MedicalXpress

A better way to grow bone: Fresh, purified fat stem cells grow bone faster and better

June 11 2012

UCLA stem cell scientists purified a subset of stem cells found in fat tissue and made from them bone that was formed faster and was of higher quality than bone grown using traditional methods, a finding that may one day eliminate the need for painful bone grafts that use material taken from the patient during invasive procedures.

Adipose, or fat, tissue is thought to be an ideal source of cells called mesenchymal stem cells - capable of developing into bone, cartilage, muscle and other tissues - because they are plentiful and easily attained through procedures such as liposuction, said Dr. Chia Soo, vice chair for research at UCLA Plastic and Reconstructive Surgery. The co-senior authors on the project, Soo and Bruno Péault, are members of the Eli and Edythe Broad Center of Regenerative Medicine and Stem Cell Research at UCLA.

Traditionally, cells taken from fat had to be cultured for weeks to isolate the stem cells which could become bone, and their expansion increases risk of infection and genetic instability. A fresh, non-cultured cell composition called stromal vascular fraction (SVF) also is used to grow bone. However, SVF cells taken from adipose tissue are a highly heterogeneous population that includes cells that aren't capable of becoming bone.

Péault and Soo's team used a cell sorting machine to isolate and purify human perivascular stem cells (hPSC) from adipose tissue and showed that those cells worked far better than SVF cells in creating bone. They

also showed that a growth factor called NELL-1, discovered by Dr. Kang Ting of the UCLA School of Dentistry, enhanced the bone formation in their animal model.

"People have shown that culture-derived cells could grow bone, but these are a fresh cell population and we didn't have to go through the culture process, which can take weeks," Soo said. "The best bone graft is still your own bone, but that is in limited supply and sometimes not of good quality. What we show here is a faster and better way to create bone that could have clinical applications."

The study appears June 11, 2012 in the early online edition of the peer-reviewed journal *Stem Cells Translational Medicine*, a new journal that seeks to bridge stem cell research and clinical trials.

In the animal model, Soo and Péault's team put the hPSCs with NELL-1 in a muscle pouch, a place where bone is not normally grown. They then used X-rays to determine that the cells did indeed become bone.

"The purified human hPSCs formed significantly more bone in comparison to the SVF by all parameters," Soo said. "And these cells are plentiful enough that patients with not much excess body fat can donate their own fat tissue."

Soo said if everything goes well, patients may one day have rapid access to high quality bone graft material by which doctors get their fat tissue, purify that into hPSCs and replace their own stem cells with NELL-1 back into the area where bone is required. The hPSC with NELL-1 could grow into bone inside the patient, eliminating the need for painful bone graft harvestings. The goal is for the process to isolate the hPSCs and add the NELL-1 with a matrix or scaffold to aid cell adhesion to take less than an hour, Soo said.

"Excitingly, recent studies have already demonstrated the utility of perivascular stem cells for regeneration of disparate tissue types, including skeletal muscle, lung and even myocardium," said Péault, a professor of orthopedic surgery "Further studies will extend our findings and apply the robust osteogenic potential of hPSCs to the healing of bone defects."

Provided by University of California, Los Angeles