MYOCARDIAL LAYER-SPECIFIC EFFECT OF MYOBLAST CELL SHEET IMPLANTATION FOR MYOCARDIAL REGENERATION EVALUATED BY TISSUE STRAIN IMAGING STUDY

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Authors: Yasuhiro Shudo, Shigeru Miyagawa, Satoshi Nakatani, Atsuhiro Saito, Taichi Sakaguchi, Satoshi Kainuma, Tatsuya Shimizu, Teruo Okano, Yoshiki Sawa, Osaka University Graduate School of Medicine, Suita, Osaka, Japan, Tokyo Women Medical University, Tokyo, Tokyo, Japan

Background: The implantation of skeletal myoblast cell (SMB) sheets over the affected area of a myocardial infarction (MI) has been demonstrated to improve global left ventricular (LV) function. However, it is not known about its functional mechanism such as the regional recovery. Currently, tissue strain M-mode imaging (TDI-Q, Toshiba) provides a myocardial layer-specific strain value, based on the transmural myocardial strain profile (TMSP). To elucidate the effect of SMB sheet implantation on regional function, we assessed the TMSP in porcine MI model.

Methods: SMBs were cultured on temperature responsive culture dishes to obtain cell sheets. An ameroid constrictor was placed around the left anterior descending coronary artery to induce MI in mini-pigs. Four weeks later, the animals were divided into 2 groups: SMB sheet implantation (Sheet) and no treatment (Sham) (n=6 in each). About 30 cell sheets (1.5 x 10^7 cells per sheet) were placed on the epicardium covering the infarcted and border regions in the Sheet group. Subendocardial and subepicardial strain values were measured in the infarcted, border, and remote regions by TMSP analysis.

Results: LV remodeling was prevented and the ejection fraction increased significantly in the Sheet group compared with the Sham group. Subendocardial strain was significantly larger than subepicardial strain in the border region, and the strain tended to be larger even in the infarcted region, although the sheets were placed on the epicardium, suggesting involvement of the paracrine system. No significant change from baseline was found in the Sham group.

Conclusions: Cell-sheet implantation on the epicardium improved subendocardial myocardial strain in the border region. Assessment of the TMSP allows precise evaluation of the effect of cell sheet implantation on layer-specific myocardial functions.