IPN Researchers Collaborate with Italy and France to Create Upper Limb Rehabilitation Device

- **The scientists developed the device ReHArm, which is notable for its compact size, lightweight design, and customizable treatment options.**
- **The prototype's resistance, rigidity, and interface ensure effective treatments for developing joint stability, muscle coordination, and strength.**

A team of specialists from the Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada (CICATA), Unidad Querétaro of the Instituto Politécnico Nacional (IPN), in collaboration with members of the University of Calabria (Unical), Italy, and the Pprime Institute at Poitiers University, France, has developed a device for the rehabilitation of upper limbs (arms, forearms, wrists, and hands) affected by injuries, surgeries, or neurological damage that have resulted in a loss of mobility.

The researchers, led by Dr. Eduardo Castillo Castañeda from IPN and Dr. Med Amine Laribi from the Pprime Institute, developed a variable rigidity device called ReHArm, which is based on a fully articulated system. This system allows for a wide range of movements during rehabilitation and provides a safe, customizable treatment depending on the patient's needs.

The device's resistance, rigidity, and the development of its interface, which have been patented, were crucial in ensuring personalized, effective treatments with greater versatility in exercises to develop muscle strength, improve joint stability, and promote muscle coordination, as stated by the researchers.

El Dr. Eduardo Castillo explained that the ReHArm device is characterized by its compact size, lightness, and customizable treatment options. It also provides versatile support for a broad range of rehabilitation exercises.

Additionally, the specialists developed the dynamic interface called A.R.M.S. (Arms Rehabilitation Management System), which provides an interactive and progressive rehabilitation pathway to guide patients through a series of exercises and allows real-time monitoring of their performance.

"Dr. Med Amine added that the system includes two symmetrically variable rigidity joints, table clamps, a five-bar mechanism, a pantograph, and a mouse casing, allowing for the communication and instantaneous translation of the patient's movements to the interface, as well as a handle for support.

He explained that the variable rigidity joints feature a system of gears, linear guides, and racks to adjust the resistance of two pairs of springs on the sides of the device, located inside the handle. Additionally, they include a locking mechanism to limit unnecessary movements.

The researchers further elaborated that the rehabilitation stages of ReHArm are divided into three categories, each with progressively complex phases aimed at providing a continuous, safe, and effective recovery process. The exercises start with basic movements and increase in difficulty with more complex patterns, ultimately reaching the final stage: a random maze where the learned motor skills converge.

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