Introduction

Extracellular matrix stiffness influences cell proliferation, differentiation, and gene expression. Monitoring the mechanical properties of 3D cell culture scaffolds is a critical aspect of tissue engineering and regenerative medicine. Here, the ElastoSens™ Bio² is used to evaluate the gelation kinetics and stiffness of a variety of collagens used in 3D cell culture.

Study Design & Methods

In this study, the mechanical properties of soft biomaterials were non-destructively measured with the ElastoSens™ Bio² system. Advanced BioMatrix (Carlsbad, California), a world leading provider of collagen for cell culture and tissue engineering applications, supplied the materials. The type I human, bovine and porcine collagens tested here are ideal for 2D surface coatings or 3D cell cultures.

Collagens were tested for gelation kinetics and shear elastic moduli. The kinetic elasticity curves for all collagens were sigmoidal when incubated at 37°C. All materials gelled rapidly with highly repeatable gelation times ($t_{onset}$ = 12 ± 2 min) and consistent elasticities with mean Young’s modulus of 854 ± 74 Pa for bovine Nutragen®, 735 ± 41 Pa for bovine PureCol®, 719 ± 36 Pa for bovine GelCol®, 667 ± 46 Pa for porcine FlexiCol®, and 582 ± 32 Pa for human-derived VitroCol® as shown in Figure 1.

About the ElastoSens™ Bio²

The ElastoSens™ Bio² is a benchtop instrument that measures viscoelastic properties of soft gels as a function of temperature or time. This instrument allows contactless, non-destructive testing that maintains sample sterility. This way, gelation profiles and long-term changes in viscoelastic properties can be measured on the same sample. Our patented technology uses low-amplitude mechanical vibration to excite a confined sample. Lasers detect the dynamic response, which is then converted into viscoelastic parameters (shear storage and loss moduli).

Advantages of the ElastoSens™ Bio²

- 3D print directly into sterile sample holders
- Measure stiffness changes in 3D cell cultures
- Repeat longitudinal tests on the same sample
- Analyze up to 3 specimens simultaneously
- Load samples quickly and easily

Rapidly obtain statistical significance with simultaneous testing of multiple samples.