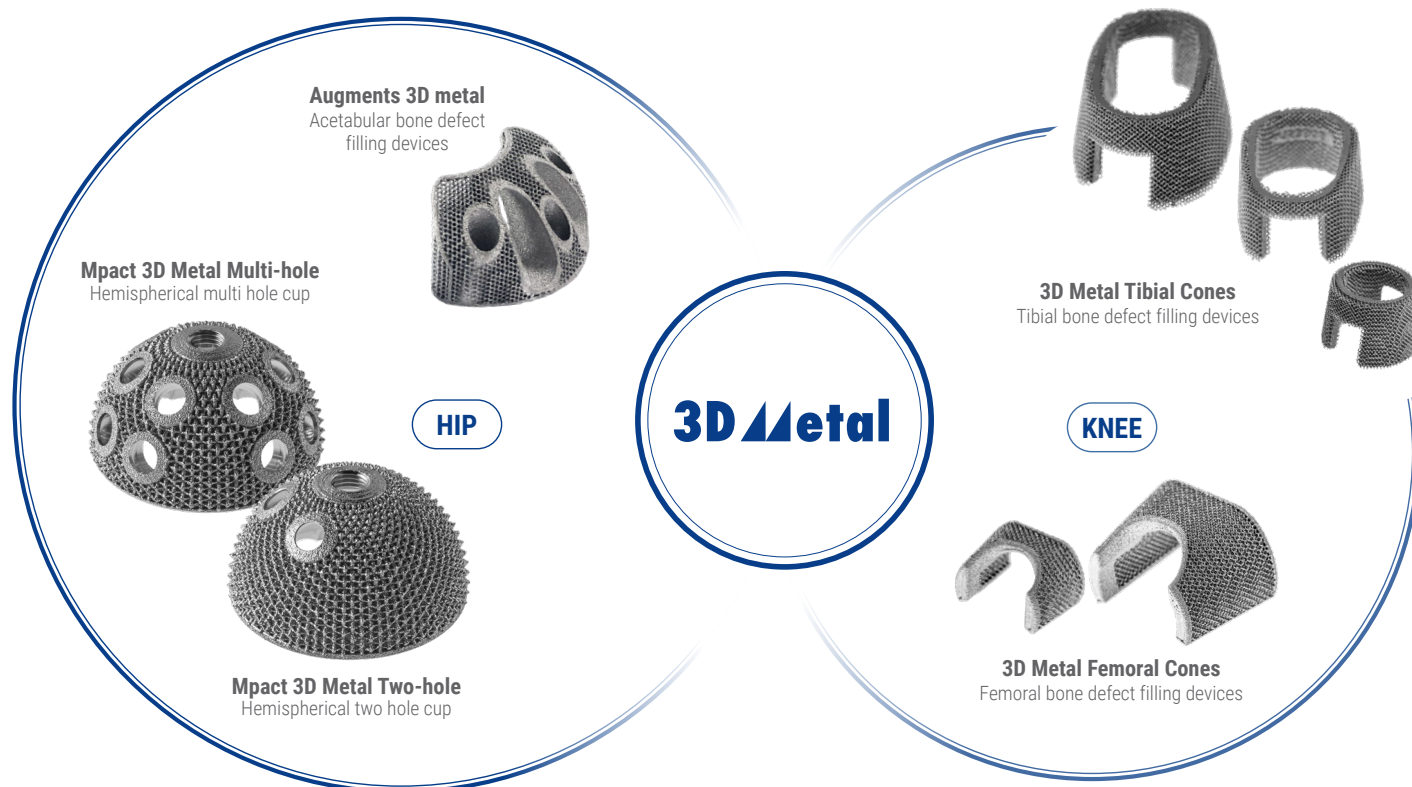
By means of a **SINGLE technology** it is possible to design and manufacture **different advanced net structures** which, applied to **different products** across the **entire Medacta's joint replacement portfolio**, allow the surgeon to **effectively face most clinical cases** (from **standard primary** to **complex revision surgeries**).



REINFORCED PYRAMID STRUCTURE
Enhanced grip for maximized primary stability and structural properties



HONEYCOMB STRUCTURE
Optimized pores interconnection, supporting structural connection with bone



REFERENCES

- [1] T. R. Shultz, J. D. Blaha, T. A. Gruen, T. L. Norman. *Cortical Bone Viscoelasticity and Fixation Strength of Press-Fit Femoral Stems: A Finite Element Model*. *Journal of Biomechanical Engineering* 2006; 128: 7-12
- [2] Medacta: data on file
- [3] B. Levine. *A New Era in Porous Metals: Applications in Orthopaedics*. *Advanced Engineering Materials* 2008; 10, No. 9
- [4] L. Dall'Ava, H. Hothi, J. Henckel, A. Di Laura, P. Shearing, A. Hart. *Comparative analysis of current 3D printed acetabular titanium implants*. *3D Printing in Medicine* 2019; 5:15

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