

Hyaluronic acid based adipose tissue derived extracellular matrix scaffold in wound healing: Histological and immunohistochemical study

Young-Joon Jun*, M.D., Ph.D.,MBA
Department of Plastic & Reconstructive Surgery, Seoul St. Mary's Hospital, The Catholic University of Korea

Introduction

Adipose tissue is considered the most accessible and optimal source of extracellular matrix (ECM) products in clinical settings. We evaluated the effectiveness of human adipose tissue-derived ECM (adECM) sheets as a wound dressing material. To enhance healing potential and cost-effectiveness, we modified adECM sheets by adjusting ECM concentration and incorporating crosslinked hyaluronic acid (HA) Adipose tissue was obtained from healthy donors, processed, and casted into ECM sheets.

Materials and Methods

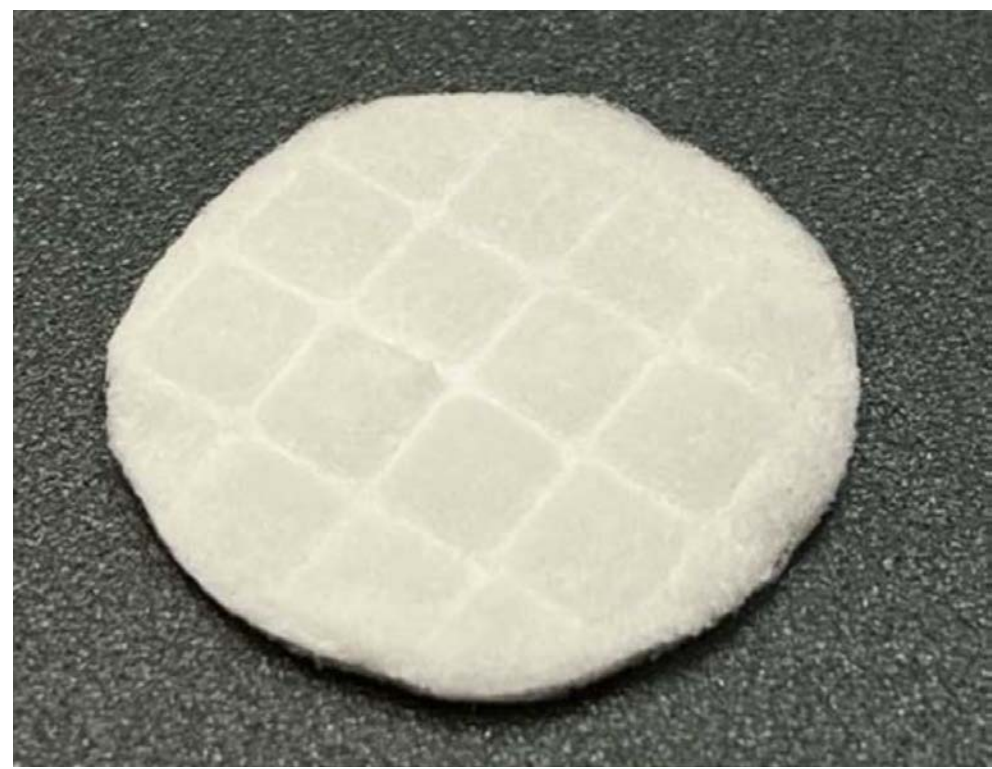
Crosslinked HA was added to create ECM-HA sheets (Scaffiller, Medikan, Korea). In vitro analysis involved seeding adipose-derived stem cells (ASCs) onto porous ECM-HA sheets and evaluating cell survival rate and cytokine array after 3 days. In vivo efficacy, applying ECM-HA sheets to full-thickness wounds in a rat model, with HA-based dressing and adECM sheets as control groups. Re-epithelialization and collagen deposition were examined through histopathological examinations, while immunohistochemistry was used to wound healing.

Conclusion

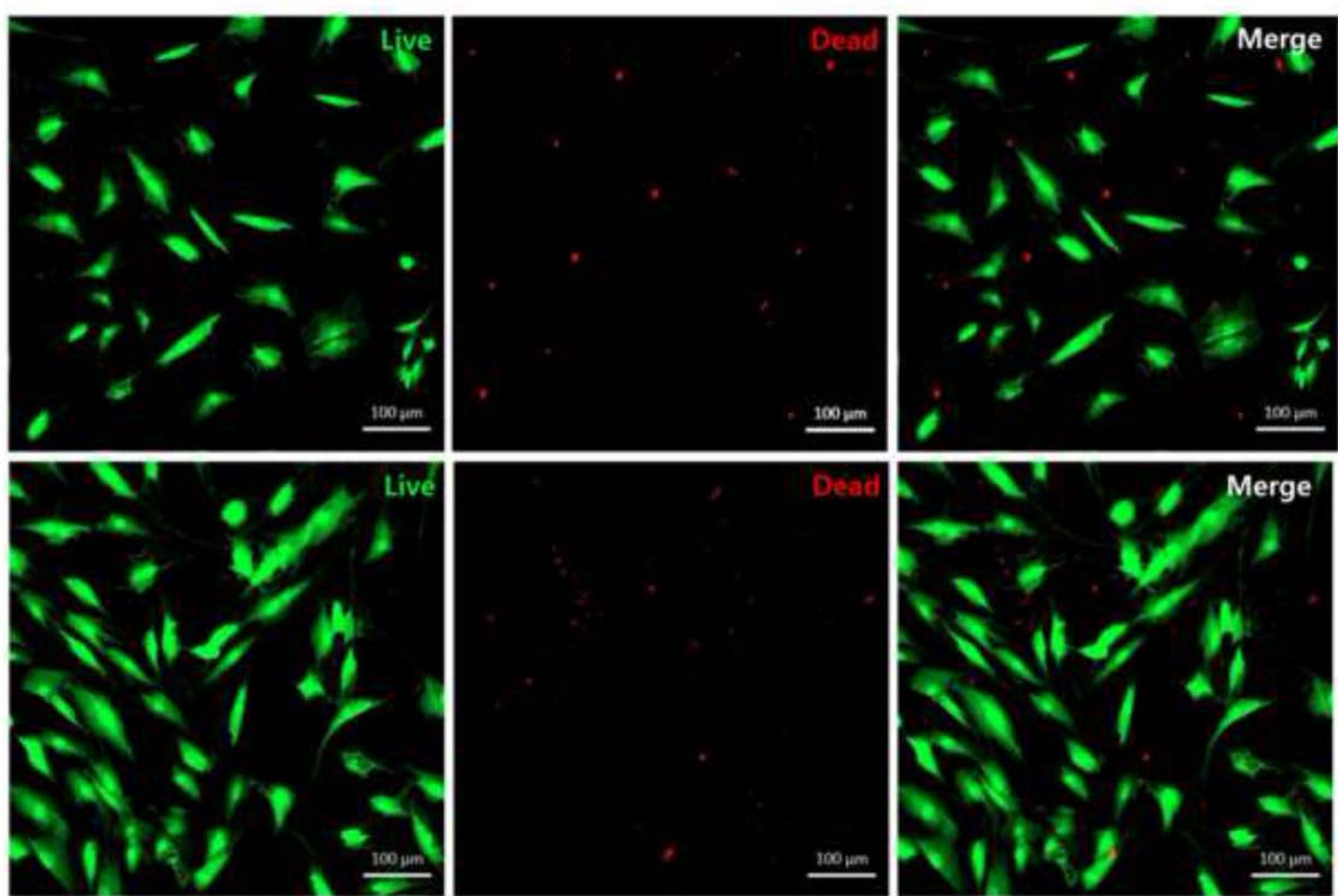
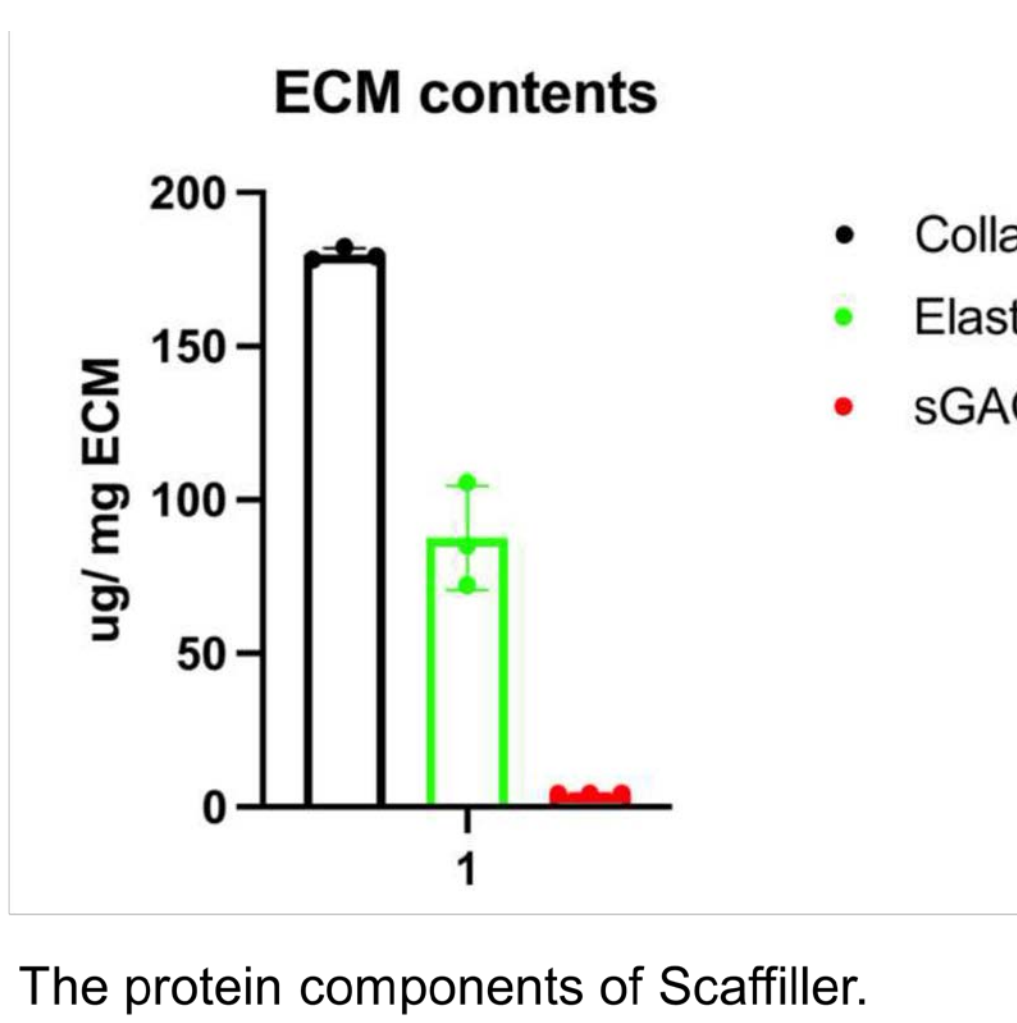
Our study successfully fabricated ECM-HA sheets incorporating adECM and HA, hold promise as scaffolds for adipose-derived stem cells, showcasing significant therapeutic potential for wound healing applications.

Results

The extracted ECM components accounted for approximately 5% of the original tissue volume, with ECM-HA sheet production efficiency being six times higher than adECM sheet. In vitro analysis revealed favorable ASC survival rates and increased angiogenic and bioactive cytokine levels in ECM-HA sheet. Macroscopic evaluation showed enhanced healing rates, while histological analysis demonstrated improved epithelialization, thicker dermis, increased collagen deposition, and enhanced vascularity in the ECM-HA group.



Macroscopic view of ECM-HA sheet derived from human adECM and crosslinked HA. (Diameter of 20mm)



Fluorescence microscopy images of Live/Dead assay. ASCs cultured in Scaffiller after 3 days. Red denotes dead cells, whereas green denotes live cells. The combined photos show both living and dead cells. Scale bar = 100 μm.

