Postgraduate Biophysical Seminars
Institute of Biochemistry and Biophysics, University of Tehran, Iran
1395-96a

Polymeric scaffolds in repairing tympanic membrane

Sara Nourani*, Hedayatollah Ghourchian

Institute of Biochemistry and Biophysics, University of Tehran, Tehran, Iran

"Presented at the Postgraduate Biophysical Seminars, Autumn 95 (2016)"

Abstract

Introduction: Tympanic membrane (TM) is a thin semi-transparent structure of middle ear. Perforations of the TM are common and the most common etiologies include trauma, otitis media [1]. The use of novel adjuvant substances and tissue engineering techniques have been applied in both the laboratory and clinical settings to enhance the healing of TM perforations and to potentially replace autologous grafts in human patients [2]. Mathematical models have also played a central role in helping the research community understand the mechanics of the eardrum [3]. More recent strategies in TM tissue engineering have involved utilizing biosynthetic scaffold materials to produce an ideal structure that acts as an ECM until host cells can repopulate and resynthesize a new natural matrix [4]. The electrospinning technique has been used as an efficient processing method to manufacture nanoscale fibrous structures for tissue engineering [5]

Methods: 3D scaffolds were fabricated via electrospinning. Scanning electron microscopy (SEM) was used to investigate the size of nanofiber. Constitutive modeling was used to estimate an elastic modulus based on the elastic modulus of collagen.

Results and discussion: The fiber diameters will depend on various elements like the polymer concentration and applied voltage which can affect on mechanical properties of electrospun nanofibers. Mathematicl method has been successfully used in polymer science and engineering to rationalize the molecular structure, function, and interaction of the polymer material and to determine its macroscopic structure and properties.

Conclusion: In this regard, nanoscale fibrous scaffolds can provide an optimal template for cells to seed, migrate, and grow. A successful regeneration of biological tissues and organs calls for the development of fibrous structures with fiber architectures beneficial for cell deposition and cell proliferation

Keywords: Scaffold, Polymer, Tissue engineering, Electrospinning

Reference

1. Kim, J., et al., *A healing method of tympanic membrane perforations using three-dimensional porous chitosan scaffolds.* Tissue Engineering Part A, 2011. **17**(21-22): p. 2763-2772..
2. Hong, P., M. Bance, and P.F. Gratzer, *Repair of tympanic membrane perforation using novel adjuvant therapies: a contemporary review of experimental and tissue engineering studies.* International journal of pediatric otorhinolaryngology, 2013. **77**(1): p. 3-12
3. Fay, J., et al., *Three approaches for estimating the elastic modulus of the tympanic membrane.* Journal of biomechanics, 2005. **38**(9): p. 1807-1815.
4. Huang, Z.-M., et al., *A review on polymer nanofibers by electrospinning and their applications in nanocomposites.* Composites science and technology, 2003. **63**(15): p. 2223-2253.
5. Chen, Z., X. Mo, and F. Qing, *Electrospinning of collagen–chitosan complex.* Materials Letters, 2007. **61**(16): p. 3490-3494.