

# Comprehensive and synthetic occupational therapy protocol for post-stroke hemiplegic patients

Protocolo terapia ocupacional abrangente e sintético para pacientes hemiplégicos após o acidente vascular cerebral

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## Abstract

**Objective:** The aim of this study was to devise an Occupational Therapy protocol for post-stroke patients and to measure the functional evolution of the group. **Methods:** The study included 210 post-stroke hemiplegic patients, undergoing treatment at the Occupational Therapy Sector of the Rehabilitation Center of the Irmandade da Santa Casa de Misericórdia de São Paulo, and was conducted between March 2008 and December 2010. The protocol comprised twenty 60 minute therapy sessions once a week, during five months, and was split into five phases: Warm-up, Guided activities in standing position, Guided activities using functional electrical stimulation, Training on Activities of Daily Living (ADL) and specific free activities. **Results:** The pre and post therapeutic intervention results were compared and analyzed. A statistically significant improvement was found for all assessments, FIM (<0.01) and Box and Blocks Hand Dexterity Test ( $p<0.01$ ). **Conclusions:** On the study, the Comprehensive and Synthetic Occupational Therapy protocol was able to improve functionality hemiplegic post-stroke patients.

**Keywords:** Stroke, Activities of daily living, Rehabilitation, Hemiplegia, Occupational therapy

## Resumo

**Objetivo:** O estudo prospectivo se propôs a organizar um protocolo específico em Terapia Ocupacional para o atendimento de pacientes hemiplégicos pós - AVC e mensurar comparativamente a evolução funcional dos mesmos. **Métodos:** Foram incluídos 210 pacientes, com diagnóstico de hemiplegia por AVC em seguimento no Serviço de Terapia Ocupacional do Centro de Reabilitação da Irmandade da Santa Casa de Misericórdia de São Paulo. O protocolo de tratamento teve a duração de cinco meses ou vinte sessões terapêuticas ocupacionais semanais, com a duração de sessenta minutos cada, e foi constituído de cinco fases: Aquecimento, Atividades dirigidas em ortostatismo, Atividades dirigidas com estimulação elétrica funcional (FES), Treino das AVD e Atividades específicas livres. **Resultados:** Os resultados foram analisados comparativamente, entre antes e após a referida intervenção terapêutica. Níveis de significância positivos foram encontrados para todas as avaliações, MIF (<0,01) e teste de destreza manual da caixa e blocos ( $p<0,01$ ). **Conclusões:** Com a amostra deste estudo foi possível organizar um protocolo Terapia Ocupacional Abrangente e Sintético e proporcionar a melhora funcional do paciente hemiplégico após Acidente Vascular Cerebral.

**Descritores:** Acidente vascular cerebral, Atividades cotidianas, Reabilitação, Hemiplegia, Reabilitação, Terapia Ocupacional

## Introduction

Hemiplegia is the main sign of a lesion on the motor cortex, leading to an impairment of conscious movement. This impairment is associated with spasticity, which favors the onset of deformities and also prevents function<sup>(1-5)</sup>.

The functional and occupation impairment are

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treated in rehabilitation according to the concepts of Bobath, Kabat, Rood and Brunnstronn<sup>(2-4)</sup>.

Two important principles of Occupational Therapy are: the principle of Compensation and of Facilitation. To make it simple: Compensation refers to training the non-affected side in order to compensate the neurological handicap and Facilitation means active and repetitive exercises on the affected side in order to improve their function<sup>(3-11)</sup>.

Furthermore, occupational therapy also aims to guide the participation of patients in life, promoting his adaptation, restoring, strengthening and easing the learning of essential skills for daily living<sup>(12,13)</sup>.

The aims of this research were to organize an Occupational Therapy protocol with specificity for post stroke patient care at third level hospitals and to measure the patient's functional evolution before and after having completed the Comprehensive and Synthetic Occupational Therapy protocol (in Portuguese TOAS).

## Methods

The casuistry was constituted by 210 patients, 54% male and 46% female, with the diagnosis of hemiplegia due to Stroke, being followed at the Occupational Therapy sector of the Rehabilitation Center of the Irmandade da Santa Casa de Misericórdia de São Paulo, from March 2008 until December 2010.

The distribution of the cerebrovascular diseases was 82% ischemic and 18% hemorrhagic.

The mean age was 56 years, 53% were married or had a steady union and 47% were single, divorced or widowers.

As for risk factors 99.5% had hypertension, 46% were diabetic, 25% had a heart condition, 48% had a past of alcoholism and 52% were smokers.

Right hemiplegia was found in 49% of the patients and 51% had a left sided deficit, while 97% of the patients were right handed before the stroke.

To develop this research a treatment protocol in Occupational Therapy was organized. It was named Complete and Synthetic Occupational Therapy protocol designed to begin as early as possible after hospital discharge and a given time period to end. Our intention was enable and/or rehabilitate the post stroke patient to regain his independence stimulating his return to his family, society and professional environment.

The patients were sent to our sector after medical and social services evaluation, first to be evaluated functionally and hence start the TOAS protocol.

All patients were evaluated by the occupational therapist and were included in the study. Two instruments were used for evaluate all patients before and after TOAS: 1-the Functional Independence Measure

(FIM) and 2- the Box and Blocks Hand Dexterity Test (BBHDT). The latter was modified in this study in one aspect: the shape of the blocks, originally a cubic shape was modified to a cylinder, easier for hemiplegic or even paretic patients to hold.

There were 2 evaluations, at admission and at the end of the protocol. All patients agreed to participate on the research and each one signed a term of consent. At this point all patients were thoroughly oriented on the research itself about the use of the results and that their privacy would be respected.

The study was approved by the Ethics and Research Committee of the Irmandade da Santa Casa de Misericórdia de São Paulo project number 387/10.

To be submitted to the Protocol the sample was split in 35 groups of six patients each, regardless of age, gender, functional disability and the stroke onset period.

The inclusion criteria: All patients with occupational deficit which were in attendance at Rehabilitation Center of the Irmandade da Santa casa de São Paulo from March 2008 until December 2010 and that were able to follow the Protocol.

All orthosis, adaptation and accessories were manufactured in the Orthosis Lab of our rehabilitation center. In this study 88% of all patients used wrist and fingers positioning 69% used shoulder positioning neoprene® devices, and 24 % used kinesio-tape bandage.

The TOAS protocol was carried out in weekly sessions of one hour each in a five-month period. There were a total of 20 sessions. The protocol was organized in such a way as to improve occupational performance, achieving independence in ADL's with safety and quality of movement and returning to society or professional activities but in a realistic way, that is, totally aware of his/hers functional capability. It is composed of five phases:

**Warm-up:** Lasts 15 minutes and is divided in four activities under command: 1.Circle movements of great range; 2. Bilateral movements for elbows and wrists; 3. With a wooden bat the patients perform movements in order to achieve the greatest range of motion possible of the hemiplegic/paretic limb. The aims were: first reach the height of the shoulder and secondly the height of the head; 4. Bilateral activities with a ball over the table.

The warm-up is meant to improve body's symmetry, restoring the normal alignment of the trunk. It is meant to also improve the notion of body's scheme, teach how to reduce the abnormal posture of arm and leg during the activities and to lengthen the spastic muscles of the arm. Avoiding undesired movements and associated reactions during volitional movement are aims of this step too. And last but not least, enlarge the range of motion and restore as much as possible

motor coordination thus making the patient use the affected limb in the activity.

Therapy in groups eases the social support amongst patients for each one of them is more hopeful about their own future as they see others handling similar difficulties.

**Guided activities in standing position:** 1. Guided activity up and down steps with a wooden bat; 2. Bilateral activity with arc of different heights and rings; 3. Bilateral activity with a bilateral ladder and rings.

This second step had the objective of enlarging the range of motion, restore motor, visual-motor and space coordination. Also fine motor coordination with or without resistance is improved. The aim is to achieve a better occupational performance quality of the hemiplegic superior limb and to correct distribution of weight on the inferior limbs. Those activities must be performed safely i.e. without risks of falling.

The therapist has an active role in this step, teaching the patient the normal movement feeling and helping with movements/activities until his help was no longer needed.

**Guided activity associated with functional electrical stimulation:** This step lasts 20 minutes. The patients have guided activity linked with functional electrical stimulation with the objective of gaining muscle reconditioning, reduction of spasticity, reorganization of the motor act, as well as reduction or abolishment of the affected limb neglect. In this sample the muscles stimulated were wrist and fingers extensors, triceps, deltoid and scapula elevators. When using FES technique the patient was able to see the muscle contraction and to perform the activity during the resting period. The verbal support of the therapist was relevant during this process that we named transport effect. The muscles deltoid and scapula elevators were stimulated to prevent shoulder pain. Triceps stimulation has the objective to control the spasticity in elbow flexion and consequently preventing deformity.

**Training on ADLs:** In this phase 10 minutes were used to practice activities of daily life, basic and instrumental, at the ADL lab.

These trainings were done in groups, but each patient lived every activity as requested by the therapist in each session.

By Activities of Daily Life (ADL) are meant since the fundamental activities for survival or personal activities (eating, keeping himself warm, avoiding dangers, maintenance of personal hygiene) until those that require social basic skills (cooking, shopping and domestic work).

The Therapist participated of the ADLs guiding each activity and offering options for troubles aroused during execution of a task.

This step meant to achieve the best occupational performance for daily tasks with safety and movement quality.

**Free activities:** This last phase of five minutes was dedicated to free and expressive activities with the intention to cope individual needs such as writing, drawing, painting and sewing.

Family members were also asked to remove any doubt about the need to repeat the protocol at home. Both patients and relatives were instructed to do so twice a day, every day of the week.

The results regarding the Functional Independence Measure are plotted in Table 1 and regarding the Box and Blocks Dexterity Test in Table 2.

This table presents the average and the standard deviation of the functional independence measure obtained on two different moments of the sample (initial measure avg. 95,6 std. dev. 20,9 and final measure avg. 112,9 std. dev.10,8) splitting the results on motor FIM and cognitive FIM we can also visualize different values on initial and final application values motor FIM (initial measure avg.=68,5 and std. dev.=16,5 and final measure avg.=81,2 and std. dev. =8,2);and cognitive FIM ( initial application: avg.=27,1 and std. dev.=6,3 and o final application: avg. =31,6 and std. dev.=3,9). For descriptive level (p) we adopted the t-Student

Table 1

**Distribution of the initial and final evaluation scores of the Functional Independence Measure (FIM)**

Variable	Moment	average	Pd	Mean	p*
FIM	I	95.6	20.9	101.0	<0.001
	F	112.9	10.8	116.0	
FIM <sub>Motor</sub>	I	68.5	16.5	73.5	<0.001
	F	81.2	8.2	83.0	
FIM <sub>Cognitive</sub>	I	27.1	6.3	29.0	<0.001
	F	31.6	3.9	33.0	

\* t-Student paired test

**Table 2**

**Distribution of the initial and final evaluation scores of the Box and Blocks Hand Dexterity test (BBHDT).**

<i>Variable</i>	<i>Moment</i>	<i>average</i>	<i>pd</i>	<i>mean</i>	<i>p*</i>
<b>BBHDT Hemiplegic Limb</b>	<b>S</b>	20.1	20.2	17.0	<0.001
	<b>F</b>	29.2	25.1	31.5	
<b>BBHDT Non-Hemiplegic Limb</b>	<b>S</b>	52.5	15.1	54.0	<0.001
	<b>F</b>	67.2	11.4	69.0	

\* t-Student paired test

paired test with significance level of 5%. Note that on both moments of application the null hypothesis was rejected ( $p < 0,001$ ).

This table presents the average and standard deviation of the box and blocks hand dexterity test on both moments of application on the hemiplegic limb (initial measure :avg. =20,1 and std. dev.=20,2 and final measure: avg.=29,2 and std. dev.=25,1); and on the non-plegic limb, we have also seen different results on the initial measure: avg.=52,5 and std. dev.=15,1 and final measure : avg. 67,2 and std.dev.11,4 For descriptive level (p) we adopted the t-Student paired test with a significance level of 5%. Note that on both moments the null hypothesis was rejected  $p < 0,001$ .

## Discussion

The recovery after a stroke is thoroughly studied as regarded to functional improvement obtained in the first three months after the stroke itself. This study shows that there is also functional recovery after that period.

We thought it would be fundamental to develop a protocol of treatment simple enough to simulate daily activities and foresee the possibility of reproduce it at home in a daily basis.

The movements sequences chosen during therapy should be similar to those performed in ADL. In this way we can build a bridge between treatment and functional use<sup>(6-8,10)</sup>.

After approximately 10 sessions of guided activities in standing position in front of a mirror the patient began to give positive response leading to an independent posture correction, attention in the sequence, and modulation of movement for functional activity performance.

In his work Brunnstronn\* states that the way to facilitate muscle group actions between synergies should include the use of reflex responses and the development of voluntary control. As a result, the aim

of treatment is to achieve synergic control of extensors and flexors up to the point where it is possible to combine movement patterns in order to grasp, get to walk and performing personal activities<sup>(3,4,7,9,10)\*</sup>.

One of the challenging aspects of this protocol, is the introduction of new tasks, at each therapeutic sessions Those tasks were specific for each patient aiming the best occupational performance.

During motor reconditioning training, where the use of functional electrical stimulation is included with an activity, the patients compare the affected side with the non-affected side, paying attention solely to the movement and the accomplishment of the functional task itself.

The FES must always be used by an Occupational Therapist and/or Physical Therapist and the objectives of the FES technique in hemiplegic patients are: muscular reconditioning, spasticity reduction, and reorganization of the motor pattern<sup>(14,15)</sup>.

The protocol provided a larger apprenticeship of trained task and also a greater ability in retaining what was learned as well as transferences from trained tasks to non- trained ones at their homes or real environment.

When the occupational therapist is present in patient ADL's he becomes a facilitator and an inhibitory agent at the same time. He facilitates when teaches the patient how to use the affected side in the task and he inhibits when uses inhibitory techniques to restrain a part of the body in order to prevent unwanted movements and/ or reactions that might occur during volitional movement or task<sup>(6)</sup>.

It is very important those trainings take place in a plain clean, safe, fresh and clear place that is also warm and that makes the ADL Lab the most suited place for that intervention.

Patients with left plegia or paresis have a cognitive impairment of visual, tactile, and/or motor negligence; they also neglect their own handicap for they continue to use the dominant superior limb to accomplish ADL tasks. In those cases the facilitation

\* APUD por Kawahira et al, 2010<sup>(3)</sup>; Petruseviciene D, Krisciunas (2008)<sup>(4)</sup> Greene, Roberts(2002)<sup>(7)</sup>; Mathiowetz, Bass-Haugen(2005)<sup>(9)</sup>; Meyerhof(1978)<sup>(10)</sup>

patterns must be done in a combined way in order to improve motor skills like: rolling, sitting, standing up and ADL tasks.

The authors established that the protocol should be no longer than 5 months because of the huge amount of post stroke patients to be taken care of. They also demonstrated with this research that this amount of time was enough to accomplish the goal of improvement of the occupational performance, although there was a great expectancy as far as the patients are concerned that this time could be extended.

The patients of this casuistry expressed concern upon difficulties in finding physical oriented activities, hobbies and social participation alternatives.

In spite of having a protocol to deal with we were able to respect and fulfill the plurality of clinical and personal situations lived by those patients.

The findings of this study show that the Functional Independence Measure<sup>(15-18)</sup> and the Box and Blocks Manual Dexterity test<sup>(19-22)</sup> added relevant data on the neurological patient under rehabilitation process.

“In order to establish with certainty the treatment and objectives for each patient it is necessary a detailed analysis of the disability”<sup>(23-25)</sup>.

In most cases, patients were able to return to work, but could not return to their former jobs. Thus safety guards have become keepers to the company they worked at, and even a dentist surgeon became dental technician in order to stay in the same branch.

The patients of this sample were open-minded with regards of professional task or job replacement something that was discussed with each patient individually.

“Work is a vital aspect of daily life. It is the way of earning money of keeping social contacts and restructuring life. It is a key for the maintenance and development of personal identity and it adds a sense of participation and physical well being”<sup>(26)</sup>.

In this study the use of assistive technology was relevant to functional improvement and for instrumental ADL.

“Occupational therapy maximize functional independence and occupational autonomy and uses assistive technology, the Stroke Program Review Group (SPRG) has done research on this matter for its relevance”<sup>(5)</sup>.

A critical analysis of the study showed that most patients needed to be aware of their improvement in order to stay in Occupational Therapy.

## Conclusion

In the study, the Comprehensive and Synthetic Occupational Therapy Protocol was able to improve functionality post-stroke.

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