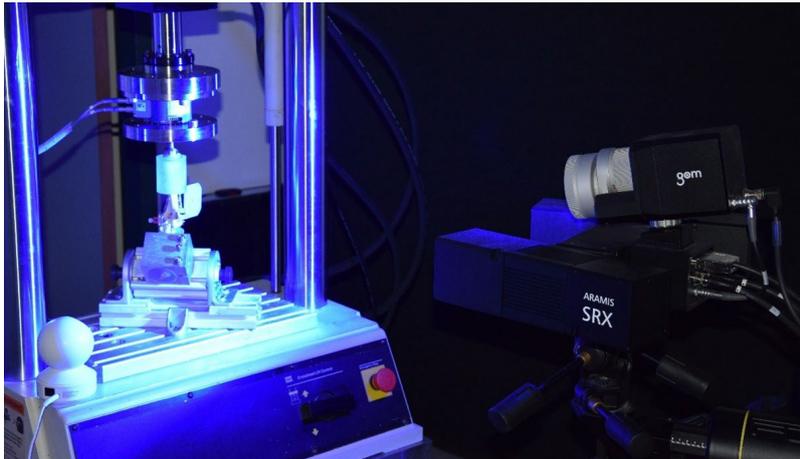


Research in Graubünden

Stable bones through biomechanics

Collaboration Between Medicine and Engineering



Test setup with mounted specimen, ready for biomechanical testing. Image:
AO Foundation

Develop standardized techniques for fracture fixation. After surgery, a broken bone must be stabilized so that it can withstand everyday movements and mechanical loads. Even with careful surgical procedures, implant constructs can fail. One contributing factor is the reduced bone quality often seen in older patients, which increases the risk of implant loosening and the need for revision surgery. Understanding how stable a bone-implant construct is—and the loads it can safely bear—is therefore essential.

These questions are investigated systematically at ARI. Interdisciplinary research teams test how effectively screws, plates, and intramedullary nails stabilize fractures. Constructs are mounted in material testing machines that apply controlled compressive, tensile, and torsional forces to simulate real-life loading conditions. High-precision measurement systems capture how fracture fragments move, how materials deform, and when fixation fails. The aim is to make fracture treatment safer and more effective. Implants must hold the repositioned bone fragments securely until healing is complete. Stability and load-bearing capacity are critical to enable early partial weight-bearing during rehabilitation. Findings from these biomechanical studies feed directly into the development of improved surgical techniques and implants. In addition, computer simulations make it possible to model different loading scenarios, as well as varying screw positions and construct designs, in a virtual environment—saving both time and resources.

Close collaboration with surgeons is central to this work. Clinical problem cases are analyzed jointly and translated into experimental or simulation-based studies. The results are published in scientific journals and provide the basis for further preclinical and clinical research. Beyond mechanical considerations, biological factors also play a decisive role in successful bone healing. Combining an

The AO Research Institute Davos (ARI) is an internationally renowned center dedicated to studying the healing of bone fractures and injuries of the musculoskeletal system. A key focus lies in the biomechanics of implants used to stabilize fractures.

Biomechanics brings together medicine, biology, and engineering. It explores how forces act on the human body and how bones, muscles, tendons, and implants respond. At ARI, researchers de-

optimal mechanical environment with a deep understanding of biological processes is key to improving fracture care. Every new insight into the load-bearing capacity of fixation methods contributes to safer surgeries and faster recovery for patients.

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Ivan Zderic. Image: AO Foundation

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