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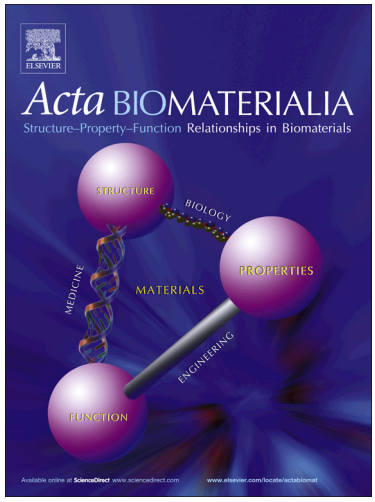

Full length article

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Templated dentin formation by dental pulp stem cells on banded collagen bundles nucleated on electrospun poly (4-vinyl pyridine) fibers *in vitro*

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Statement of Significance

The past decade has been focused efforts in the use of dental pulp stem cells (DPSC) for dental regeneration. Eventhough the factors required for DPSCs differentiation have been well studied, actual mineral deposition, positively identified as dentin, has not been achieved *in vitro*. Hard tissue is known to be a templated process *in vivo* where the mineral to protein ratio is tightly controlled via proteins which aid in collagen conformation and mineral sequestration. Here we show that one can mimic this process *in vitro* via the combination of materials selection and morphology. The material chemistry is shown to induce genetic upregulation the genes responsible for collagen and osteocalcin, while Raman spectroscopy confirms the translation and adsorption the proteins on the substrate. But, we show that the simple presence of collagen is not enough to template actual biomineral deposition similar to that found *in vivo*. Mineral deposition is a complicated process templated on collagen bundles and mediated by specific sibling proteins that determine the protein to mineral ratio. Here we show that surface curvature can reduce the barrier to collagen bundle formation, directing DPSC differentiation along odontogenic lineage, and subsequently templating actual dentin, comparable to that found *in vivo* in human teeth.