



A Novel Bioactive Glass Implant Surface Installed in Low-density Bone: An In Vivo Study in Healthy and Diabetic Rabbits

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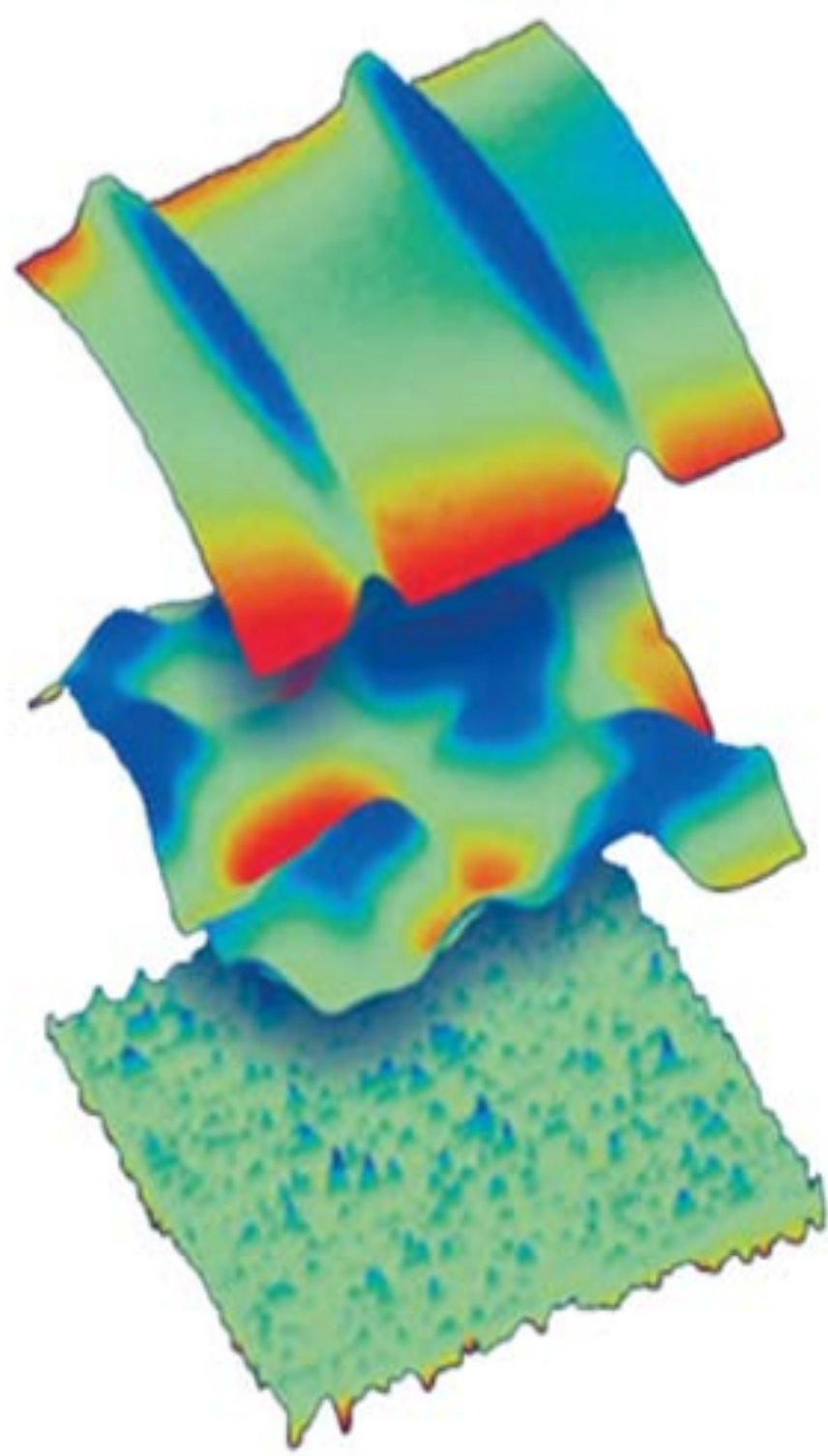
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Introduction

OSSEOINTEGRATION:

- implant design
- **physicochemical properties of the surface**
- bone quality
- patient conditions
- surgical techniques



Most failures of dental implants occur during the osseointegration phase, and the systemic conditions of the patients, such as Diabetes Mellitus (DM) have an important impact on this process, these events impact bone formation and osseointegration.

Aim

This study aimed to investigate the influence of a novel composition of bioactive glass coated on dental implants and installed in the low-density bone of diabetic and healthy rabbits

Bioactive glasses are highly active materials that can induce the upregulation of osteoblasts proliferation and differentiation resulting in a biologically active bone on their surface.



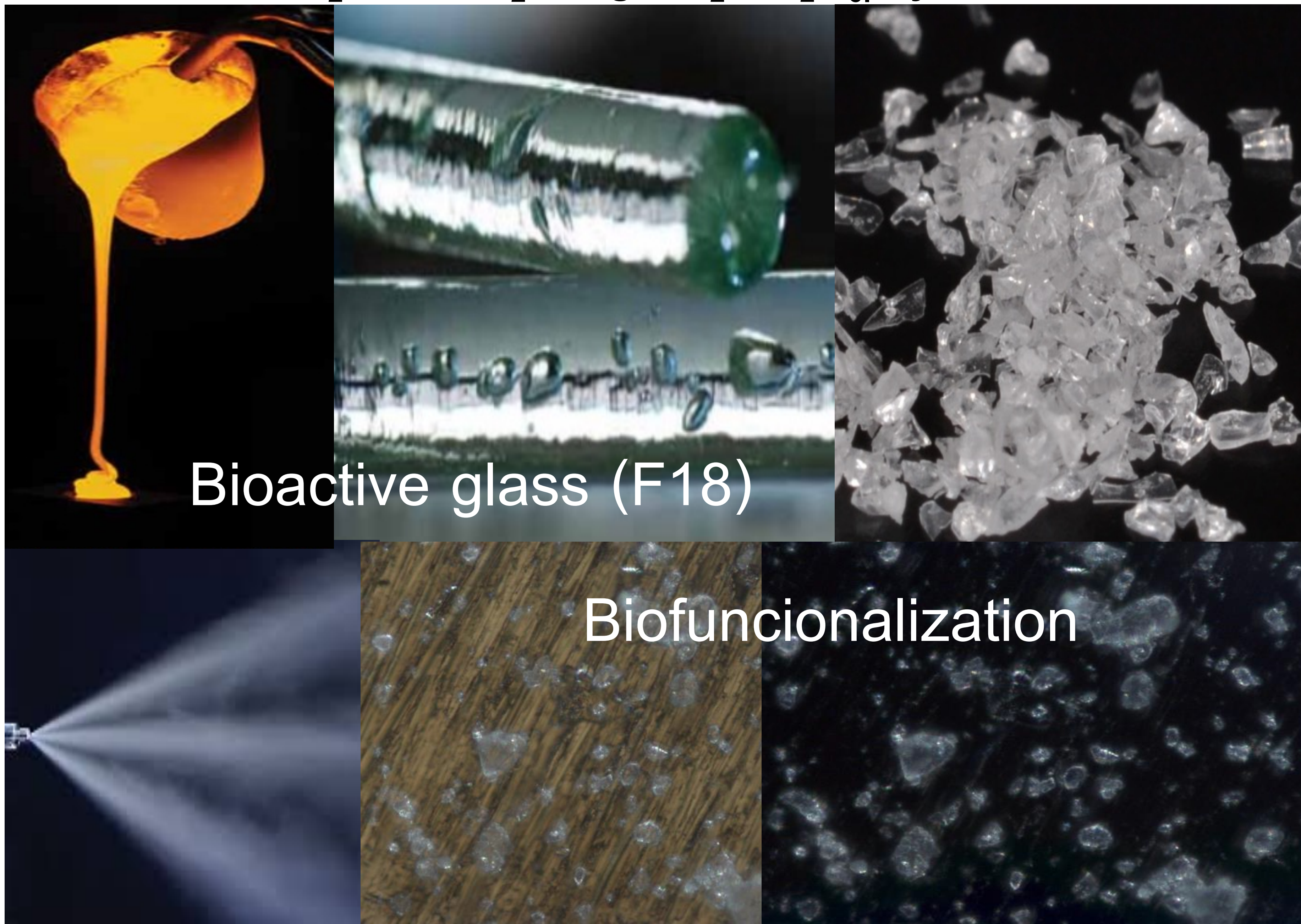
UFSCAr, Brazil
Zanotto Lab

Peitl et al., 2012; Souza et al., 2014; Soares et al., 2018

A new bioglass (**BSF18**) protected by patent was developed to improve and accelerate the osseointegration response.

Biofuncionalization with bioactive glass F18 into surfaces

SiO₂-CaO-Na₂O-MgO-K₂O-P₂O₅ system



Bioactive glass (F18)

Biofuncionalization

Biofuncionalization with bioglass particles (SiO₂-Na₂O-K₂O-MgO-CaO-P₂O₅ system) through the pneumatic atomization technique (50 µm) – **Patent 2014 003817 5 (Brazil)**
Vitreous Materials Laboratory, UFSCar

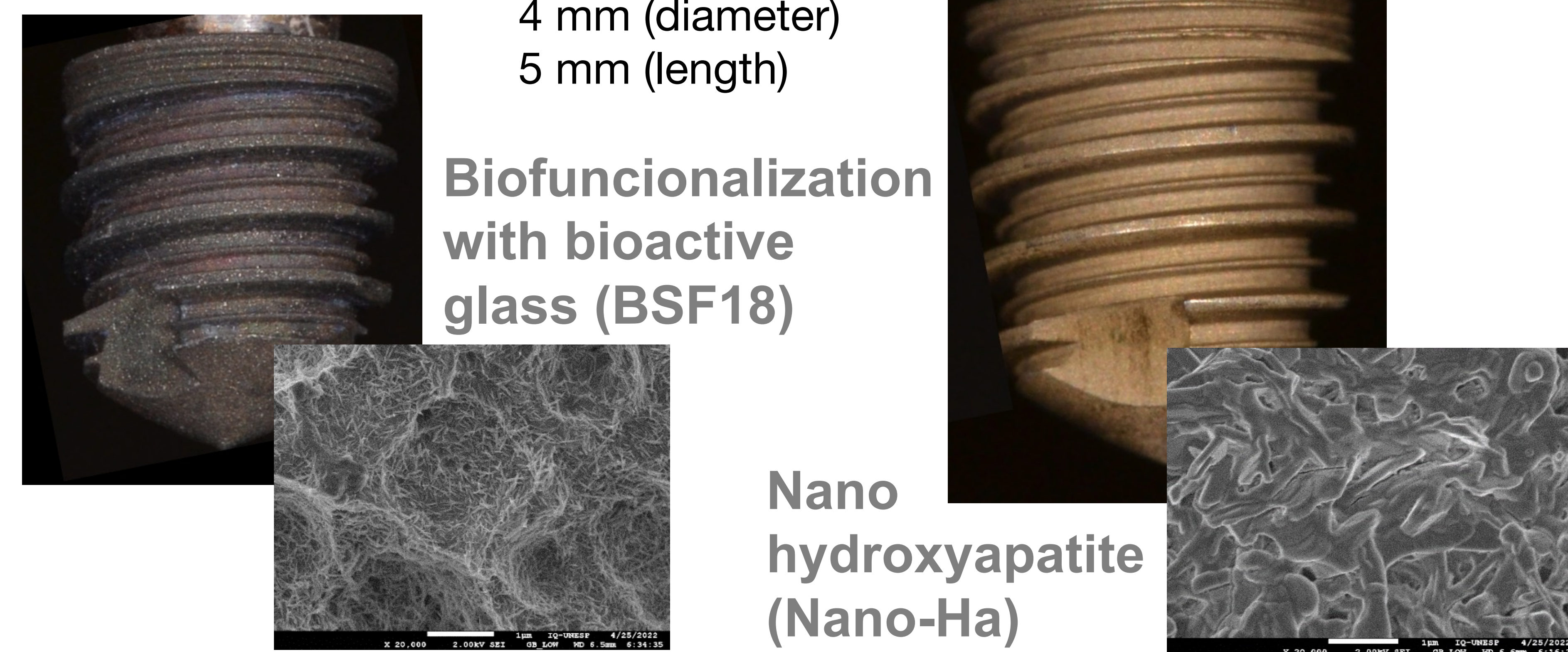
Open question (?)

diabetic patients

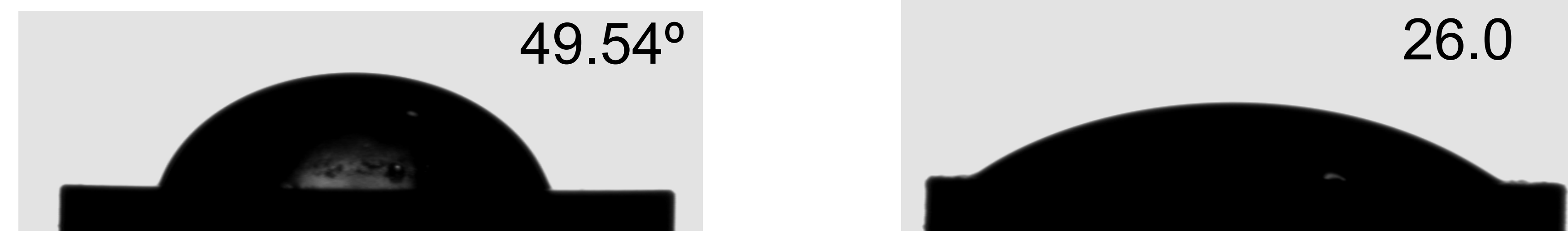
poor quality of bone

Material and Methods

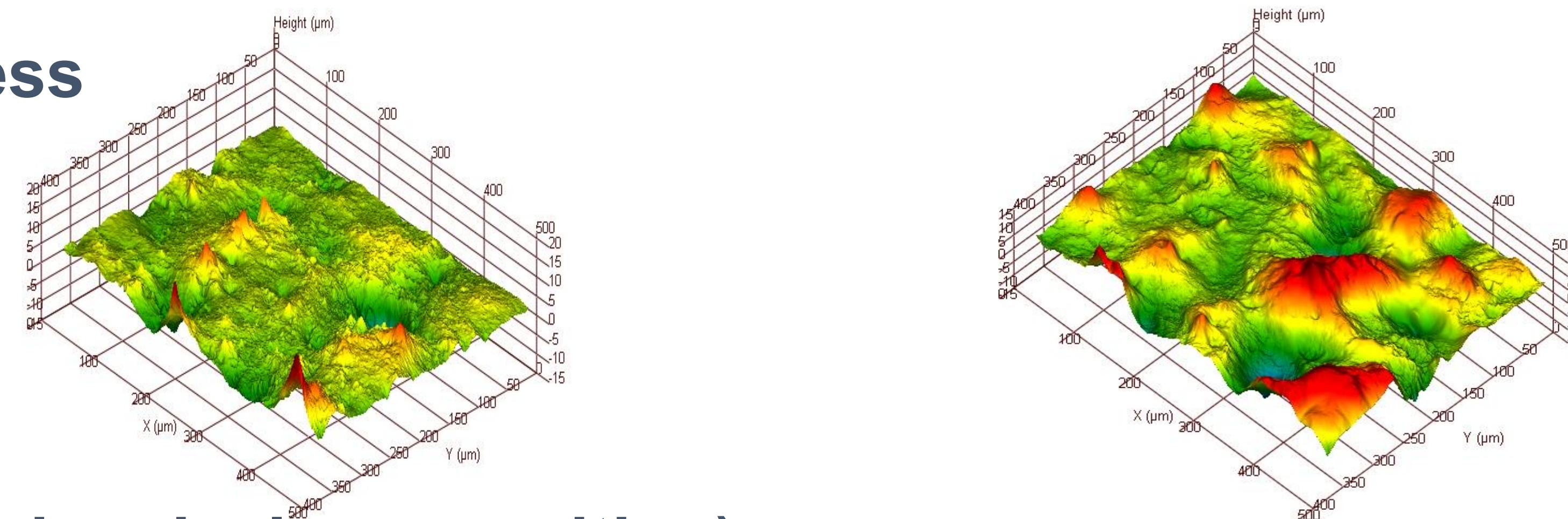
Physical-chemical properties of dental implants



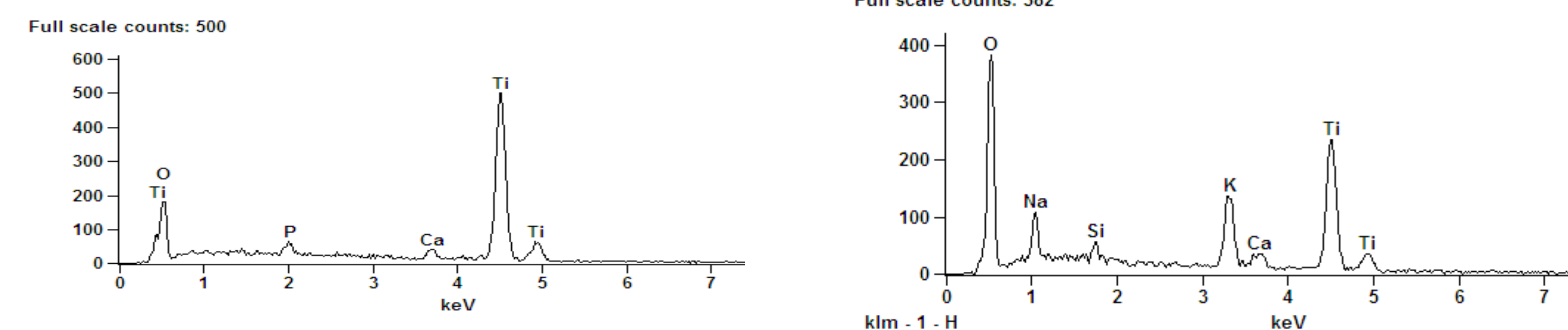
Wettability



Roughness



EDS (% chemical composition)



Diabetes Mellitus Type I induction

Diabetic animals:

Intravenous injection of Alloxan (105 mg/kg)

- Fasting 12 hours
- 5% glucose solution
- Criteria: >300 mg/dL

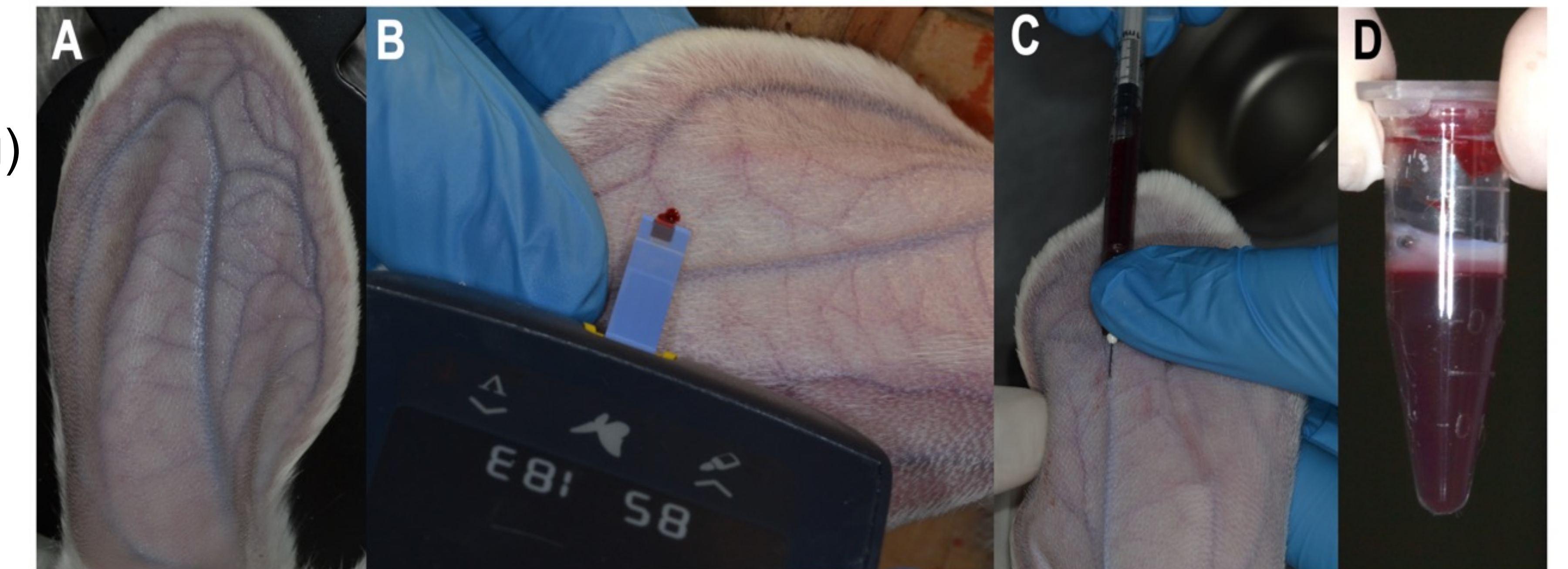
Healthy animals:

Saline Solution

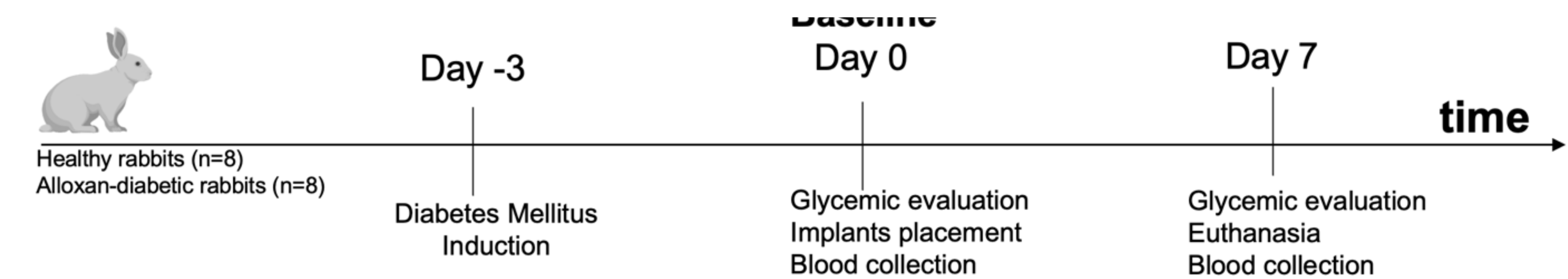
- Criteria: 75 mg/dL to 155 mg/dL



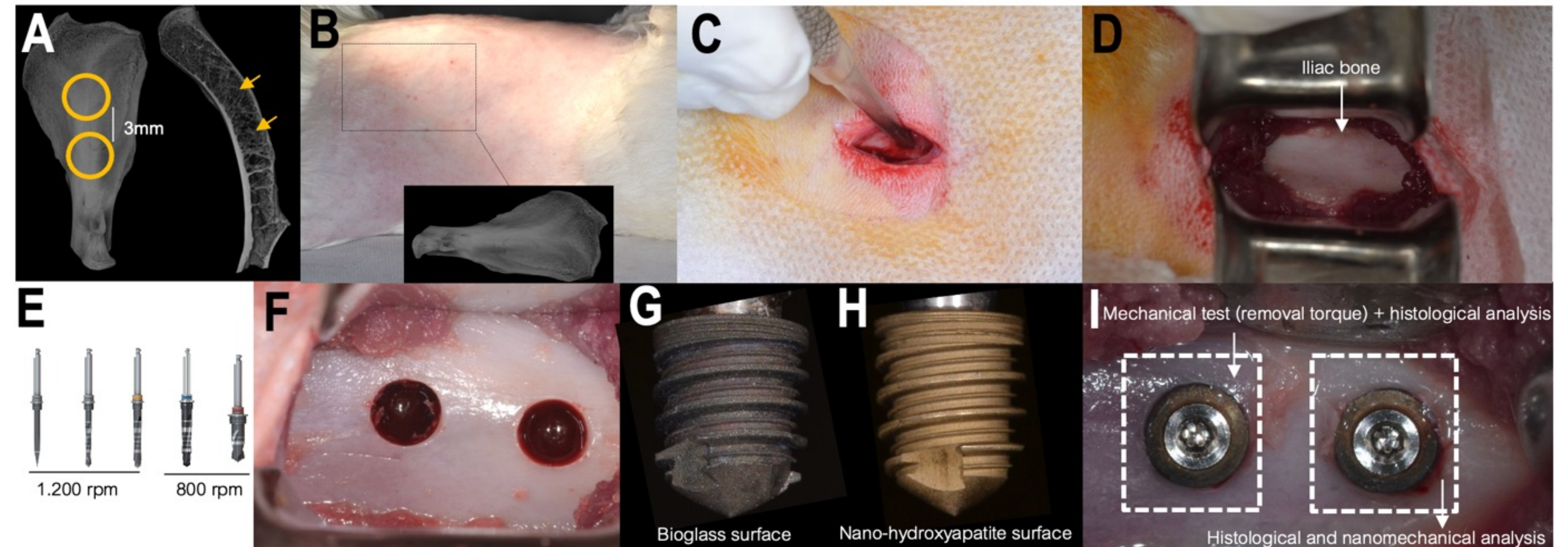
Healthy rabbits (n=8)
Alloxan-diabetic rabbits (n=8)



Blood evaluation

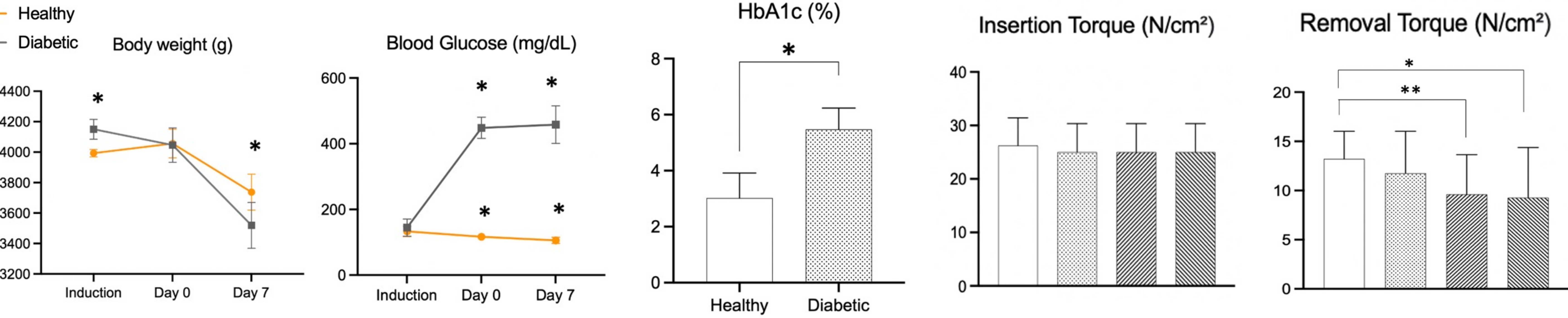
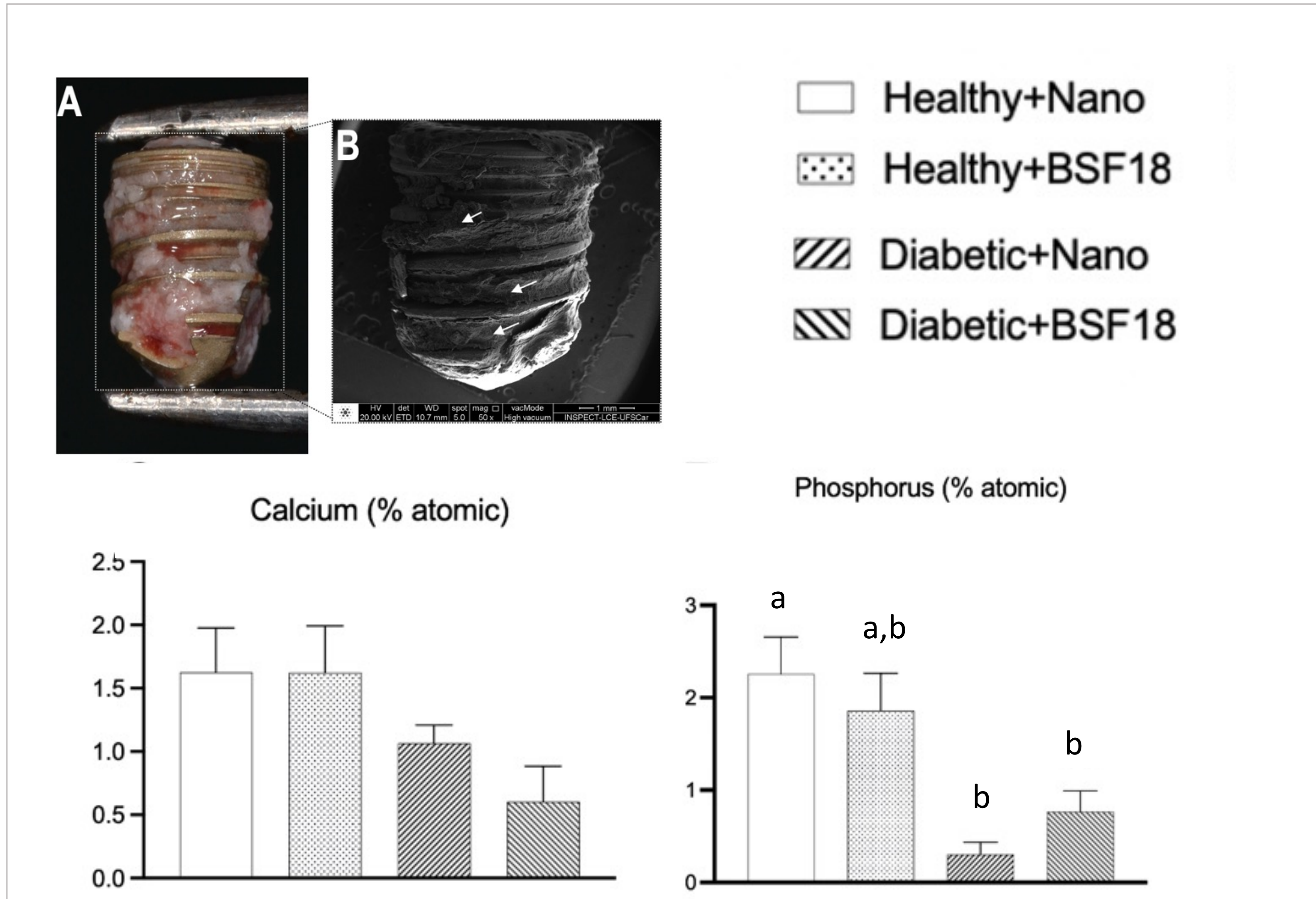


Surgery of implants

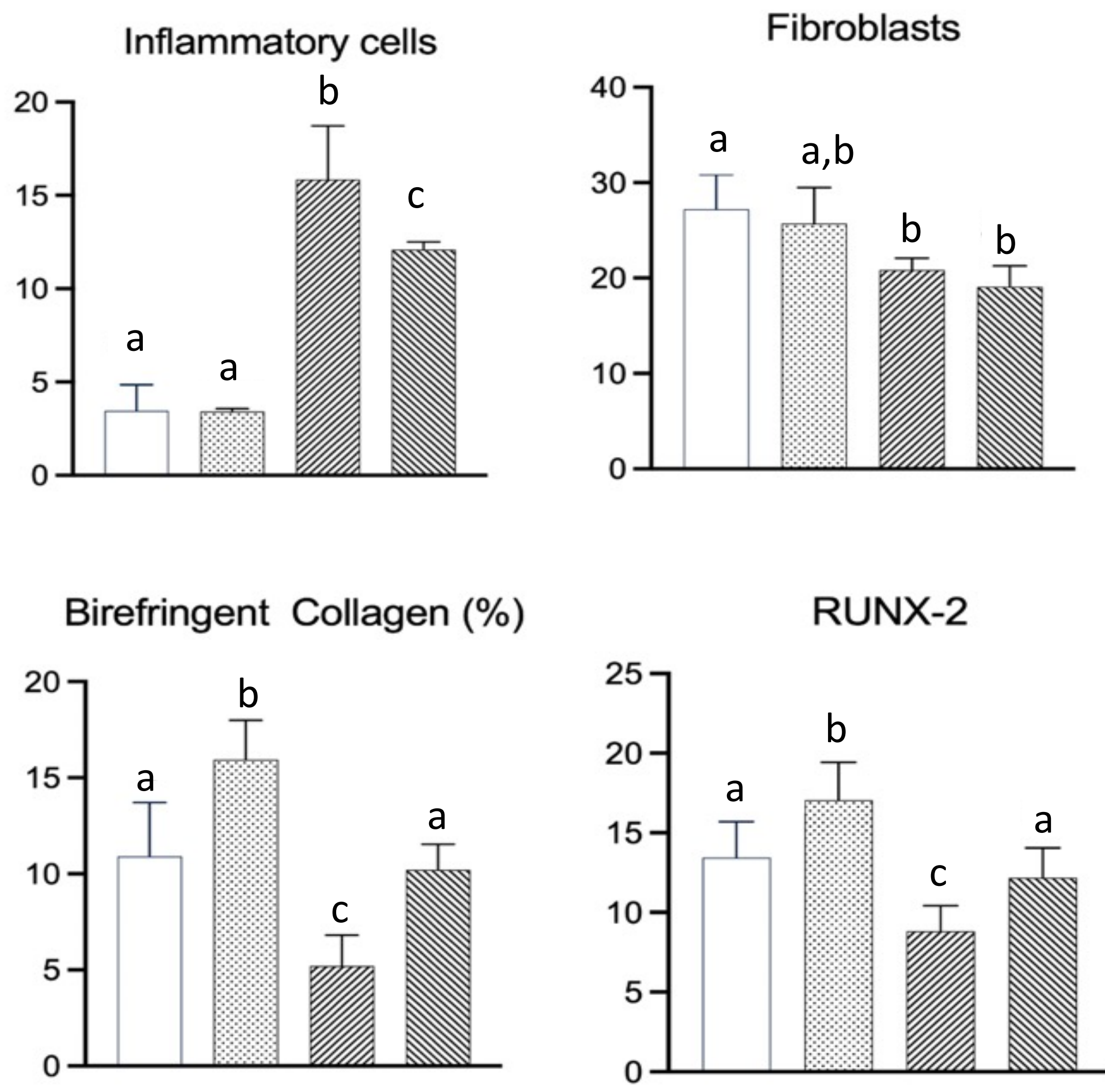


Results

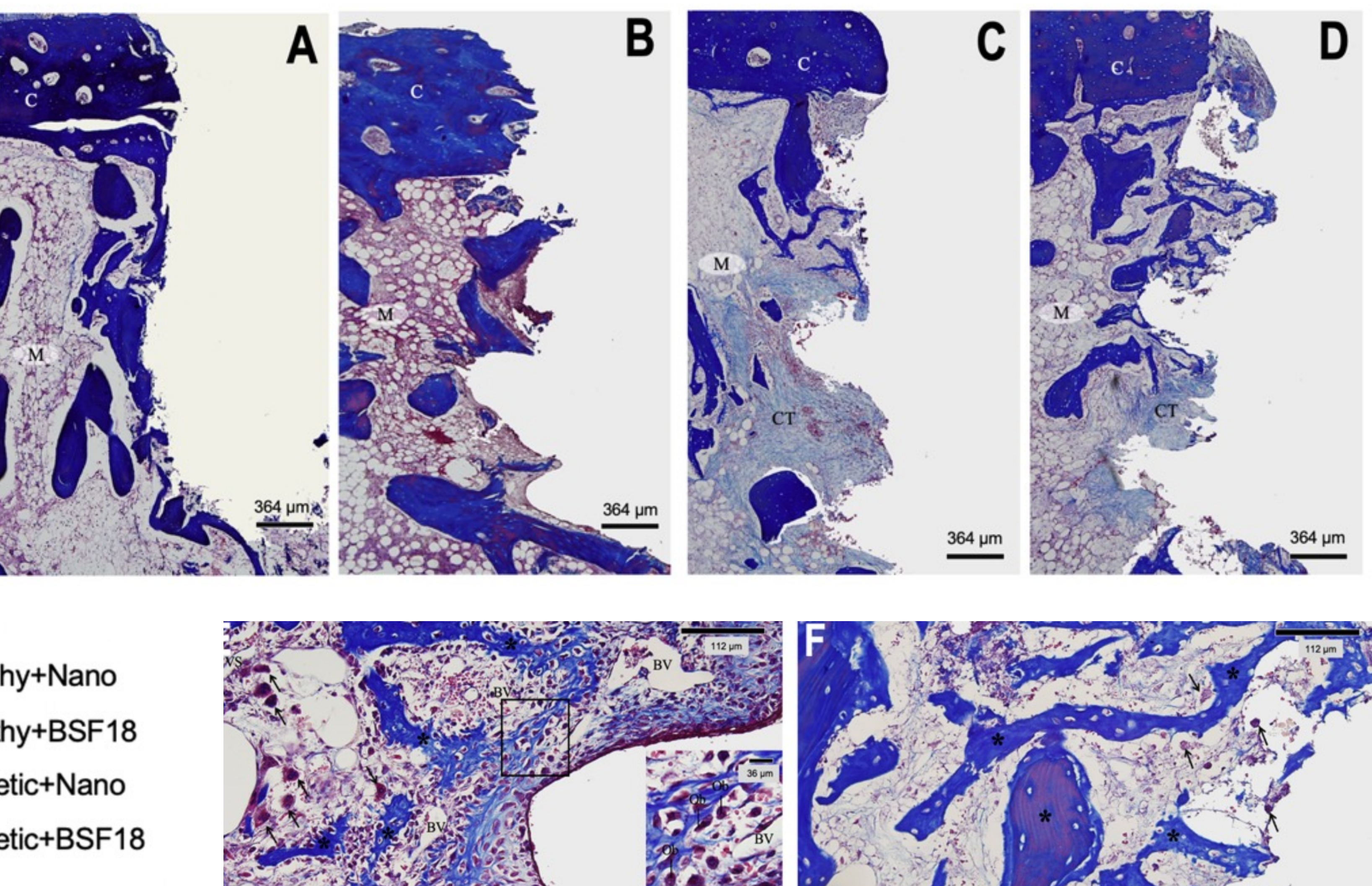
Body weight and biochemistry parameters



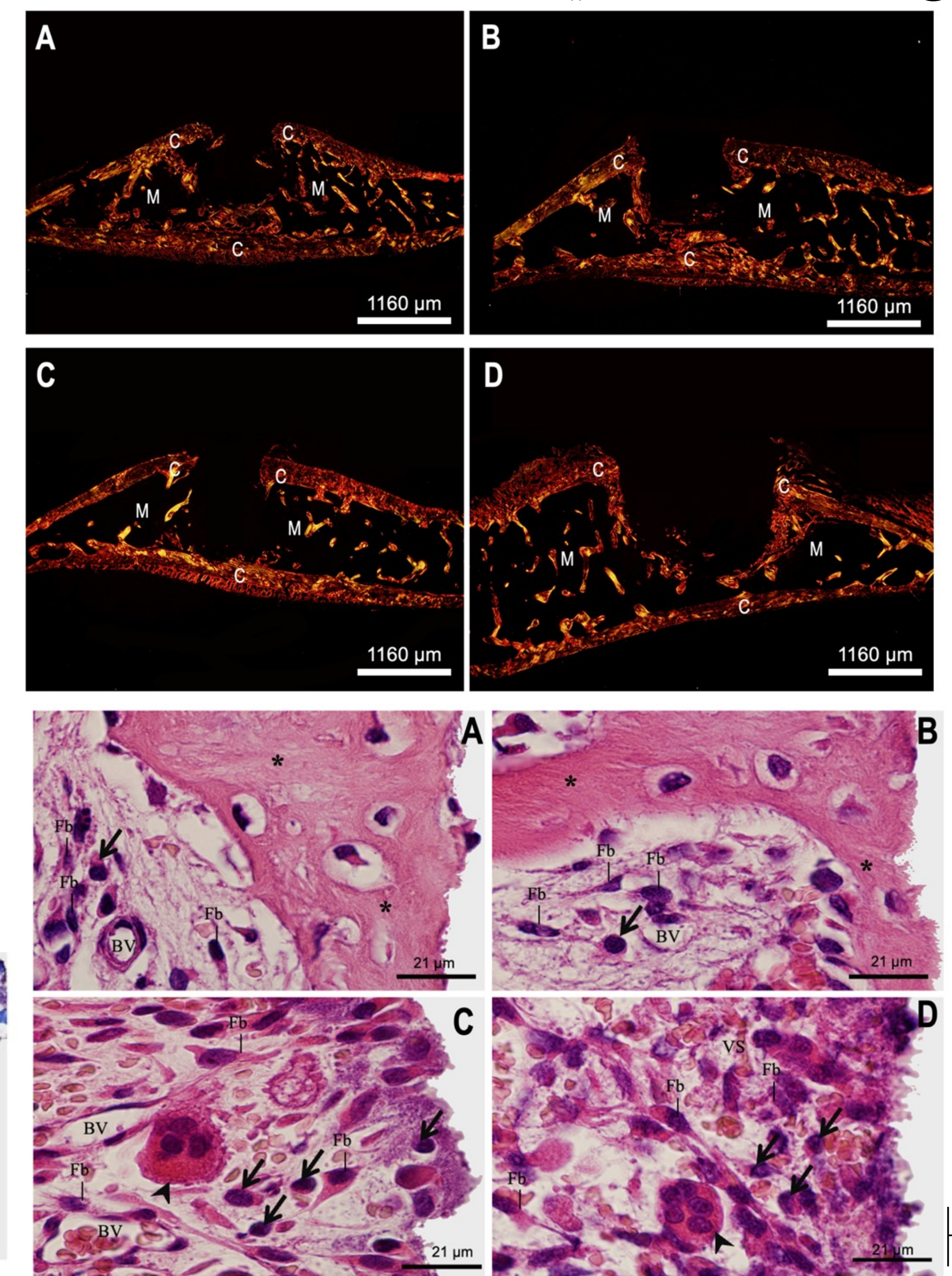
Descriptive and histometric histology of decalcified sections



Masson's Trichrome Staining

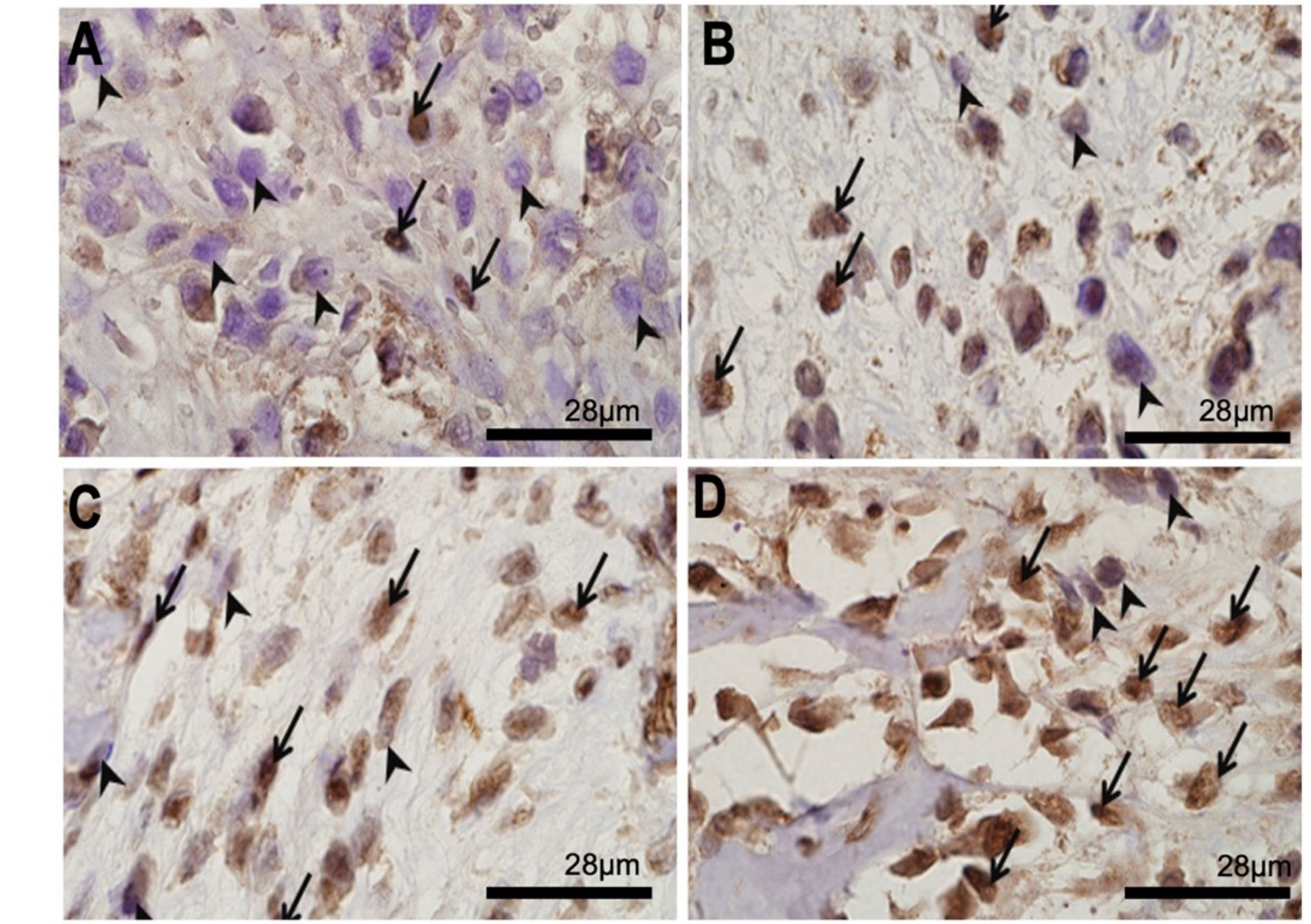


Picrosirius Red (polarized light)



Immunohistochemistry

Runx-2 expression

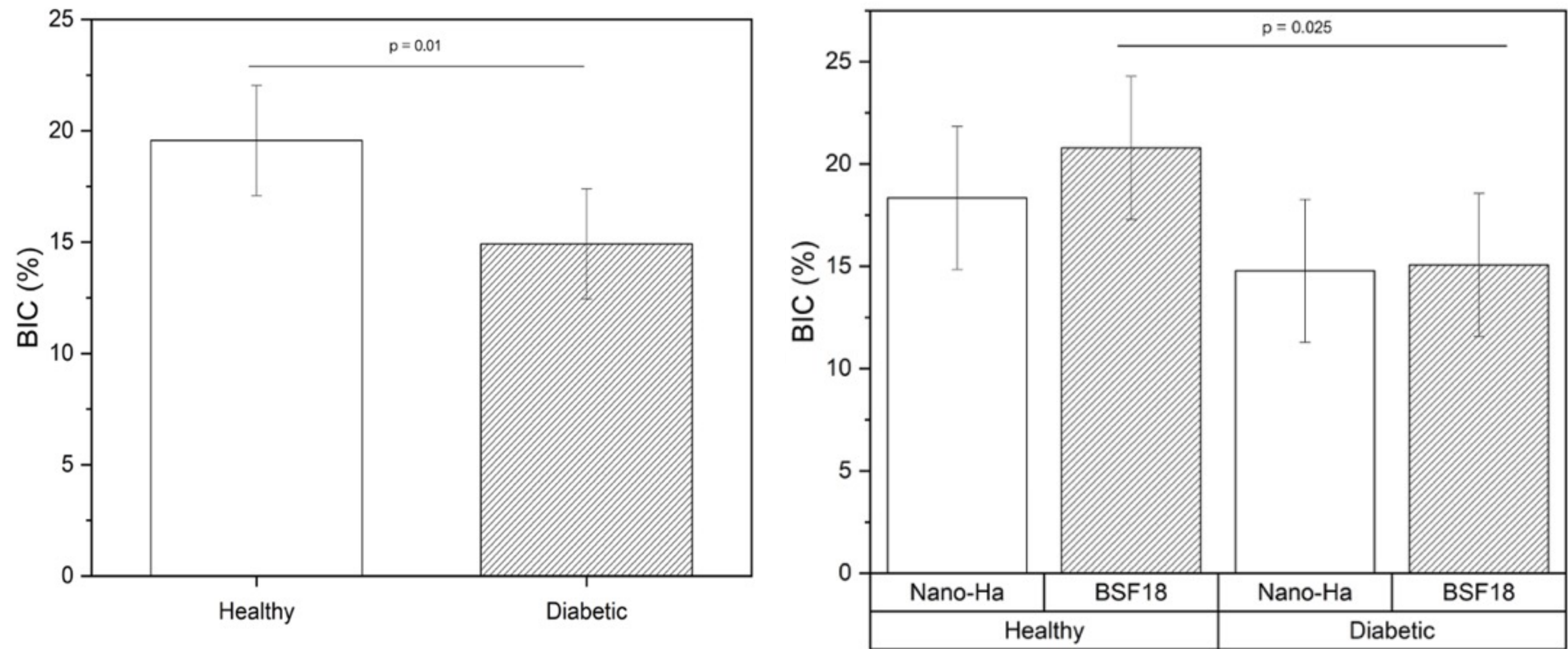


Hematoxylin-eosin Staining

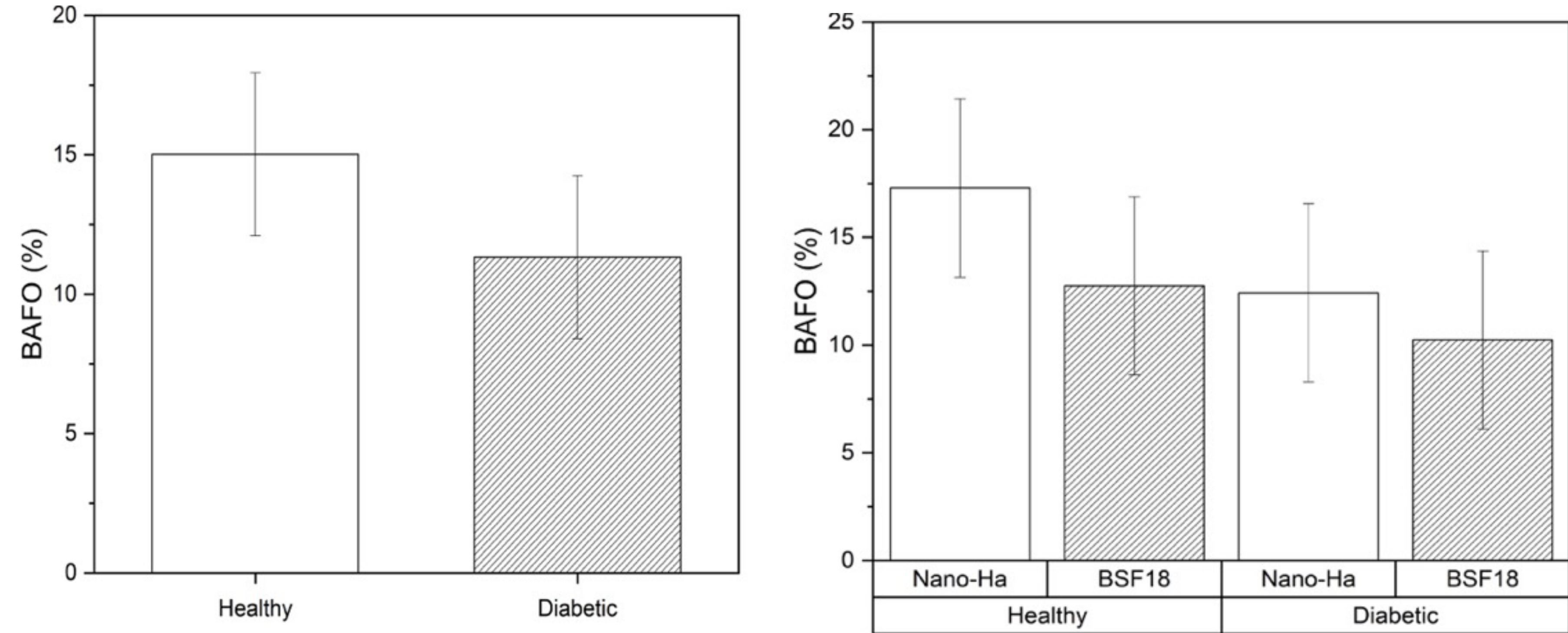
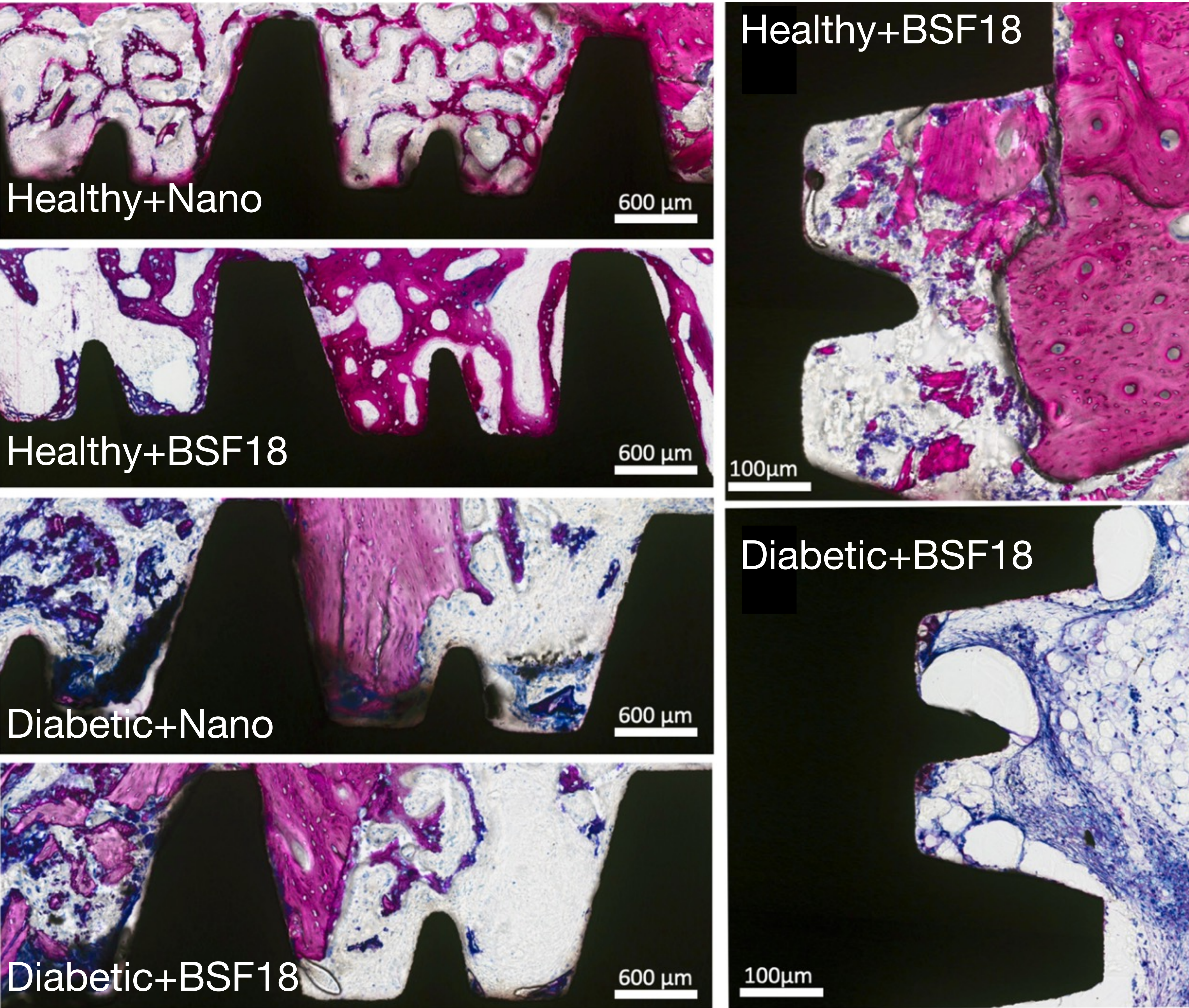
A: Healthy+Nano
B: Healthy+BSF18
C: Diabetic+Nano
D: Diabetic+BSF18

Results

BIC (bone implant contact)

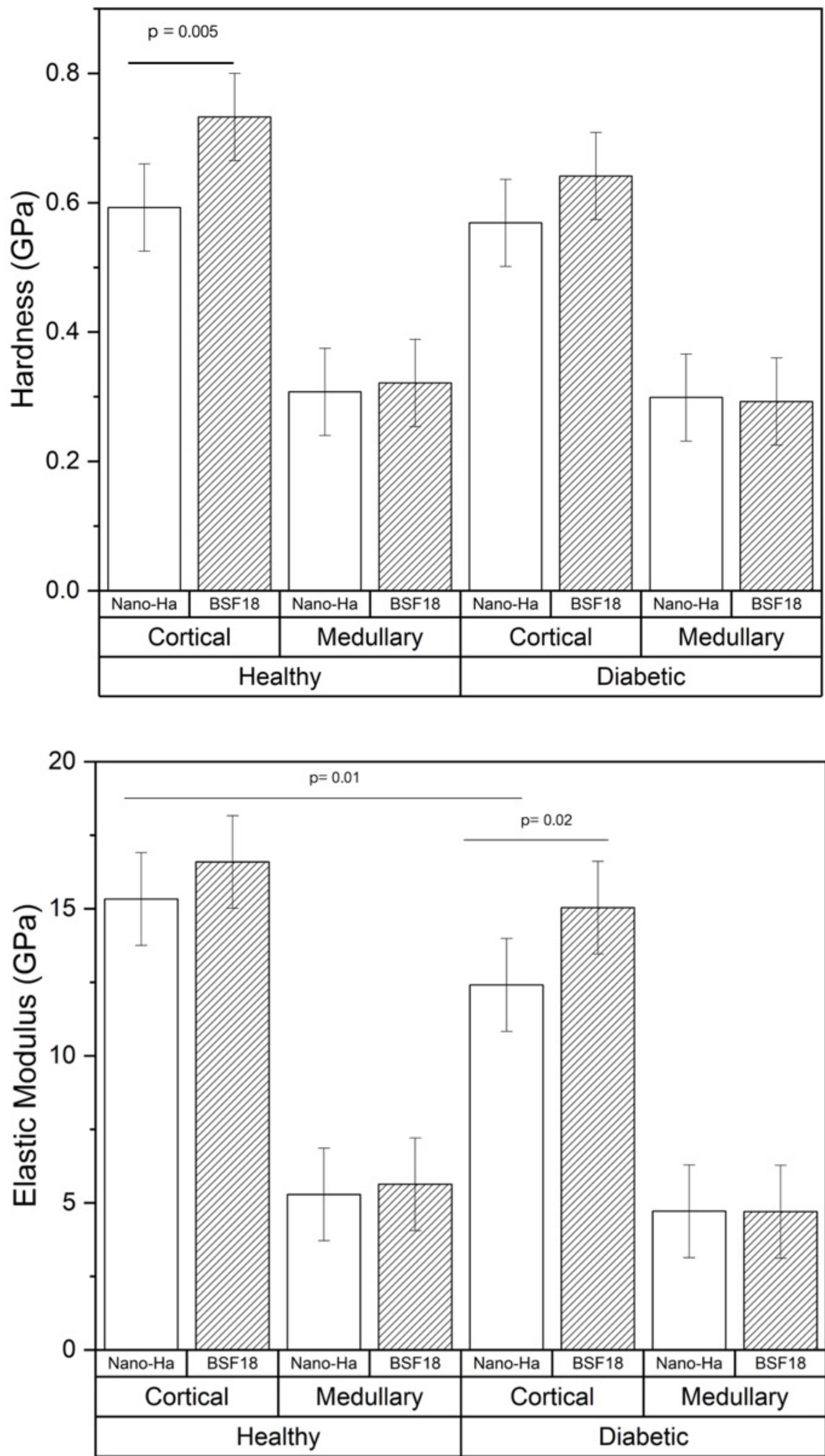


BAFO (bone area fraction occupancy)



Steven's Blue & Fucsina Staining

Nanomechanical properties



Conclusion & Clinical Implication

It can be concluded that the BSF18 surface can present promising biomechanical results and could be relevant to compensate for impaired bone healing in diabetic and healthy conditions.

Acknowledgments

The Sao Paulo Research Foundation (FAPESP) n. 2013/07793-6; n. 2021/00632-3; n. 2021/14557-3; n. 2022/15076-1
Center for Research Technology and Education in Vitreous Materials, Sao Carlos, Brazil
SIN Implants, Sao Paulo, Brazil
Witek Lab, New York University, College of Dentistry, USA