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New stem cell technology developed at Hebrew University leads to better treatment for complicated bone fractures

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A novel technology involving use of stem cells, developed by Hebrew University of Jerusalem researchers, has been applied to provide better and rapid healing for patients suffering from complicated bone fractures.

The technology, involving isolation of the stem cells from bone marrow, was developed by Dr. Zulma Gazit, Dr. Gadi Pelled, Prof. Dan Gazit and their research team at the Skeletal Biotechnology Laboratory at the Hebrew University Faculty of Dental Medicine and was given public exposure in an article that appeared in the prestigious journal Stem Cells.

The technology has now successfully been used to treat complicated fractures in seven patients at the Hadassah University Hospital in Ein Kerem, Jerusalem.

To date, in clinical orthopedics, standard treatment for severe bone loss has involved either amputation or a prolonged period of disability. The use of prosthetic implants tends to fail in the long term. Excessive bone loss may result in non-uniting fractures, which are observed in more than one million new cases per year in the US alone.

In recent years, the use of mesenchymal stem cells (MSCs, or multipotent stem cells that can differentiate into a variety of cell types) has been claimed to be a promising biological therapy that could be used to treat complicated fractures and other disorders in the skeleton. These cells constitute a unique population of adult stem cells that can readily be isolated from various sites in the human body, especially from bone marrow and adipose (fat) tissues. Following isolation, MSCs can be utilized to repair a variety of injured tissues including bone, cartilage, tendon, intervertebral discs and even the heart muscle.

The conventional method of MSC isolation, using prolonged periods of growth in designated incubators, has proved to be laborious, costly and also possibly injurious to the therapeutic quality of the cells. Therefore, an alternative method involving the immediate use of these stem cells was an unmet need in the field of regenerative medicine.

Now, the Hebrew University group has developed a technology called immuno-isolation in which MSCs are sorted out from the other cells residing in a bone marrow sample, using a specific antibody. In the Stem Cell paper it was shown that the immuno-isolated cells could be immediately used to form new bone tissue when implanted in laboratory animals, without having to undergo a prolonged incubator growth period.

Following this breakthrough, a unique and close collaboration was established among clinicians (Prof. Meir Liebergall, head of orthopedics, Hadassah University Hospital), the Good Manufacturing Practice (GMP) facility at Hadassah (Headed by Prof. Eithan Galun) and the Gazit group at the Faculty of Dental Medicine.

Within this collaborative effort, a clinical-grade protocol for the use of immuno-isolated MSCs was established. Subsequently a clinical trial was initiated at Hadassah, aimed at establishing the foundation for the use of immuno-isolated MSCs in orthopedic surgery.

To date, seven patients suffering from complicated fractures have been treated successfully with a combination of their own immuno-isolated MSCs and blood products. The entire procedure lasted a few hours and without any need to grow the cells for weeks in a laboratory.

It is anticipated that future development of the current endeavor will extend to treat other injuries in the skeleton, such as degenerated intervertebral discs or torn tendons. The Gazit group believes that further clinical trials will demonstrate that the immuno-isolation technology is useful in overcoming morbidity in patients suffering from skeletal fractures and diseases, and might restore function and quality of life to sick and injured people.

In this regard, Yissum Research Development Company of the Hebrew University of Jerusalem, the technology transfer arm of the university, licensed the immuno-isolation technology to TheraCell Inc. of California in July 2009. TheraCell aims to further develop and commercialize the technology for advanced regenerative medicine procedures such as spinal fusion.

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Further information: www.huji.ac.il