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Evaluation of biocompatibility and myogenic differentiation of the transplanted myoblast using 3D cell printed muscle construct in rats

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Severe skeletal muscle loss and long-term denervation lead to an irreversible degenerative process. In this regard, the development of engineered skeletal muscle including fusion of myoblast have investigated to promote muscle regeneration and functional recovery of injured muscle tissue. However, further researches are needed to mimic the structure and function of native muscle. In this study, we investigated 1) the differentiation of transplanted myoblasts (C2C12) using 3D cell printed muscle construct and 2) the aspect of behavioral changes in sensory and motor function after transplantation. 3D cell printed muscle (Artificial muscle) was constructed by printing of myoblast-encapsulated muscle decellularized extracelluar matrix (mdECM) bioink in nanofiber structure. To transplantation, artificial muscle was fixed to the gastrocnemius muscle. Tibial nerve transection was performed, and then the proximal end of transected nerve was implanted into artificial muscle (artificial muscle group) and into the gastrocnemius muscle (nerve implantation group) in male Sprague-Dawley rats. Behavioral test for mechanical sensitivity of the hind paw and motion capture to quantify motor function was conducted before and after artificial muscle transplantation. Immunohistochemistry was performed at the implanted nerve-muscle junction to confirm viability of transplanted muscle construct and differentiation of myoblasts. After implantation, paw withdrawal threshold was significantly decreased in both of the nerve implantation and the artificial muscle group. But it was still higher compared to those of tibial nerve injury only. Rats in both nerve implantation group and artificial muscle group showed a similar pattern with the increased range of motion (ROM) in knee joint while ROM in ankle joint decreased. Distance of strides did not show any significant changes in both groups. The present results demonstrated that the potential for myogenic differentiation of transplanted myoblasts. It suggests that possibility of creating customized functional muscle substitutes for the therapeutic treatment of the muscular injuries.

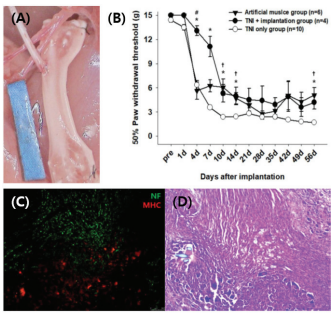

Figure 1 (A), (B) shows the surgical procedure with transplantation of artificial muscle and behavioral test in sensory function after transplantation. Immunofluorescence staining (C) and H&E staining (D) was performed.

Biography

Junesun Kim is P.T. and Ph.D. in Physiology. She is a professor at Department of Physical Therapy Korea University College of Health Science. Her major fields of academic interest are the peripheral and central mechanisms of chronic pain, and regenerative mechanisms governing spinal cord injury. She has several publications in in peer-reviewed journals. She provides continuing education lectures regarding neurological physical therapy for SCI and mechanisms of chronic and pathologic pain to student majoring in rehabilitation science at graduate program.

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