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EFFECTS OF NON-PHARMACOLOGICAL INTERVENTION THROUGH THE THERAPEUTIC ROBOT PARO IN PERSONS WITH ALZHEIMER'S DISEASE AND OTHER DEMENTIAS

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INTRODUCTION

Robotherapy is a non-pharmacological therapy (NPT) consisting in the use of robots that simulate animals, equipped with artificial intelligence and multiple sensors that allows them to behave and interact with users as if it were a real animal. One of the most studied examples with people with dementia (PwD) is Paro (Wada, Shibata, Saito, & Tanie, 2003), a seal-shaped social robot that has shown, in multiple studies, capacity to promote socialization and communication, improve mood and reduce the behavioural and psychological symptoms of dementia (Broekens, Heerink, & Rosendal, 2009).

This study aim to assess if robotherapy is an effective NPT to reduce the behavioural and psychological symptoms of dementia (BPSD), apathy and depression as well as to improve the quality of life of PwD. It will also asses if robotherapy can be useful to improve the cognitive and functional status of the participants.

On the other hand, we try to verify if the sessions of robotherapy produce a relaxing effect and are able to improve the mood and lead to a higher engagement of the participants in the activity.

Hypothesis

It is expected that after the robotherapy's period the intervention group:

- Reduce their scores on the Neuropsychiatric Inventory (NPI-NH).
- Reduce their scores on the Apathy Rating Scale (APADEM-NH).
- Improve their scores on the Yesavage Geriatric Depression Scale (GDS-15).
- Improve their scores on the Quality of Life Scale (QoL-AD).

In addition, the sessions of robotherapy:

- Will have an effect of blood pressure and heart rate reduction.
- Improve the mood of the participants, measured through the Smiley Face Assessment Scale.
- Provide a positive experience and high engagement in the activity measured through the NPT-ES scale.

METHOD

Procedure

The study used a controlled and randomized repeated measures design.

The intervention consisted of 12 sessions which were conducted in 3-user groups, 20 minutes long, at a rate of 3 sessions per week for 4 consecutive weeks.

The sessions were carried out by an Occupational Therapist following the protocol developed from the "Caregiver's Manual for Robotherapy" (Wada & Inoue, 2010).

During the intervention sessions the control group continued with their usual treatment.

Participants

In this research, 12 users of the CREA day care centre were selected according to the following inclusion / exclusion criteria:

- Diagnosis of moderate-severe dementia (GDS between 4-6) according to NINCDS-ADRDA criteria.
- Presence of apathy or other BPSD such as anxiety or depression.
- User's desire to participate in therapy and signing of informed consent.
- Stable and controlled medication within the clinical needs of each participant.
- Do not suffer from an acute or severe illness that makes it impossible to participate in therapeutic sessions.
- Absence of severe sensory and physical limitations that prevent participation in sessions.
- Do not suffer a severe disconnection with the environment or very limited attention level.

One of the users of the intervention group suffered medical problems that prevented him from continuing to participate in the research, so that the final sample remained as indicated in table 1.

Table 1

Sociodemographic and clinical specifications. Attendance to sessions

	Total sample	Robot therapy group	Control Group
n	11	5	6
Age	77.09 (6.68)	75.80 (8.67)	78.17 (5.12)
Age range	67-87	67-87	69-84
Sex M/F	2/9	0/5	2/4
GDS	5	5	5
AD	7	3	4
Mixed dementia (AD/VaD)	3	2	1
LBD	1	0	1
Attendance to sessions	-	11.8	-

Note. AD: Alzheimer Disease; VaD: Vascular dementia; LBD: Lewy Body Dementia; GDS: Global Deterioration Scale (Reisberg, Ferris, de Leon, & Crook, 1982).

Table 2

Outcomes, instruments and method of application, used in the study.

Outcome	Instrument	Evaluation time	Applied to
ADL	IDDD	Pre and post intervention	Family
Cognitive condition	MMSE	Pre and post intervention	User
BPSD	NPI-NH	Pre and post intervention	Informant (Aux)
Apathy	APADEM-NH	Pre and post intervention	Informant (Aux)
Depression	GDS-15 Yesavage	Pre and post intervention	User
Quality of Life	QoL-AD (family)	Pre and post intervention	Family
	QoL-AD (user)		User
Relaxation	BP and HR Record	Before and after each session	User
Mood	*Smiley-Face Assessment Scale*	Before and after each session	User
Experience in NPT	NPT-ES	At the end of each session	Therapist

RESULTS

After the intervention period, although there was a decrease in neuropsychiatric symptoms (NPI-NH) and apathy (APADEM-NH), a statistically significant effect of the Paro intervention was not found. Likewise no effect on depression (GDS-15), cognition (MMSE) or functional capacity (IDDD) was found.

However, the results showed a significant effect on quality of life, measured through the primary caregiver as informant (QoL-AD caregiver) as it increased for participants in the Paro intervention and was reduced for the control group.

Table 3

Pre and post-intervention means (and standard deviation) for the robotherapy and control groups of the administered scales. Results of repeated measures ANOVA and pairwise comparisons.

		Pre *M* (*SD*)	Post *M* (*SD*)	*df*	*F* (Pre-Post*Group)	*p*	η_p^2	Pre vs. Post (*p*)
IDDD	Robotherapy	81.03 (9.26)	74.80 (10.33)	1,9	2.087	.182	.188	.024*
	Control	80.17 (10.50)	18.42 (8.88)					.426
MMSE	Robotherapy	12.20 (6.72)	11.40 (6.07)	1,9	0.329	.580	.035	.562
	Control	13.67 (5.72)	11.83 (3.66)					.165
NPI-NH	Robotherapy	9.40 (6.15)	7.80 (6.34)	1,9	0.005	.945	.001	.845
	Control	16.83 (9.97)	16.00 (24.74)					.911
APADEM-NH	Robotherapy	16.80 (18.14)	11.00 (16.26)	1,9	0.292	.602	.031	.195
	Control	19.33 (13.60)	10.50 (5.89)					.044*
GDS-15	Robotherapy	1.80 (2.05)	1.80 (0.84)	1,9	2.517	.147	.219	1.000
	Control	3.33 (2.07)	2.00 (1.26)					.043*
QoL-AD user	Robotherapy	37.25 (4.11)	37.25 (2.63)	1,8	0.339	.576	.041	1.000
	Control	34.17 (4.92)	35.83 (2.71)					.384
QoL-AD family	Robotherapy	30.00 (5.96)	32.80 (5.31)	1,9	12.641	.006*	.584	.005*
	Control	26.33 (2.58)	25.50 (2.74)					.257

**p <.05*

Additionally, it was found that the intervention sessions with Paro had a positive effect on the mood, $t(4) = -3.442$, $p < .026$, 95% CI [-0.70354, -0.07525], $d = 1.162$, since this increased from a mean pre-session of 4.15 (*SD* = 0.35) to a mean post-session of 4.54 (*SD* = 0.31). Also, after the intervention sessions with Paro there was a decrease in the participants' blood pressure (see table 4), indicating a relaxing effect of the intervention, similar to that found in animal-assisted therapy studies.

Finally, it was verified that the Paro sessions generate a very positive experience for the participant as assessed by the therapists using the NPT-ES scale, with very high scores in *Participation, Pleasure* and *Relationship with others*, and very low for *Displeasure or Rejection* (*Displeasure* and *Rejection* items are reversed, a high score indicates they never appeared).

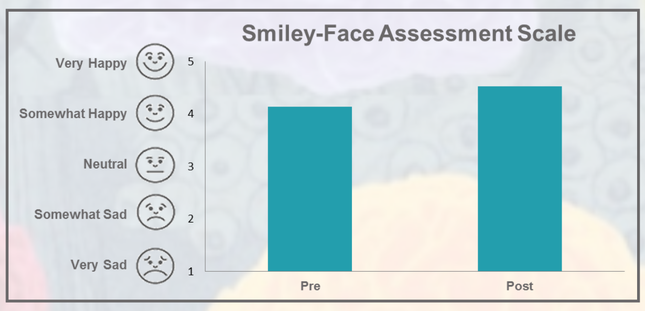

Figure 1. Pre and post-session mean of mood assessments (Smiley-Face Assessment Scale).

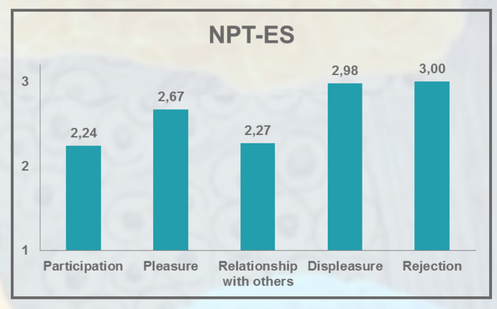

Figure 2. Mean of each of the items of the NPT-ES scale

Table 4

Pre and post-session mean (and standard deviation) for the heart rate and pulse pressure of the robot therapy group. Results of the Wilcoxon Signal Range test.

	M (*SD*) Pre	*M* (*SD*) Post	*Z*	*p*	*r*
Pulse Pressure	52.19 (15.09)	48.77 (13.73)	2.023	.043*	0.639
Heart Rate	72.58 (8.46)	71.37 (8.08)	-0.674	.500	0.213

**p <.05*

Note. Pulse Pressure = Systolic Pressure – Diastolic Pressure

CONCLUSIONS

Results show that robotherapy with PARO can be a NPT appropriate for PwD as it can have a relaxing effect, generate a positive mood during the intervention and improve the person's quality of life in the long term. In addition we have verified how robotherapy offers a positive experience for the participants, giving rise to multiple manifestations of pleasure.

On the other hand, according to the results and the experience of the therapists themselves, robotherapy does not seem to be effective in improving the cognitive or functional status of the patients unless the sessions were concretely directed to those objectives.

We have not found a significant effect of robotherapy on neuropsychiatric symptoms, apathy or depression. However, it seems interesting to continue studying in the future the effects of PARO on BPSD.

This study has as limitations the small sample used as well as the low scores on depression and neuropsychiatric symptoms. This may have caused a floor effect that underestimates the ability of robotherapy to improve these symptoms.

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