COLLAGEN-MIMETIC HYDROGEL MATRICES RECAPITULATE MALIGNANT AND NON-MALIGNANT MINERAL DEPOSITION

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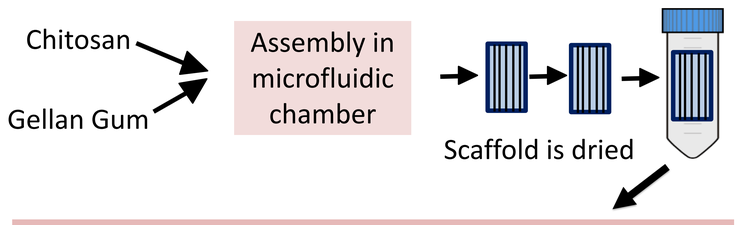
Introduction

- Early diagnosis and histological characteristics help manage treatment and improve patient outcomes in breast cancer [1].
- **Microcalcifications**: insoluble deposits of calcium minerals; considered a hallmark of ductal carcinoma in situ (DCIS)[2].
  - **Type 1** (calcium oxalate, benign tumors)
  - **Type II** (calcium phosphate, hydroxyapatite, malignant tumors)
- Hydrogel matrices: aligned fibrous structure and hierarchy of collagen, an extracellular matrix protein found in cancer cell invasion.
- Material characteristics must be understood to understand the role of the microcalcifications in disease progression

Hypothesis

Incubation of hydrogel matrices in phosphate and oxalate buffer will result in increasing deposition of type I and type II minerals over a period of ten days.

Methods



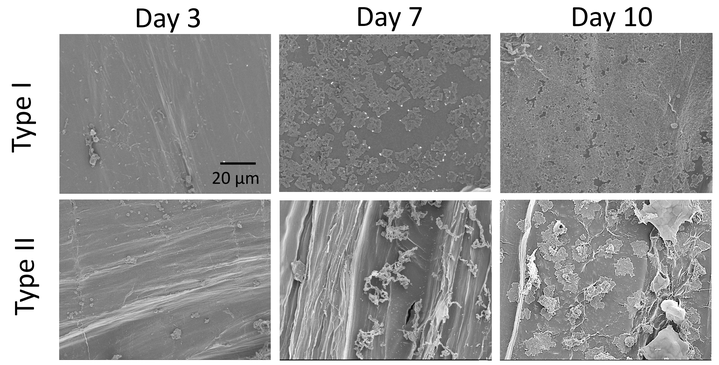
Scaffold is incubated for 3, 7, and 10 days in calcium oxalate or calcium phosphate (Simulate Body Fluid).

Mineral Characterization
- X-Ray Diffraction (XRD)
- Fourier Transform Infrared Spectroscopy

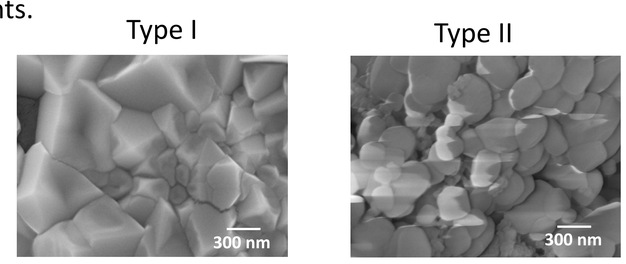
Material Characterization:
- Scanning Electron Microscopy (SEM)

Results

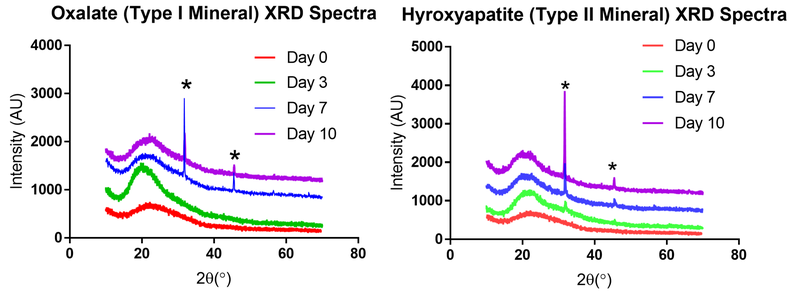
Scanning Electron Microscopy (SEM)



- Confirmed presence of minerals starting at three days with distinct morphological features appearing around day seven.
- Visible differences in the extent of mineralization at all time points.

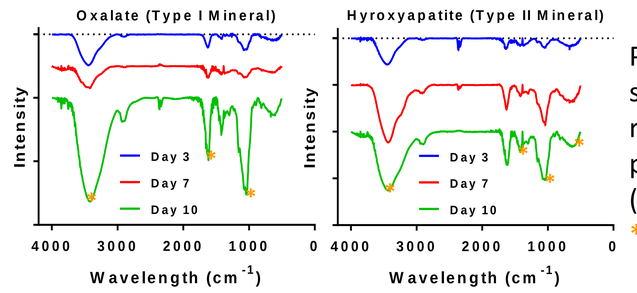


X-Ray Diffraction (XRD)



- Peaks of XRD spectra match reference (indicated by *) [3] [6]
- Missing peak at 15° in XRD of Type I microcalcifications, which may be obscured by the XRD of the organic scaffold.

Fourier Transform Infrared Spectroscopy (FTIR)



Peaks of FTIR spectra match reference peaks (indicated by *) [4] [5].

Discussion

- Mineralization occurs to a significant degree through ten day period (confirmed by SEM and change in XRD/FTIR peaks)
- XRD confirms crystal structure of type I and type II minerals
- FTIR spectra confirms functional groups of type I and type II minerals.
- End result: Successfully characterized properties of type I and Type II minerals deposited in the hydrogel matrices
- These mineralized matrices will be further used to study effect of microcalcifications on tumor progression

References

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Acknowledgements

The project was supported in part by award number P30CA047904 from the National Cancer Institute and the Henry L. Hillman Foundation (SS) and Summer fellowship to NN by the Swanson School of Engineering and the Office of the Provost (NN).