Experimental Assessment Of The Revascularization Of Acellular Human Dermis In The Wound Bed Treated With Mesenchymal Stem Cell Under Subatmospheric Pressure

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Abstract

Background: Acellular cadaveric dermis (ACD) is a biomaterial used widely in plastic surgery practice. The most important problem associated with usage of ACD is neovascularization. In this study, we aimed to improve the revascularization of ACD (FlexHD MTF/Ethicon Inc, Somerville, NJ, USA) with combining the effects of vacuum-assisted closure system (VACS) (VAC, Kinetic Concepts, San Antonio, TX) and mesenchymal stem cells (MCS) on angiogenesis.

Methods: In this study, 36 female Sprague-Dawley rats were used and divided into four groups. Full thickness dorsal skin defects were created in 2x2 cm dimensions. The wounds were treated with only the ACD in the group 1, the ACD and VACS in the group 2, the ACD and MSCs in the group 3, the ACD and VACS and MSCs in the group 4. By the ninth day of surgery, the excisional biopsy samples were histologically examined to identify the rates of the ACD intake by the recipient bed, the newly formed blood vessels which penetrate the ACD vertically and vascularization were evaluated by immunohistochemical staining. Green fluorescent protein (GFP)-transfected MSCs were used in two subjects in group four to show the survival of MSCs.

Results:The graft intake rates were higher in the group 4 than the other groups statistically, $p = 0.003$. The numbers of immunohistochemically stained ($CD31^+$) newly formed micro vessels were higher in the group 4 than the other groups statistically, $p \leq 0.05$. All subjects in the group 4 had the vertical vessels in normal calibration with open lumens vessels which penetrate the ACD. GFP-transfected MSCs were showed in two subjects with immunofluorescence.

Discussion: These findings suggest that MSC transplantation induces angiogenesis more efficiently when used with VACS. Revascularization of human acellular dermis can be accelerated with synchronous use of VASC and MSCs.

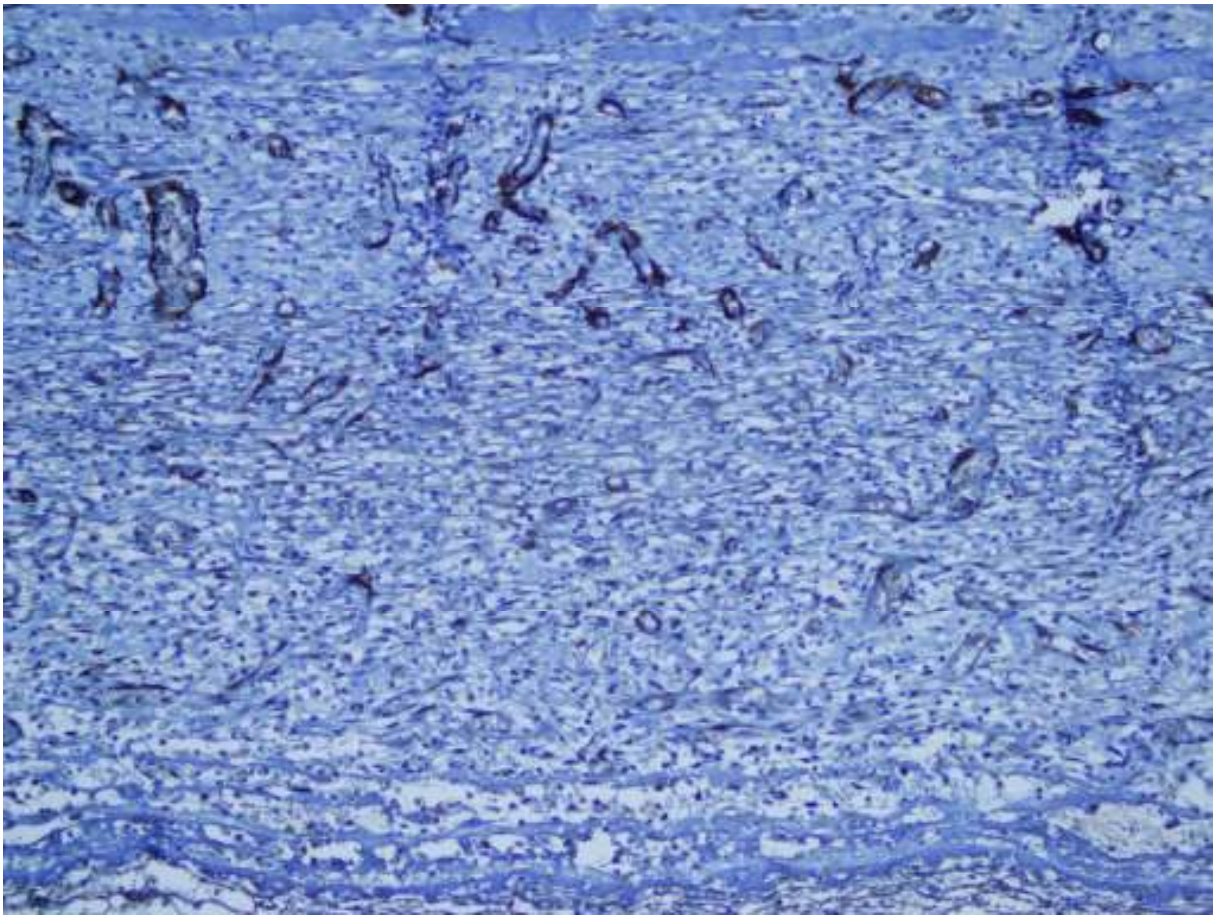

Figure 1. CD31-stained section demonstrates CD31-positive small number of blood vessels in group 1.

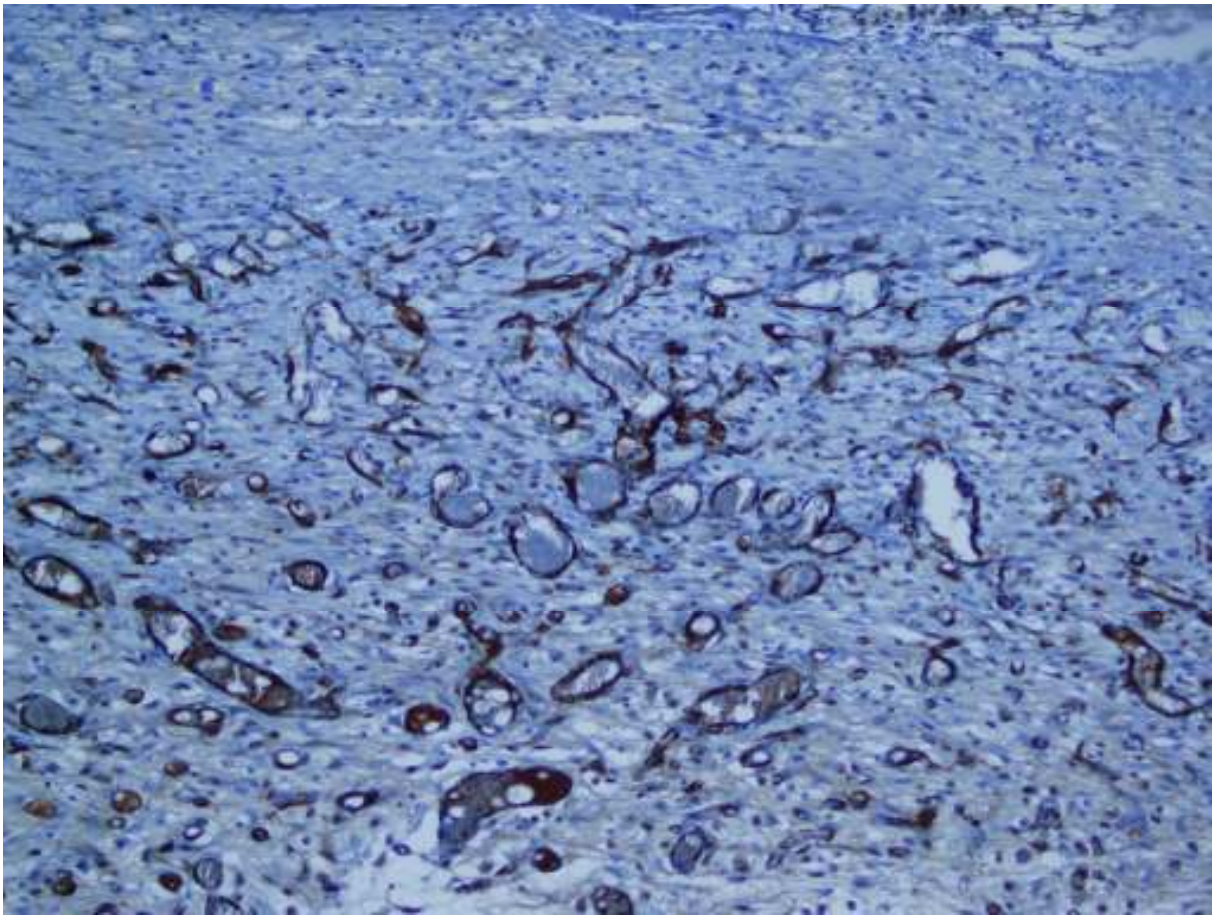

Figure 2. CD31-stained section demonstrates CD31-positive diffuse pattern of blood vessels in group 4.

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