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## Neuromotor rehabilitation and cognitive outcomes in patients with traumatic brain injury through the method BAPNE

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### Abstract

After the acute phase of hospitalization, patients with severe brain injury, requiring interventions in health and social care in the long term: the work of rehabilitators is to facilitate the recovery of several disorders caused by trauma and involves all possible areas to return the patient to full functionality within the autonomy and satisfaction of basic needs, and psychological support they need. The recent use of body percussion through BAPNE method in neurorehabilitation offers the possibility of studying the development of motor skills, attention, coordination, memory and social interaction of patients with neurological diseases. The experimental protocol involves 52 patients with GCA selected on the basis of shared and structured requirements. The trial will provide the coaching protocol BAPNE (in two weekly sessions of 50 minutes to a maximum of 10 weeks in a group of patients), to the traditional rehabilitation activities. The control group will continue to perform exclusively the cognitive and neuromotor rehabilitation according to traditional protocols. All subjects will be: monitored the levels of cortisol in-time 0 - 75-180 days; recorded beats per minute through a heart rate monitor on your wrist; through the use of Lybra (equilibrium) and Kimeja (virtual reality) will be recorded data regarding the ability to adjust the balance of the patient in standing and sitting using the visual input and data relating to the patient's ability to coordinate fine motor skills in a virtual environment; through the administration of neuropsychological tests (HADS, NPI) will be detected improvements in mood and behavioral disturbances in the regression if available. At 6 months after administration of the protocol is expected to re-test to assess if present, the maintenance of the effects of rehabilitation obtained. The research is led by three neurologists from the center of neurorehabilitation Fondazione Roboris ASL RME in Rome.

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## 1. Introduction

The stroke is the appearance of a more or less rapid decrease of brain function following the alteration of the blood circulation in the brain. This can be characterized as obstruction of a cerebral artery, such as hemorrhage, or as a temporary decrease in blood flow. (A. Gaggioli, M. Pigatto, A. Meneghini, 2009). One of the most common consequences of this disease is the sensory-motor deficits dell'emisoma affected (hemiplegia). Rehabilitative efforts to reduce the deficit and facilitate the return to an active and productive life are based on a combination of interventions aimed at restoring the functions; teach to those affected and their families' new approaches to everyday life, while providing a proper education and practical support. (G. Raw, F. Morandi, G. Riva, M. Ortolani, 2009). The restoration of motor function of the upper limb is of crucial importance to give back to the patient autonomy. In the past, the rehabilitation treatments were based solely on observation of the patient, without an understanding of the neural processes related to motor recovery. (Barreca S, Wolf SL, Fasoli S, Bohannon R., 2003).

Recent studies in the area of neuroscience have highlighted as a result of a lesion of the motor cortex, brain areas are recruited intact and occur anatomical modifications such as axonal sprouting and synaptogenesis not only in areas perilesional, but also in motor areas against side. The two cerebral hemispheres are functionally connected and in balance through a mutual intra-hemispheric inhibition. (Borojerd B., U. Ziemann, R. Chen, CM Butefisch., Cohen LG., 2004). To achieve this functional reorganization of the motor cortex, it is seen how therapeutic exercise is one of the most important factors capable of inducing the acquisition of new motor tasks. The phenomenon of motor learning is a process associated with practice or experience leading to permanent changes in the ability to produce movements finalized. The variables that impact significantly on the ability of learning are: the intense repetition, the functional significance of the gesture, and the use of visual feedback, auditory and tactile during exercise (Taub E., Nudo RJ, Milliken GW., Jenkins WM., Merzenich MM. 1980-1999)

### 1.1. Cerebral stroke: Epidemiological and social impact

In the world, every year, 15 million people are affected by Stroke, six million of them die. Stroke is the second leading cause of death worldwide and the third leading cause of death in the G8 countries, preceded only by heart disease and cancer (Sarti C, 2000; Strong K, 2005). In Italy, the stroke is, for epidemiological size and social importance, one of the most serious health and welfare problems. It is, in fact, the leading cause of permanent disability (Di Carlo A, 2003; Murray CJ, 1997, Marini C, 2004) and the second leading cause of dementia, as well as the third leading cause of death (but is set to become the second), causing 10-12% of all deaths.

The annual incidence in Italy, according to the main epidemiological studies available, is 1.79 / 2.92 new cases per thousand inhabitants. Of these, about 80% are ischemic strokes, while the remaining 20% are hemorrhage (brain or subarachnoid). As reported by the Italian Guidelines (SPREAD, 2010), each year occur in Italy, according to surveys of 1999, approximately 186,000 strokes, of which 80% are new episodes (148,800) and 20% are repeat offenders (37,200).

The risk of stroke increases with age: in practice doubles every 10 years starting from the age of 45. The risk of recurrence ranges from 10% to 15% in the first year and 4-9% for each year in the first 5 years of the initial episode.

The incidence increases steadily with age, reaching a maximum value in people of more than 85 years old. Then 75% of strokes, strikes after age 65, but 5% of strokes occur before age 45. The prevalence rate in the elderly Italian population (65-84 years old) is 6.5%, slightly higher in men (7.4%) than women (5.9%). Of those who are affected by stroke, 20-30% die within three months, 40-50% permanently lost their autonomy, while 10% have a severe relapse within 12 months. In accordance with the recent acquisitions in neurorehabilitation, new techniques have been proposed to try to maximize the potential of the motor recovery in patients with severe brain injury outcomes. This paper describes a research hypothesis, being tested at the Center Adelphi, (Day Centre for the GCA) to Rome (ASL RME), using the methodology of BAPNE Phd. F.J. Romero Naranjo in order to integrate the process of rehabilitation and cognitive outcome of patients with severe acquired brain injury and to monitor the effects of short- and long-term.

### 1.2. Centro Adelphi

The Day Centre Adelphi (Foundation Roboris) according to Rome in Hall 12 of the hospital complex of Santa Maria della Pietà (ASL RME), houses inside outcomes of 27 patients per day in severe brain injury rehabilitation treatment.

As a day care center, is framed as a continuum between post-acute rehabilitation and social reintegration of the patient where possible.

The property is home to 27 patients per day under the semi-residential, from 9.00 to 16.00 and is equipped with machinery for the rehabilitation of the last generation, such as LOKOSTATION Treadmill with a particular robot-assisted gait, the VRRS (Virtual Reality rehabilitation system) equipment for rehabilitation in virtual reality that refines and perfects the active movement through a system with feedback; the rail to ceiling with H-pattern, capable of supporting the subject in an upright position while giving the maximum freedom of movement.

The property also has 2 gyms and a spa medical 30sqm where hydrotherapy is performed.

The main feature of the Centre Adelphi lies in multidisciplinary pursued, inherent in the concept of integrated rehabilitation

### 1.3. Il Metodo BAPNE e Le intelligenze multiple

BAPNE method is a method created by Dr. Francisco Javier Romero Naranjo for the development of multiple intelligences of Howard Gardner, through the fundamentals and the classification of systemic principles of the teaching body percussion.

BAPNE word is an acronym formed from the words: Biomechanics, Anatomy, Psychology, Neuroscience and Ethnomusicology. With the contribution of each of these disciplines each exercises of body percussion, is focused in the development of motor skills, coordination, attention, memory, group interaction.

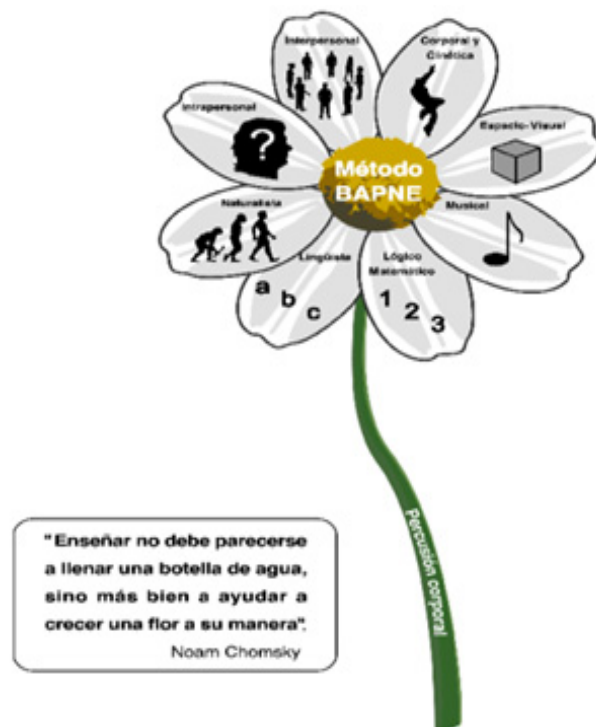


Fig. 1 BAPNE Method and Multiple Intelligences - F.J. Romero Naranjo

Gardner sees intelligence as a set of mental abilities related to each other by a neuroscientific basis. Defines intelligence as a semi-autonomous system of processing information that manifests itself in the ability to solve problems or create new products useful in a culture.

According to the author, all people have multiple intelligences but differ in the amount and use that make it; each one, then, manifests in one or more strong points and weak in other intelligences (Gardner H. *Frames of Mind* 2013).

## 2. Methods

This method is being tested in neurological rehabilitation for patients with GCA, in Italy at the Foundation Roboris (ASL RME, Osp. Holy Spirit), and in neurodegenerative diseases (Parkinson's and Alzheimer's) at the University of Alicante (Spain).

The team that follows the completion of the project, is composed of neurologists, physiatrists, neuropsychologists, physical therapists and educators.

### 2.1. Subjects

The experimental in treatment has been evaluated and approved by the ethics committee.

All patients voluntarily agreed to participate in the trial, by signing the informed consent to the processing of personal data.

The experimental protocol involves 47 patients with GCA selected according to requirements shared and structured for the two groups (experimental and control).

The general criteria for inclusion in the experimental group provided by the clinical protocol are:

- Occurrence of cerebrovascular damage between 12 and 72 months after start of treatment
- Cut-off scores in standard tests neuropsychological of sustained attention, divided and alerts
- Cut-off scores in the standard for procedural and semantic memory
- Absence of cognitive impairment (MMSE > 21)
- Absence of psychiatric disorders prior to the stroke
- At least one intact emisoma
- Unassisted ambulation without aids
- Ability visual, auditory and speech intact

Table 1. *Summary of key medical records*

Patients	Sex	Age	Type of GCA	Hemisindrome motor	Other motors boards
32	M	<14>63	18 TC	R 12	Q8
			14 Stroke	L 8	DE4
15	F	<26>58	5 TC	R 5	Q3
			10 Stroke	L 2	DE5

### 2.2. Procedura

The experiment involves the combination with the protocol BAPNE (in two weekly sessions of 50 minutes for 10 weeks in a group of patients), to the traditional rehabilitation activities.

The circulate arrangement of the group in the space of therapy is to help a non-hierarchical but egalitarian relationship and to support the possibility of inter-and intrapersonal relationship.

The Bapne method provides a motor stimulation for the activation of multiple and simultaneous brain areas.

Through the coordination of upper limb motor and adjusting the impact on the one hand contributes to, ability of the therapist to realize the functions of sense-perception, the other works on the patient in the management and control of movement .

During the training is also asked patients to repeat an exercise in improvisation mode previously handled by the trainer, with the aim of stimulating the ideational capacity, understanding the financial year, and the positive feedback due to the improvement of mood in feeling active in the rehabilitation process.

In some types of exercises the therapist's presence allows the guided movement of the limb also hemiplegic, in controlled traction.

During all the training stimulates the patient's ability to maintain focused attention, divided and sustained through the execution of movements of body percussion sequences that are repeated in cyclic and steady pace.

The repetition of the movement allows motor learning.

The management of the movement in average liabilities allows the patient to increase motivation in rehabilitation as it gets positive feedback on the movement of a limb not functional ..

Patient groups are not homogeneous for disease severity and outcome.

The control group continued to perform exclusively the cognitive and neuromotor rehabilitation according to traditional protocols.

The traditional multidisciplinary rehabilitation activities include:

- Neuromotor Rehabilitation
- Neuropsychological Rehabilitation
- Speech and language therapy
- Psycho-Behavioral Rehabilitation
- Hydrotherapy

In addition, the patient undergoes a daily basis, in small groups, in different laboratories whose purpose are represented by the promotion of a climate of sharing, and online relational exchanges between patients but especially to increase self-esteem. In the structure are also organized groups of psychological support for families and supported research activities

### 2.3. Assessment tools

All subjects will be: monitored the levels of cortisol in-time 0 - 75-180 days (4 samples at fixed times daily); recorded beats per minute through a heart rate monitor on your wrist; through the use of Lybra (equilibrium) and Kimeja (virtual reality) will be recorded data regarding the ability to adjust the balance of the patient in standing and sitting using the visual input and data relating to the patient's ability to coordinate fine motor skills in a virtual environment; through the administration of neuropsychological tests (HADS, NPI) will be detected improvements in mood and behavioral disturbances in the regression if available. All data will be analyzed and compared using the SPSS statistical system.

At 6 months after administration of the protocol is expected to re-test to assess if present, the maintenance of the effects of rehabilitation obtained

### 3. Results

The neurorehabilitation protocol is being tested. To date, there are no conclusive data for research and statistical comparisons. Let us assume, however, to publish these results in 2015. In any case, we are absolutely convinced that this project will provide important information even in the short-term functional recovery in support of the theory of cerebral neuronal plasticity.

#### 4. Discussion

Recent acquisitions in the field of neuroscience have changed the approach to the patient with brain injury, including new prospects for the use of new methodologies for the functional recovery of any damage. In the eighties, several experimental studies have shown that the adult brain retains the ability to regroup during the entire span of life (Taub E.2006). Starting from this assumption, it has been hypothesized that the rehabilitative intervention is essential reeds in the stabilized phase of the injury, not only to prevent secondary complications, but also to encourage the acquisition of new motor patterns.

As of today it seems particularly interesting, given its potential transferability in clinical rehabilitation, the possibility of combining neuromodulation techniques with therapeutic exercise rehabilitation.

In conclusion, the recent use of body percussion, through the method bapne, in neurorehabilitation offers the possibility to study and monitor the development of motor skills, attention, coordination, memory and social interactions in patients with neuropsychological disorders.

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