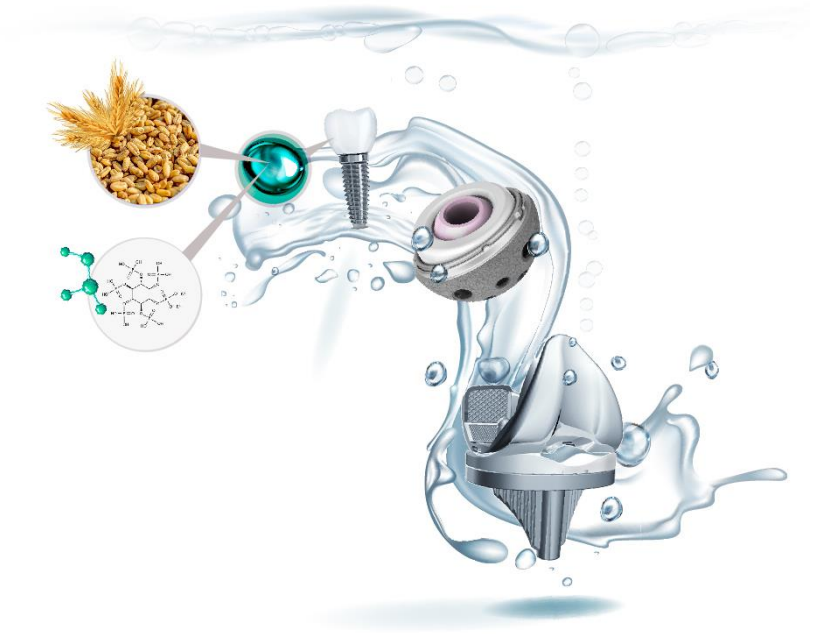
NuMat Medtech

NM_977 SURFACE



SURFACE TECHNOLOGIES ADDRESSED TO DENTAL AND ORTHOPEDIC MARKETS

A. Background

Myo-inositol hexakisphosphate, also called **phytic acid, or phytate (IP6),** is a natural molecule abundant in **plant seeds and grains**. It inhibits the crystallization of calcium salts in body fluids and has been widely studied to prevent and **therapeutically treat calcification disorders in soft tissues.**

IP6 acts as an **inhibitor of bone resorption**. It is adsorbed on the surface of hydroxyapatite crystals, the mineral constituent of the bone matrix, inhibiting its dissolution and decreasing the progressive loss of bone mass in osteoporotic animal models. IP6 has been reported to inhibit osteoclastogenesis (the bone resorption process) in vitro **without impairing growth and differentiation of cells to osteoblasts**.

Polyphosphates have also shown interesting antimicrobial effects, inhibiting the growth of several gram-positive and gram-negative bacteria and have also been described as antioxidants.

B. Aim

Permanent implant failures are mainly associated either to a poor osseointegration around the implant, or to the occurrence of infection procedures that can lead to implant loss.

NuMat Medtech has developed a coating based on phytate linked to the surface with the following characteristics:

- Robust and **easy wet chemistry** production method.
- **Stable**.
- Actively enhances **implant osseointegration**.
- Decrease on bacterial adhesion, thus **diminishing the risk of infection**.

NuMat Medtech aims to demonstrate that these two last features of the IP6-coated implants can decrease implant failure risk and extend the implant lifetime.

C. How?

Phytate-modified titanium surfaces **retain the osteoconductive properties** of titanium while **adding other bioactivities**:

- ✓ Decrease of inflammation Antibacterial effect:
  - **Decrease bacterial adhesion**
  - **Decrease in biofilm formation**
- ✓ **Osteogenic** potential

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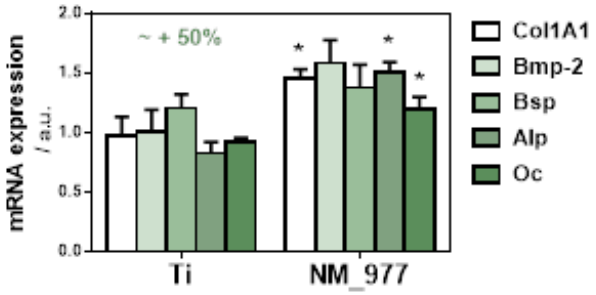
The coating process based on wet chemistry is robust, reproducible and simple, and can be applied to any 2D and 3D implants having as a result a non-cytotoxic and stable coating.

D. What do we know so far?

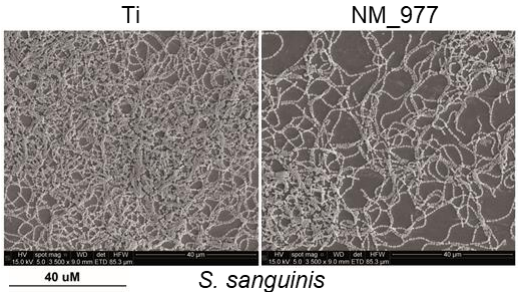
- Ti-IP6 surfaces were **not cytotoxic** for osteoblastic MC3T3 cells

- **Bone formation:** osteogenic potential due to induced mRNA expression levels of osteogenic markers

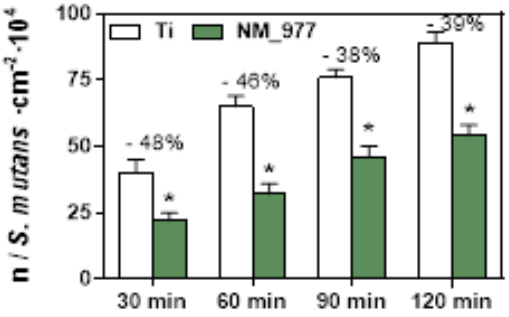


- Antibacterial effect:

✓ The **adhesion and biofilm** viability of S. mutans and S. sanguinis was **decreased** without bactericidal effect



✓ The colony-forming units of E. coli formed in agreement with the **ISO 22196:2011** were within the threshold to consider the coating to have an **antibacterial activity**.



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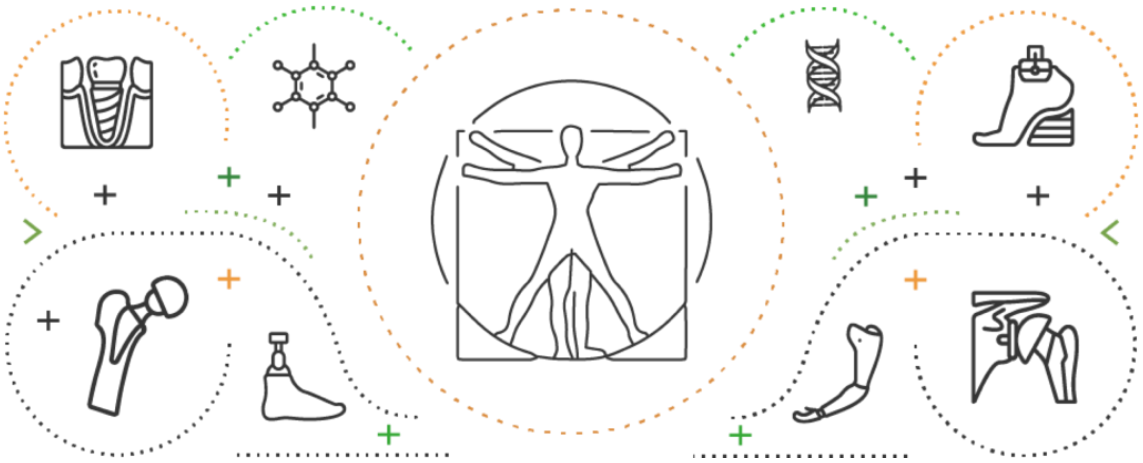
E. Publications

• Córdoba, A.; et al. (2016). Direct Covalent Grafting of Phytate to Titanium Surfaces through Ti–O–P Bonding Shows Bone Stimulating Surface Properties and Decreased Bacterial Adhesion. *ACS Applied Materials & Interfaces 8 (18): 11326-11335.*

• Arriero, M. M. ; et al. (2012). Inositol hexakisphosphate inhibits osteoclastogenesis on RAW 264.7 cells and human primary osteoclasts. *Plos One 7 (8): e43187*

• Arriero, M. M. ; et al. (2012). Differential response of MC3T3-E1 and human mesenchymal stem cells to inositol hexakisphosphate. *Cellular Physiology and Biochemistry 30 (4): 974-986*



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