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# Osteoblast Response to Hydroxyapatite-Functionalized Titanium-Based Implants: A Systematic Review



Marzena Dominiak<sup>1</sup>, Julia Kensy<sup>2</sup>, Paweł Kubasiewicz-Ross<sup>1</sup>, Jacek Matys<sup>1</sup>

<sup>1</sup> Department of Dental Surgery, Faculty of Dentistry, Wrocław Medical University, Krakowska 26, 50-425 Wrocław, Poland;

<sup>2</sup> Department of Pediatric Dentistry and Preclinical Dentistry, Wrocław Medical University, Krakowska 26, 50-425 Wrocław, Poland

Corresponding/presenting author: Julia Kensy  
julia.kensy@student.umw.edu.pl



## OBJECTIVES

To systematically evaluate the effects of hydroxyapatite (HA) coatings and their functional modifications on:



Osteoblast response



Osseointegration



Implant biocompatibility



## METHODS



Databases:  
PubMed, Web of Science,  
Embase, Scopus



Search strategy:  
"titanium AND osteoblasts  
AND hydroxyapatite"



PRISMA guidelines  
followed

## STUDY SELECTION – PRISMA FLOW



2,016

records identified  
through database  
searching



1,273

records after  
duplicate removal  
and screened



34

full-text articles  
assessed for  
eligibility



34

studies included  
in qualitative  
synthesis

## KEY RESULTS

### nHA COATINGS vs. UNCOATED IMPLANTS



↑ Osteoblast adhesion



↑ Proliferation



↑ Differentiation



↑ Mineralization



↑ Osseointegration

### FUNCTIONALIZED nHA COATINGS

Studies investigated coatings incorporating:



Collagen



Chitosan



Gelatin



Silver  
nanoparticles



Magnesium  
nanoparticles



Alliin

- ✓ Improved bioactivity
- ✓ Enhanced osteogenic responses
- ✓ Antibacterial properties
- ✓ Favorable biocompatibility

### NOTES

The observed effects varied depending on:



Coating composition



Fabrication technique

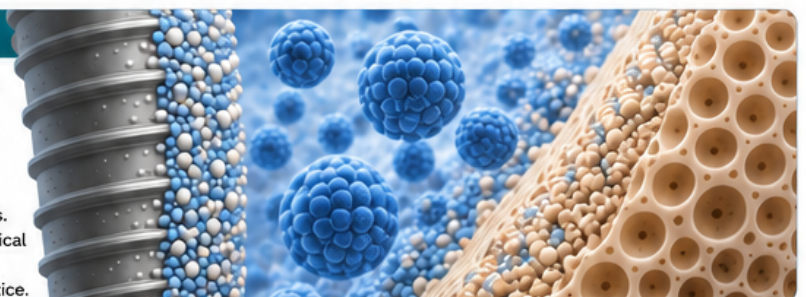


Experimental model

## CONCLUSIONS



Hydroxyapatite coatings and their functional modifications represent a promising strategy to enhance the biological performance of titanium-based implants by promoting osteoblast activity and osseointegration. Incorporating bioactive compounds may further improve implant integration and reduce the risk of biological complications. Standardized experimental studies and well-designed clinical trials are needed to identify the most effective coating compositions and translate them into routine clinical practice.



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