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Research in Graubünden

Cartilage regeneration through movement

Research on self-healing of joints



Laura Mecchi prepares the machine, which then imitates knee movements for an hour. Image: Daniele Zedda, AO Foundation

“Research is fun,” says Laura Mecchi, a PhD student at the AO Research Institute in Davos, with enthusiasm. “One of the best moments is when a study is successfully completed, and you get the answers to the questions you previously posed.” However, research usually progresses in very small steps and can take years or even decades before the results are visible in patients. Laura’s motto: “You have to stay positive and not let failure overwhelm you.”

Mecchi is in her third year of a project investigating how damaged cartilage tissue can regenerate itself. The body cannot heal cartilage in the knees, hips, and elbows as quickly as it heals other tissues, such as skin or bones, because cartilage lacks blood vessels. This makes it difficult for cells to reach the area to initiate regeneration. However, researchers have already discovered that movement and mechanical forces can activate a specialized protein in the cells, which stimulates the regeneration of cartilage tissue. Mecchi is currently focusing on questions such as: What type of movement produces the best results? Or is it a combination of forces acting on the knee, for example? And how often and for how long each day should these movements be performed?

The studies are conducted using simple models. The AO Research Institute has several machines with different stations that mimic knee movements, making it possible to observe the impact on cells and their

changes. These stations consist of a holder, a scaffold, and a so-called bioreactor. The bioreactor includes a smooth ceramic ball, similar to those used in artificial hip joints, a holder, and a motor. The ball moves either up and down (compression) or back and forth (shearing). Special bone marrow stem cells are injected into a 3D-printed polymer structure. This structure is placed in the holder, surrounded by a so-called medium, similar to what is found in the human body. For now, the structure is exposed to the forces of the ceramic ball for one hour per day. After approximately three to four weeks, the 3D-printed structure is examined for the presence of the protein in question.

“The next step could be to study the behaviour of the cells under conditions of inflammation, which can occur after cartilage injury, and to observe how movement and mechanical forces influence them,” Mecchi explains. Her contract with the AO Research Institute will end in 2026, and the studies for her doctoral thesis will be completed. Afterwards, someone else will continue the research based on Mecchi’s findings. Mecchi will already have the opportunity to present the current status of her research to a wide audience at the conference “Graubünden forscht”, which will take place in November in Davos.

Laura Mecchi and Barbara Caderas



Laura Mecchi

Image: AO Foundation,

Communications and Events

Graubünden forscht 2024

On November 8 and 9, 2024, the Academia Raetica will host the ninth conference “Graubünden forscht” at the Davos Congress Center. On Saturday, November 9, 2024, the public is invited to gain insight into the diverse research activities in the canton at the exhibition “Mittag der Forschung” (Science Noon) and experience science up close. For details, visit www.gr-forscht.ch.

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