Fiber-based scaffold characterization for medical devices: development, implementation, and utilization of image-based test methods

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Fiber-based scaffolds offer significant promise for regenerative medicine and medical device applications. Of particular note, fiber-based scaffolds are able to mimic the mechanics, architecture, and functionality of native tissues while providing a temporary replacement for new cellular and tissue growth. Development of fiber-based scaffold characterization continues to be an ongoing effort as new methodologies are being developed, validated, and utilized as release criteria for these products. Accurate and timely measures of vital release criteria are desirable to ensure high quality, safety, effective, and consistently reliable products are provided to clinicians. Poly-Med’s extensive work on fiber-based scaffolds and devices spans the use of technical textiles (warp knit, weft knit, and braided constructs) as well as the emerging technologies of electrospinning and additive manufacturing. In this talk, scaffold characterization criteria will be reviewed with an emphasis on image-based analysis approaches reviewing periodicity, porosity (void space), and fiber size of a variety of constructs. Method development and release testing will be examined along with batch-to-batch variations and the importance of establishing robust specifications that can be accurately and reproducibly measured. Fiber-based scaffolding continues to be an ideal platform for tissue scaffolds and medical devices that require superior characterization to advance their utilization in emerging medical therapies.

Figure 1a-c: Fiber-based scaffolds formed from varying technologies of weft knitting (a-b) and electrospinning (c) with differing void space, fiber size, and orientation.