Effect of Dimethyloxalylglycine-Embedded Poly(ε-caprolactone) Fiber Meshes on Odontoblastic Differentiation of Human Dental Pulp-Derived Cells

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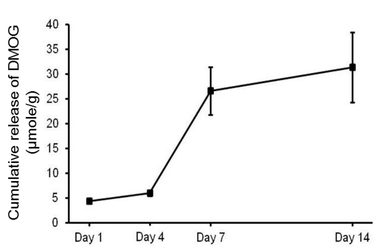
INTRODUCTION

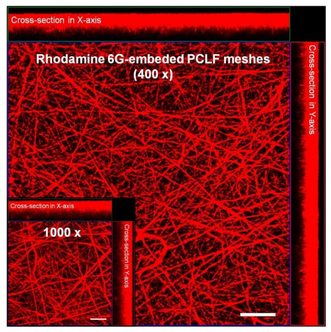
- Recovering odontoblastic layer and vital pulp tissue are essential but challenging parts in regeneration of the dentin-pulp complex. These two parts have close interactions during dentinogenesis, and thus, angiogenesis is considered to be an integral part of dental pulp regeneration.
- Aim: Regarding previous reports about *in vitro* effect of prolyl hydroxylase inhibitors on angiogenesis, we investigated the effect of DMOG-embedded poly(ε-caprolactone) fiber (PCLF/DMOG) on odontoblastic differentiation of human dental pulp-derived cells (hDPCs) by transplantation of the dentin slice model.

METHODS

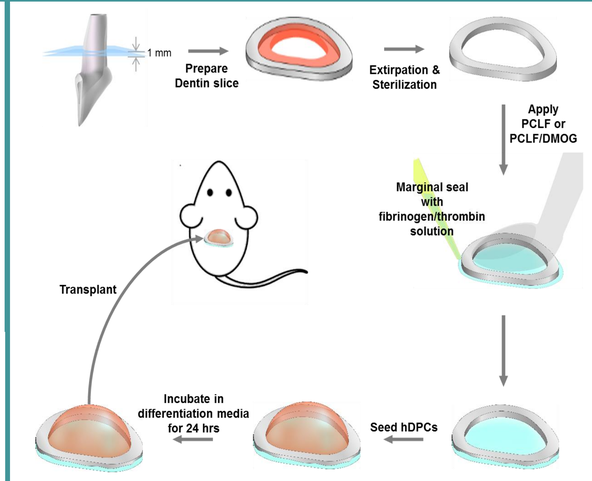
- PCLF served as drug-delivering scaffold and cellular niche.
- hDPCs were seeded onto electrospun PCLF and PCLF/DMOG in dentin slices and then transplanted into nude mice.
- The surface topography was evaluated for both PCLFs, and DMOG release from the PCLF/DMOG was examined.
- The effects of the PCLF/DMOG were assessed by histology and RT-qPCR.

[Fig 1] Cumulative release of DMOG from the PCLF/DMOG meshes.





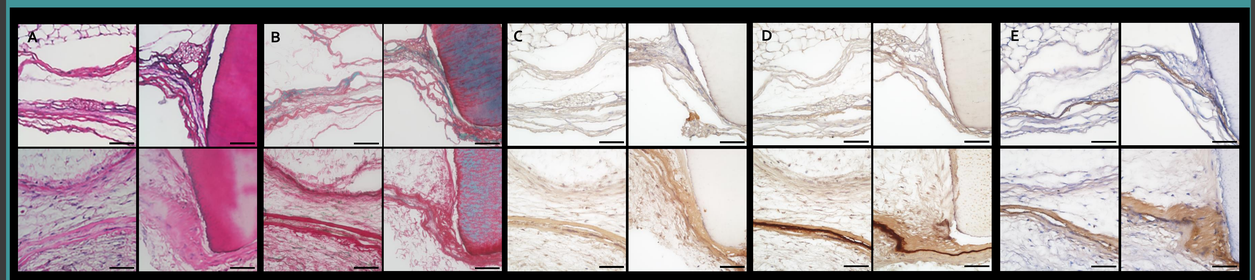
[Fig 2] Confocal microscopic image of rhodamine 6G-loaded PCLFs.



[Fig 3] This schematic diagram shows the hDPCs-seeded dentin slice model that was prepared for *in vivo* transplantation. PCLF was used as drug-delivering scaffold and cellular niche.

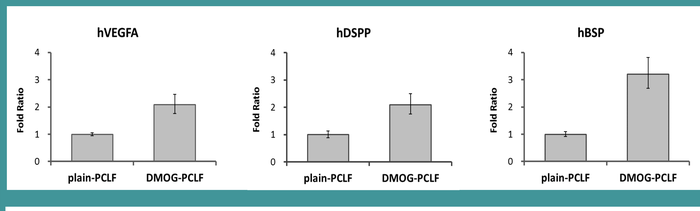
RESULTS

- The PCLF/DMOG treated dentin slices showed higher cellularity with a palisading arrangement of hDPCs and organized collagen fibers.

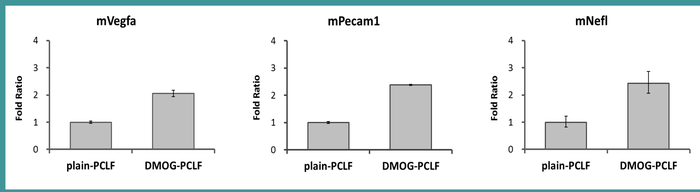


[Fig 4] Transplanted hDPCs with PCLF (upper) and PCLF/DMOG (lower),stained with (A) H&E, (B) Syrus Red/Fast Green collagen stain, immunostained with (C) anti-Runx2, (D) anti-DSP, (E) and anti-human mitochondria.

- We found that the PCLF/DMOG significantly stimulated the expression of VEGF, DSP, and BSP in the hDPCs ($P < 0.05$) and mVegfa, mPecam 1, and mNefl in the surrounding host cells ($P < 0.05$).



[Fig 5] Effect of the PCLF/DMOG on the expression of hVEGFA hDSPP, hBSP in transplanted hDPCs.



[Fig 6] Effect of the PCLF/DMOG on the expression of mVefga, mPecam1, mNefl in surrounding host cells.

CONCLUSIONS

- These results show that PCLF/DMOG has potential in pulp-dentin complex regeneration by promoting odontoblastic differentiation of hDPCs and by enhancing host cell recruitment, angiogenesis, and neurogenesis, through the released DMOG-mediated cell responses.