

<https://rehabilitacjawpraktyce.pl/rehabilitacja-pacjentow-po-udarze-niedokrwiennym-mozgu-w-koncepcji-acx-rehab/>

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Topic:

Rehabilitation of patients after ischemic stroke in the ACX REHAB concept.

Abstract:

The aim of this article is to present the results of research on the effects of improving hand function needed to perform everyday activities – eating, using the ACH REHAB robotic system.

Keywords:

- Ischemic stroke
- ACX REHAB
- ICF classification (International Classification of Functioning, Disability and Health)

Keywords in English:

- Ischemic stroke
- ACX REHAB
- International Classification of Functioning, Disability and Health

Entry:

The control group consisted of 46 patients (24 men - 52.2% and 22 women - 47.8%) who stayed at the Neurological Wards of the Upper Silesian Rehabilitation Center "Repty" in Tarnowskie Góry in 2023. The criterion for inclusion in the research group was female gender, in the age range of 42 to 86 years, in the ICF classification – code d550, which defined the problem with eating function to a moderate or significant degree.

Patients taking part in rehabilitation classes in the hand clinic and using ACX REHAB virtual reality, constituted 20% of all patients, staying in neurological wards at that time.

1. Ischemic stroke:

An ischemic stroke (also called ischemic stroke, cerebral infarction, or ischemic stroke) is a type of stroke that occurs when the blood supply to a part of the brain is interrupted or significantly reduced. This condition results from a clot or narrowing of blood vessels, leading to inadequate blood and oxygen supply to brain cells. This is in contrast to a hemorrhagic stroke, in which blood bleeds into the brain. It is the most common form of stroke, accounting for about 80-85% of all stroke cases. The Burden of Stroke in Europe report shows that in 2017 alone, a total of 1.12 million Europeans suffered a stroke. Europeans suffered a stroke and 0.46 million died from it [1].

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The most common causes of ischemic stroke are:

- Arterial thrombosis - This occurs when blood clots in one of the blood vessels, forming a clot that blocks blood flow.
- Artery stenosis - This may result from a build-up of atherosclerotic plaque on the walls of blood vessels, which leads to restricted blood flow.
- Arterial embolism - This occurs when a clot from another area of the body, such as the heart, travels to the brain and blocks a blood vessel.

Symptoms of an ischemic stroke can include sudden difficulty speaking, loss of sensation or weakness in one side of the body, difficulty seeing, problems with coordination, and severe headache. Prompt medical attention is essential in the event of an ischemic stroke because treatment must be provided as quickly as possible to restore blood flow to the damaged area of the brain. Treatment may include clot-busting drugs (thrombolytics) or interventional procedures such as thrombectomy.

Prevention of ischemic stroke includes controlling risk factors such as high blood pressure, diabetes, smoking, high cholesterol, and adopting a healthy lifestyle, including physical activity and a healthy diet. In some cases, antiplatelet drugs or other causes of clots may also be recommended. People with suspected stroke or increased risk should seek immediate medical attention.

The heterogeneous etiology of stroke in young adults and the wide range of factors that can affect the risk of stroke mean that diagnosis is more difficult than in older patients. Over the last decade (2010-2019), the number of patients treated in stroke units has increased [2]. Among people under 45 years of age, the number of ischemic strokes is still low compared to older patients, but the reversal of trends, i.e. an annual increase in the number of strokes occurring in younger people and an annual decrease in the number of strokes occurring in older people, has shown the importance of developing primary prevention dedicated to young adults.

Year	18–44	45–65	> 65	Total
2010	1,353	35,511	39,399	76,263
2011	1,381	35,792	40,227	77,400
2012	1,496	48,699	27,900	78,095
2013	1,463	34,824	40,928	77,215
2014	1,581	33,393	40,453	75,427
2015	1,545	32,186	40,390	74,121
2016	1,590	31,482	39,819	72,891
2017	1,739	31,144	40,233	73,116
2018	1,760	30,841	40,113	72,714
2019	1,847	29,609	39,007	70,463

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Table 1. Changes in the number of patients with ischemic stroke in the age groups 18-44, 45-65 and > 65 in 2010-2019 [2].

2. ACX Rehab

ACX Rehab is a concept of modern technology of rehabilitation and diagnostics in virtual reality, combining classic methods with the possibilities of modern technology. In accordance with the concept, we achieve the highest quality rehabilitation results by combining the knowledge and practice of Therapists with the possibilities of virtual reality. ACX Rehab combines three main components:

- research and rehabilitation possibilities of stabilometric, dynamographic and balance platforms
- rehabilitation possibilities of medical devices working under the control of safe elastic resistance
- software enabling the use of virtual reality

Using ACX Rehab makes the rehabilitation process more objective, and thanks to the intuitiveness of the software used in ACX Rehab, it supports the daily work of physiotherapists. All data, including tests, each rehabilitation exercise and its results are collected automatically on individual patient cards, so you can always check and evaluate the improvement of the patient's health.

Devices that were used during the research process:

VECTIS MINI uses elastic resistance in the comprehensive rehabilitation of the upper limb in the shoulder joint. The device allows for the following movements:

- internal rotation
- external rotation

The device has been designed to operate using elastic resistance elements, the most important advantage of which is generating a small resistance in the initial phase of movement, which increases evenly in the later phases of the exercise. Thanks to these properties, the VECTIS MINI is particularly useful in post-traumatic, post-operative, orthopedic and neurological rehabilitation.

Features:

- measurement of range of motion
- dynamic exercises
- exercises with integrated real-time biofeedback
- objectification of the rehabilitation process
- adjusting the difficulty of the exercise to the patient's current needs

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Benefits:

- increasing range of motion through active movements
- increasing muscle strength and endurance
- improving joint stabilization through proprioceptive re-education - improving muscle coordination



CUBITO uses elastic resistance in the comprehensive rehabilitation of the upper limb in the forearm and wrist area. The device allows for the following movements:

- conduction/abduction
- internal/external rotation
- dorsal/palmar flexion

Thanks to the use of elastic resistance elements, the most important advantage of which is generating a small resistance in the initial phase of movement, increasing evenly in the later phases of the exercise, CUBITO is particularly useful in post-traumatic, post-operative, orthopedic and neurological rehabilitation.

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Applications:

- measurement of range of motion
- dynamic exercises
- exercises with integrated real-time biofeedback
- objectification of the rehabilitation process
- adjusting the difficulty of the exercise to the patient's current needs

Effects:

- increasing range of motion through active movements
- increasing muscle strength and endurance
- improving joint stabilization by re-educating the body's proprioception (deep sensation)
- improving muscle coordination



X-COGNI is a multi-sensory device for hand and cognitive therapy:

The X-COGNI therapeutic system is used in neurological rehabilitation of the upper limbs. Repetitive active exercises and training promote neuronal plasticity and thus the change (adaptation) of synapses, nerve cells and even entire brain areas to regain lost functionality.

- tests and exercises focused on visual-motor skills and cognitive functions (divided attention, memory, problem-solving),

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- Assessment and therapy focused on motor function and strength of the upper limbs (range of motion and strength),
- therapy based on patient test results and therapy progress,
- a set of accessories for everyday activities: a cup, a roller, an attachment for rotation and pulling,
- easy adjustment of the screen touch area and marker position,
- virtual reality and biofeedback to support patient motivation and faster therapeutic progress,
- possibility of integration with the therapist's central base and other devices for the rehabilitation of upper and lower limbs.

The main indications for using the X-Cogni system are:

- Stroke (hemorrhagic, ischemic)
- Traumatic brain injuries (TBI)
- Spinal Cord Injuries (SCI)
- Brain tumors
- Parkinson's disease
- Chronic diseases such as multiple sclerosis (MS)
- Cerebral Palsy (CP)
- Motor neuron diseases such as amyotrophic lateral sclerosis (ALS)
- Meningitis, encephalitis
- Muscular dystrophy
- Paralysis caused by a herniated disc in the cervical spine
- Hemineglect
- Fractures and injuries of the distal part of the upper limb (remodeling phase)

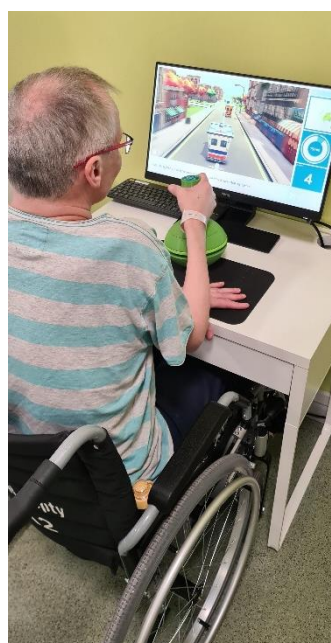
There are also absolute contraindications to the use of the X-COGNI system:

- Acute pain despite conventional therapy in the area of the affected upper limb
- Adjustment and positioning of the patient to the individual physiological position must be maintained, especially in the case of contractures or severe spasticity of the exercised upper limb.
- Limited contact with the patient (psychotic illnesses or severe neurotic disorders)
- Severe ataxia
- Severe osteoporosis (high risk of fractures)
- Fractures - Training should not be performed on unstable or still inadequately consolidated fractures.

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CAPRI (coordination rehabilitation of hand movements) is a therapeutic device that can be used in the rehabilitation of patients suffering from dysfunctions of grip control and accuracy, motor and hand coordination. The **CAPRI system** is usually used in occupational therapy and physiotherapy as a therapeutic support, reinforcement and intensification, as an addition to conventional forms of therapy. Active, repetitive exercises and training promote neuronal plasticity and thus changes (adaptation) of synapses, nerve cells and even entire brain areas in order to regain lost functionality.



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3. ICF:

The International Classification of Functioning, Disability and Health (ICF) is a classification system developed by the World Health Organization (WHO). The ICF was adopted by the WHO in 2001 and is used to describe health and health-related issues, including function and disability. This classification aims to take into account not only health problems but also social and environmental aspects.

The ICF consists of two main parts:

- **Body Functions and Structures** - This section covers the description of physiological functions (such as breathing, circulation, vision) and body structures (such as organs and systems). This classification helps to understand what body functions are maintained or impaired.
- **Activity and Participation** - This part focuses on the ability of an individual to perform various activities (activity) and on their participation in social life (participation). This classification includes both positive and negative aspects.

The ICF also considers contextual factors that affect an individual's abilities and functions. It divides them into two categories:

- **Environmental Factors** - includes external factors such as the physical, social and cultural environment that may influence an individual's abilities and functions.
- **Personal Factors** - includes individual characteristics of an individual such as age, gender, lifestyle, life experiences, etc.

The ICF is used in a variety of fields, including health care, rehabilitation, social policy, and research. This classification helps to better understand health and disability, and enables information to be compared internationally.

Summary:

Rehabilitation using virtual reality in the ACX REHAB concept proved that the patients' eating function improved to a small degree or no hand dysfunction. During the research process, it was proved that in 88% of patients at the end of the rehabilitation stay, the hand function improved, which was translated into the ICF classification. The percentage results of the research are as follows:

In 88% of the study participants, hand grip efficiency improved to the level of a slight hand function problem, while in 12% of patients, as a result of the rehabilitation, the problem disappeared completely.

The innovative method supports the interdisciplinary rehabilitation plan for patients after ischemic stroke.

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