Title: Ascorbic acid 2-phosphate-releasing poly(trimethylene carbonate) biomaterials for pelvic organ prolapse tissue engineering

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Abstract

Pelvic organ prolapse (POP) occurs when pelvic organs descend into or through the vagina due to weakened connective tissues in the pelvic floor. Lowered collagen content and increased stiffness of these tissues have been associated with POP. Therefore, the ideal biomaterial for POP treatment should provide mechanical support and promote the remodeling of connective tissues. To promote tissue remodeling, we have used ascorbic acid 2-phosphate (A2P), which stimulates the collagen production and proliferation of different cell types. To address the mechanical requirements, A2P is combined with highly elastic poly(trimethylene carbonate) (PTMC).

PTMC materials were prepared by co-precipitation of polymer and 0, 5 or 10 wt% of A2P (PTMC0, PTMC5 and PTMC10) followed by compression moulding. Human vaginal stromal cells (hVSCs) and human adipose-derived stromal cells (ASCs) were cultured on membranes. Proliferation and collagen production of the cells were analysed during 14 d culture period with various methods, such as CyQUANT proliferation assay, Live/Dead imaging, RT-qPCR and Sircol collagen assay.

Proliferation of both hASCs and hVSCs increased on A2P -releasing PTMC membranes compared to membranes without A2P. In addition, both cell types remained viable on all PTMC materials. Further, the total collagen content and the expression of collagen types I and III increased on A2P -releasing membranes, especially on PTMC5.

A2P embedded PTMC promotes the proliferation and collagen production of both hASCs and hVSCs. Therefore, this novel biomaterial could promote connective tissue remodeling and be a promising candidate for POP tissue engineering.