

Therapeutic impact of cell transplantation aided by magnetic factor

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Two studies in the current issue of *Cell Transplantation* (21:6), now freely available [on-line](#), demonstrate how the use of magnetic particles are a factor that can positively impact on the targeted delivery of transplanted stem cells and to also provide better cell retention.

A research team from the University of British Columbia used focused magnetic stem cell targeting to improve the delivery and transport of mesenchymal stem cells to the retinas of test rats while researchers from Cedars-Sinai Heart Institute (Los Angeles) injected magnetically enhanced cardiac stem cells to guide the cells to their target to increase cell retention and [therapeutic benefit](#) in rat models of ischemic/[reperfusion injury](#).

According to study co-author Dr. Kevin Gregory-Evans, MD, PhD, of the Centre for Macular Degeneration at the University of British Columbia, degeneration of the retina - the cause of macular degeneration as well as other eye diseases - accounts for most cases of blindness in the developed world. To date, the transplantation of mesenchymal stem cells to the damaged retina has had "limited success" because the cells reaching the retina have been in "very low numbers and in random distribution."

Seeking to improve [stem cell transplantation](#) to the retina, the researchers magnetized rat [mesenchymal stem cells](#) (MSCs) using superparamagnetic iron oxide nanoparticles (SPIONs). Via an externally placed magnet, they directed the SPION enhanced cells to the peripheral

retinas of the test animals.

"Our results showed that large numbers of blood-borne magnetic MSCs can be targeted to specific retinal locations and produce therapeutically useful [biochemical changes](#) in the [target tissue](#)," explained Gregory-Evans. "Such an approach would be optimal in focal tissue diseases of the outer retina, such as age-related macular degeneration."

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The cardiac stem cell, said researchers at Cedars-Sinai Heart Institute, represents a promising candidate for regenerating the injured myocardium, the place where they reside. However, because of cyclical cardiac contraction, 'venous washout' is a factor that causes extremely low cell retention and undermines the potential beneficial impact of cell transplantation.

"Because the efficiency of intracoronary stem cell transplantation is limited by low cell retention, we sought to improve cell retention by magnetic targeting," said study lead author Dr. Eduardo Marban.

The researchers injected cardiac stem cells labeled with iron microspheres into the left ventricular cavity of syngenic rats during brief aortic clamping. After 24 hours, they found that placement of a magnet above the heart during and after injection enhanced cell retention by over five-fold.

"The success of cell therapy relies on effective delivery to the desired region," explained Dr. Marban. "In the heart, cardiac contraction results in substantial cell loss during and after cell delivery. We found that magnetic attraction can focus iron-tagged therapeutic agents within a target region as we successfully used magnetism to counteract venous washout and improve cell retention in the contracting heart."

More information:

Yanai, A.; Häfeli, U. O.; Metcalfe, A. L.; Soema, P.; Addo, L.; Gregory-Evans, C. Y.; Po, K.; Shan, X.; Moritz, O. L.; Gregory-Evans, K. Focused Magnetic Stem Cell Targeting to the Retina Using Superparamagnetic Iron Oxide Nanoparticles. *Cell Transplant.* 21(6):1137-1148; 2012.

Cheng, K.; Malliaras, K.; Li, T.-S.; Sun, B.; Houde, C.; Galang, G.; Smith, J.; Matsushita, N.; Marbán, E. Magnetic Enhancement of Cell Retention, Engraftment, and Functional Benefit After Intracoronary Delivery of Cardiac-Derived Stem Cells in a Rat Model of Ischemia/Reperfusion. *Cell Transplant.* 21(6):1121-1135; 2012.

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