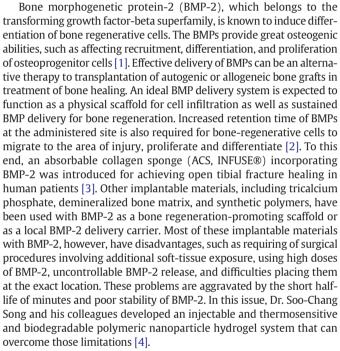
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^{Cover story} Biodegradable thermosensitive polymer gel for sustained BMP-2 delivery



The system by the Song group is based on the poly(phosphazene) polymer substituted with hydrophobic isoleucine ethyl ester and hydrophilic poly(ethylene glycol) for amphiphilicity and thermosensitive sol–gel transition property [5] and with carboxylic acid moiety for interacting with the positively charged BMP-2. These dual interacting polymeric nanoparticles (D-NPs) form compact nanocomplexes in the presence of BMP-2, keeping the protein inside the hydrogel network. The thermosensitive transformation of nanocomplex solution to hydrogel at the body temperature allows injection into the body, suppression of the initial burst release, extended retention at the injected site, continuous stimulation of bone generation, and efficient generation of new bone. D-NPs were superior to the control polymer without carboxylic acid groups the longer duration of BMP-2 release (21 days vs.

10 days), and 14–50% higher bone regeneration ability in ectopic and orthotopic bone generation tests with no sign of inflammatory responses at the injection sites during the animal experiments. The thermosensitive and biodegradable hydrogel system by Dr. Song's team could provide clinical benefits for its non-surgical administration with increased safety. The system can also be used as a platform technology for protein delivery because proteins have hydrophobic domains and individual isoelectric point at physiological condition of pH 7.4, which could interact with the dual interacting polymeric nanoparticle.

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For more than a decade, a very large number of nanoparticle systems have been developed mainly for the tumor-targeted drug delivery. But a real potential of nanoparticle systems as a drug delivery vehicle may be found in other applications. As shown by the Song group, nanoparticle hydrogel systems can be effectively used in localized, sustained delivery of BMP-2 with good outcomes. Current nanotechnology allows manipulation of nanoparticle properties as desired, and this ability can be used wisely by choosing the right applications. Until the time when scientists can figure out how to control biodistribution of nanoparticles after intravenous injection, the sensible use of nanoparticles may reside in localized delivery.

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