2015 Science Writers Symposium

The Many Applications of 3D Printing
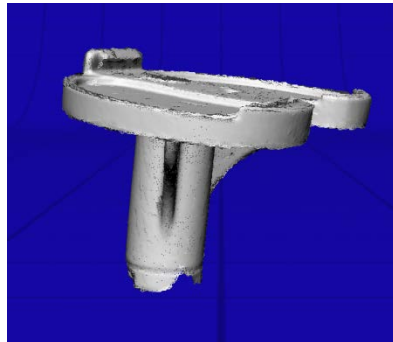
Matthew Di Prima, Ph.D.

Materials Scientist

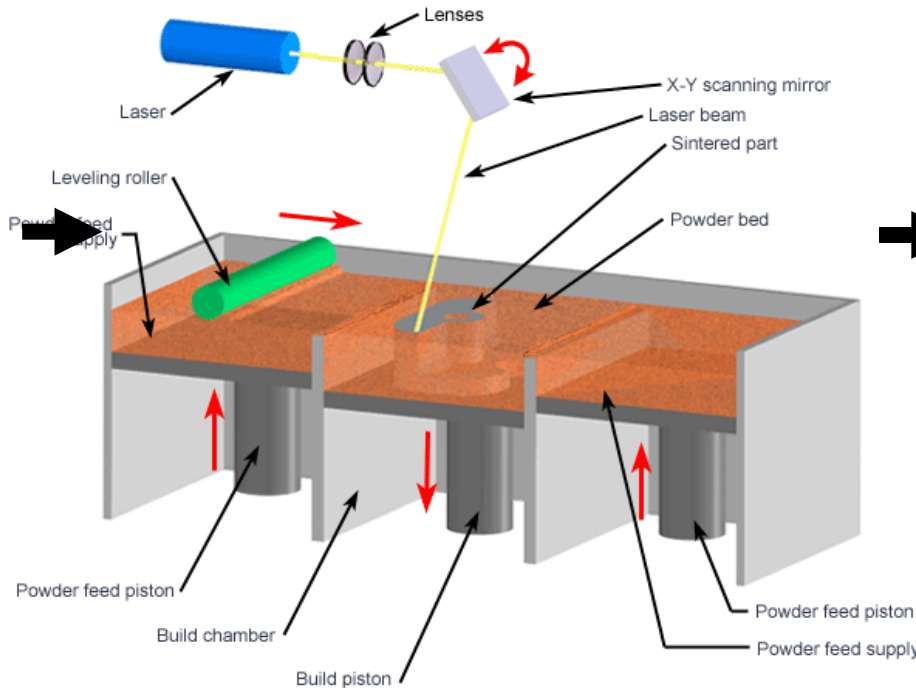Office of Science and Engineering Laboratories/Center for Devices and Radiological Health

September 18, 2015

Overview of 3D Printing

- Start with digital model; can be based on patient imaging.
- Build layer by layer using a number of technologies.

Digital model

Component

www.custompart.net

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3D Printed Medical Devices

- Patient matched implants
  - Skull plate
  - Maxillofacial implants

    K121818
    OsteoFab by OPM
    http://www.accessdata.fda.gov/cdrh_docs/pdf12/K121818.pdf

- Patient matched surgical guides
  - Craniofacial
  - Knee
  - Ankle

    K120956
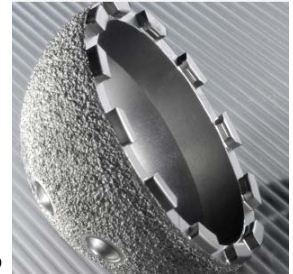   VSP® by Medical Modeling
    http://www.accessdata.fda.gov/cdrh_docs/pdf12/K120956.pdf

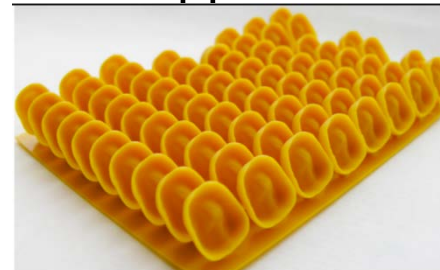- Orthopedic devices
  - Hip cups
  - Spinal cages
  - Knee trays

    K102975
    Novation Crown by Exatech
    http://www.accessdata.fda.gov/cdrh_docs/pdf10/K102975.pdf

- Dental
 - Temporary bridges
  - Reconstructive surgery support

    K102776
    e-DENT Temporary Resin by DeltaMed GmbH
    http://www.accessdata.fda.gov/cdrh_docs/pdf10/K102776.pdf

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FDA Research

Mechanics and Materials

- Investigating the effect of orientation on fatigue properties

- Investigating the effect of energy source of metal printers on mechanical properties

- Using radiation to cure plastics post printing


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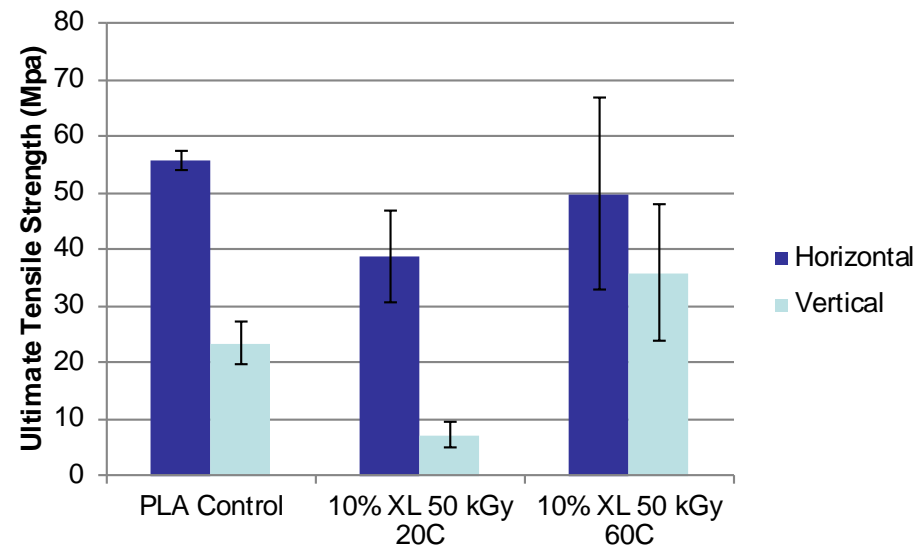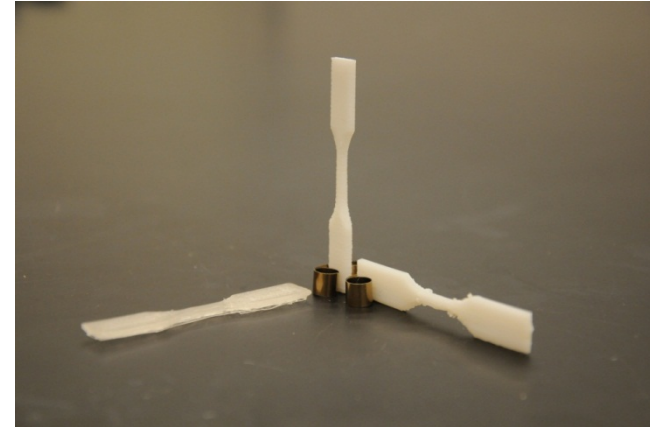
FDA Research

Biological Interactions

- Investigating how 3D printing affects hydrogel/soft material properties

- Cleaning validation and biocompatibility evaluation of 3D printed materials
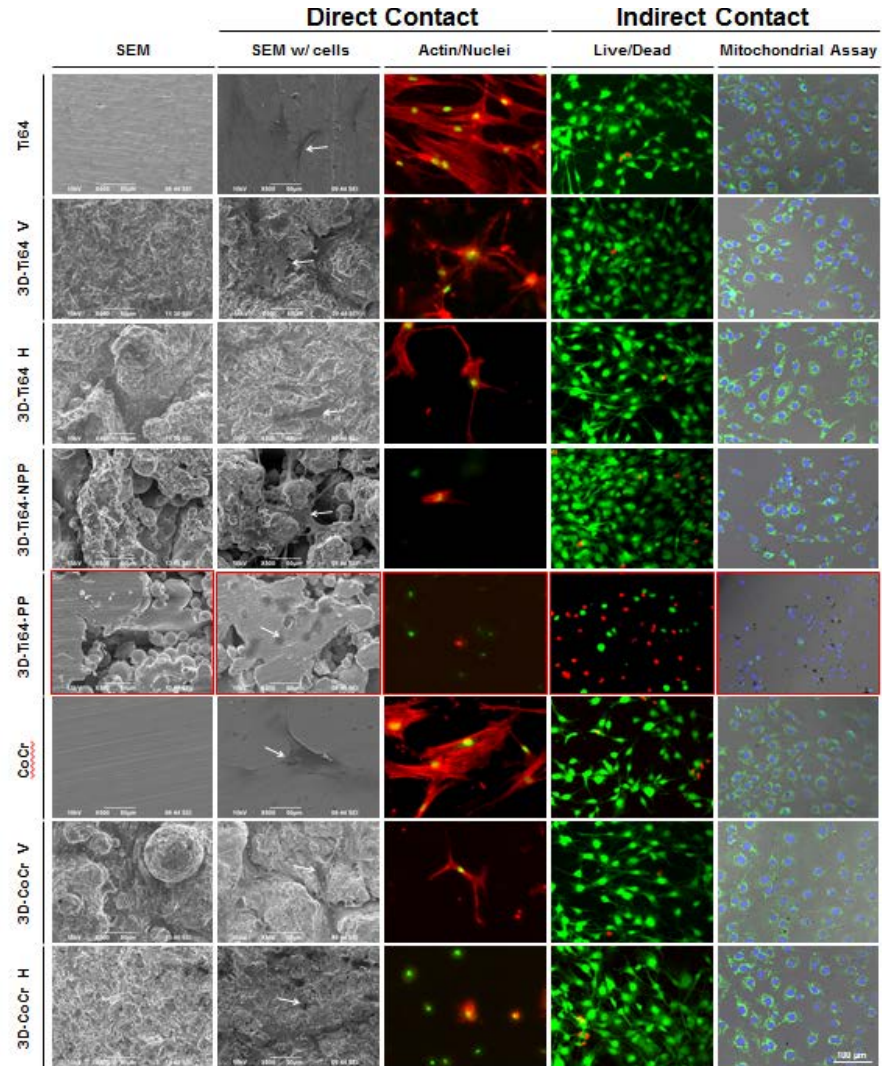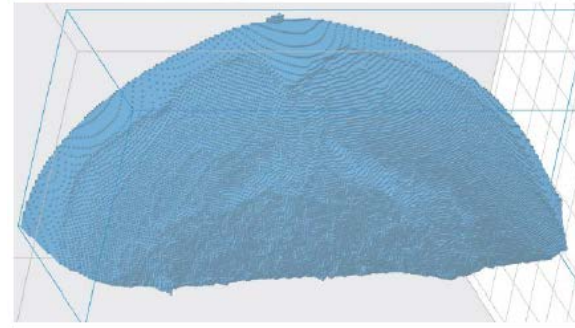
FDA Research

Tissue Phantoms

- Enables fabrication and rapid dissemination of biomimetic (i.e. anatomically correct) test objects

- Developing breast phantoms for better evaluation of X-ray mammography

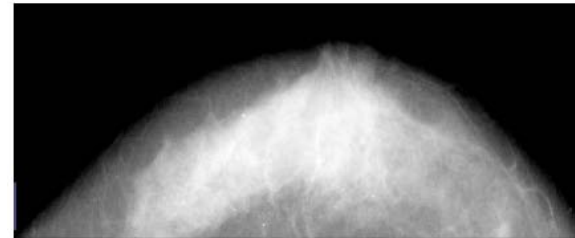- Developing vascular phantoms for oximetry device evaluation
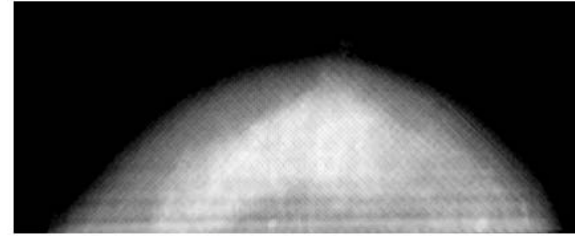
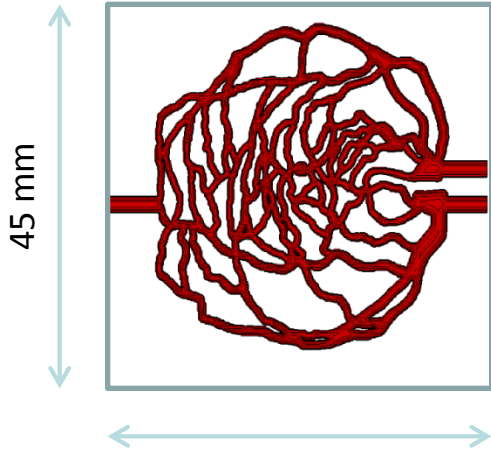(d) Radiography printed phantom

(c) 3D printed phantom.

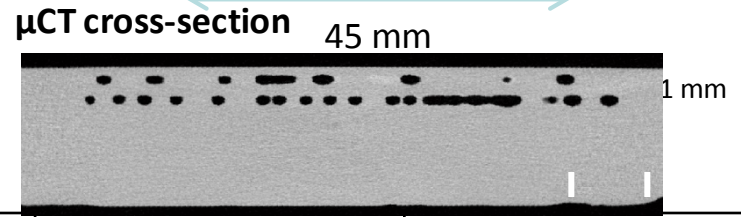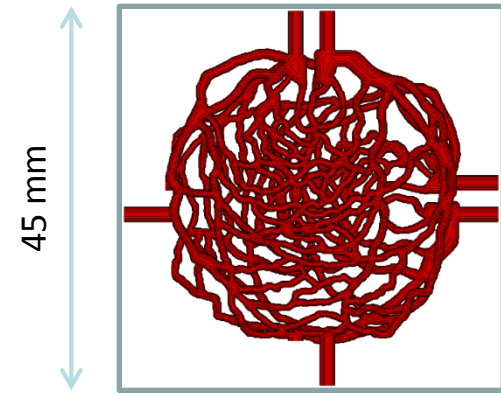(b) Rendering processed triangle mesh object.

(a) Original CC mammography.

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Geometric Validation – μ-CT Image Volumes

One-layer phantom
Top view

45 mm

μCT cross-section 45 mm

13 mm

750 μm

5 mm
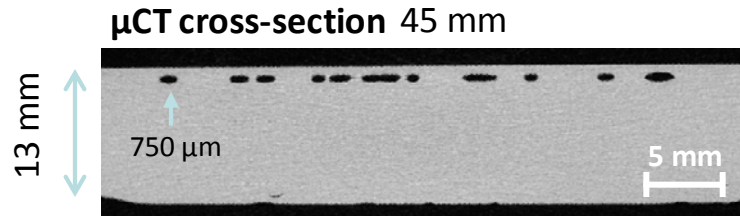
1-layer Phantom	Designed	Measured
Channel thickness	1.32 mm	750 μm
Channel depth	350 μm	750 μm

Two-layer phantom
Top view

45 mm

μCT cross-section 45 mm

13 mm

1 mm

2-layer Phantom	First layer		Second layer	
	Designed	Measured	Designed	Measured
Channel thickness	1.58 mm	950 μm	1.58 mm	950 μm
Channel depth	350 μm	850 μm	2.28 mm	2.76 mm

FDA Research

Patient Matched Tools

- Patient matched tools are printed to be a match to a patient's anatomy

- Investigating clinician preference as well as developing metrics to evaluated efficacy

http://www.fda.gov/downloads/MedicalDevices/NewsEvents/WorkshopsConferences/UCM418393.pdf

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