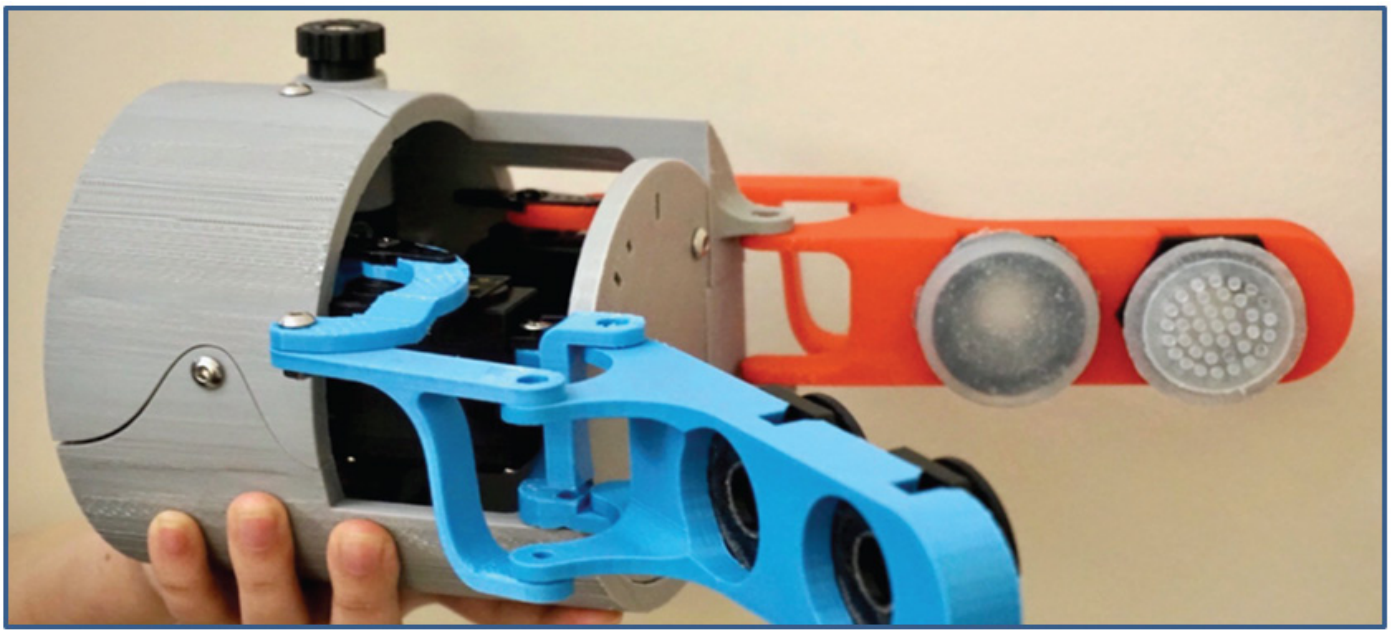

How Adjustable Adhesion Improves Mechanical Gripping

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Can't Get a Grip?

The Hatton Lab has developed adjustable-adhesion surfaces made of silicone that can vary the frictional force exerted on an object. A mechanical gripper design was requested by the client in order to evaluate the effectiveness of the adjustable-adhesion surfaces and to demonstrate their functionality in a practical device. Upon further refinement of the design, the gripper could be incorporated into prosthetic hand end-effectors, as existing designs lack methods for fine-tuned grip control and slippage prevention.

Improved Gripping Ability Through Material Science and Mechatronics Integration

The team designed and built a prototype to serve as a testing platform to demonstrate the practical use of the gripping surfaces. Servo motors are used to move the fingers of the gripper into a position that allows the gripping surfaces to engage with an object. Air pressure is then used to deflect the silicone gripping surfaces into a concave (negative pressure) or convex shape (positive pressure) to allow for the fine tuning of the applied frictional force on the object's surface. This allows the gripper to grip objects without requiring that the object have surface features that the gripper can mechanically lock around or enclose. To enhance the testing capabilities, the angle between the planes-of-motion of the fingers can be adjusted to be between 90° (perpendicular) and 180° (parallel). To better demonstrate and quantify this ability, the team designed a testing plan that incorporates changing the test object's weight, size, and surface finish.

Due to the limited resources available to the team, the gripping surfaces were scaled-up to remove the requirement for unavailable facilities. However, the test results of this gripper can direct future iterations by outlining the strengths, weaknesses, and limitations of using pneumatics with silicone surfaces for gripping.