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Research Article

The effect of the "Golden Circle" exercise on personal goal achievements of stroke survivors: Preliminary findings

Eli Carmeli[1]*, Irit Grencel[2] and Yacov Fogelman[3]

[1]Department of Physical Therapy, Faculty of Social Welfare and Health Sciences, University of Haifa, Israel

[2]BPT, Freelance Therapist, Israel

[3]Leumit Health Maintenance Organization, Department of Family Practice, Tel Aviv, Israel

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***Corresponding author:** Eli Carmeli, PhD. PT, University of Haifa, Faculty of Social Welfare and Health Sciences, Department of Physical Therapy, 199 Aba Khoushy Ave, Mount Carmel , 3498838 , Haifa, Israel, Tel: 972507393454; E-mail: ecarmeli@univ.haifa.ac.il

ORCiD: https://orcid.org/0000-0002-1704-112X

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Abstract

The success of a patient's rehabilitation depends greatly on many variables. Stroke survivors are often not sufficiently or fully aware of their mental health condition, and as a result are unresponsive, frustrated, and have difficulty with executive functions. The aim was to investigate the effect of the "Golden Circle" cognitive exercise on the quality of life of post-stroke patients.

The subjects were 30 volunteers at a subacute stage after an ischemic stroke. They were randomly allocated to either an experimental group (n = 15) or a control group (n = 15). Quality of life questionnaire and Visual Analogue Scale administered. They were asked to draw a circle on a blank A4 page and at the top to write a title, and within the circle to write their problems, their suggested solutions and to intuitively write associations to a color, a taste, an animal, and a general physical sensation, and below these the date.

Following the intervention experimental group showed improvement in walking, standing up, daily activities and general quality of life.

Using the "Golden Circle" exercise to improve self-awareness and motivation in stroke survivors contributes to coping and taking responsibility for their rehabilitation.

Introduction

According to a survey conducted by the Israel Ministry of Health in 2021, approximately 18,000 stroke events occurred that year. About 14,000 people, 92% of the cases, were hospitalized with an ischemic stroke caused by a blood clot that obstructs the blood supply to the brain. About 10% suffered from a problem with the blood vessels in the brain that caused a cerebral hemorrhage. About 2,000 additional people suffered from a mild stroke and did not go to the hospital [1].

Many ischemic stroke survivors need a rehabilitation program that can include one or more of the following treatments: physical therapy, occupational therapy, speech therapy, and counseling by a psychologist, social worker, nutritionist, etc. [2]. The success of the patient's rehabilitation depends on the nature of the injury, the patient's character (from psychosocial aspects), culture, customs, skills, and support network [3].

Many stroke survivors are not sufficiently aware of their physical, health, and mental condition. As a result, they are helpless, frustrated, and have difficulty in achieving management goals [4] such as choosing strategies for solving problems, improving working memory, and finding ways of compensating for their limitations and alternative means of coping. They experience difficulties in daily functioning, are not satisfied with their quality of life, and may spend money on treatments that do not produce results [5]. Many stroke survivors show a decrease in social "participation" according to the International Classification of Functioning, Health, and Disability (ICF) model. Such a situation is sometimes due to the

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unavailability of transportation or lack of an elevator in their apartment building, and therefore they stay at home even if they do not suffer from significant physical impairments [6].

Mental control and introspection are extremely essential skills for adapting and dealing with a chronic disability such as a stroke [7]. These skills can help stroke patients learn to take responsibility for their health, manage their time for rehabilitation purposes, and understand the importance of motivation and the desire to achieve a solution to their condition [8].

The literature reports that when stroke patients are aware of their condition, their rehabilitation aligns with their physical abilities and corresponds to their expectations [9]. However, as indicated above, in many cases stroke patients are not sufficiently aware of their condition, thereby hindering the success of their rehabilitation and possibly leading to many negative consequences [10]. The need to raise awareness, look inward (self-awareness/insight), and focus on achieving a significant quality of life, are extremely essential because many stroke survivors suffer, for example, from anxiety and depression [11]. Raising internal awareness leads to a change in thinking and behavioral patterns, thereby facilitating the choice of decision-making strategies and improving the subject's cognitive abilities and mental state. All of these may improve a person's quality of life following a stroke [12].

The professional literature mentions several treatments for increasing self-awareness, such as meditation, mindfulness, yoga, and others [13-15]. Another method uses symbols, such as the mandala, as a tool for medical diagnosis in cases of patients suffering from dementia [16], breast cancer [17], dissociative disorder [18], and anxiety [19,20]. The "Golden Circle" exercise as presented here is based on "self-ritualism": patients draw a circle, and after being asked to look inside themselves, give a title to the circle and describe in writing their perceived problems and suggested solutions. Thereby, intuitively, connections are created to the senses, such as sight (color), taste, and general physical sensations (feeling light, tired, alert). There is a connection between color choice or preference and emotional states [21]. Previous research with school children found that warm colors encourage active emotions, such as anger and stress, and cold colors can stimulate calm and quiet emotions such as sadness, tension, and fatigue [22]. In studies dealing with executive functions after a stroke, relationships were found between thoughts about senses and movement and the performance of an executive function. A connection was found between the sense of taste and disturbances in executive functions due to damage to the prefrontal cortex. Thinking about the sense of taste can evoke a feeling of pleasure, satisfaction, disgust, and even nausea [23].

Guided imagination or Mental Imagery (MI) can influence mental and physical states to change habits and increase motivation and reduce anxiety, fear, and pressure. Guided imagination makes it possible to bring up unconscious thoughts through association. Another treatment for stroke survivors to reduce stress and anxiety is the Neuro-Linguistic Programming (NLP) method [24]. "Thought creates reality" is a claim presented in several articles to explain tools for relieving stress and reducing anxiety. Findings indicate that mental activities that involve intentionality, awareness, free will, faith, and normality can create changes in or a new reality [25].

Main objective

To assess the effect of the "Golden Circle" exercise on the quality of life of stroke survivors in a subacute state.

Methods

The "Golden Circle" has not been tested previously on healthy or diseased populations.

A prospective study of 5 - 6 weeks was conducted with the division of 30 volunteer participants into two groups of 15 participants each: experimental and control. We used randomization in assigning participants to intervention and control groups, assuming that each participant has an equal chance of being assigned to any group. A sample size of 30 participants usually approximates the standard normal distribution and assumptions about the Stroke survivors' distribution are meaningless since the sampling distribution is considered normal. Therefore, even if the mean of a sample of size > 30 is described using the variance, a normal distribution can be used for the probability distribution.

Reviewing for stroke severity was not one of the goals of the study and therefore we did not use common assessment tools such as FIM, Scandinavian Stroke Scale, and Beck Depression Inventory.

Participants

For the study 30 stroke survivors between the ages of 40-65 were recruited voluntarily through family doctors in the Leumit Health Maintenance Organization (HMO).

Inclusion criteria: Participants in the sub-acute phase, from 2 up to 6 months after a stroke caused by an ischemic background. A system for categorization of subtypes of ischemic stroke based on etiology represents 3 subtypes of ischemic stroke: large-artery atherosclerosis, 2) small-vessel occlusion and 3) stroke of undetermined etiology. However, it is important to note that quite often there is a situation of 'clinically silent lacunes', a common neuroimaging characteristic of cerebral small vessel occlusion that affects cognitive function, and many stroke patients without cognitive impairment experienced mild neuropsychological changes in a clinical investigation [26]. The topographic feature for cerebral ischemia infarcts was observed in the superior temporal cortex, insula, putamen, inferior and superior occipitofrontal fascicles, and the superior longitudinal fascicle. Participants were found to be medically balanced neurologically, hemodynamically, and metabolically. The participants lived at home and wished to return to their daily routine as soon as possible [27]. All signed a consent form.

Exclusion criteria: participants living in an inpatient setting such as a medical center, sheltered housing, or nursing

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home, with cognitive impairment (mini-mental test lower than 23 points out of 30), unable to read or to write, or with frontal impairment (according to imaging) affecting mental flexibility, moods and executive functions.

Outcome measurements

The Stroke Specific Quality of Life (SS-QOL) questionnaire [6] was administered by a researcher to all 30 participants in their homes before the intervention and 5 - 6 weeks following it. Secondary outcome measures of two common Activities of Daily Living (ADL) were sit-to-stand and walking.

To test if the participants even have the ability to understand and answer the questions in the "Golden Circle", before the visit to the participant's home, a phone call was held to check the ability to understand and to communicate, and of course to coordinate an appropriate arrival time.

Intervention

Experimental group participants filled in the "Golden Circle" (Figure 1), explained in detail below.

The "Golden Circle" exercise was performed only by the experimental group participants. The control group participants were instructed to write answers to five open-ended questions, listed below, unrelated to quality of life or to physical functioning. The "Golden Circle" is a cognitive exercise lasting about 10 minutes that was administered by a researcher in the home of each experimental group participant. The exercise consisted of five main steps described below:

Step 1: a) Assessment and identification of the participant's understanding of the physical and emotional state of health and level of functioning in daily activities; b) Verification of the participant's level of understanding of ways or means of treating the "problem"; c) Verification of the participant's nature and degree of involvement of professional support and friendships of family and friends.

Step 2: Verbal explanation of the "Golden Circle" exercise and demonstration of the activity.

Step 3: The participant was asked to sit at a table and to draw the "Golden Circle." First, the researcher demonstrated on a blank sheet of A4 paper how to make a circle and stated:

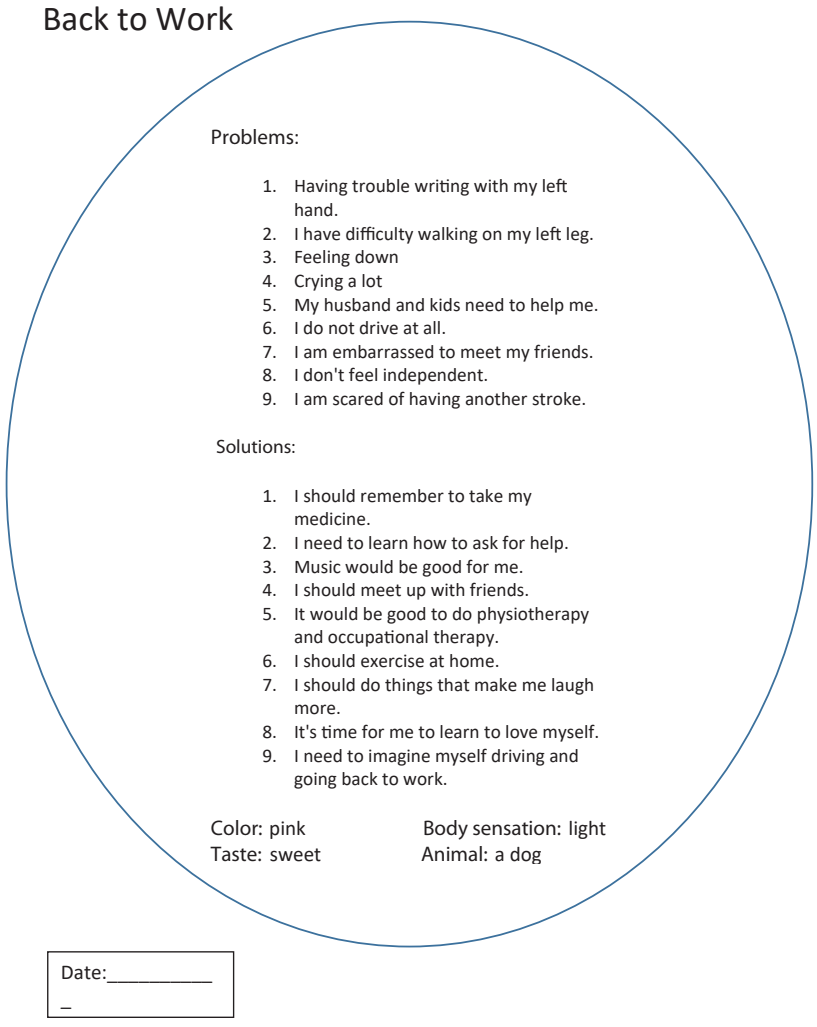

Figure 1: The Golden Circle.

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"*Draw a large circle in the center of the page, and write a title above and outside the circle;*" the instruction was that the title should be related to the participant's rehabilitation goal (for example. "Difficulty Walking"). The title is actually the goal the participant wants to achieve, for example, "to be able to walk like before the event." Then the participant was instructed to write within the circle a list of "problems/difficulties" faced since the event (for example lack of independence to go to the bathroom), followed by a list of proposed "solutions" to the problems or difficulties (for example physical therapy for walking). Below these, the participant was asked to write down overwhelming feelings or thoughts. The instruction to the participant was to "choose intuitively" what you feel physically (for example a feeling of lightness in half of the body), what sense of taste they feel (for example: sweet), what color comes to their mind at this moment (for example: green) and what animal comes to your mind right now (for example bird). Lastly, the participant was instructed to note the date below and outside of the circle.

Step 4: After these explanations, the participant performed the "Golden Circle" exercise. After the activity, the participant folded the sheet of paper and buried it between the pages of a book or in a drawer.

Step 5: Evaluation took place 5 or 6 weeks after the intervention after the first meeting by again administering the SS-QOL questionnaire to all 30 participants.

Below are the five questions presented in the first meeting with the control group participants and that they were requested to answer in writing:

1. What was the movie you watched and liked the most in recent years? Is the plot of the movie drama, romance, comedy, fantasy, suspense, scary, or other?
2. Where would you like to be right now if you could? Please elaborate.
3. What book that you read did you like the most? Write why.
4. Who is the person you would most like to "sit with for lunch" to have a conversation or ask questions? Explain why and what you would discuss.
5. In which historical event, since time immemorial, would you like to be present? Please elaborate.

Ethical consideration

The proposal was approved by the Ethics Committee of the Leumit Health Maintenance Organization.

Statistical analysis

All data collected were coded and analyzed using the software Statistical Package for Social Sciences (SPSS), version 28 (SPSSTM Inc., Chicago, IL, USA).

Results

Table 1 and Figure 2 shows that most of the study participants were women (about 70%), and the Golden Circle was comprised of just over half of the participants (about 55%). One participant in the control group died a few days after completing the questions.

It can be seen from Table 1 that most of the study participants are women (about 70%) and in addition, there are just over half of the subjects from the Golden Circle experimental group (about 55%). Also, the age average of the study participants was 58.93 years with 4.89 years standard deviation. Moreover, the general average time spent in activities related to the quality of life in the second measurement (T2) is 6.35 minutes with 2.13 minutes Standard deviation: The average time in the category Quality of life is 4.08 minutes with 2.39 minutes standard deviation; the average time in the category Communication is 8.15 minutes with 2.14 minutes standard deviation; the average time in the category Mobility is 6.17 minutes with 2.71 minutes standard deviation; the average time in the category Daily functions is 7.52 minutes with 2.31 minutes standard deviation; the average time in the category Productivity is 5.18 minutes with 3.25 minutes standard deviation; and the average time in the category motor Upper limbs is 7.01 minutes with 2.91 minutes standard deviation.

Table 2 shows that there are significant differences in all the measurement categories in the T2 time averages and in the difference (change) between the times (T2-T1) in favor

Table 1: Distribution of Gender Variable Background of Subjects by Study Group (*n* = 29).

		frequency	%	Mean	SD
Gender	Women	19.0	65.5		
	Men	10.0	34.5		
Age				58.93	4.83
T2	Quality of life			4.08	2.39
	Communication			8.15	2.14
	Mobility			6.17	2.71
	Daily functions			7.52	2.31
	Productivity*			5.18	3.25
	motor Upper limbs**			7.01	2.91
	General Average			6.35	2.13
Research Group	The Golden Circle	16.0	55.2		
	The Control Group	13.0	44.8		

*Productivity questions included: "In daily work around and inside the house"; Finishing jobs or tasks"; "Job/occupation you used to do in the past"

** Motor Upper limbs questions included: "Writing or printing"; "Knitting socks"; "Wearing shoes"; "Button closure"; "Closing a zipper"; "Opening a jar"

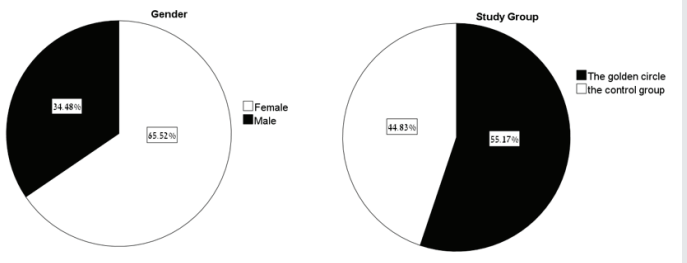

Figure 2: Distribution of gender background of subjects according to study group (*n* = 29).

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Table 2: Comparison of the questionnaire items in the present study - mean and standard deviation of the two test times and the difference (change) between them according to the study group (n = 29).

	items in the index	Research Group - The Golden Circle						Control Group								
		T1		T2		T2-T1		T1		T2		T2-T1		T1	T2	T2-T1
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	t	t	t
Quality of Life	1-5	3.47	2.82	5.10	2.61	1.63	2.06	3.20	1.70	2.84	1.33	- .36	1.73	.32	2.83**	2.78**
communication	6, 7	7.04	2.47	8.94	1.39	1.90	1.74	7.73	1.67	7.17	2.54	- .56	1.27	- .89	2.26*	4.26***
Mobility	8-12	5.14	2.63	7.49	2.03	2.35	2.14	4.55	2.72	4.55	2.60	- .00	1.06	.59	3.43***	3.86***
day functions	13-17	6.39	2.06	8.67	1.22	2.28	1.82	6.07	2.84	6.11	2.58	.04	1.51	.35	3.28**	3.55***
Productivity	18-20	4.20	2.89	6.95	2.54	2.75	2.62	2.88	2.32	3.01	2.72	.13	.79	1.33	4.03***	3.80***
motor Upper limbs	21-26	5.75	2.86	8.28	1.98	2.53	2.15	6.37	2.49	5.45	3.17	- .92	1.40	- .62	2.81**	4.99***
General Average	1-26	5.33	1.97	7.57	1.44	2.24	1.37	5.13	1.84	4.85	1.88	- .28	.32	.28	4.41***	7.12***

* p < .05; ** p < .01; *** p < .001

of the experimental group ("Golden Circle" participants). Table 2 data also indicate that the differences in T1 time averages between the two study groups are not significant in favor of the experimental group ("Golden Circle") in the following categories: quality of life, mobility, daily functions, productivity, and overall general average. In contrast, in the communication and upper limb motor categories the mean of T1 times was found to be higher and not significant in favor of the control group.

It can be seen from Table 2 that in all the measurement categories in both the T2 time averages and in the time difference (change) between the times (T2-T1) there are significant differences, in favor of the study group (The Golden Circle). In addition, it can be seen from Table 2 that the differences in T1 time averages between the two study groups are not significant, in favor of the study group (The Golden Circle) for the categories: quality of life, mobility, day functions, productivity, and overall General average. In contrast, in the communication and motor categories in the upper limbs, the mean of T1 times was found to be higher and not significant, in favor of the Control Group.

Figure 3 demonstrates the comparison of means and mean changes over time (T2-T1) in subjects' responses to the index categories by study group. The Golden Circle group has significantly changed in all investigated categories particularly in 'productivity' items.

It can be seen from Table 4 of the Research Group - The Golden Circle: A positive-medium and significant correlations were found between quality of life and mobility at all three times: in T1 (r = .53, p <.05), in T2 (r = .46, p <.05), And in T2-T1 (r = .45, p <.05). In other words, the better / less good the quality of life, the higher / lower the mobility, respectively, at a medium and significant intensity at all three times: T1, T2, and T2-T1.

It can be seen from Table 5 of the Research Group - The Golden Circle: A negative-weak and medium with non-significant correlations were found at two times: in T1 (r = .30, p = .13 > .05), And in T2 (r = .24, p = .19 > .05). In other words, the better / less good the quality of life, the higher / lower the Providing needs in the toilets, respectively, at weak and medium with non-significant intensity at two times: T1 and T2.

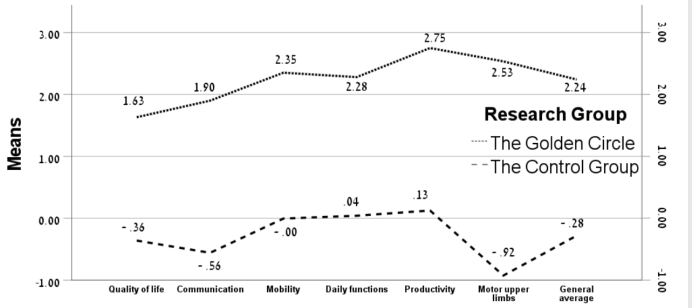

Figure 3: Changes over time in subjects' responses to the index categories.

In addition, a negative and non-significant relationship was found between quality of life and Providing needs in the toilets in times difference T2-T1(r = - .02, p = .47> .05). In other words, the better / less good the quality of life, the less / better the Providing needs in the toilets, respectively, at zero and insignificant intensity in T2-T1 difference time.

Discussion

The purpose of this study was to test the effect of the "Golden Circle" exercise on the quality of life and daily functions of subacute stroke survivors. Results show that 5 - 6 weeks after the day the "Golden Circle," activity was performed, there were positive and significant changes in the general functioning and quality of life of the participants in the experimental group compared to those in the control group.

The "Golden Circle" is a simple cognitive exercise that uses symbols to activate sensory imagery (taste, sight, and perception), drive (motivation), self-responsibility, pleasure and a person's inner need to change his reality. Anchored and integrated within the "Golden Circle" exercise are elements that affect cognitive abilities and psychological functions, and enable achieving a positive change in a stroke survivor's quality of life.

The "Golden Circle" can be used as a therapeutic tool that mobilizes the prefrontal cortex of people with functional difficulties due to a problem in the central nervous system; thereby, it can increase their self-awareness, meaning of life, and their motivation to achieve the things that are really important to their life [28]. The "Golden Circle" tool allows participants to choose strategies for dealing with their situation, prioritize ways of coping, and empowers them to take responsibility for their health and the process of rehabilitation [29].

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Table 3: Pearson correlations of secondary outcome measures between walking and getting up from the chair among the Golden Circle group according to times T1, T2, and the change (T2-T1) (n = 16).

T1			T2			T2-T1		
	getting up from the chair			getting up from the chair			getting up from the chair	
walking	Research Group - The Golden Circle	Control Group	walking	Research Group - The Golden Circle	Control Group	walking	Research Group - The Golden Circle	Control Group
	.72***	.10		.50*	.35		.77***	.15

* p < .05; ** p < .01; *** p < .001

Table 4: Pearson correlations between the quality of life category and the mobility category among the Golden Circle group according to times T1, T2, and the change (T2-T1) (n = 16).

T1			T2			T2-T1		
	mobility			mobility			mobility	
quality of life	Research Group - The Golden Circle	Control Group	quality of life	Research Group - The Golden Circle	Control Group	quality of life	Research Group - The Golden Circle	Control Group
	.53*	.36		.46*	.47		.45*	.20

* p < .05; ** p < .01; *** p < .001

Table 5: Pearson correlations between the quality of life category and the Services category among the Golden Circle group according to times T1, T2, and the change (T2-T1) (n = 16).

T1			T2			T2-T1		
	Providing needs in the toilets			Providing needs in the toilets			Providing needs in the toilets	
quality of life	Research Group - The Golden Circle	Control Group	quality of life	Research Group - The Golden Circle	Control Group	quality of life	Research Group - The Golden Circle	Control Group
	.30	.51*		.24	.02		- .02	- .07

* p < .05; ** p < .01; *** p < .001

The influence of the "Golden Circle" treatment is explained on the basis of four factors: executive functions pathway; placebo effect; Hawthorne effect; and the claim that thoughts can create reality and become beliefs.

Executive functions pathway

The development of the "Golden Circle" exercise was based on the rationale that it might activate the prefrontal cortex. The "Golden Circle" is a means to motivate the participant to think about his condition and thus mentally stimulate the area responsible for executive functions: the ability to initiate, persist, delay and change behavior. In addition, the prefrontal region of the brain is involved in emotional regulation and social and academic functioning. Concentration, focus, and attention are driving forces for the pre-brain cortex in order to open filters (a network of synapses) through which individuals consciously reach goals they have set for themselves. That is, it is a physiological activity that begins at the level of the cerebral cortex, i.e., at the cognitive level, and ends with an application at the level of "participation" according to the ICF model. This is a known top-down process [30].

The "Golden Circle" process is also based on conditioning. An unconditioned stimulus (such as drawing a circle) causes an unconditioned response (for example, concentration, alertness, curiosity, hope, and anticipation, all related to executive functions) and these responses are mediated by cognitive and emotional conditioning that affect neuro-endocrine secretions. Performing the "Golden Circle" exercise promotes the same activity that is expressed in concentration and focus of thought according to a path known as top-down." The hypothesis is that through a new cognitive exercise, namely the "Golden Circle," the person mobilizes the areas of the brain that are responsible for executive functions through a top-down process and in a cognitive way enables implementation of one's goals and desires [23]. The process is achieved using rituals, and symbols while activating guided imagination (mental imaging) [31], and sensory imagination (taste, vision, and perception). This process also produces motivation, pleasure, satisfaction, self-confidence, beliefs, and the need to change reality, and therefore applies to quality of life [32]. The prefrontal cortex receives bottom-up information and provides top-down processing and regulation; thus, the bottom-top process retrieves information. Accordingly, the prefrontal cortex is responsible for high functions of judgment, planning, initiative, inhibitions, etc. Following cognitive deficits, a person may experience a decreased emotional state, leading to depression, reduced socialness, and avoidance of social participation [33].

Placebo effect

The "Golden Circle" is constructed by the participant and involves actually writing and drawing a circle. The "Golden Circle" serves as a platform for several mechanisms related to executive and psycho-neurological functions that result from the placebo effect. In recent years, a few randomized controlled trials have been conducted designed to evaluate the placebo effect in medical treatment in general and in rehabilitation treatment for stroke survivors in particular. No significant differences were found between the experimental group and the placebo group that received "only" personal treatment and positive reinforcement [34-37]. Many shared neurobiological pathways are involved in placebo physiology, such as activating top-down and bottom-up cortical responses and activating a reward system that triggers feelings of satisfaction. The placebo effect is particularly important in the context of research on brain injury patients. In this study, we

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claim that by writing down their problems and the suggested solutions to them, the stimulation of the participant's senses in the "Golden Circle" activity triggered different circuits in the brain that provide clues. Some stem from previous experience, social learning, conditioning, interpersonal connections, and expectations; all of them activate a placebo effect after a brain injury, just as in any other disease. The "Golden Circle" enables stroke survivors to see their situation in a more positive light by reducing anxiety levels or by inspiring a greater commitment to rehabilitation efforts.

Hawthorne effect

Previous studies found that every patient who actively and voluntarily participates in research, even without medical interpersonal communication, is in the midst of a healing process. This phenomenon, known as the Hawthorne effect, describes a patient's behavioral change in response to the attention received while being observed, a situation that is apparently enjoyed [38]. The neurobiological mechanism of the placebo effect indicates brain activity related to the following areas that control emotional functions, awareness, insight, tuning, and anticipation: the Dorsolateral Prefrontal Cortex (dlPFC), Orbitofrontal Cortex (OFC), and Anterior Cingulate Cortex (ACC). These areas of the brain control "understanding what is happening" and are also responsible for understanding verbal cues and implicit learning.

The participant's thoughts, curiosity, and anticipation while doing the "Golden Circle" activity produce a change in reality by processing cortical information and by a secondary activity that evokes paths of anticipation for an outcome. This phenomenon, known as "anticipation of hope and reward," is also evident in pain relief and in the pathway of dopamine secretion [39-41].

Thoughts can create reality and become beliefs

By performing the "Golden Circle" activity, the participant engages in a process of "thought that produces reality." The "Golden Circle" exercise is characterized by the use of symbols and rituals (drawing a circle and writing a list of tasks within it) that can promote and improve self-awareness and motivation, thereby enabling patients to take responsibility for their health, better understand their abilities, choose appropriate management strategies, and function optimally and independently in different environmental circles (family, society, work, community, etc.) [42].

Several limitations of the study cannot be ignored. The selected quality of life questionnaire did not include essential functions such as driving, preparing coffee, and kitchen work. In addition, some of the participants referred for participation in the study did not meet the inclusion criteria. Since the number of participants suitable for the study was small, it was necessary to expand the geographical distance, which affected the research time and budget.

Notably, many participants expressed satisfaction and gratification with the study and the attention they received from the HMO, and therefore their cooperation was excellent.

In light of the research process and results, we recommend conducting a similar study on a population suffering from brain dysfunction, for example, a mental disorder like depression or anxiety, or Parkinson's disease. Moreover, since lacunar strokes have unique etiology, prognosis, and clinical aspects [43] future research needs to assess the "Golden Circle" exercise's effect on stroke personal goal attainment in ischemic lacunar versus non-lacunar stroke.

Conclusion

There is little research evidence indicating the effect of a stroke on a person's mental control, ability to introspect, and ability to recover. However, using the "Golden Circle" exercise to improve self-awareness and motivation in stroke survivors contributes to coping and taking responsibility for their rehabilitation. Moreover, further study is needed to ascertain the efficacy of the "Golden Circle" as a cognitive tool for people with central nervous system impairment [33].

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