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Professor Jae Young Lee's research team develops a hydrogel manufacturing system that can be controlled deep in skin tissue

□ GIST (President Seung Hyeon Moon) – Professor Jae Young Lee the School of Materials Science and Engineering has led a research team in developing a hydrogel * manufacturing system that can be controlled in deep places in the body and has successfully delivered stem cells.

* Hydrogel: a substance having a three-dimensional network structure of a hydrophilic polymer and is capable of absorbing a large amount of water

- This is a method of producing a hydrogel using superparamagnetic nanoparticles * that generate heat under an alternating magnetic field **. The hydrogel can be manufactured under biocompatible conditions and can be used for stem cell transfer.

* Superparamagnetic nanoparticle: A nanoparticle with magnetic properties only when there is a magnetic field. Generates heat as the direction of magnetism changes periodically under an alternating magnetic field

** Alternating magnetic field: a magnetic field generated by an alternating current that changes the direction of the magnetic field due to the alternating current

- Currently, most hydrogel insertion does not need incisions and sutures. The research team developed a system to manufacture the 'hydrogel,' and developed a system that can control the hydrogel manufacturing process after injection into the body, and it has been published in the journal *Advanced Healthcare Materials*.
 - The research used a gold nanorod that generates near infrared rays with sensitivity to heat generated by the body and overcomes the limitation that it cannot be controlled after injection into the body, which is a disadvantage of conventional hydrogel.
 - However, near infrared rays have a disadvantage in that there is a limit to the bio-transparency. Even if only 5 mm of the tissue is penetrated, most of the strength is lost, and it is difficult to inject and manufacture the hydrogel in deep tissue, so that it can be applied only to the skin layer.

- On the other hand, magnetic fields are so highly transmissive that there is practically no limit to the depth of penetration, and stability is ensured for use in medical devices such as MRIs.
 - The research team has devised a 'magnetic field induction hydrogel manufacturing system,' which is a next step in the near-infrared-based hydrogel manufacturing system. In this system, hydrogels can be prepared even in a 2 cm-thick tissue, and the hydrogels have been successfully manufactured at deeper locations in animal experiments. In addition, it was confirmed that stem cells were delivered and showed a high survival rate over 7 days.

- Professor Jae Young Lee said, "This research has confirmed that hydrogel can be created and controlled by simple manipulation deep into the skin, and it is expected that this will contribute greatly to the future of tissue engineering research because it can carry and transmit stem cells."

- This research was led by Professor Jae Young Lee and Dr. Guru K. Thirunavukkarasu. The research was supported by the Global Research Laboratory program of the National Research Foundation of Korea, and the Korea Health Technology R&D Project of the Ministry of Health and Welfare. The research was published on June 23, 2018 in *Nano Research*, an international academic journal in the field of nanotechnology.

