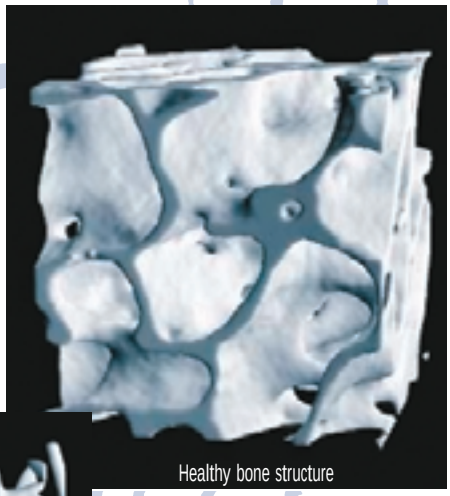
Research

Project

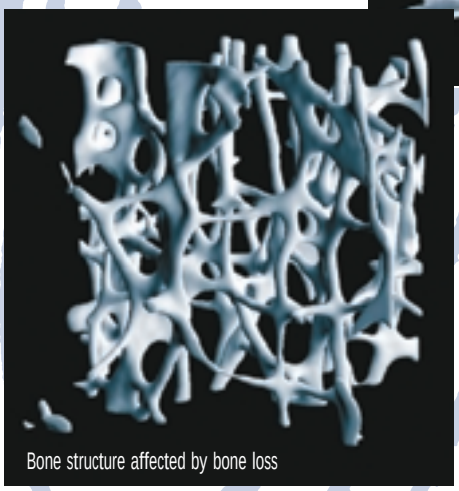
Fighting Osteoporosis with ESA Innovations

Osteo-porosis spreads quickly, as Europe's population Ages

ESA is helping to develop innovative tools to detect, monitor and combat osteoporosis - a disease spreading out quickly amongst the world's population. Osteoporosis is a bone loss disease with increasing impact on human society, as the world's population ages. As the bones' density diminishes, they are more susceptible to fractures. In Europe, 500 000 people are hospitalized because of osteoporosis per year. Within 50 years, the number is expected to double.



Healthy bone structure



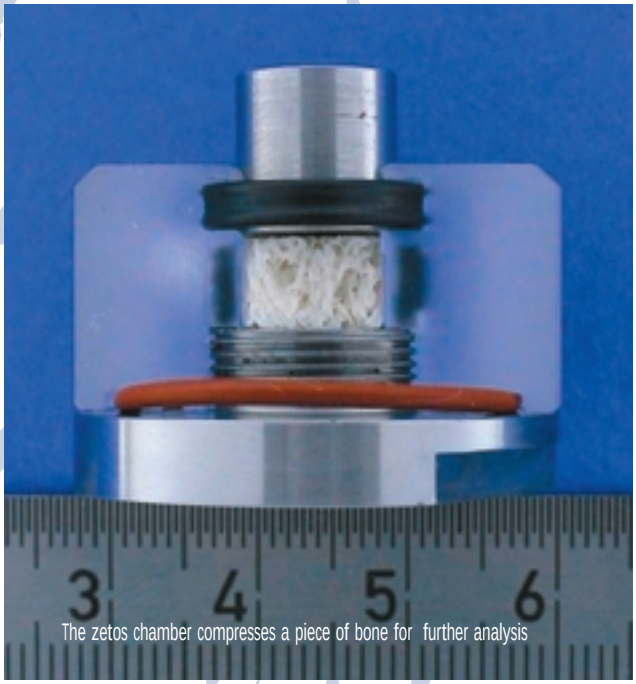
Bone structure affected by bone loss

The space environment has a similar effect on astronauts: after a long stay in space, astronauts suffer from a kind of bone-loss similar to osteoporosis. The reason for this is weightlessness, triggering two major factors which foster the development of bone-loss: first, the human body floats in microgravity, there is no weight charged on the skeleton anymore, as objects are weightless. Second, there is a reduction of movement, as the body does not have to fight gravity to move about. In this way, weightlessness accelerates bone loss: most astronauts lose one percent of bone and muscle mass per month. The ISS is the ideal place to develop effective measures that may reduce or work against bone loss - with the help of the most prominent test persons ever: astronauts.

In the Space Environment, Astronauts have to Face Bone loss

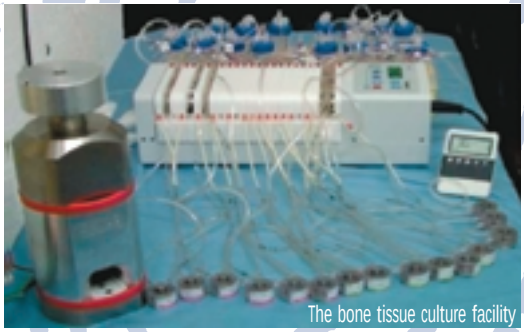
ESA is devoted to research-related bone remodelling issues. For instance, ESA in cooperation with the Institute for Biomedical Engineering in Zürich and Scanco Medical, designed and enhanced a scanner that can generate high-quality, three dimensional images of living bone-structures. With this device, bone-growth and the process of the build-up of bone-substitutes can be accurately measured.

Future goal: an automated facility for the Space Station



The zetos chamber compresses a piece of bone for further analysis

Currently, ESA is defining three-dimensional bone tissue cultures to replace animal models currently used to test new treatments. One of the future goals is to build an automated facility that can be shipped to the ISS for research in weightlessness.


The bone tissue culture facility

Another future objective is to develop a bone substitute culture facility - a system where bone marrow cells are harvested from the patient, then multiplied in culture, shaped into appropriate structures on an artificial bone scaffold, and finally implanted into the patient.

Ultimately, this research will provide tissue-engineered lattices for direct use in the skeletal system by helping scientists understand the relevant biomechanical cues. With this knowledge, the right mechanical stimulus might not only improve the quality of the new bony tissue, but might also shorten the time needed to cultivate the tissue before implantation.

ESA contributes to the Development of New Therapies

Researchers at ESA thereby create highly accurate ways to define and evaluate new countermeasures to detect osteoporosis earlier and more accurately, and to contribute to the development and evaluation of new therapies. Moreover, these research results are an ideal toolkit for healthcare companies investigating bone diseases such as osteoporosis. ■

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