Scientist devises new way to more rapidly generate bone tissue

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Using stem cell lines not typically combined, researchers at Columbia University Medical Center have designed a new way to "grow" bone and other tissues.

The inability to foster angiogenesis – a physiological process involving the growth of new blood vessels from pre-existing vessels – has been a major roadblock in tissue regeneration. Previous approaches have included the use of angiogenic growth factors and the fabrication of artificial blood vessels. However, there are problems associated with these approaches. Among these problems: artificially fabricated blood vessels do not readily branch out and network with host blood vessels, and blood vessels induced by angiogenic growth factors tend to be immature and "leaky."

To overcome these obstacles, a team of Columbia researchers has co-transplanted hematopoietic and mesenchymal stem/progenitor cells to promote the regeneration of vascularized tissues. What they found was that the tissue regenerated in bone more rapidly than when either type of stem cell was used alone.

The work by Jeremy Mao, DDS, Ph.D., published today in the Public Libraries of Science, takes a new approach: rarely have mesenchymal and hematopoietic cells been delivered in combination for the healing of defects and the treatment of diseases – partially due to the separate research communities in which these two cell groups are studied.

"Dr. Mao's research in tissue engineering represents the fruits of interdisciplinary science. His work has relevance for oral health care, as well as many other health care disciplines," said Dr. Ira Lamster, Dean of the Columbia University College of Dental Medicine.

Dr. Mao and colleagues demonstrated that when human mesenchymal stem/progenitor cells were seeded in micropores of 3D calcium phosphate scaffolds, followed by infusion of gel-suspended CD34+ hematopoietic cells, greater vascularization was seen in mice than when mesenchymal cells were used alone.

Furthermore, Dr. Mao's team found that the number of vessels and the diameter of the vessels produced by the co-transplantation of hematopoietic and mesenchymal to create vascularized tissue were dramatically increased when combined with Vascular Endothelial Growth Factor or VEGF.

"The work has potential beyond bones and may have implications for the growth of muscle, nerve and organs," Dr. Mao said. "The synergistic action of mesenchymal cells and hematopoietic cells provide an alternative approach for regrowing a host of vascular tissues."

Source: Columbia University