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Artículo:

Comentarios sobre la plasticidad del componente motor en pacientes con lesiones cerebrales

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Intellectica

Comment on "Plasticité du comportement moteur chez les patients cérébro-lésés" Comentarios sobre la plasticidad del componente motor en pacientes con lesiones cerebrales

The excellent review by Dr Agnes Roby Brami (Plasticité du comportement moteur chez les patients cérébro-lésés, *Intellectica*, this issue) emphasized the opportunity to obtain significant functional return in persons who have had a cerebrovascular accident (stroke).

She reviews her own work, as well as other very pertinent publications, and her conclusions should help to encourage a conceptual change in the clinical neurosciences. It is a tragedy that so many people remain dysfunctional because the clinical sciences, especially Neurology and Rehabilitation Medicine, continue to use antiquated methods that are expensive and have little evidence of efficacy. I would like to add my voice to Dr Roby-Brami's and hope that we can play a role in changing the conceptual substance of the clinical neurosciences, and thus foment the introduction of modern neurological rehabilitation. Functional rehabilitation programs that are of interest to the individual patient are designed to obtain the active, alert, motivated, and consistent participation of the patient, thus make maximum use of the patient's resources. The patient's interest and dedication add a dimension that may be lost in classical programs.

Even more than with the acute patient, post-acute rehabilitation must be motivating and related to real-life functional activities, or it may fail to enlist active participation. Present rehabilitation is expensive, labor-intensive, and insufficiently validated, and often is not available to patients who need it. Technology now offers the potential to contribute to practical, cost effective late rehabilitation programs that address all of those issues, that can be used in institutions, at home with internet connections to the Rehabilitation center and to the homes of other patients in computer assisted motivating rehabilitation (CAMR) program, and in educational models of late functional recovery (see below).

Taub and Crago (1995) noted that rehabilitation as presently practiced has meager carry-over to real-life activities, and even little carry-over from one session to another; this has had the effect of reinforcing the widespread impression in the physical rehabilitation field that once a patient reaches a plateau, usually 6-12 months after a stroke, further administration of rehabilitation therapy does not have useful results. With standard rehabilitation, Andrews and Stewart (1979) have shown that there was a difference in what the stroke patients could do in the hospital stroke unit and what the patient did at home.

Each activity of daily living was less well performed in the home situation in 25-45% of the cases, and in 52% of the cases the chief carer claimed that the patient did not do two or more activities at home which the patient was capable of performing in the day hospital.

The comments below are extracted from some of my publications on this subject (e.g., Bach-y-Rita, 1980; 1981; 1995; 2000; 2001; 2002; 2003; Bach-y-Rita and Wicab-Bach-y-Rita; 1990a,b; Bach-y- Rita, et al, 2002). For a hundred years following Broca's seminal description of cerebral localization (Broca 1861), the neurosciences were totally dominated by concepts of connectionism and strict point-to-point localization (Bach-y-Rita, 1990; 1995).

The idea of a malleable brain was overwhelmed during this time, which had a very negative effect on the field of rehabilitation.

Since brain plasticity was not a part of the conceptual substance of the basic or clinical neurosciences, how could clinicians expect reorganization? However, even during these "dark ages" for brain plasticity and rehabilitation, there were some voices of reason.

These include: Bethe, Goldstein, Lashley (a student of Franz), Foerster, and others (reviewed in Bach-y-Rita, 1972; 1995). One of the most important of these voices was Franz. We have recently thoroughly reviewed his contributions (Colotla and Bach-y-Rita, 2002). He described many of the plasticity concepts and laboratory and clinical applications that have re-appeared in recent years, such as: loss of function from disuse, centrally initiated movements, brain plasticity (e.g., by partial recovery from serial brain lesions), late stroke rehabilitation including the role of motivation, the field of neuropsychology, unmasking, and limbrestraint related recovery. We concluded our review of Franz's work with the following: "Franz's important findings, and even more important concepts, have foreshadowed the development of brain plasticity as an important area of the neurosciences, and contributed to the development of theory-based functional, motivating rehabilitation methodologies that obtain significant functional recovery in brain damaged persons".

In an effort to produce coordinated eye movements sufficient to permit them to learn to read, in children with cerebral palsy, Gauthier and his colleagues (Gauthier, Hofferer & Martin, 1978)) developed a functional pendulum. They had noted that the children resisted the usual therapy with a pendulum, getting bored and disinterested.

They used a large projection screen, sat the child in front of it, with his head immobilized, and projected children's movies (Snow White; Mickey Mouse) from the opposite side of the screen, but in a small dimension (similar to a small TV image).

As the child observed the film, the image projected against a galvanometer-controlled mirror (and back-projected to the screen while the child's head was held in a fixed position) the image moved slowly from side to side in pendular movements. They had intense 2 hour training sessions 3 times per week.

As the children gained more oculomotor control, the pendular movements became larger, and faster, and other types of movements (irregular, interrupted) were introduced. Thus, various types of eye movements could be trained. With this functional training program, sessions could last two hours without boredom or fatigue.

Marked improvement in oculomotor control was obtained. This pioneering French study should be considered to be a model for modern neurological rehabilitation.

In the middle 70's, when newly-introduced electronic pong games could be connected to a home TV and played by 2 persons controlling individual joy-sticks, we adapted a pong game for the functional training of upper extremities of persons with a hemiparetic limb (Cogan, et al, 1977).

With practice, and during the emotionally involving game, the patient ceases to think of arm movements and «The game concept helps to maintain a high level of interest, enhances motivation, and adds enjoyment to the hard work of rehabilitation.... during a pong game, the patient has an immediate goal for every movement of the arm.

The patient also receives immediate visual feedback as to the accuracy of the movement (....) patients quickly find themselves absorbed in playing the game. Some patients prefer playing against the built-in computer, or against their unaffected arm.

Others enjoy the socialization which develops during a game with an aide or another patient.» This may have been the first clinical application of what today would be called non-immersive Virtual Reality.

Based on our results during the last 25 years, we are developing late stroke rehabilitation computer-assisted motivating rehabilitation (CAMR) for the upper extremity.

With CAMR programs, instead of exercise, the patient is engaged in a game (e.g., ping-pong) and with practice, instead of concentrating on the specific movements, he/she is concentrating on the game, with the movements becoming subconscious.

Patients, even those who initially consider that they can not accomplish the task, show interest and improvement, and functional recovery appears to be extended beyond the specific movements that are trained (Bach-y-Rita, et al. 2002).

Innovative approaches to late rehabilitation include the delivery of services within educational model.

This is particularly pertinent for late rehabilitation, where the disabled person is not sick, but merely disabled. For more than 20 years, a Community College in California (Cabrillo College) has been offering a course in which the students are persons who have had a stroke. This cost-effective program offers classes in independent living skills, mobility and fitness, speech and language development and counseling in a small group setting, in which students choose their own functional goals. Individuals with disabilities register for educational rehabilitation classes, paying only $11.00 per unit community college tuition, totaling $2.00 a day cost to students, who may attend classes four days per week, four and a half hours daily. The emphasis of this late rehabilitation program is focused on functional skill development and re-integration into community activities. Rehabilitation Medicine has a wonderful mandate: the restoration of function.

The realities of the financing of medical services have created increasing problems in fulfilling that mandate. I think we must be much more innovative; it is necessary to develop a strong scientific infrastructure and to validate treatments with objective quantitative data, but it is also necessary to develop very costeffective rehabilitation, such as CAMR.

The patient is the best therapist, and responds best when the environment, the attitudes of the personnel (Bach-y-Rita and Wicab-Bach-y-Rita, 1990b), and the rehabilitation programs Encourage that participation. Persons with disabilities should be able to follow motivating rehabilitation with minimal supervision, in home, institutional and educational programs, taking advantage of modern technology such as videogames and the internet. It should be routine for persons at home to interact in therapeutic programs with both the therapist and with other persons in other homes.

Commentary: Brain Restoration is possible with very low neuronal tissue

Paul Bach-y-Rita, MD, has carried his sensory substitution research a step further by adapting the tongue interface device to restore a sense of balance in people who´ve lost their vestibular function. Cheryl Schiltz of Windsor, Wisconsin, is one such individual.

Since 1997, when Schiltz lost her vestibular sense due to a side effect of the antibiotic gentamicin, she has been unable to walk without staggering. Schiltz often requires some type of support and must consciously focus and refocus her eyes in order to see clearly when in motion. Several thousand individuals have had the same reaction in the past 40 years.

Two years ago, Schiltz's physicial recommended she contact Bach–y–Rita.

In experiments with Bach–y–Rita´s tongue interface, Schiltz dons a helmet containing an accelerometer. The workings are based on the same concept as a carpenter´s level with an air bubble that indicates its angle. The helmet responds to Schiltz´s movements by sending impulses through a computer to a strip of electrodes on her tongue. By keeping the impulses centered on her tongue, she is able to maintain her balance without assistance. Schiltz reports that this is the only time she feels "normal".

Bach-y-Rita was as surprised as Schiltz when she began experiencing "normal" balance for extended periods of time after the electronic interface was disconnected.

Most recently, after 20 minutes on the device, she experienced a three - hours after - effect.

"When I questioned Cheryl closely, even though she had been told she had a 100 percent vestibular loss, she told me that, at the end of one of the tests, she was starting to get a little nauseated. Knowing that, I suspected she must have some remaining vestibular tissue that had temporarily reorganized through use of our interface," explains Bach- y-Rita. Although this trace of function surfaces when Schiltz uses the interface, it is only temporary. She has no ability to function normally without the interface, he adds.

"Over time, we may be able to develop this into a type of rehabilitative therapy for people like Cheryl. With continuous training, she may get to the point where she doesn´t need to use the interface at all."

Bach- y- Rita links the possibility to the "2 percent" theory he has applied to vision and stroke (see main article): With as little as 2 percent of never fibers remaining following brain damage, the brain is capable of reorganizing itself to allow different sections of the brain to take over functions of the damaged cells.

Paul Bach-y-Rita 2003.