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Delayed the ESRD progression by transplanting 3D printed omental patch

Jina Ryu, Hyunwoo Jo, Boyun Kim
Department of Internal Medicine-Nephrology, Rokit Healthcare, Korea, Republic of

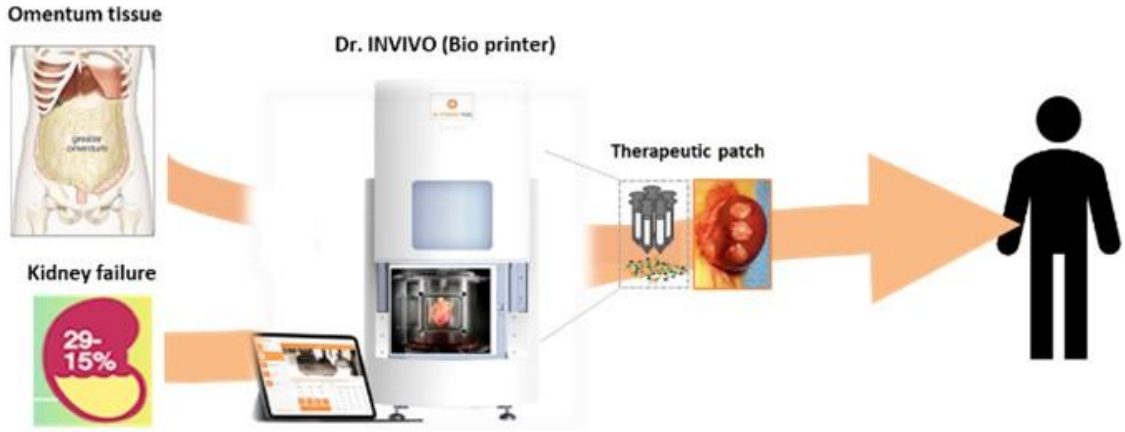
Objectives: Many studies and clinical trials are being conducted to develop new treatments for kidney disease. However, there is no newly developed renal replacement therapies yet. In this study, we developed a new treatment that can delay the progression of ESRD, using autologous omentum tissue. Omentum is one layer of the peritoneum, and it is known a rich source of biological materials that enhance tissue growth and has rich matrix. Also, growth factors such as bFGF, PDGF, HGF, and VEGF in the omentum can play a key role in renal regeneration.

Methods: We prepared the bio-ink using a micronizing omental tissue, then printed it in the form of a therapeutic patch. A 3D printed omental patch was applied to Kidney of CKD rat model. As a CKD model, unilateral ureteral obstruction (UUO) model was used. We transplanted the omental patch to a renal subcapsular layer in UUO rat, and kidneys were histologically analyzed after two weeks of transplantation.

Results: As a result, we histologically analyzed UUO models, and found symptoms of tubular necrosis, tubule dilation, interstitial fibrosis, and immune cell infiltration. However, the omentum patch implanted group shows these symptoms are significantly inhibited. After two weeks of treatment, we observed that lower glomerulosclerosis and less tubular necrosis in a patch treatment group. Also, from the results of Masson's trichrome and a-SMA staining, the patch suppressed deposition of collagen and tubulointerstitial myofibroblasts in CKD model.

Conclusions: In conclusion, we found that the omentum patch provides regenerative niche to cortex, and it is effective for anti-inflammatory, tissue repair and regeneration without immune rejection. In addition, the patch delays the progression of the kidney to ESRD. Therefore, the autologous omentum patch provides protective effects to the kidney diseases, and it has potentials as future therapeutics for the kidney repairs and its regeneration.

Graphical abstract



Lower Glomerulosclerosis and Less Tubular Necrosis in a Treatment Group