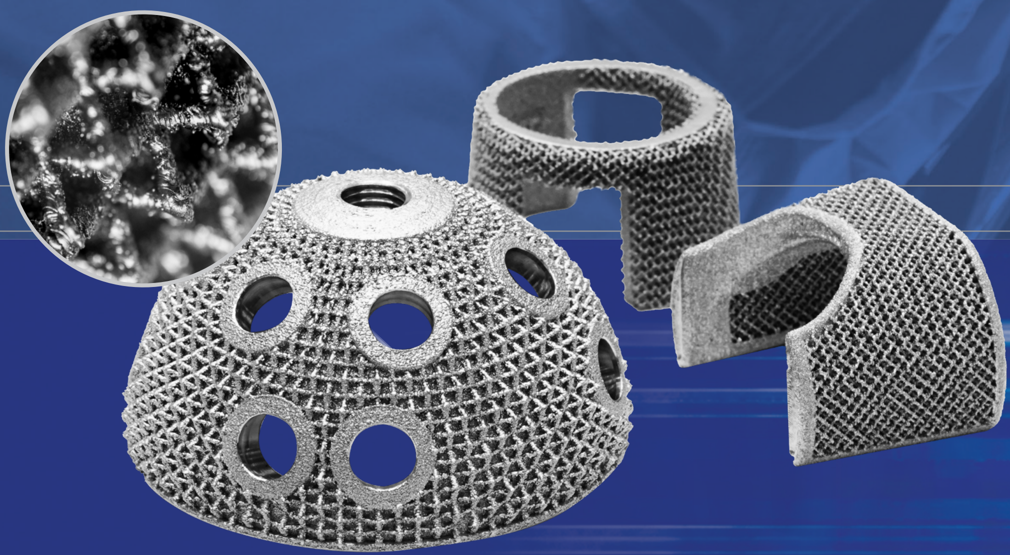
3D Metal®

FINELY ENGINEERED FOR BONE



Brochure

Joint | Spine | Sports Med

Medacta International

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**.

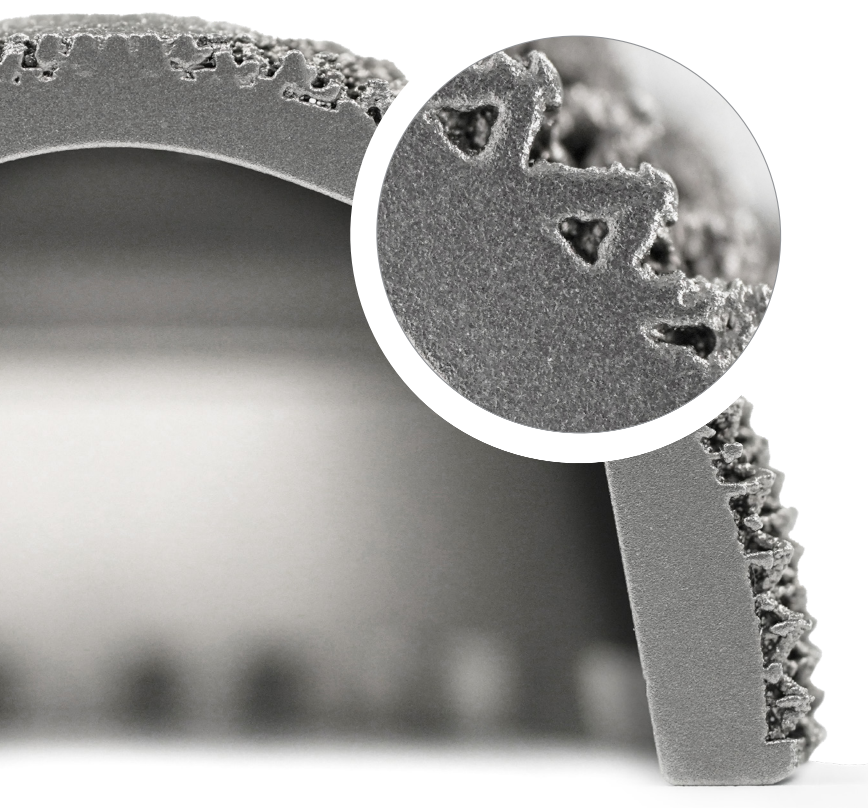
1 MAXIMIZED INITIAL STABILITY

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]



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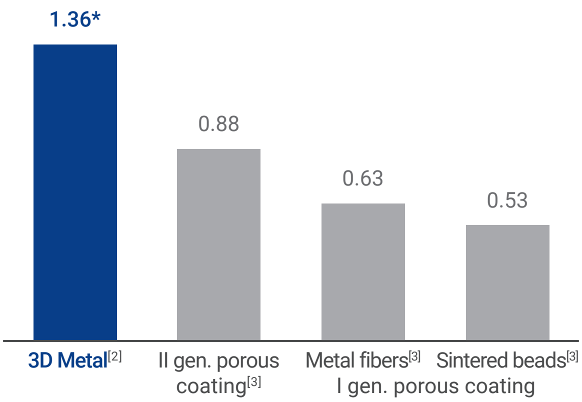
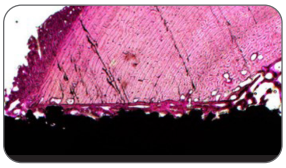
Friction coefficient: **1.36*** [2]



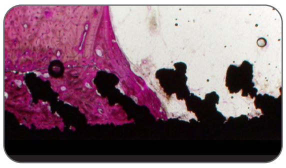
** Tests performed on the reinforced pyramid structure.*

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%*

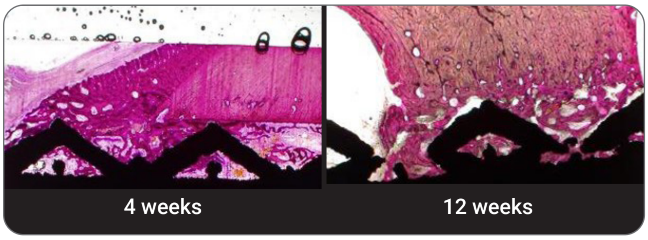
*depending on specific net structure and device analyzed region

ANIMAL STUDY EVALUATION

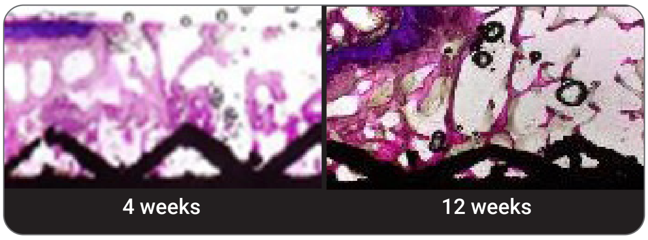
The **efficient connection with the bone** of the 3D Metal structures has been validated by means of an **animal study in young sheep**.[2]

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**.

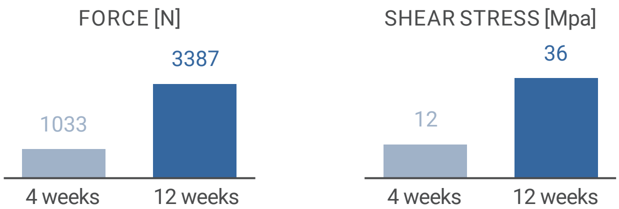
CORTICAL SITES



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.

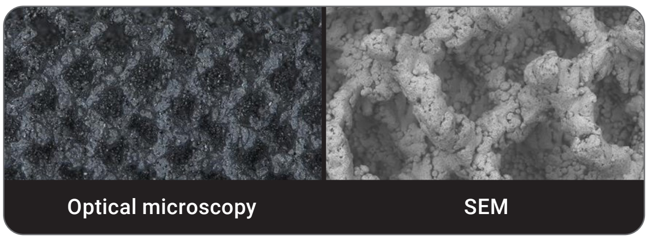


Mechanical parameters related to 3D Metal samples (as an example)

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

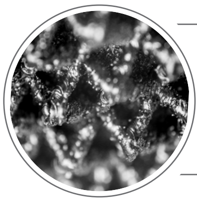
HONEYCOMB STRUCTURE



3D Metal®

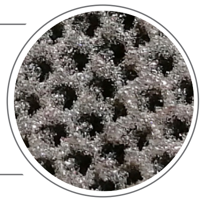
3 UNPARALLELED VERSATILITY: ONE TECHNOLOGY, MULTIPLE OPTIONS

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



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[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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