Space travel may contribute to weakened bones

By Arun Arjunan
The Battalion

Astronauts spend much of their missions repairing space stations and fixing broken satellites while protecting them from wear and tear. At the same time, the astronauts' own biological machinery is susceptible to damage.

Dr. Susan Bloomfield, associate professor of health and kinesiology, has received a $697,000 grant from the National Space Biomedical Research Institute to study bone blood flow during simulated microgravity to gain a better understanding of this problem.

Bloomfield and her research team said they suspect that long-term space travel may lead to the deterioration astronauts' bones. The zero-gravity environment of space decreases even blood flow to the bones, particularly to the bones in the legs, and may prevent essential nutrients from reaching the bones.

Bloomfield said there need to be more efforts toward finding some preventive measures.

"One of the main areas we need to look at is how bones recover after a long period of weightlessness," she said.

Bloomfield said she believes that her research also may apply to other people who suffer from rapid deterioration of bone mass.

"If we can find any solutions to the problems that microgravity presents to astronauts, we may be able to find a way to better treat patients with osteoporosis," she said.

Bloomfield published her research findings about microgravity effects on bone loss in the 2000 issue of *the Journal of Applied Physiology*. Her results show that the decrease in blood flow to bones occurs much quicker than previously thought.

The results were based on an experiment in which Bloomfield's team measured the bone formation or deterioration that occurs in rats as a result of large increases or decreases of blood circulation directed toward the leg bones. The microgravity environment is simulated by suspending the rat's limbs so the legs are not active. A shift in blood flow occurs within ten minutes of the microgravity simulation.

"The unweighted hind limbs in rats become weaker with less blood flow to the femur (thigh bone)," Bloomfield said.

Harry Hogan, a research associate in mechanical engineering, measures the bone density of the removed femurs from the experimental rats.

"The actual weight-bearing strength of the bones are measured by compression testing," Hogan said.

These studies showed that the mineral density and structural strength of the bones decreased significantly in a 28-day interval compared with a control group of rats that were subjected to regular gravitational conditions.

Bloomfield said, under a greater load, bone cells reproduce rapidly to increase bone mass and consequently increase bone strength.

"Normal weight-bearing activity stimulates the growth of osteoblasts (bone cells), which means more bone tissue to increase the overall structural strength," she said.

The research was conducted on the leg bones of rats because the microgravity of space mainly affects the lower body of astronauts. Reduced blood flow to the tibia and the femur may contribute to the decrease of bone formation.

She said these conditions may cause the loss of bone mass. The decline of blood circulation means that the bones may receive fewer essential nutrients.

"Without the necessary minerals for the bone and hormones to stimulate bone growth, then bone density will definitely be affected, "she said.

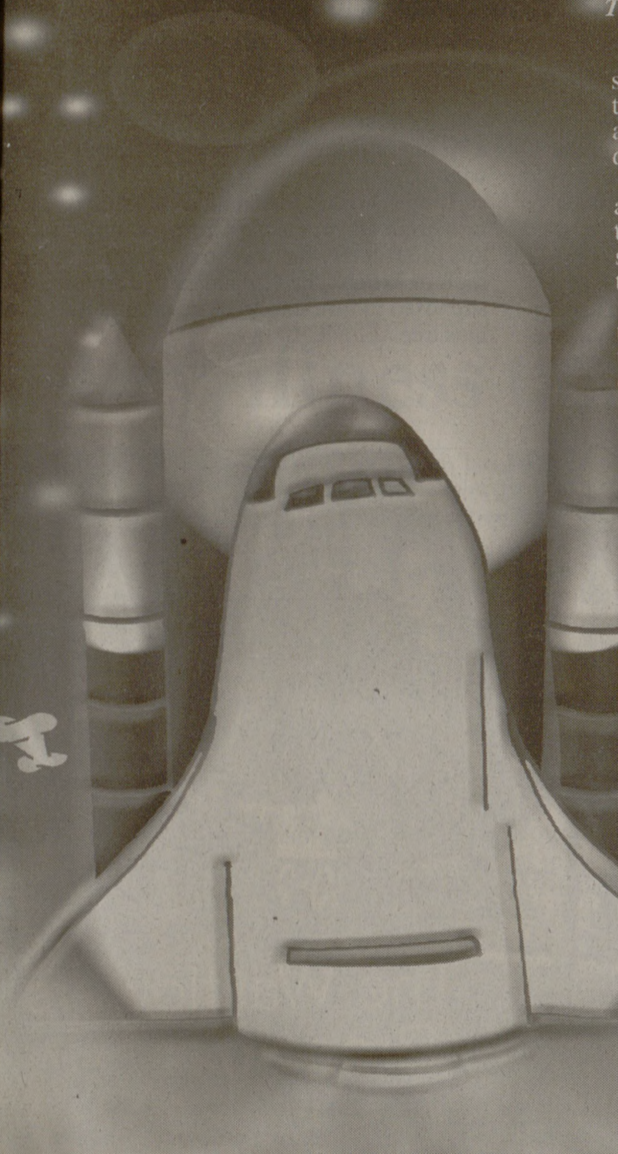
The mineral density of the bones was tested through a procedure known as peripheral quantitative computed tomography (pQCT), a technique similar to CAT scan in humans.

One particular area that Bloomfield's research team is investigating is Dobutamine, a medication used to treat congestive heart failure. Dobutamine relaxes smooth muscle and increases blood flow.

Bloomfield said she believes that Dobutamine or a related medication could be used to increase circulation to the bones.

"A pharmaceutical that allows for more blood to flow towards the bones may significantly slow down the deterioration," she said.

She said the discovery of such a preventive measure would make long-term space travel possible without the concern of bone loss.



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