Characterizing the inherent activity of urinary bladder matrix for adhesion, migration, and activation of fibroblasts as compared with collagen-based synthetic scaffold

Xiaoyu Tang and Guozhong Lu*
*Guozhong Lu, Department of Burns and Plastic Surgery, The Affiliated Hospital of Jiangnan University, Wuxi, Jiangsu, China

Background

- The mechanism of action underlying the intriguing prominent bioactivity of urinary bladder matrix (UBM) for in situ tissue regeneration of soft tissue defects remains to be elucidated.
- It is speculated that the activity of UBM for cell adhesion, migration, and activation is inherent.
- The bioactivity of UBM for in situ tissue regeneration and its relation with the structure and intact soluble components of UBM were investigated in comparison to a collagen-based scaffold, PELNAC (PEL).

Methods and results

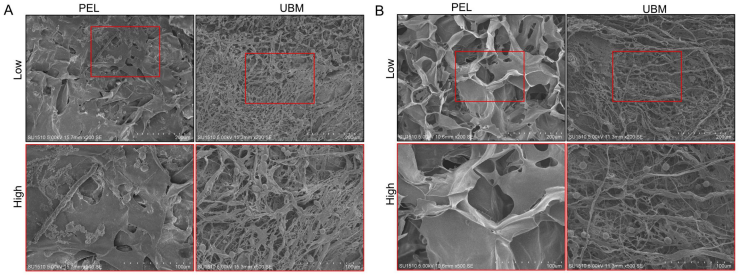


Figure1 Representative images of cells grown on the surface of PEL and on the lamina propria of UBM after adherence for 6 h in DMEM medium containing 10% FBS (A) and in DMEM medium alone (B) are shown.

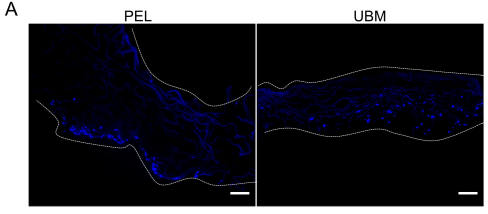
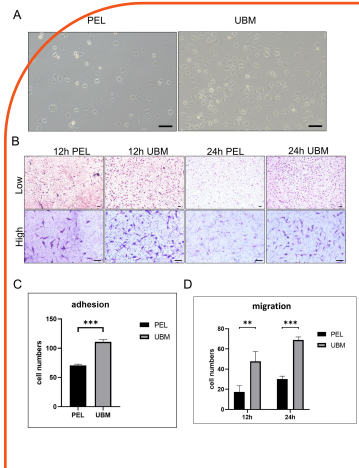


Figure2 Representative images of cells on the PEL surface as well as on the UBM lamina propria after growing into 3D are shown. Cells were stained dark blue by DAPI dye on a scale of 100 μm.



Methods and results

Figure3 Representative images of PEL and UBM soluble component cultured cells after 2.5h of adhesion are shown in Figure A (scale bar 100μm). Representative images of soluble component chemotactic cells at 12 and 24 h low and high magnification are shown in Figure B (low magnification scale 100 μm, high magnification scale 25 μm). Cells were stained purple by crystalline violet. Quantitative statistical plots of fibroblast adhesion and migrating cell counts (C,D)

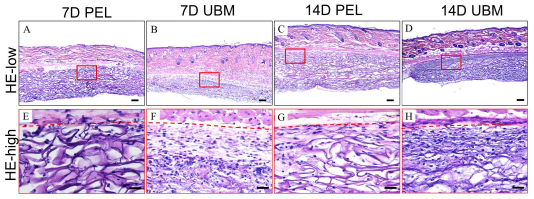


Figure4 The H&E results of PEL and UBM embedding materials at 1 and 2 weeks postoperatively are shown.

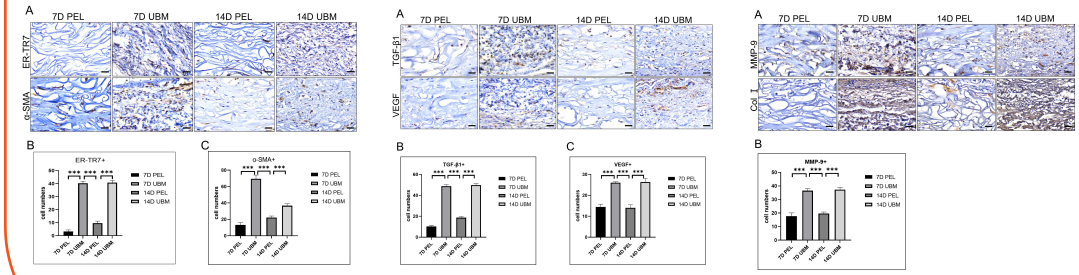


Figure5 The anti-ER-TR7 and α-SMA results of PEL and UBM at 1 and 2 weeks postoperatively.
Figure6 The anti-TGF-β1 and VEGF of PEL and UBM at 1 and 2 weeks postoperatively .
Figure7 PEL and UBM anti-MMP-9 and anti-Col I at 1 and 2 weeks postoperatively . (scale bar is 25 μm)

Conclusion

Based on our findings, we conclude that the soluble components of UBM and its own fibrous mesh structure are more conducive to fibroblast adhesion and migration to the center of the scaffold. It also provides a microenvironment containing TGF-β1, VEGF and MMP-9 to induce fibroblasts to differentiate into myofibroblasts and continuously reshape ECM. Finally, the scaffold slowly degrades in situ and forms new functional tissues.