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THE USE OF NATIVE MATRIX IN ENGINEERING HUMAN MYOCARDIUM

Jun Jie Tan[1]*

[1]Advanced Medical and Dental Institute, Universiti Sains Malaysia, Kepala Batas, 13200, Malaysia

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*Corresponding author:
Tan Jun Jie
Email: jjtan@usm.my

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SUMMARY

Heart transplantation is the only curative option for end-stage heart failure. However, this surgery is often limited by organ supply and immune-rejection. The concept of re-utilizing the native extracellular matrix scaffold in organ from cadaveric donor as the blueprint with preserved architecture for homing cellular blocks makes engineering functional organ possible. The harvest of the native matrix is done through a process called decellularization. Past studies have shown that the cell stripping process successfully removes all cellular components, with minimal alteration to the matrix and microvascular architecture. Recellularized heart matrix with cardiomyocytes shows electrical conductivity, regains regional contractile function and builds up chamber pressure, which coupled with great cell engraftment, distribution and viability under biomimetic culture. With the invention of induced pluripotent stem cells, generation of autologous, patient-specific cardiac myocytes could realize engineering of personalized organ in the laboratory. While hurdles remain in making a complex whole heart, the engineered myocardium can be turned into cardiac patch suitable for transplantation. Our preliminary data demonstrated that acellular matrix promoted vascular ingrowth from host tissue, which contributed to high cardiomyocyte viability 3 weeks after transplantation onto injured heart. Here, we review the recent progress in decellularization and recellularization technologies, and the success stories in rebuilding functional heart with the aid of native matrix.