The effect of Gelatin/PU Blended Nanofibers for Wound Dressings

Dong Nyoung Heo, Sung In Joung, Sung Eun Kim, Il Keun Kwon*
Dept. of Oral Biology & Institute of Oral Biology, School of Dentistry, Kyung Hee University, Seoul 130-701, South Korea
*Corresponding e-mail: kwoni@khu.ac.kr

Statement of Purpose: The materials of wound dressing have been aimed at protection, inhibition of exogenous microorganism, invasion, and removal of exudate. Gelatin is a natural biopolymer derived from partial hydrolysis of native collagens and has been used in pharmaceutical and medical fields, such as carrier for drug delivery and wound dressing. Polyurethane (PU) is frequently used in wound dressings because of its good barrier properties and oxygen permeability. Electrospun nanofiber for wound dressing can meet the requirements such as higher gas permeation and protection of wound from infection and dehydration. The aim of this study was to evaluate the preparation and biological test of gelatin/PU blended nanofiber for wound dressing in vitro.

Methods: The blending solutions of elastic polyurethane (PU) and hydrophilic gelatin (blending ratio; 0, 30, 50, 70 and 100% gelatin to PU) were electrospun. The characteristics of gelatin/PU blended nanofibrous scaffolds were examined by morphological, biomechanic, surface property and wettability. The gelatin/PU nanfibrous blended scaffolds seeded with fibroblast cells and the modulation of adhesion, proliferation, and cytotoxicity was analyzed by MTT assay.

Results: The morphologies and mean diameter of nanfibers were uniformly electrospun ranged from 0.4 to 2.1 μm and mean diameter of nanofibers was increased with the increasing amount of gelatin (Fig 1). Regarding mechanical test, the blended nanofibrous scaffolds were elastic that total amount of PU increased. The contact angle and water uptake of gelatin/PU blended nanofiber were increased or decreased when amount of gelatin in blended solution decreased because of its increasing hydrophilicity (Fig 2). The cell adhesion and proliferation were increased when amount of gelatin in blended solution increased (Fig 3).

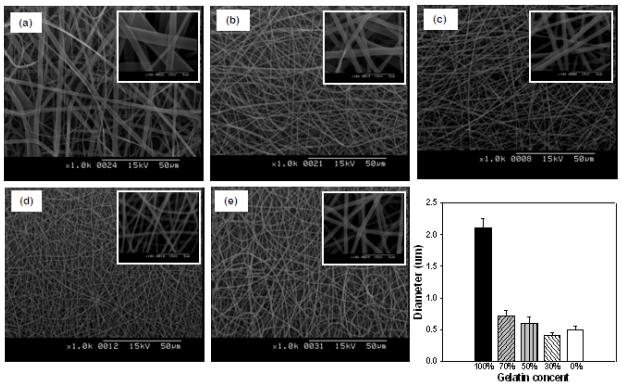

Figure 1. SEM images of electrospun gelatin/PU blended nanofibers: (a) GPU-1 (gelatin 100%), (b) GPU-2 (gelatin 70%), GPU-3 (gelatin 50%), GPU-4 (gelatin 30%), GPU-5 (gelatin 0%), and (f) mean diameter of gelatin/PU blended nanofibers.

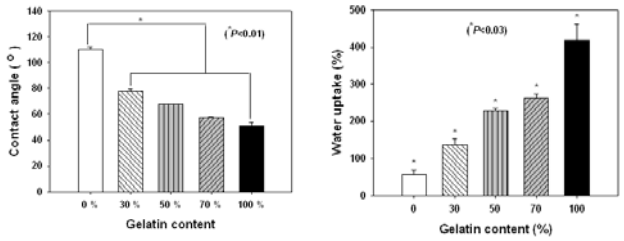

Figure 2. Surface property and water absorption capability.

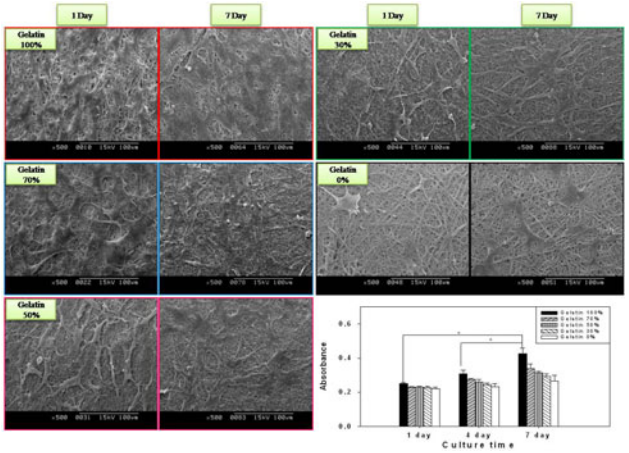

Figure 3. SEM images and cell proliferation on gelatin/PU blended nanofibrous scaffold at 1, 4, and 7 day. (*p<0.05)

Conclusions: The gelatin/PU nanofibrous scaffolds were produced with various blending ratio. The mean diameter of electrospun nanofibers was ranged from 0.4 to 2.1 μm. Increase of gelatin amount increased hydrophilicities (water uptake and water contact angle), and cell viabilities, otherwise it decreased mechanical properties. In conclusion, the gelatin/PU nanofibrous scaffolds will be potential applications for wound dressing based upon its unique properties.

References:

[1] Kwon IK, kidoaki S, Matsuda T. Biomaterials. 2005:26:3929-3939.
[2] Kwon IK, Matsuda T. Biomacromolecules. 2005:6:2096-2105.
[3] Kidoaki S, kwon IK, Matsuda T. J Biomed Mater Res B Appl Biomater. 2006:76:219-229.

Acknowledgement: This study was supported by a grant of the Korea Healthcare Technology R&D Project, Ministry for Health, Welfare and Family Affairs, Republic of Korea. (A0809570)