

# Osseointegration of Dental Implant Following Socket Preservation with ShefaBone SCPC Resorbable Bioactive Bone Graft



Academy of Osseointegration  
Washington DC, March 2019

# ShefaBone<sup>®</sup> Silica Calcium Phosphate Composite (SCPC)

- Resorbable
- Bioactive
- Porous
- Osteoconductive
- Stimulates osteogenic genes expression
- No genotoxicity, no carcinogenicity and no immunotoxicity



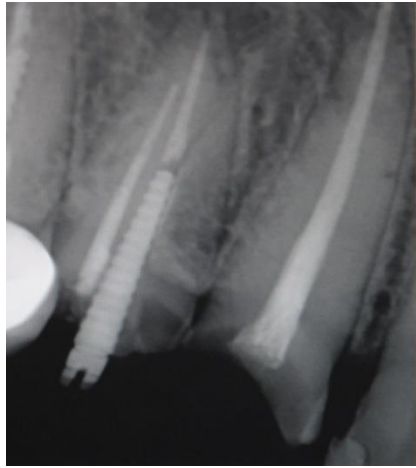
# Two Main Advantages of SCPC

Complete Resorption

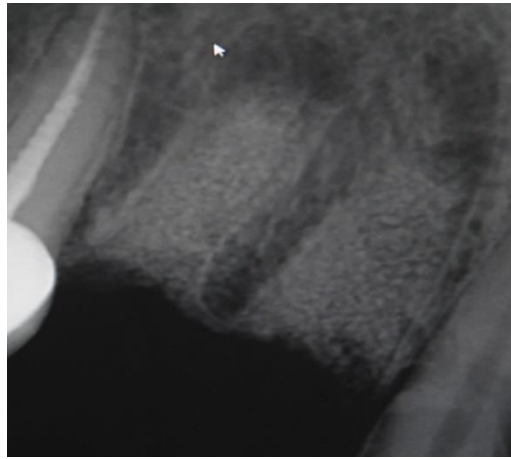
Strong Stimulation of  
Bone Growth



# Split mouth design (n= cases)



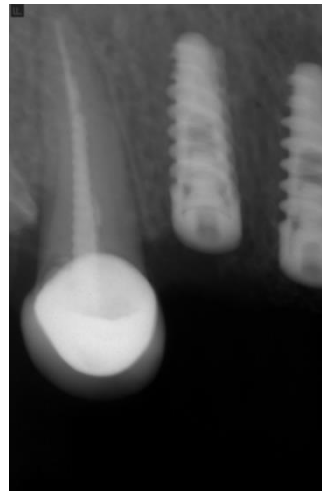
Preoperative  
periapical,



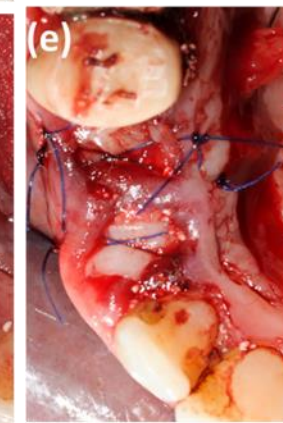
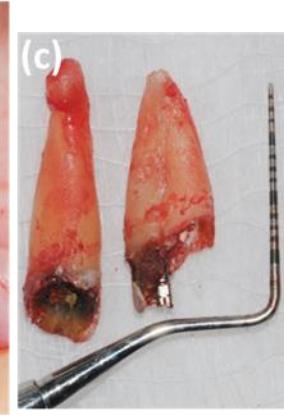
SCPC graft in the socket,



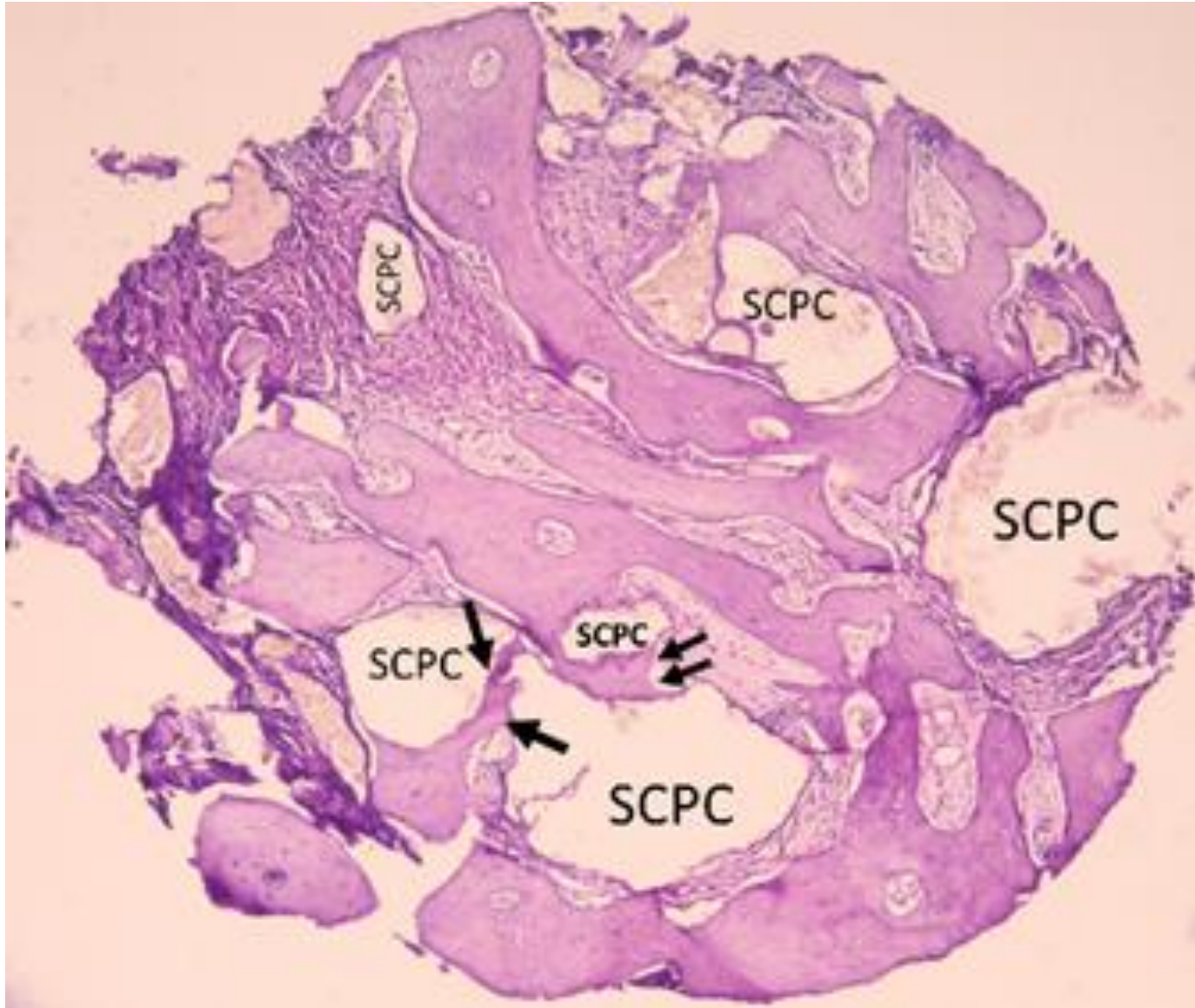
5 months healing



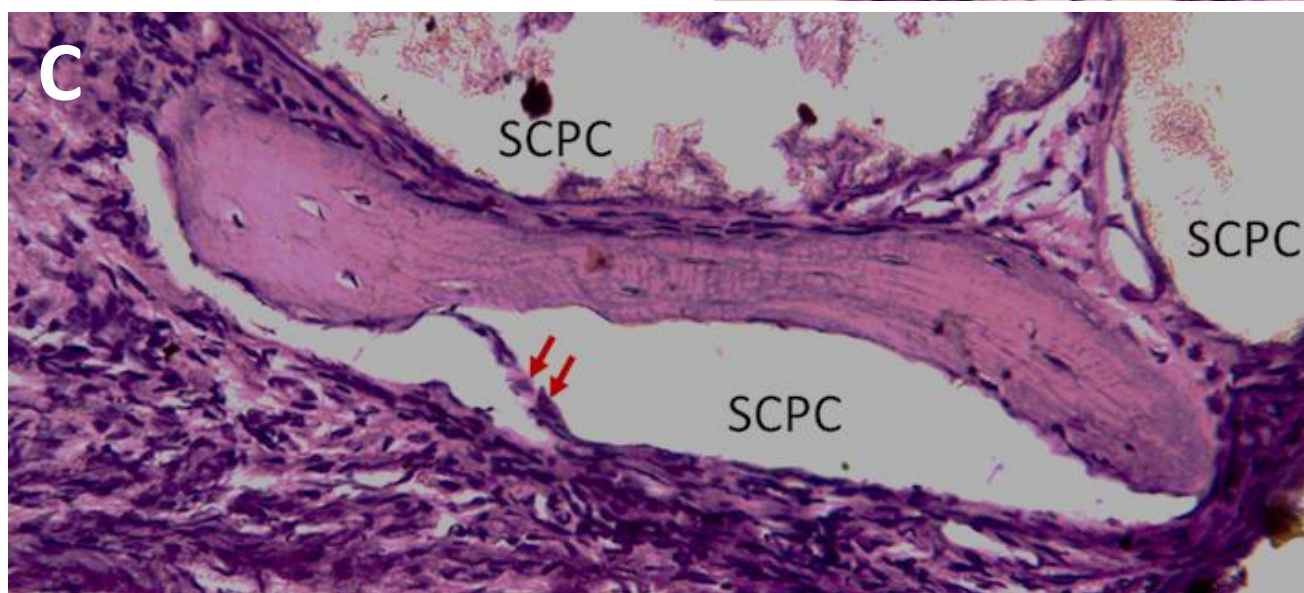
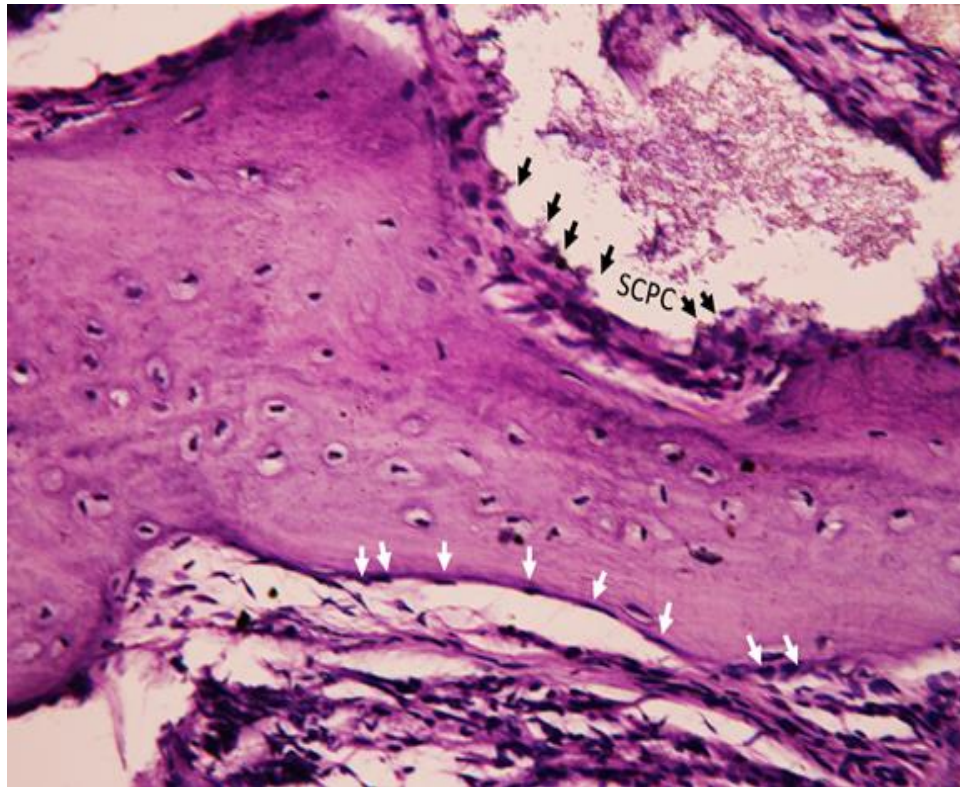
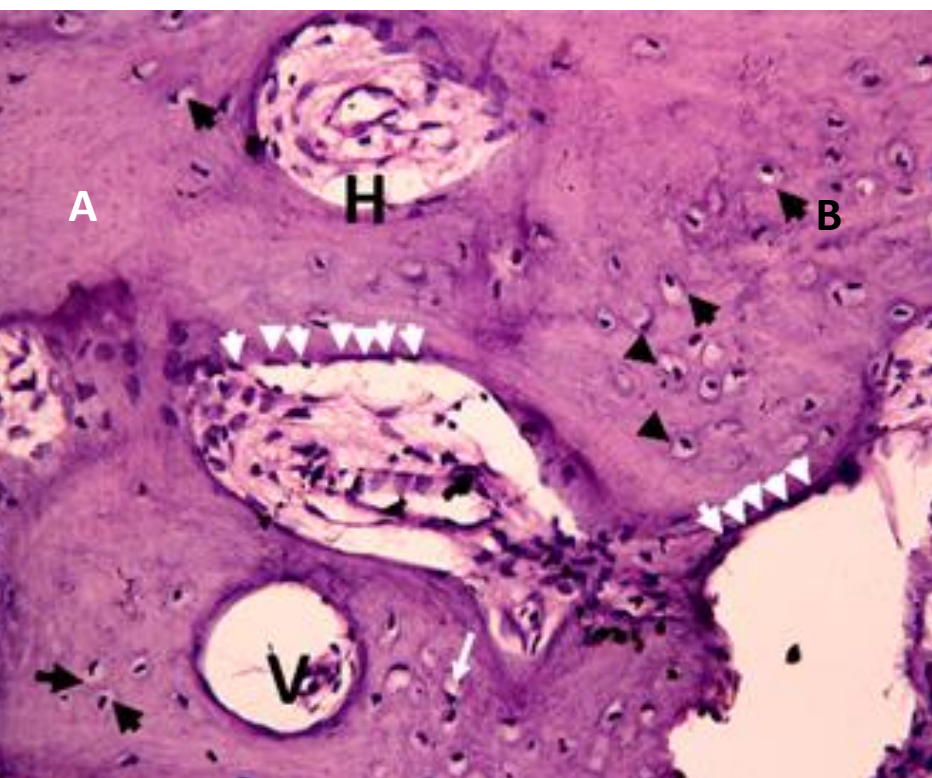
2 implants inserted in 5,6



# Histology of Core Biopsy From Socket Grafted with SCPC Granules After 5 Months

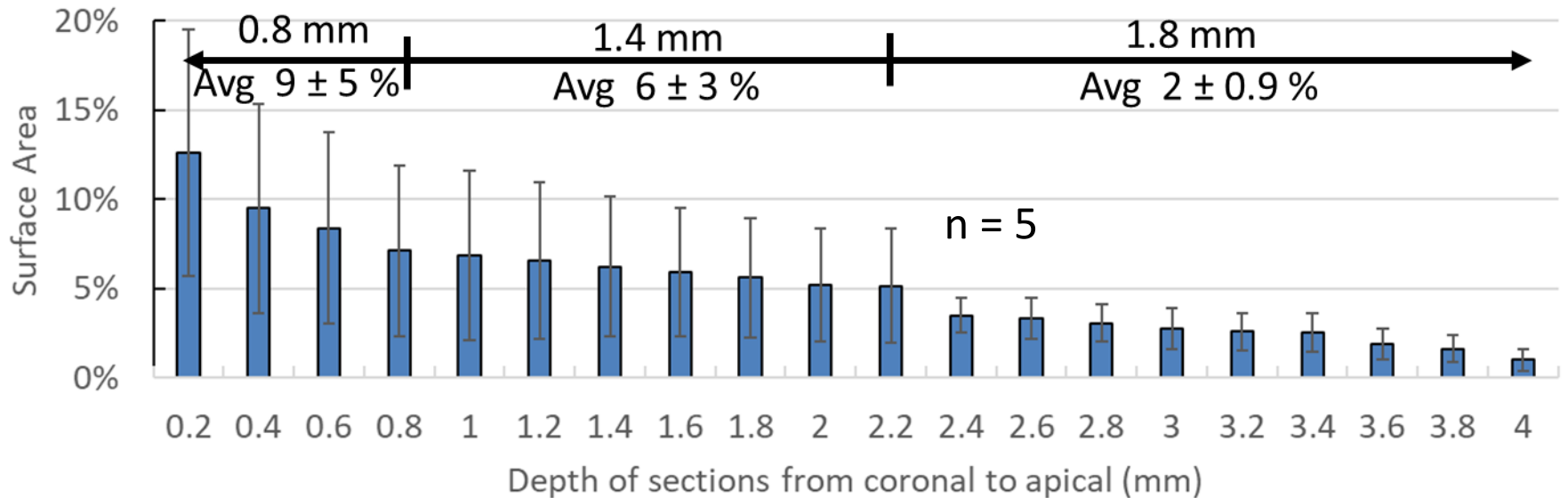






## Split mouth design (n= cases)

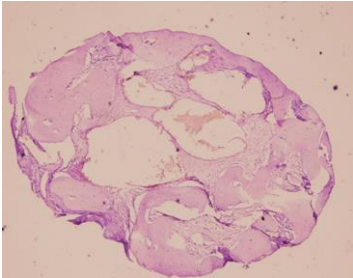
Coronal to apical depth profile of the percent surface area occupied by SCPC granules in the grafted socket



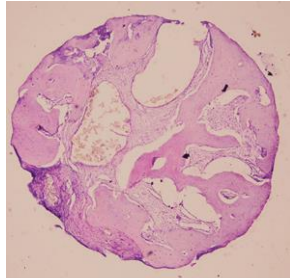
- The percent surface area of the SCPC granules present in the new bone dropped from  $9 \pm 5 \%$  in the top region of the socket to  $6 \pm 3 \%$  and  $2 \pm 0.9 \%$  in the middle and apical part of the socket, respectively.
- The significant SCPC resorption is associated with increased new bone formation.



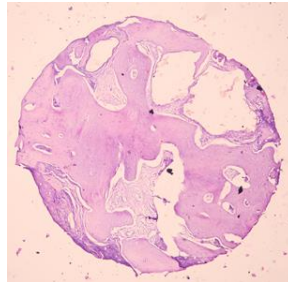
Slide # 3



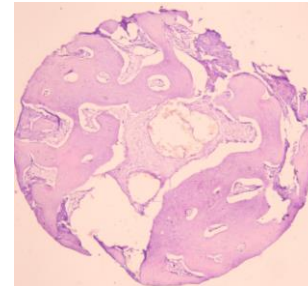
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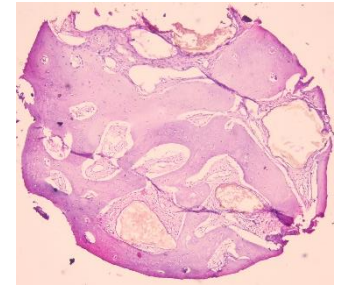
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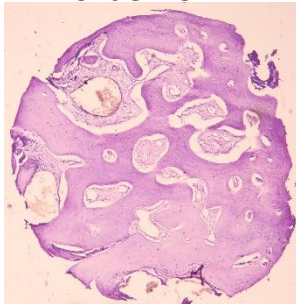
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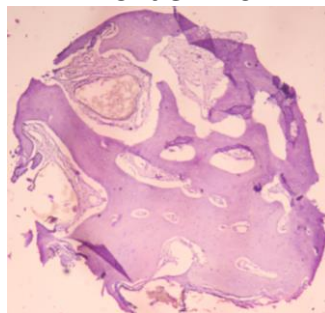
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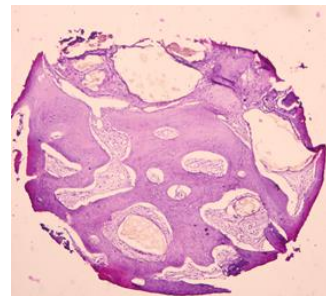
Slide # 9



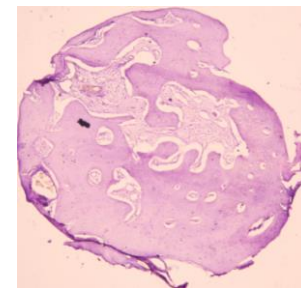
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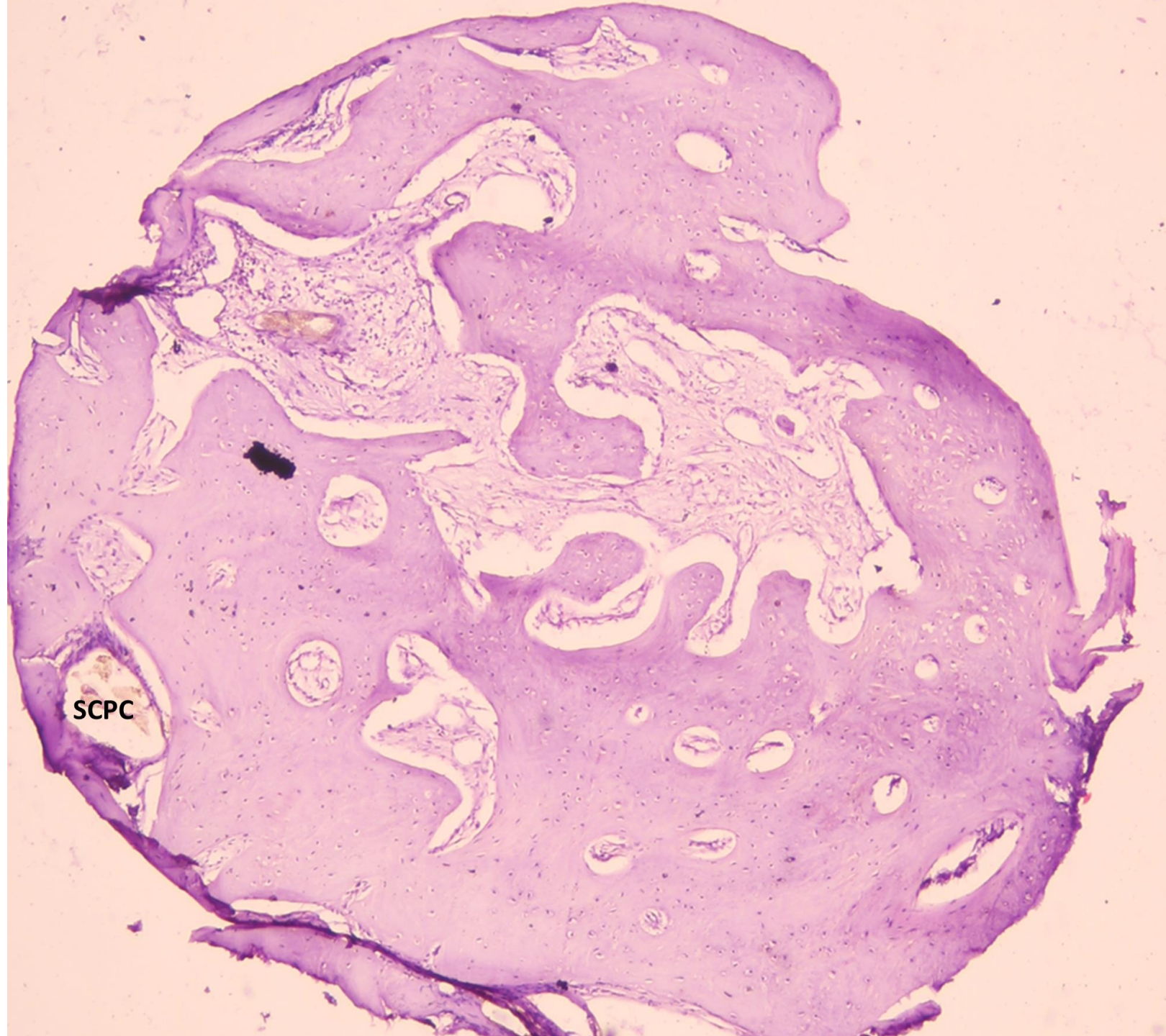
Slide # 11



Slide # 12

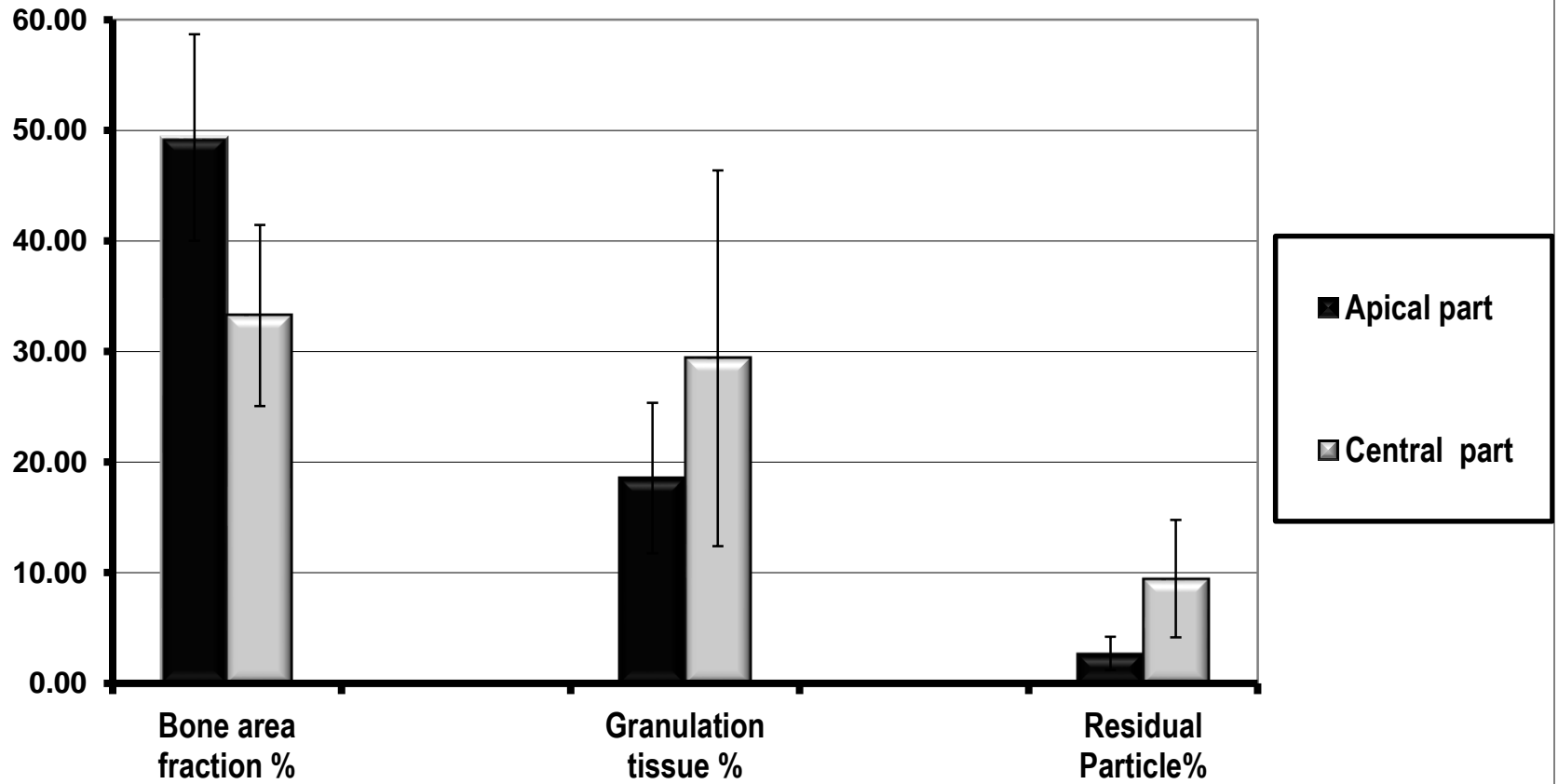




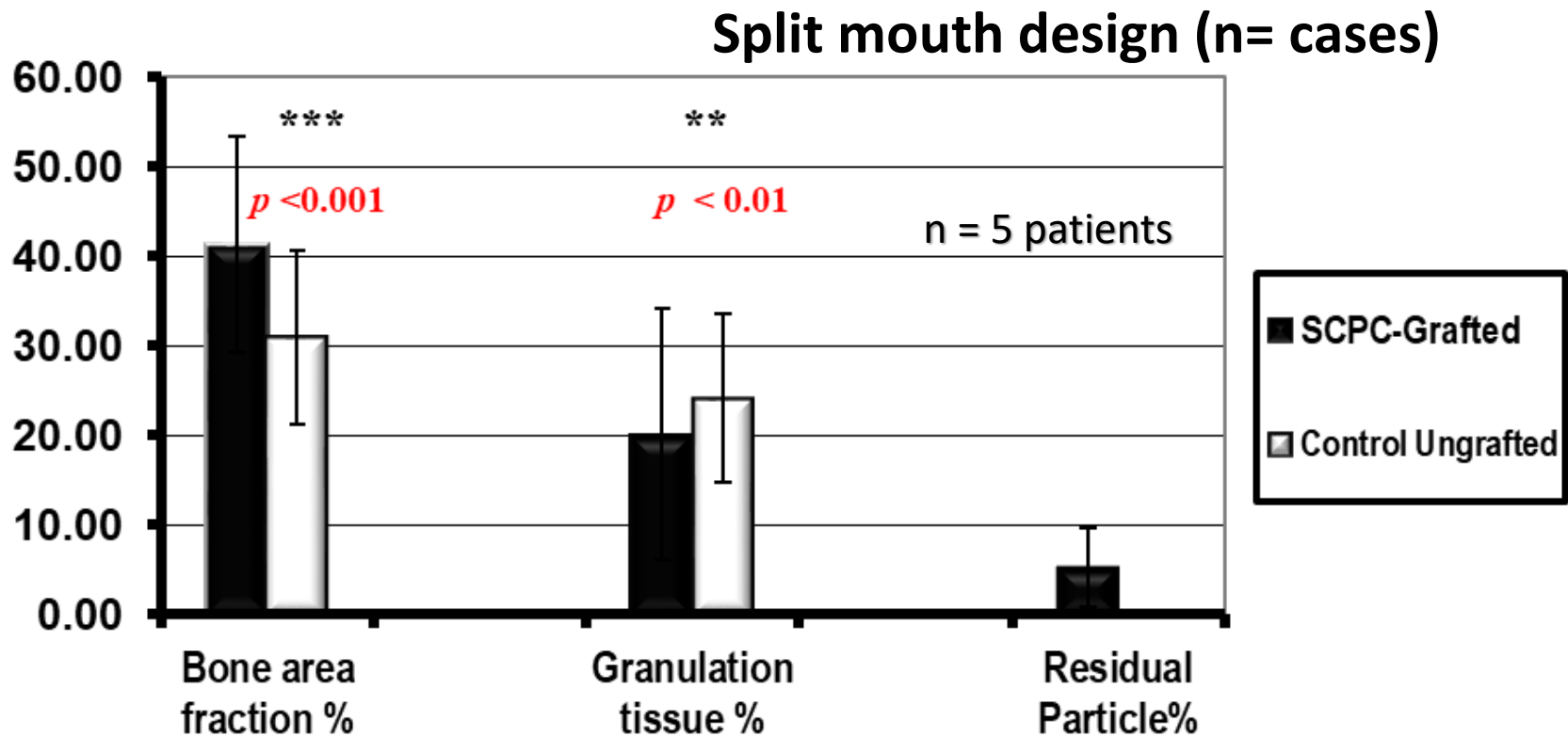


SCPC

## Split mouth design (n= cases)



# Histomorphometry Analysis of New Bone Formation in SCPC-Grafted vs Un-grafted Sockets After 5 Months

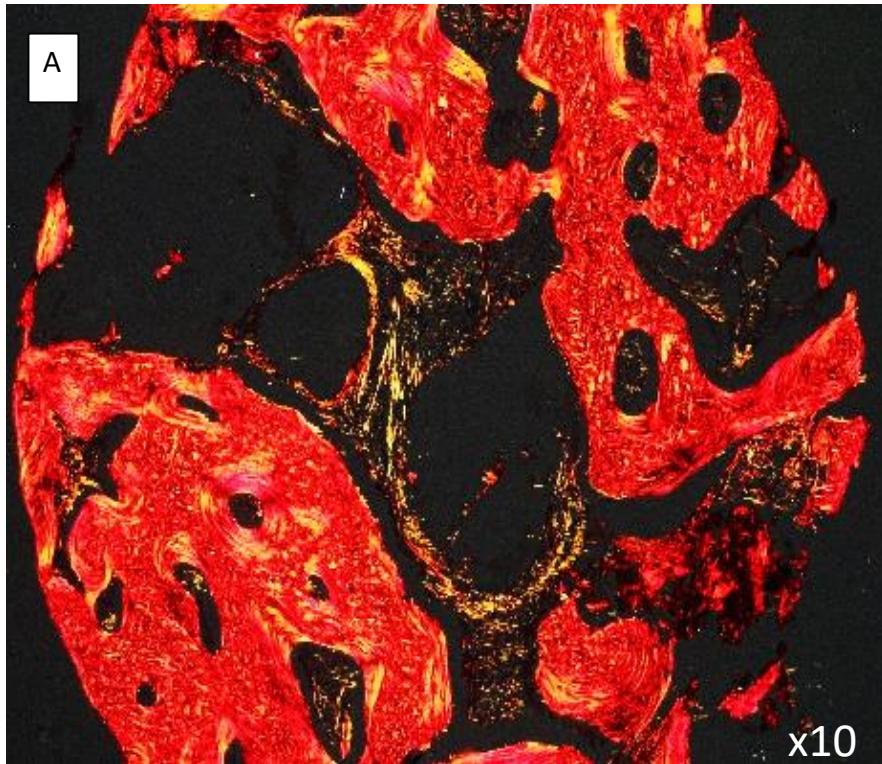




# Characterization of Bone Quality: Mineralized Collagen I

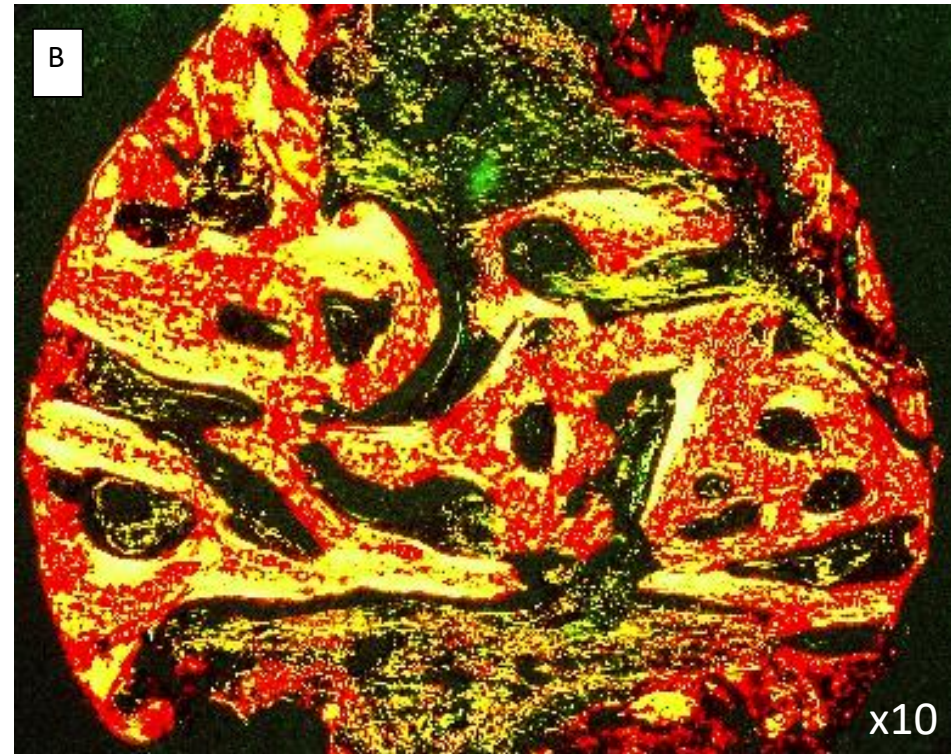
Polarized light microscopy of Sirius red stained specimens

SCPC-grafted socket



Well packed collagen type I (red color)

control ungrafted

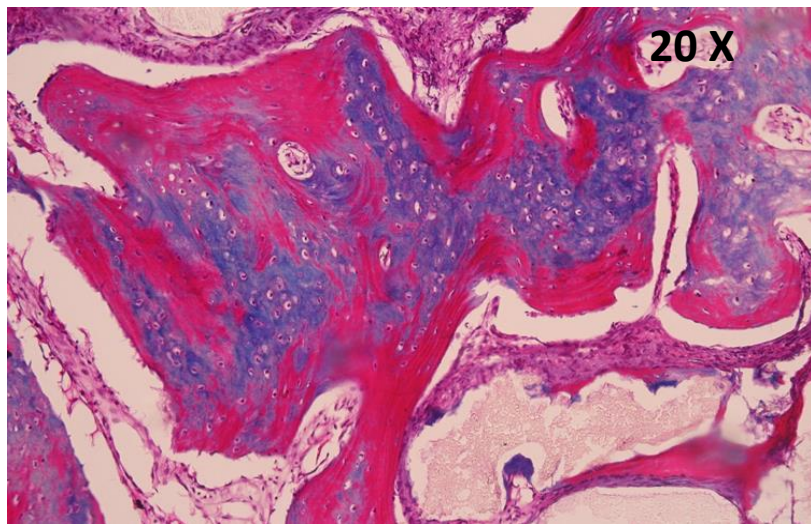
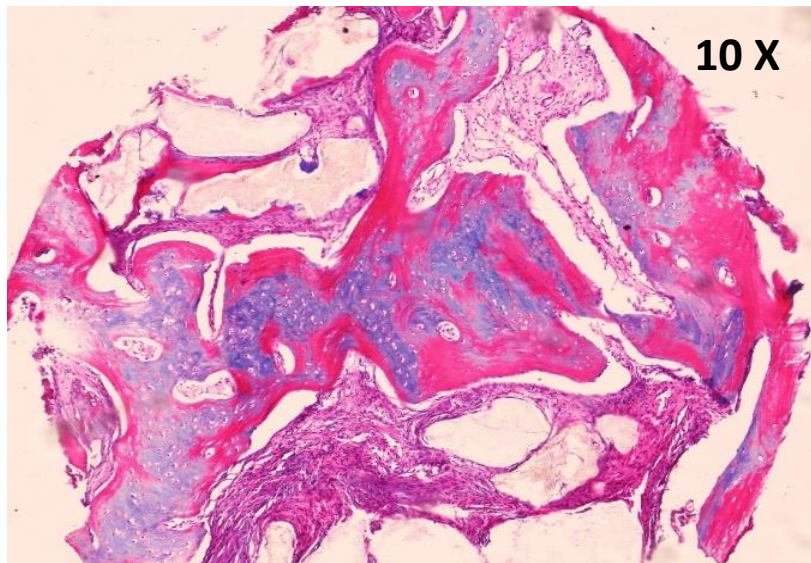


The (yellow- green) color indicative of packing of collagen type III in socket.

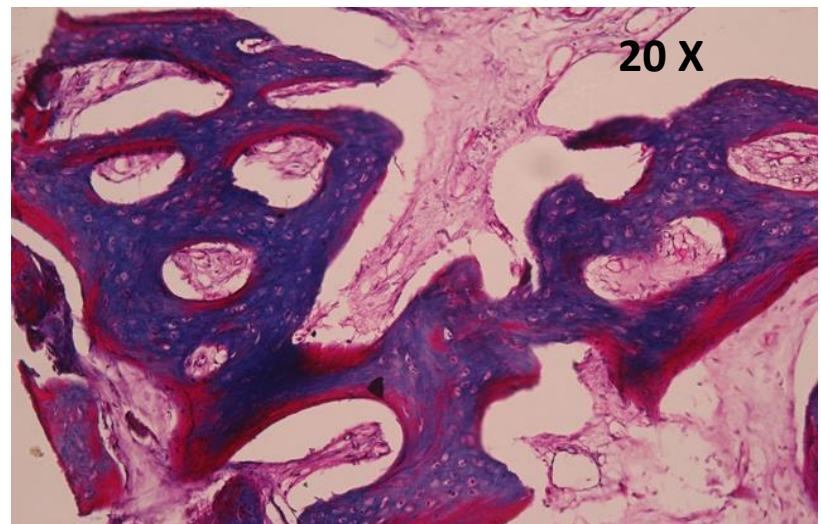
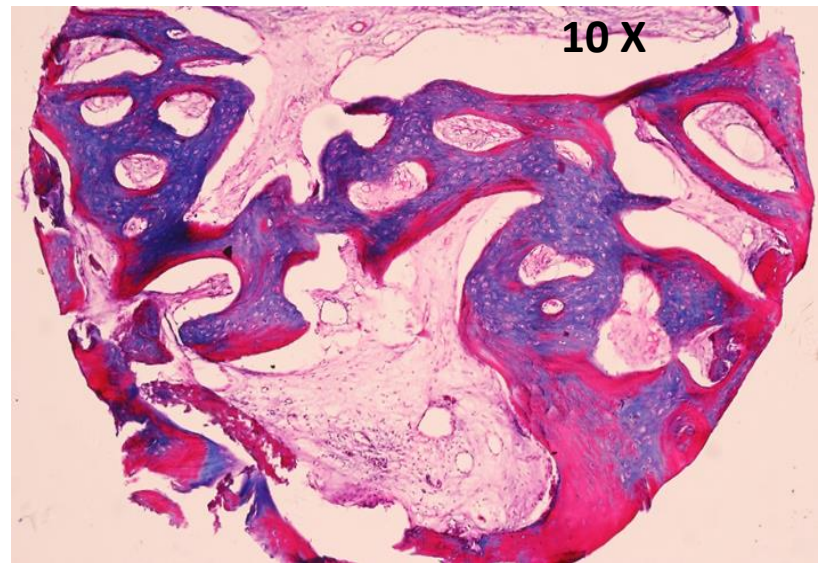
Limited formation of collagen I (reduced red color.)



**SCPC Grafted Socket**



**Control ungrafted socket**

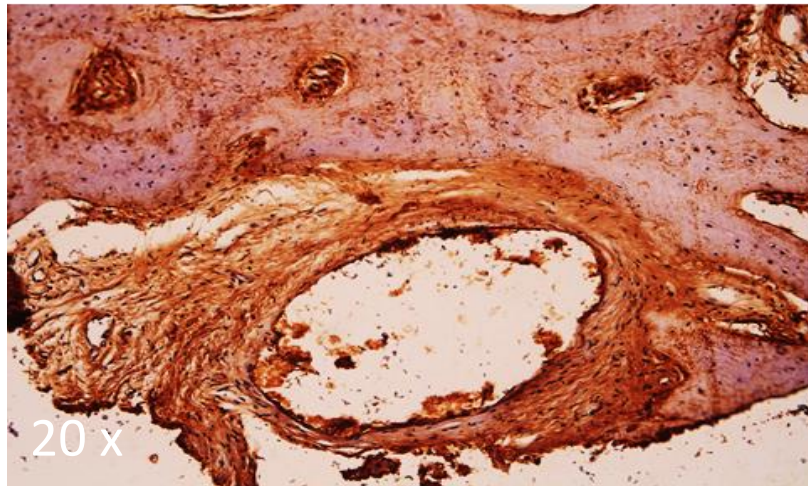
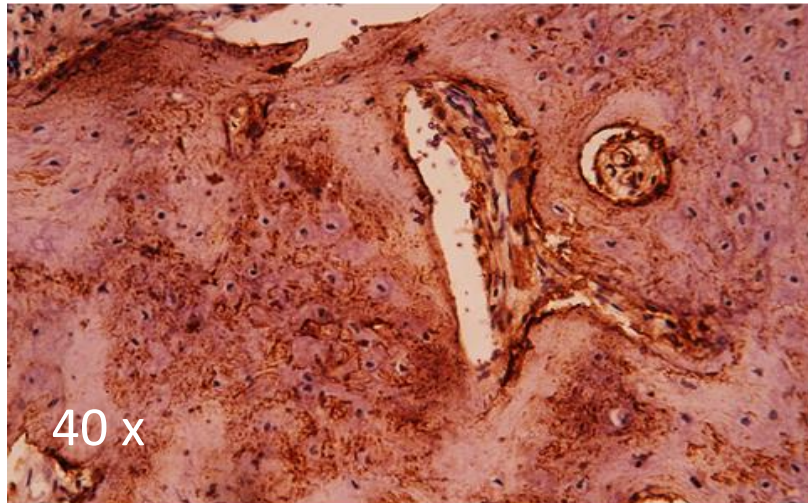


Masson's trichrome showed increased areas of bone trabeculae stained red, indicating more bone maturation in the SCPC grafted specimens. In contrast ,control specimens showed predominance of bluish bone trabeculae that indicate less mature type of bone.



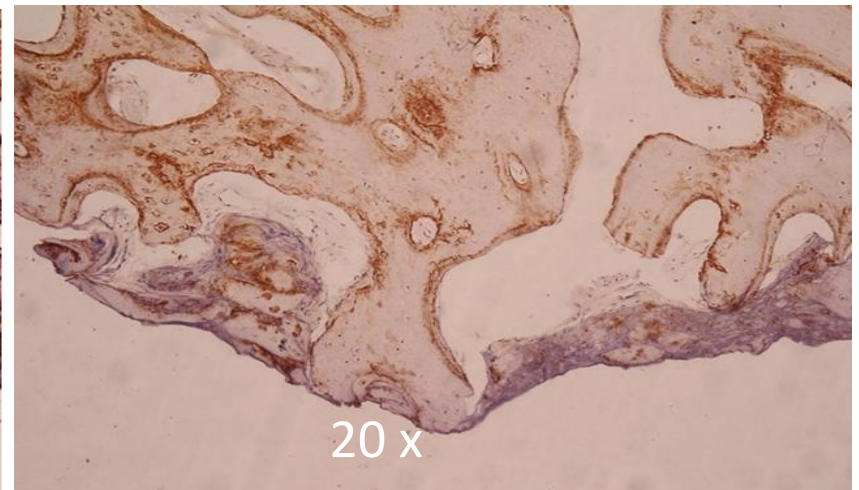
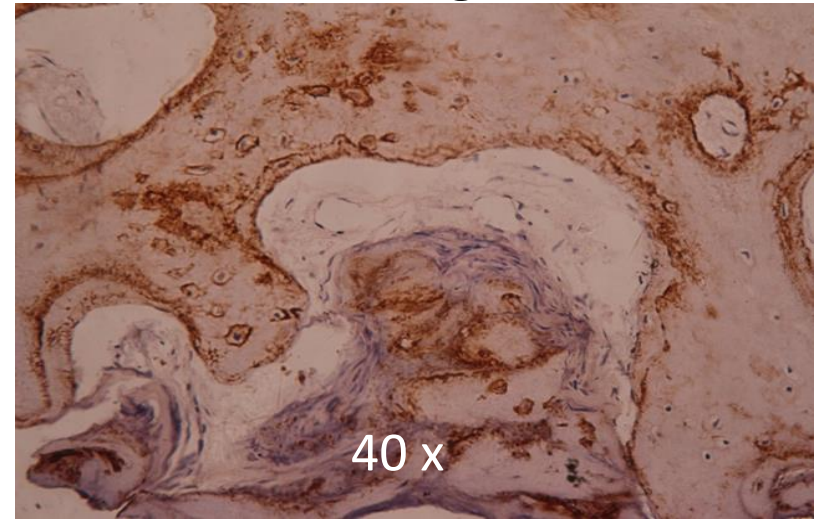
# Osteopontin Staining

SCPC-grafted socket



Higher Osteopontin staining  
indicating more osteopontin  
expression by bone cells

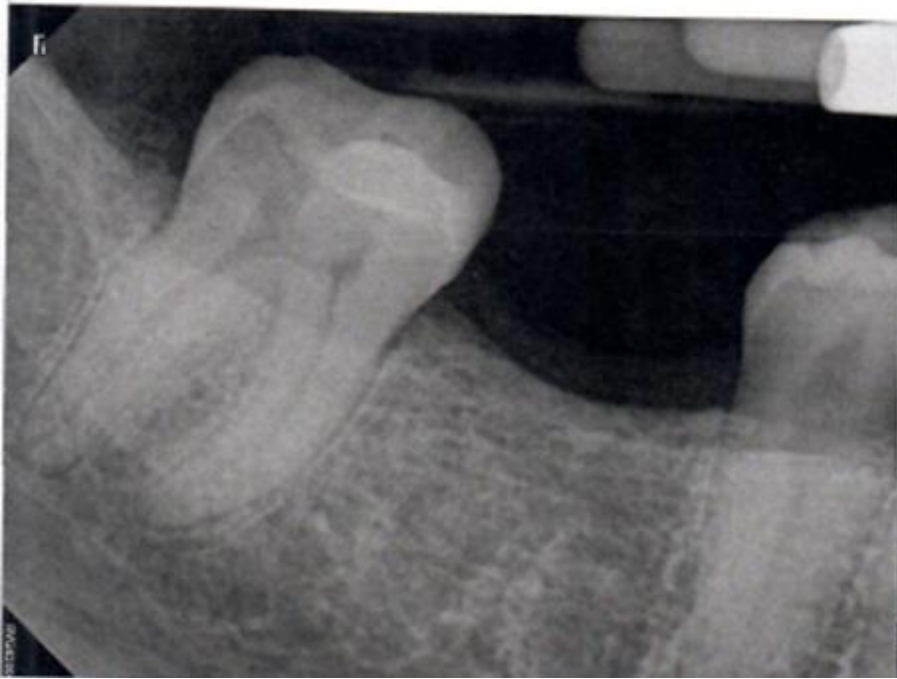
control ungrafted



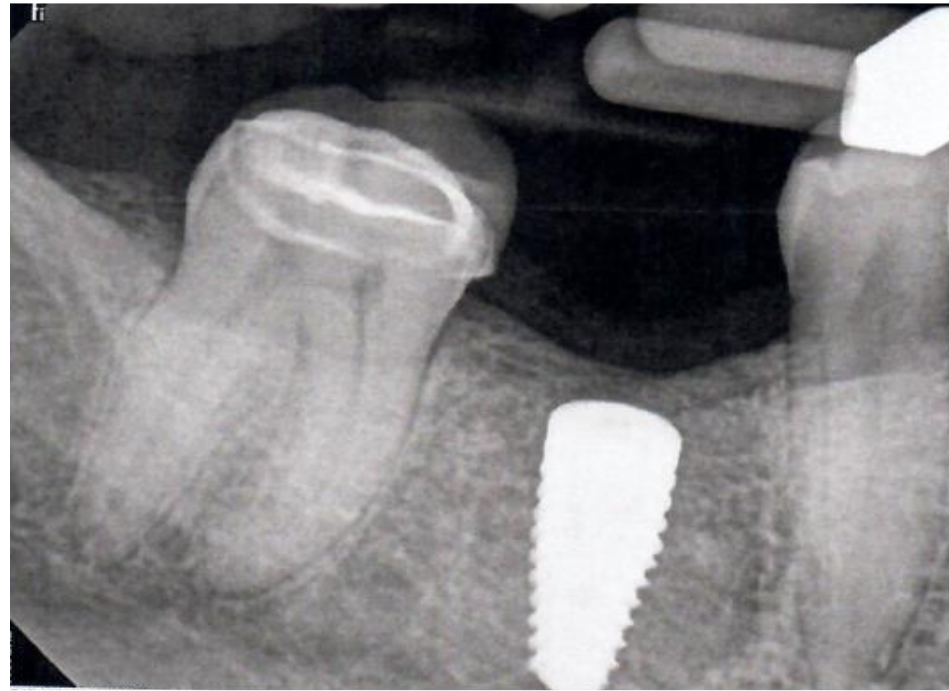
Lower Osteopontin staining  
indicating and less number of  
osteocytes



# 65 Years Old Female



Bone healing in a grafted socket after **3 months**



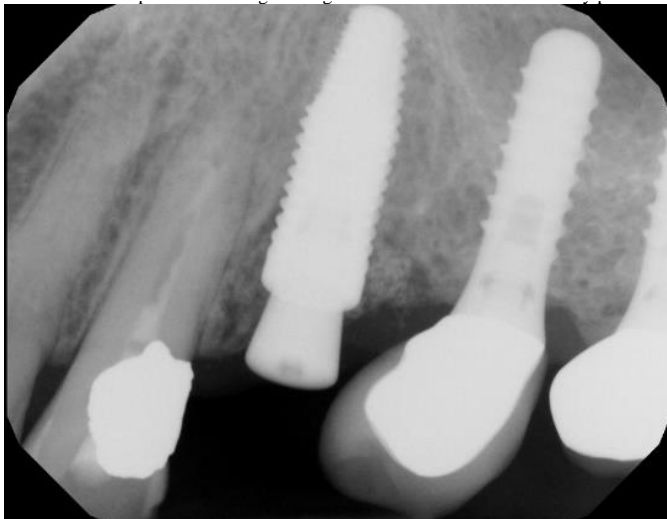
Dental implant placement inside the newly formed bone in the SCPC-grafted socket.

F

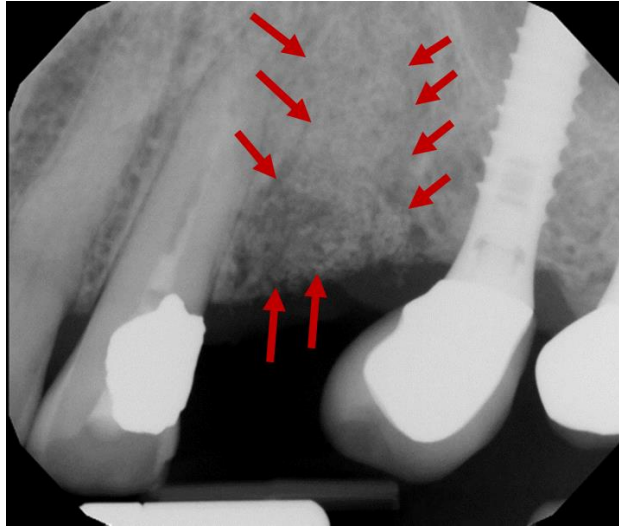
19 Months Post operative



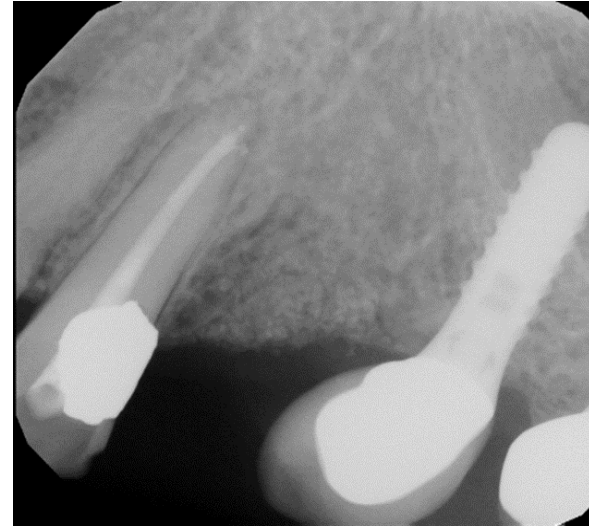
# 66 years old male with failed implant



pre-removal of failed  
implant #12



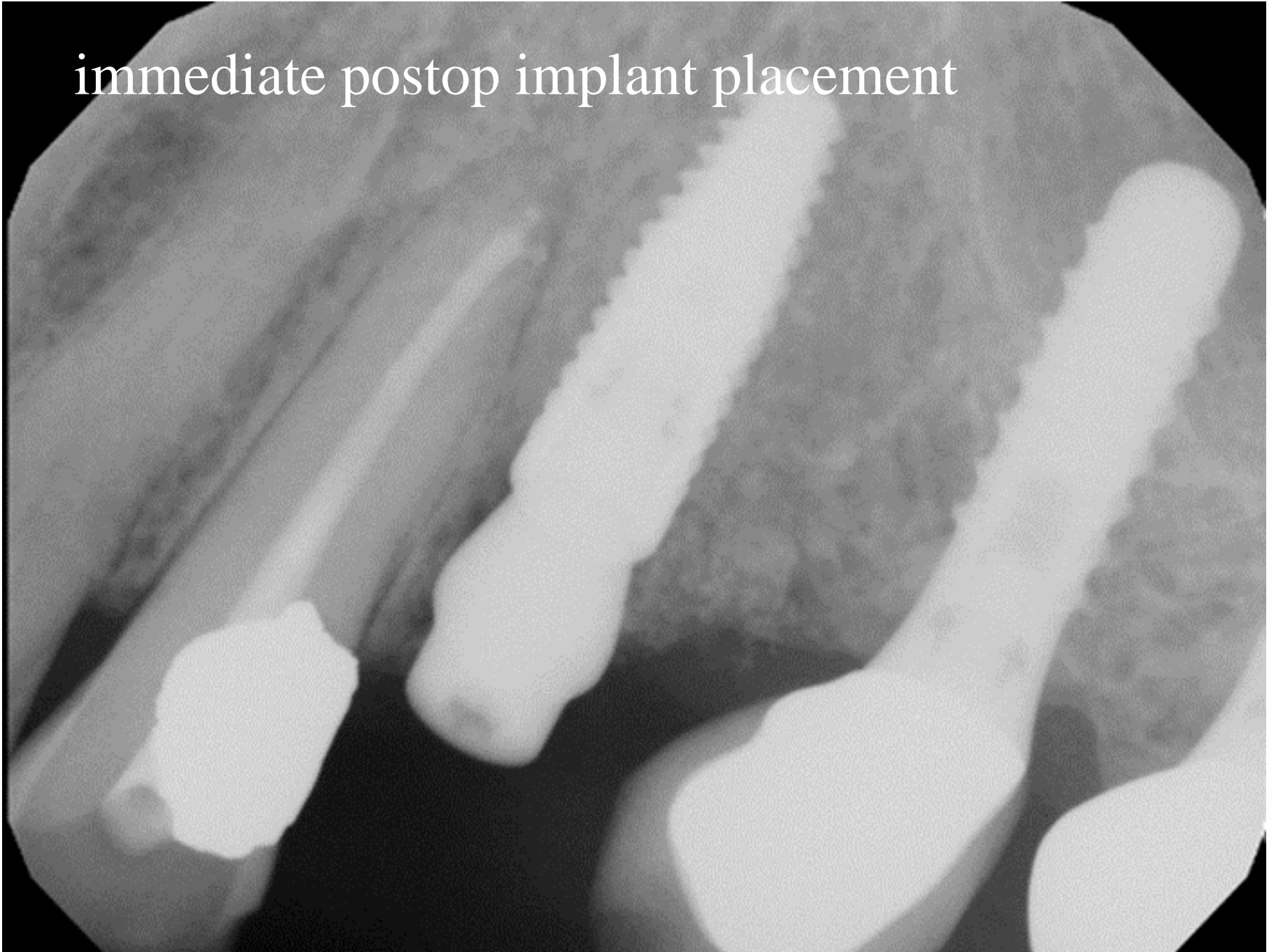
Immediately after  
SCPC grafting



18 weeks post SCPC  
grafting

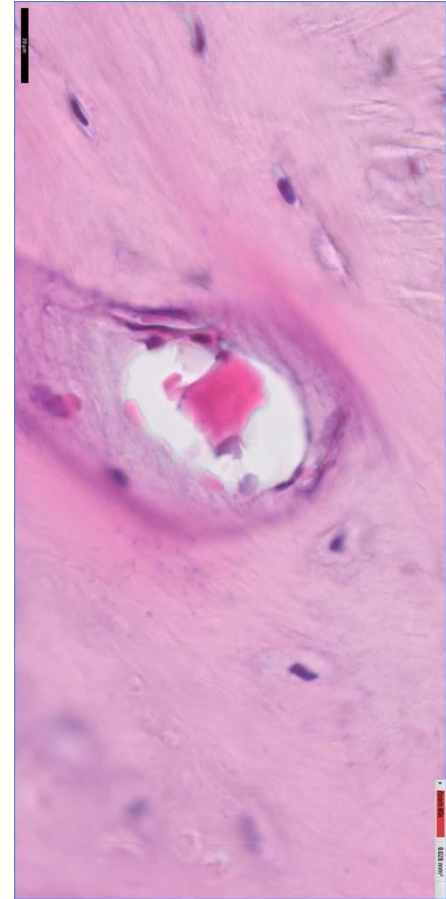
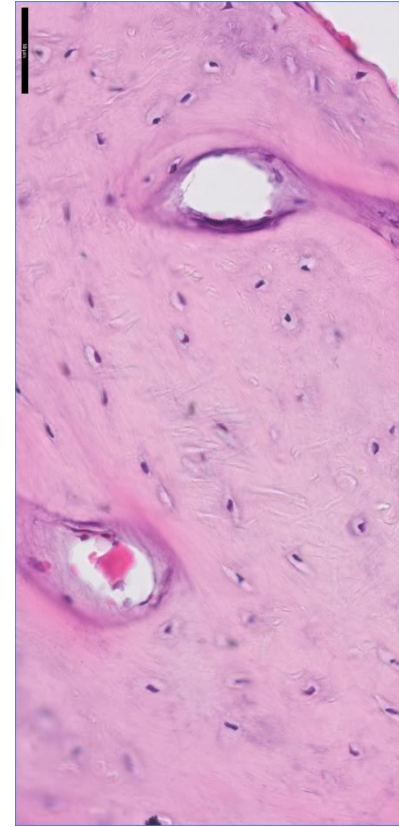
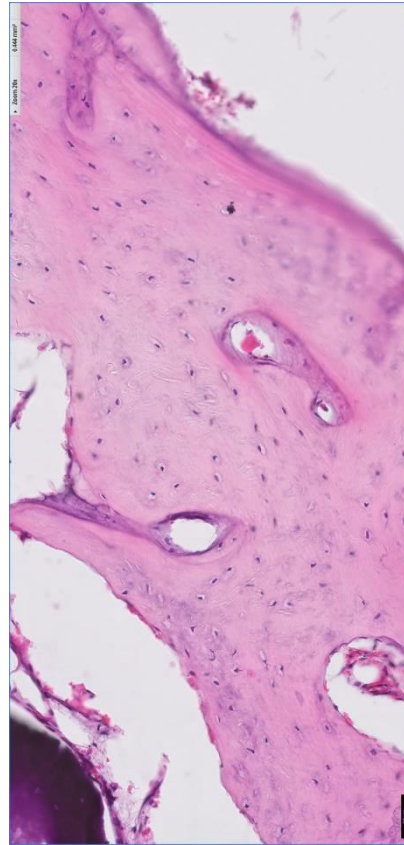
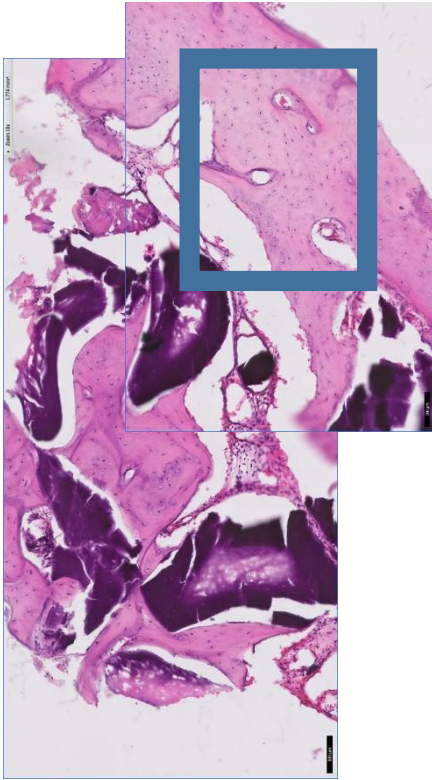


immediate postop implant placement



46% by volume of core biopsy is mature bone showing osteocytes, osteoid and blood vessels.

Total tissue volume 4.15 mm<sup>3</sup>

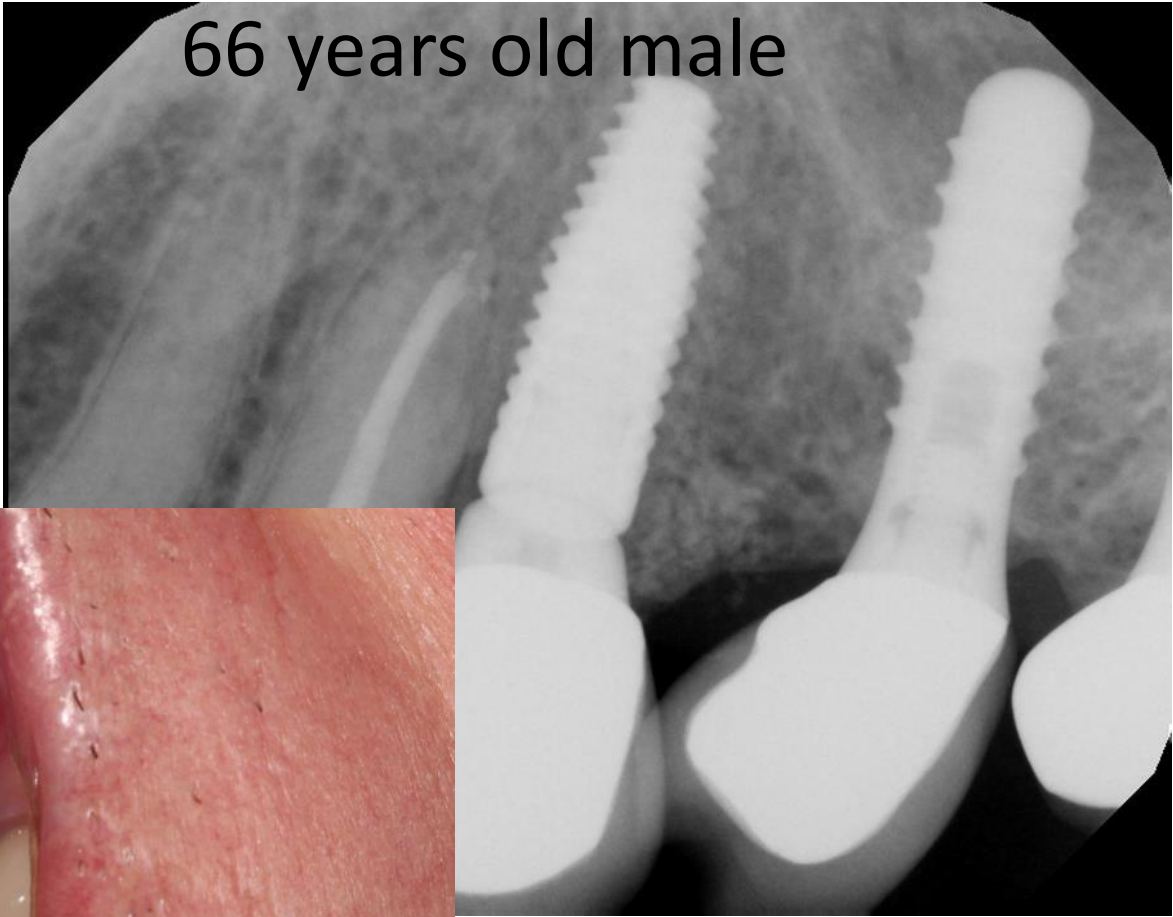


24% SCPC granules,  
30% connective tissue.

New bone appeared mature,  
vascularized and contained  
high density of osteocytes

10 Months After  
Implant  
Placement in  
SCPC Grafted  
Socket

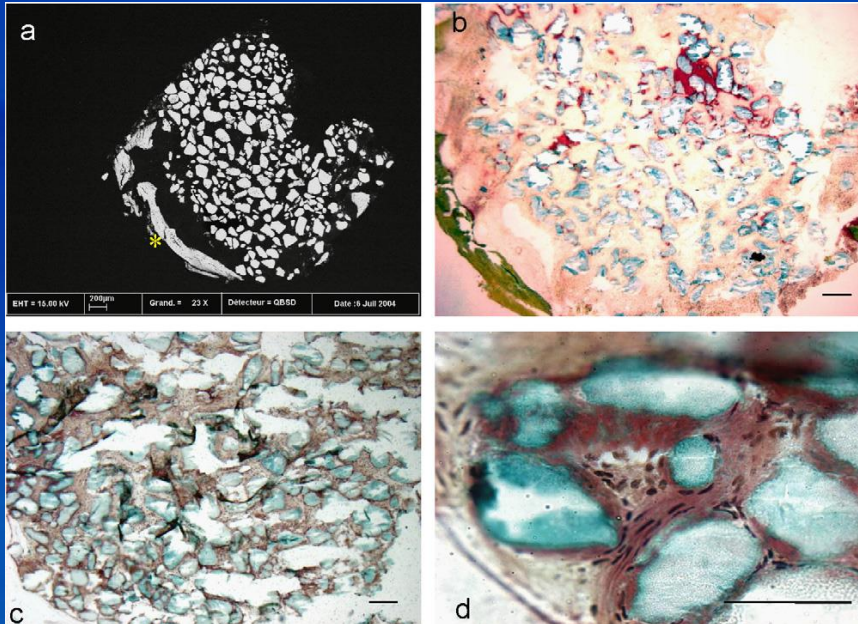
66 years old male





Pierre Weiss et al., Biomaterials 28 (2007) 3295–3305

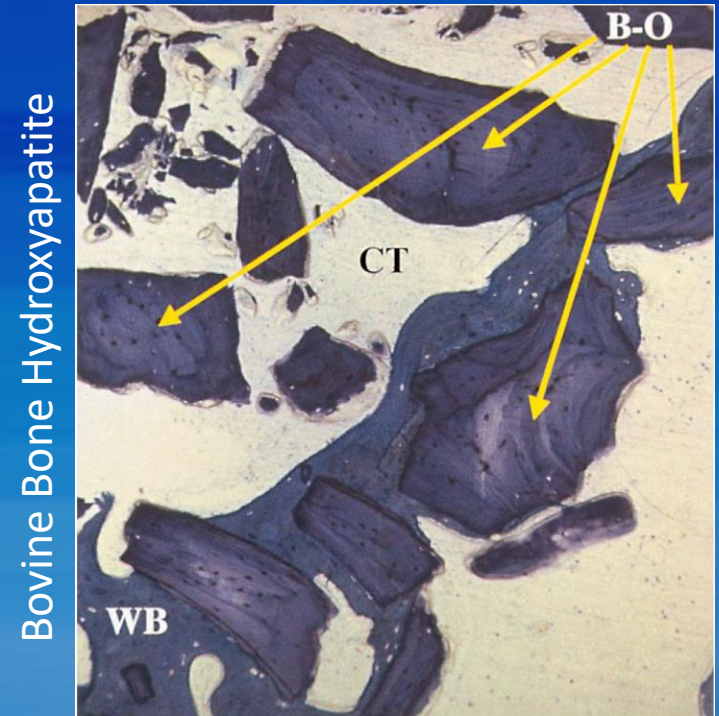
Biopsy was harvested after 3 years of filling the dental socket with **Biphasic Calcium Phosphate (BCP)** particles



(a) SEM micrograph showing the BCP granules 80–200 µm and mineralized bone (\*) in the lowest region of the defect, (b, c and d) histological sections showing osteoid tissue between the ceramic granules (Movat's pentachrome and Goldner's trichrome staining).

Carmagnola et al., Clin. Oral Impl. Res. 14, 2003 / 137–143

Biopsy was harvested after 7 months from sockets grafted with Bio Oss



Bio-Oss particles are surrounded by connective tissue (CT). Only 40% of the circumference of the Bio-Oss particles (B-O) was in contact with woven Bone (WB).

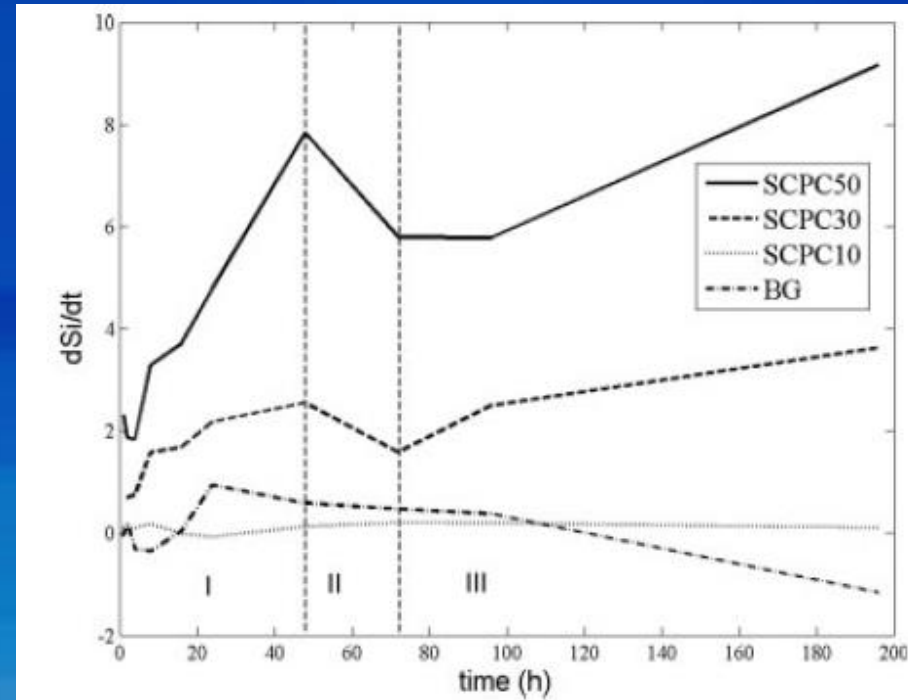
enhances vascularization

increases osteocalcin synthesis,

Enhances synthesis and  
stabilization of collagen I,

stimulate Osteoblasts differentiation  
and down regulate Osteoclasts,

Si ions  
released  
from SCPC

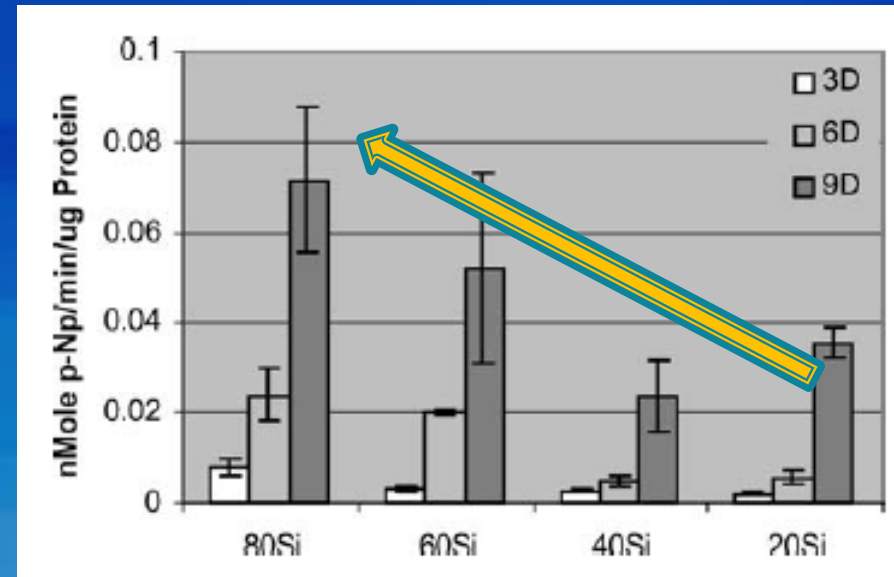
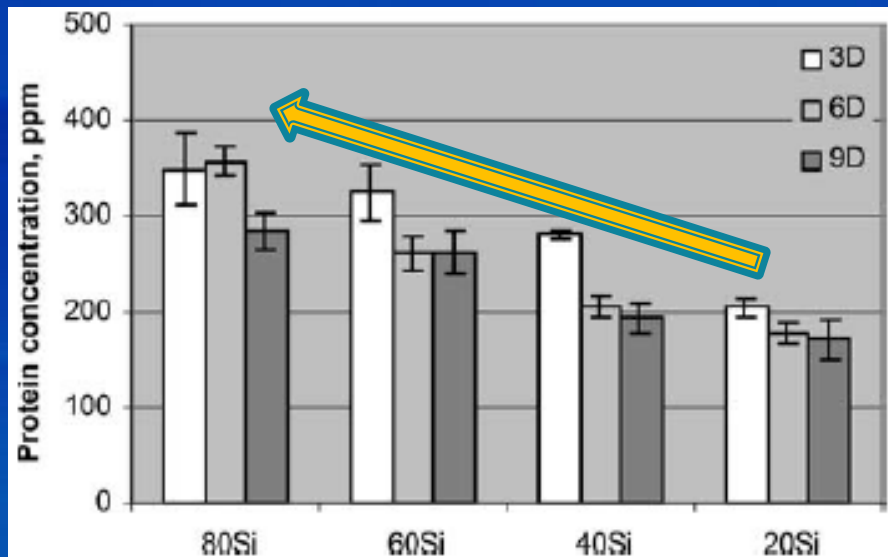


Gautam Gupta et al., JBMR 2006

1. Zhai W, et al., Acta Biomater 2012;
2. Ning CQ, et al, J Mater Sci Mater Med 2005
3. El-Ghannam A: J Biomed Mater Res 2004
4. El-Ghannam A, J Biomed Mater Res A 2006
5. Rania Abd ElAziz,, J. Oral and Maxillofacial Surgery, (2015).

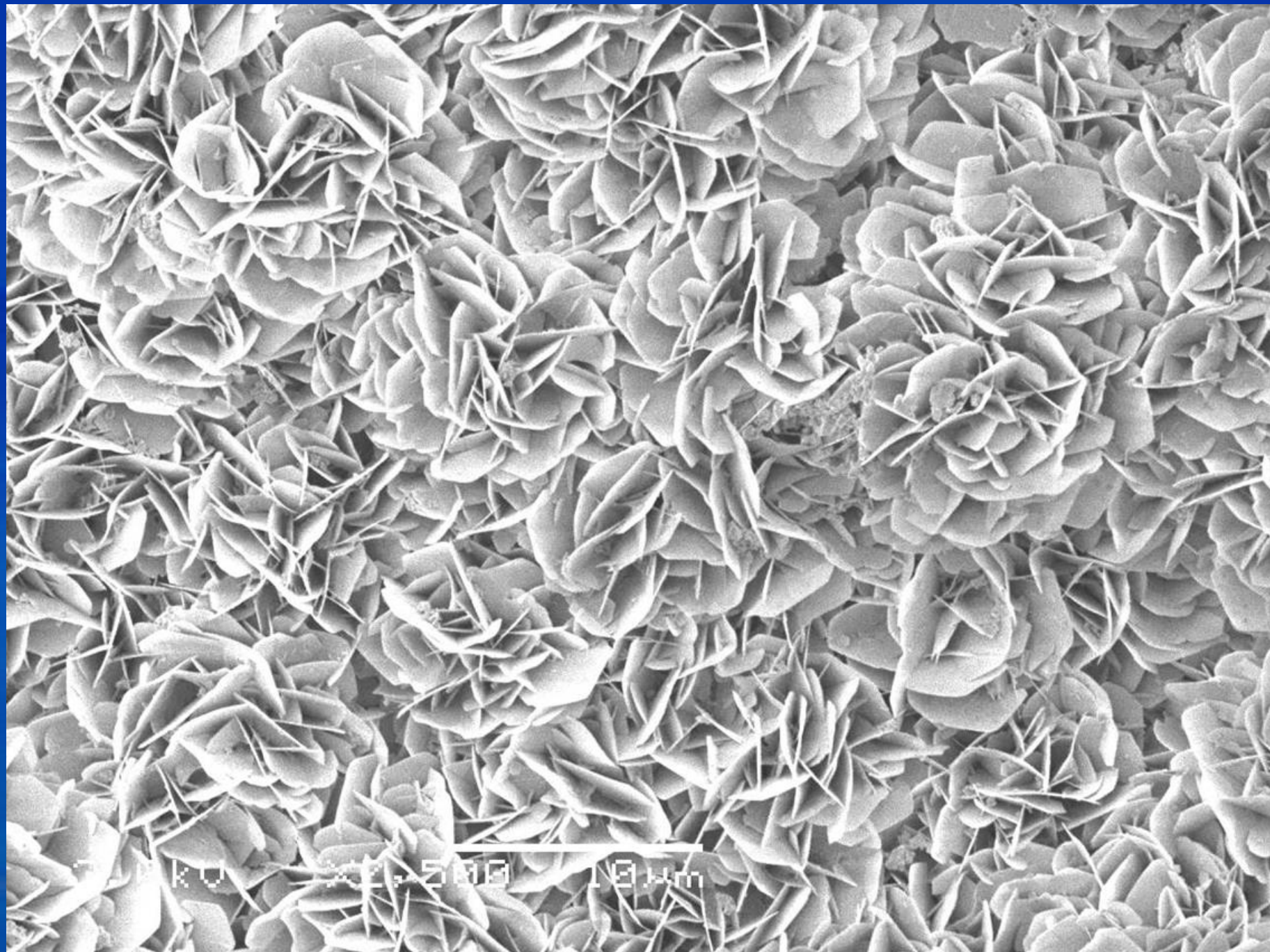


# Silica-enhances differentiation and bone matrix formation



As the silica% in the calcium phosphate substrate increased, attached cells produced

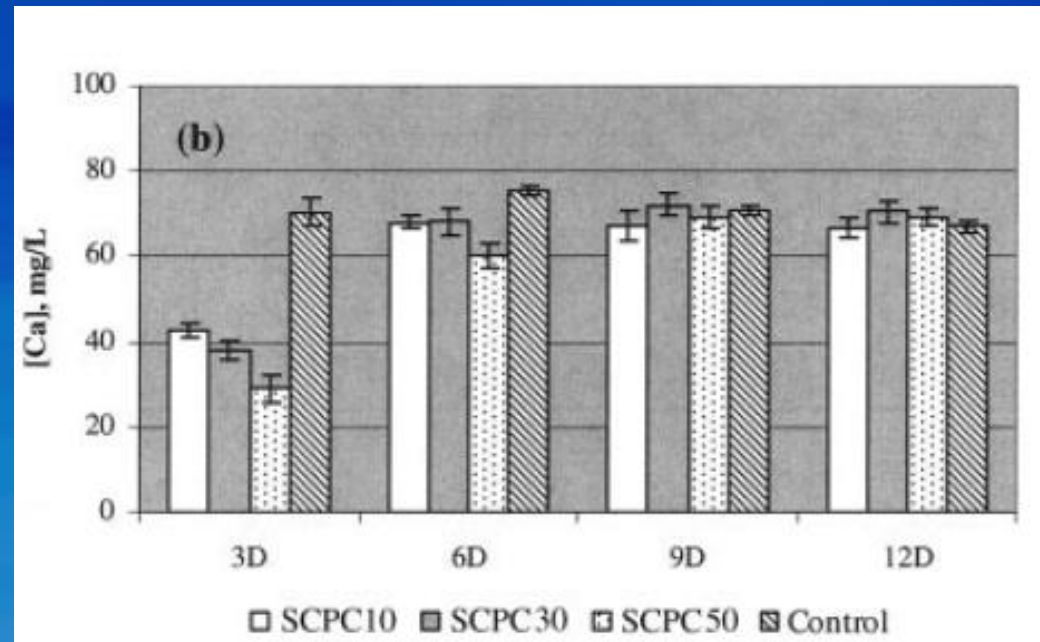
1. Higher amounts of collagenous protein.
2. Higher Alkaline Phosphatase activity





# Silica Enhances Calcium Uptake by SCPC From Physiological Solution

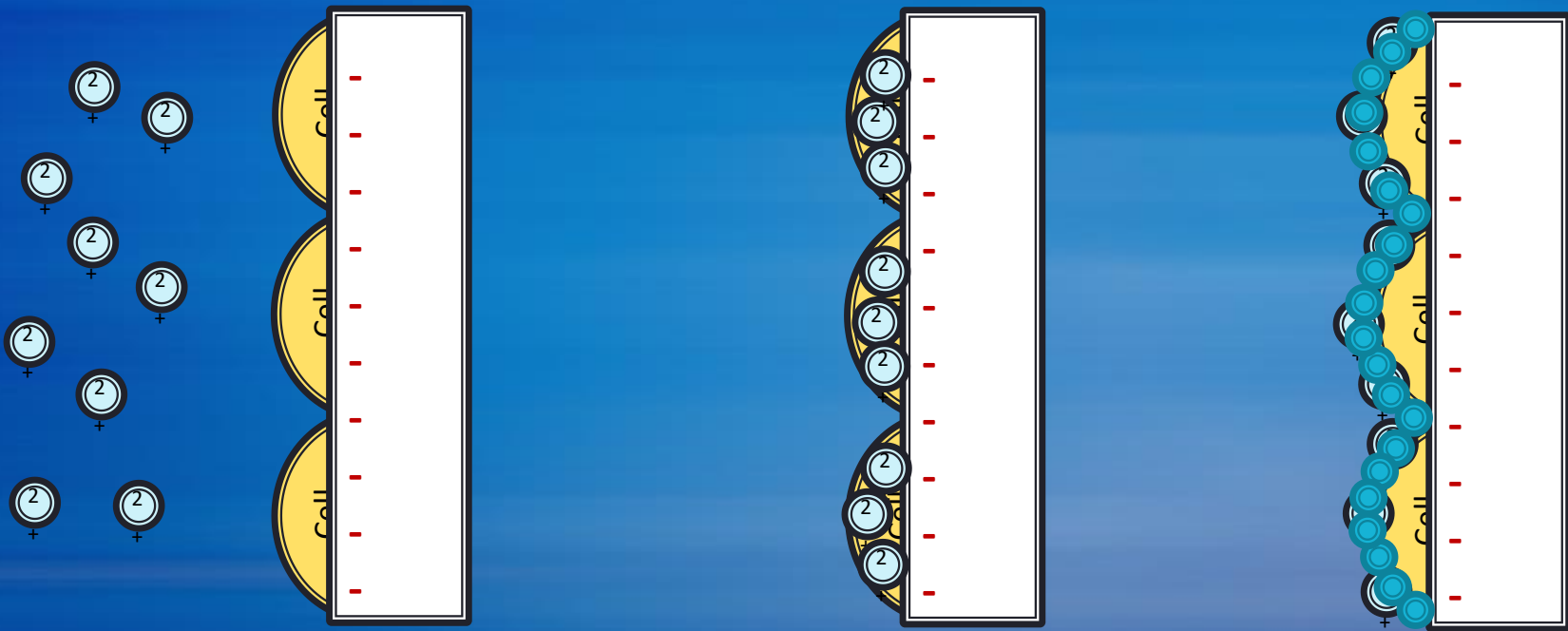
The SCPC withdrew Ca ions from physiological solution



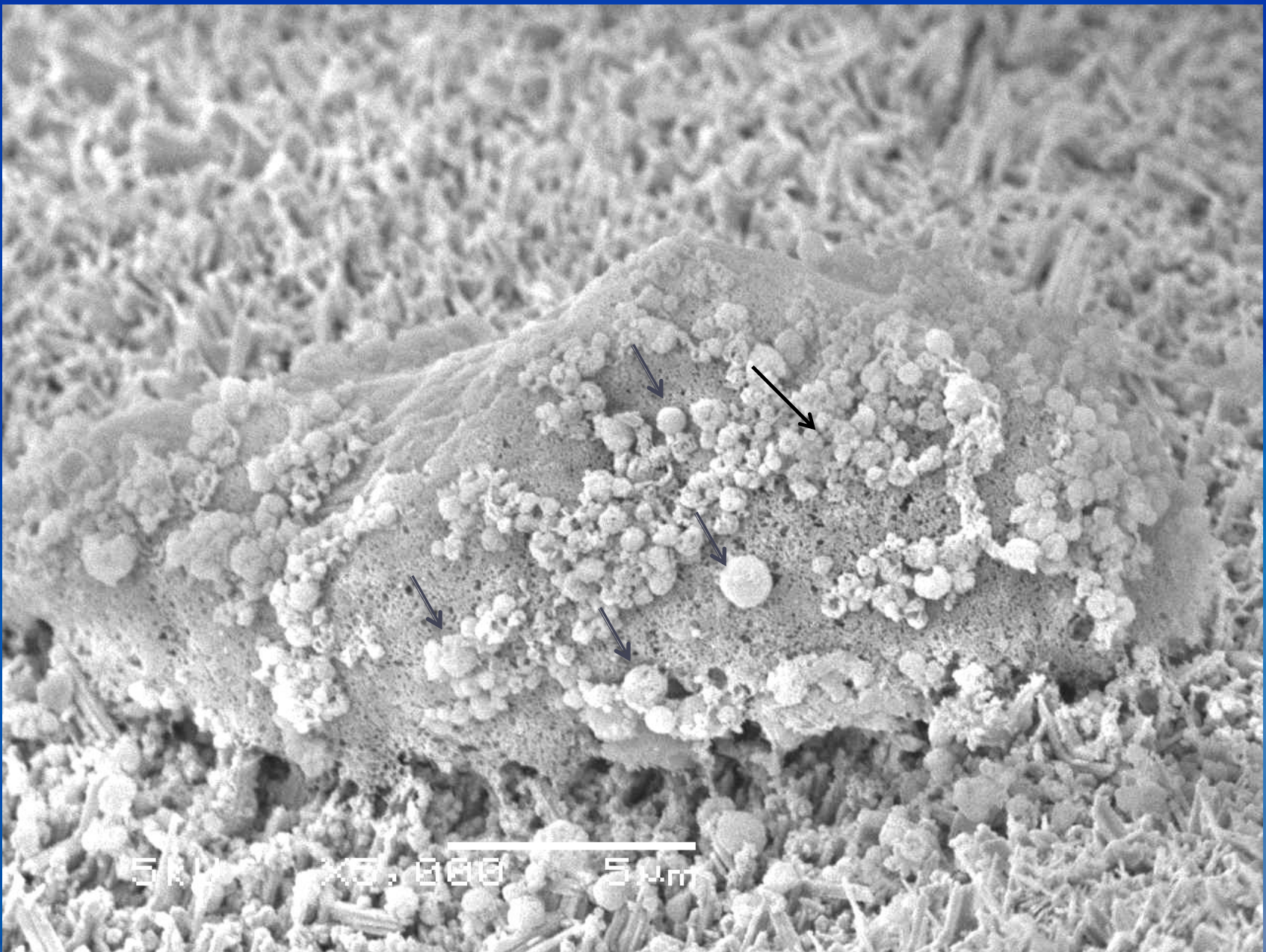
The Ca concentration in media incubated with the SCPC decreased as the silica content in the ceramic increased.

# The Effect of $\text{Ca}^{2+}$ flow on Bone Formation

- In the presence of cells, the electronegativity of the SCPC surface **itself** will cause a  $\text{Ca}^{2+}$  flow into attached cell
- To maintain intracellular ionic balance, the cells process calcium ions into calcium phosphate bone mineral.

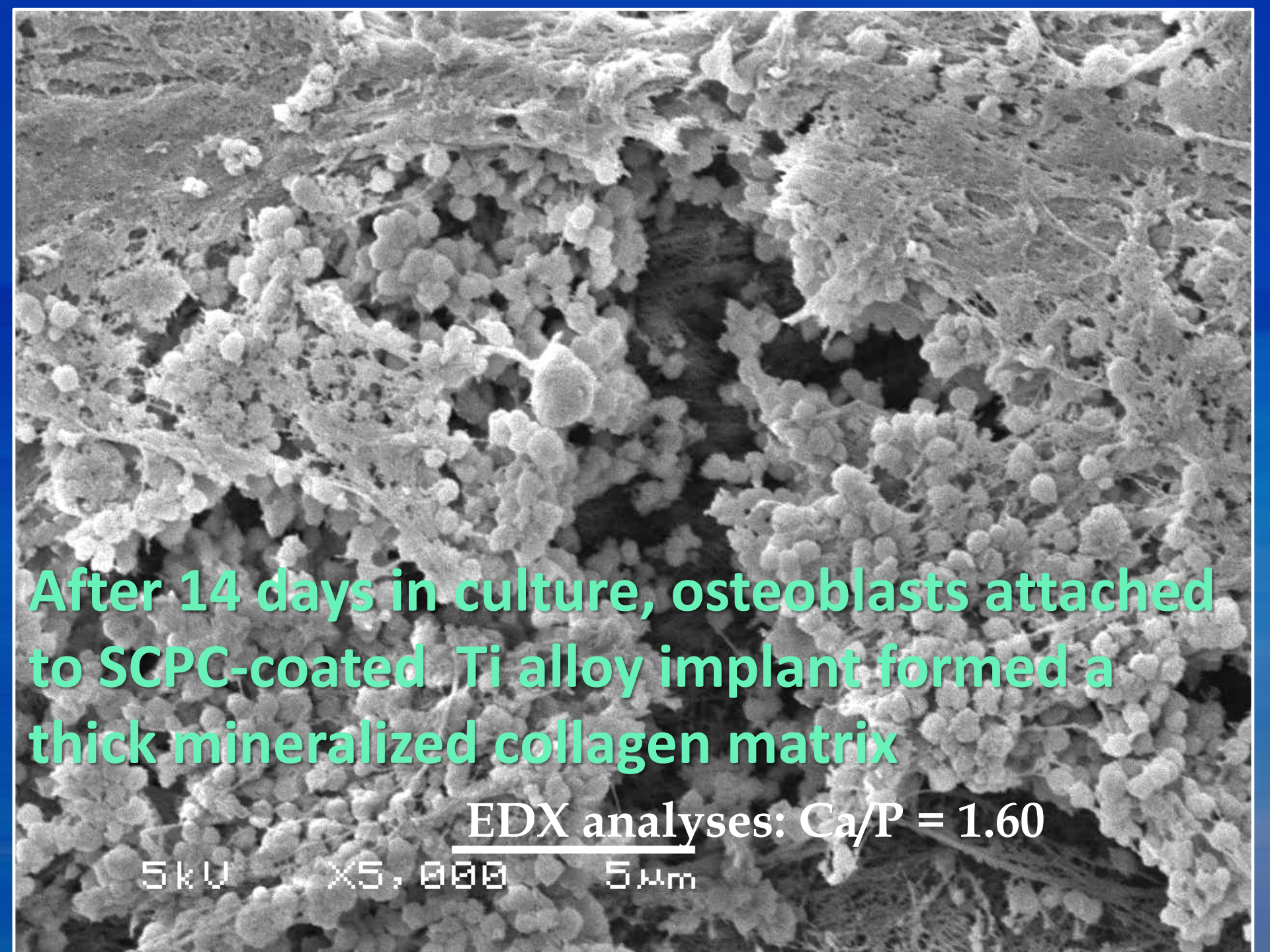






**The arrows point to the calcified nodules produced by a bone cell attached to the SCPC surface.**





This scanning electron micrograph (SEM) shows a dense, interconnected network of cells and extracellular matrix. The cells appear as rounded, clustered structures, while the matrix forms a complex, web-like structure surrounding them. The overall texture is highly porous and fibrous, characteristic of a mineralized collagen matrix.

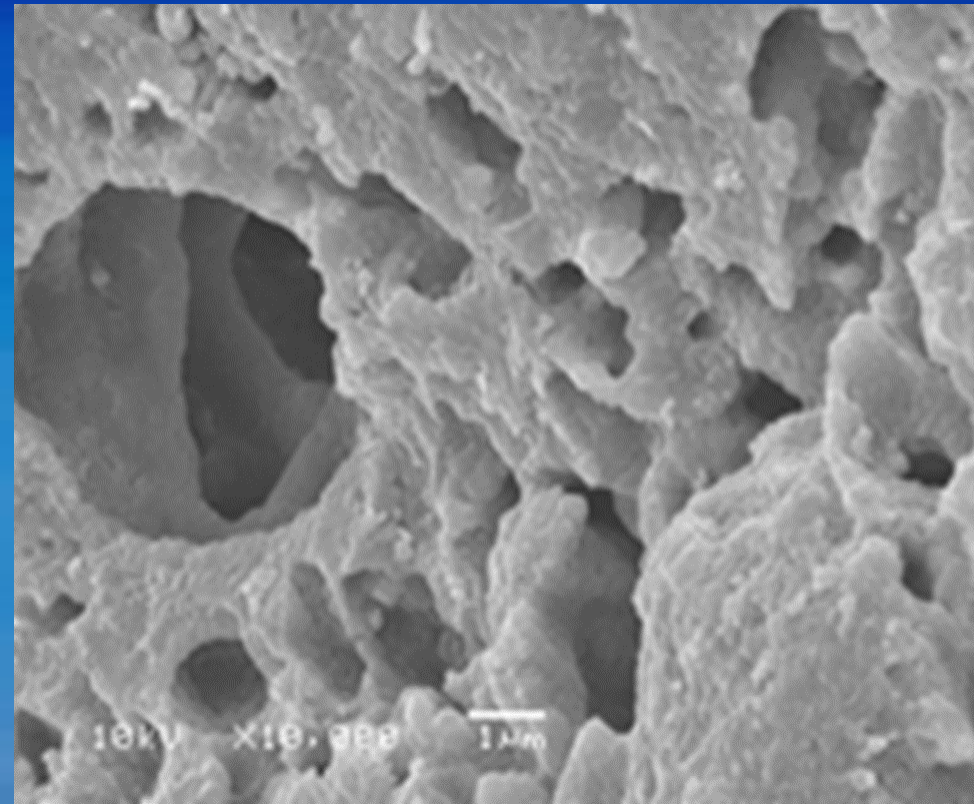
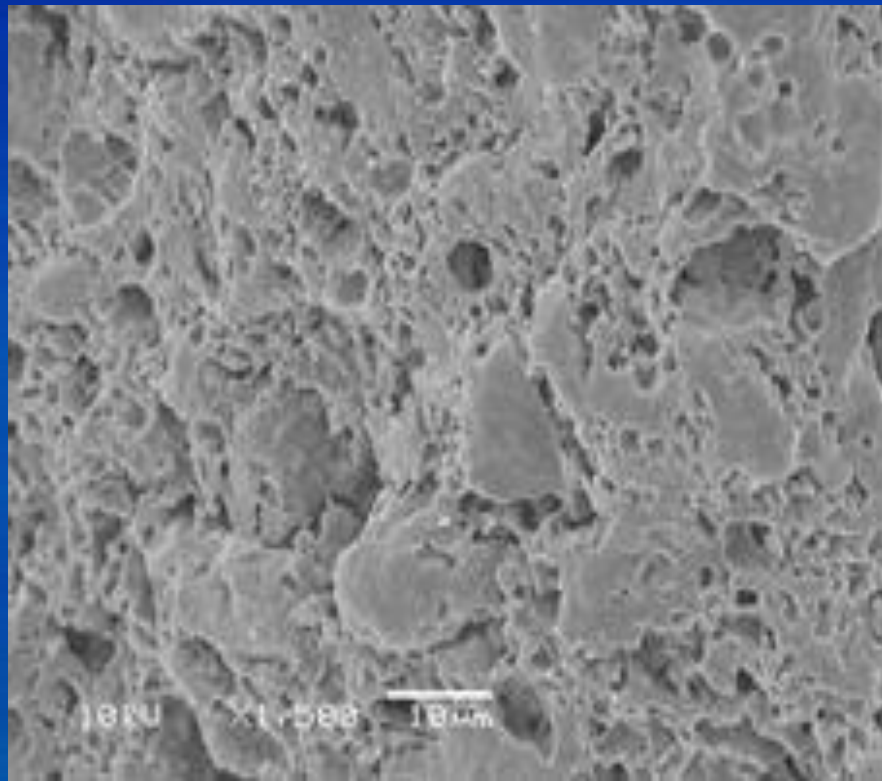
After 14 days in culture, osteoblasts attached to SCPC-coated Ti alloy implant formed a thick mineralized collagen matrix

EDX analyses: Ca/P = 1.60

5kV X5,000 5μm



# Porous Structure Provides High Surface Area in Contact With Cells





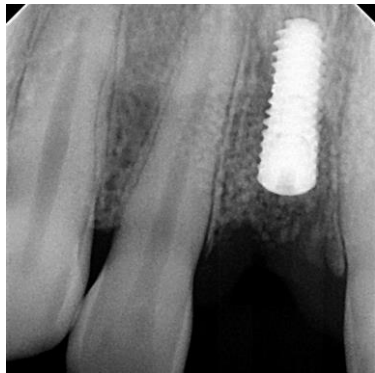
**Perforated Root canal  
on #8**



**After tooth removal**



Immediately after grafting with SCPC granules bioceramic . A resorbable collagen cellulose fibers (sure-stop), was placed on the top of the SCPC granules.



**After 3 month,  
the implant was  
placed**



**After 13 months**





# ShefaBone SCPC: We Grow Bone

