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Oxygen-generating electrospun ultrathin fibers for cartilage tissue engineering application

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Problems related to aging in the elderly, specifically joint wear, involve joint pain from years of cartilage deterioration. Cartilage, a non-regenerative avascular tissue with low oxygen levels, poses challenges. Besides the main problem is the mechanical properties of the cartilage native. Recent studies introduced biopolymers loaded with nanoparticles to create nanofibers for drug delivery and to create a room similar to the matrix extracellular native, beads presences and diameter of nanofibers are essential for increasing the mechanical properties of the nanofibers and the cellular proliferation. In this context, this research presents a biomaterial modified for cartilage engineering. Polyvinyl alcohol (PVA) hydrogel and calcium peroxide nanoparticles (CPO) were synthesized by electrospinning at 0.3 mL/h and 0.7 mL/h and 14 kV and 17 kV. Electron microscopy (SEM) confirmed the formation of the ultrathin fibers, the nanoparticles placed, and the beads formed. The presence of the beads showed an increase associated with the flow rate and voltage increase during the process. Besides the CPO nanoparticles decreased the diameter and mechanical properties compared to PVA ultrathin fibers. Finally, the oxygen release was promoted for 7 days.