

Collagen structure affected by production method impacts clinical outcome

Subramanian Gunasekaran, PhD

Introduction:

The structure of a type-I collagen matrix is highly significant for meeting superior tissue repair and regenerative purposes. Lyophilization or freeze-drying is widely used by many collagen manufacturers without realizing the implications of such treatment on the native structure of collagen. On the other hand, the sedimental preparation of collagen is known to retain the native structure and function of these matrices. In this study, we compared two methods of collagen preparation using cell infiltration methods and the results are extrapolated to indicate its bioactivity and possible clinical outcome.

Materials and Methods:

Using cell culture methods, the cell-matrix interactions have been assessed between the control group manufactured by a proprietary sedimentation process and most commonly used lyophilization or freeze-drying process. The quantity of cell infiltration has been monitored using microscopic and DNA content analysis.

Results and Discussion:

The cell infiltration rate is significantly increased by 27% in the control group. Lyophilization of collagen randomly distributes fibrils in a non-native configuration with an average porosity of more than 800 microns¹. Such a large porosity coupled with lyophilization induced collagen cross-links are non-conductive for cell infiltration. The collagen matrix prepared by the sedimentation process yields the fiber structure to be more native with parallel alignment. Their porosity is approximately 20 microns that attract more cells and in turn, would attract tissue regenerative factors. Based on other clinical evidence, collagen processed by sedimentation without cross-linking should be the preferred method for maximizing the regenerative clinical outcome of collagen-based matrices.

Reference:

1. Murphy & O'Brien (2010). Understanding the effect of mean pore size on cell activity in collagen... Cell adhesion & migration, 4(3), 377-381.