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Original Article

Activities of daily living and quality of life assessment during home-based rehabilitation — A multi-institutional study

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ABSTRACT

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Objective: The purpose of this study was to examine the relationship between activities of daily living (ADL) performance and quality of life (QOL) in participants in a home-based rehabilitation program, and to assess the associated changes during the program.

Methods: The subjects were participants newly enrolled in home-based rehabilitation in six facilities. The Functional Independence Measure motor subscore was used to evaluate the current ADL performance. We used PGC-MS to evaluate the emotional aspect of QOL, and ADL satisfaction for the cognitive aspect.

Results: Participants were divided into two groups: <1 year from onset and >1 year from onset; ADL satisfaction had significantly improved in the latter group (p = 0.008). A strong correlation between ADL performance and ADL satisfaction was found. On the other hand, the correlation between ADL satisfaction and PGC-MS was weaker.

Conclusions: The 'cognitive aspect' of QOL improved due to the rehabilitation staff's approach in explaining the participants' ADL abilities and motivating them to accept their limitations. It is considered that the 'emotional aspect' of QOL is difficult to change with only three months of home-based rehabilitation.

Key words: home-based rehabilitation, QOL, ADL

Introduction

In home-based rehabilitation, the therapist visits the home of the individual with a disease or disorder to provide instruction in muscle strength training, joint range of motion exercise, and activities of daily living (ADL). Home-based rehabilitation allows us to incorporate the environmental and social aspects of the individual's life, including family status and housing situation, which we find increasingly important as a mediator connecting the primary medical facilities and nursing home care and associated facilities [1, 2].

In domestic and foreign studies involving home-based rehabilitation, ADL is investigated extensively, mainly reporting the effect of home-based rehabilitation on ADL ability [3–5]. It is said that the purpose of home-based rehabilitation is to improve quality of life (QOL) as well as maintain or improve motor function and mental and physical capacity [6]. In general, ADL evaluation is used to improve QOL. However, one study that did not include home-based rehabilitation

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reported that there was no significant relationship between ADL evaluation and QOL [7, 8]; others that also did not include home-based rehabilitation indicated that it is relevant [9−12]. It has also been suggested that ADL independence is important for enhancing the subjective QOL of the elderly with disabilities [13−15].

To our knowledge, previous studies on home-based rehabilitation have not evaluated both ADL and QOL, and therefore, did not examine their relationship. On the other hand, there are various rating scales for evaluating QOL. The term QOL has a rather abstract meaning, and, consequently, different interpretations. Although QOL is divided into objective and subjective aspects, the term often refers to subjective QOL [16]. In this paper, the term 'QOL' refers to subjective QOL. Many studies have mentioned two aspects of QOL assessment, 'emotional aspect' and 'cognitive aspect' [17−19]. The 'emotional aspect' refers to psychological aspects such as an activity being fun and other emotional responses; the 'cognitive aspect' refers to the subjective degree of satisfaction in assessing one's own living conditions. Diener states that it is important to evaluate QOL with regard to both the 'emotional aspect' and 'cognitive aspect' [20].

The Philadelphia Geriatric Center Morale Scale (PGC-MS) evaluates well-being in old age as represented by the 'emotional aspect' of QOL exclusively [21]. On the other hand, as a rating system represented by the 'cognitive aspect' of QOL, the measure of ADL satisfaction is obtained using the Functional Independence Measure motor subscore (mFIM) [22, 23]. Evaluating QOL in the 'emotional aspect' and 'cognitive aspect' separately will allow for a detailed analysis of the effect of home-based rehabilitation, and help establish an ideal QOL evaluation method within the home-based rehabilitation setting.

Here, we examined ADL performance in participants over the age of 65 who had recently starting using home-based rehabilitation services in six facilities (Okayama home-based rehabilitation research group). We used PGC-MS as an indicator of the 'emotional aspect' of QOL and used ADL satisfaction as an indicator of the 'cognitive aspect.' We evaluated the participants at initiation, and at three months, six months, and one year. We assessed the change in and the relationship of the variables during the home-based rehabilitation program.

Methods

1. Participants

Participants evaluated were those newly enrolled in a home-based rehabilitation program in six facilities within the Okayama home-based rehabilitation research group. Participants were 65 years of age or older; those without aphasia or issues in comprehension and expression as well as those scoring 21 points or more on the revised Hasegawa Dementia Scale with no cognitive issues and with accurate answers to the questions were included. Individuals with progressive neurological disease and malignant tumors were also excluded because of an expected significant decrease in ADL capacity. This study was conducted with the approval of the Ethics Committee of the Kurashiki Central Hospital (Approval number 1037).

2. Evaluation

The mFIM was used as an evaluation of current ADL performance [9, 24]. The visiting therapist scored participants on the mFIM. We also used PGC-MS [21, 25] and ADL satisfaction to evaluate QOL. The PGC-MS consists of 17 question items in the following three categories: agitation, lonely dissatisfaction, and attitude toward own aging.

ADL satisfaction evaluation was based on the method proposed by Uehara et al. [23]. We used an evaluation with a 10-point scale for the 13 individual items of the mFIM. A score of 10 points indicated "fully satisfied," and 0 points, "not at all satisfied;" the total calculated score represented ADL satisfaction. Regarding the interview method, we used the Numerical Rating Scale (NRS) orally in consideration of participants with difficulty in expression due to physical disabilities, such as visual impairment.

We performed evaluations at the initial evaluation for the home-based rehabilitation program and three months after starting. The initial evaluation was conducted within one month from the start date of the home-based rehabilitation program, and the three-month evaluation was conducted within three to four months or more after starting the program.

The statistical software SPSS Statistics 20 (IBM Corporation) was used for statistical analysis. We established normal distributions in the respective evaluations using the Shapiro-Wilk test. Spearman's rank correlation coefficient was used to determine correlations between each evaluation. A comparison of the initial and three-month evaluations was performed using the Wilcoxon signed rank test with each evaluation. Upon evaluation, participants were classified into the following two groups: "less than one year since onset" and "at least one year since onset or onset unknown." These participants were also divided into the following two groups: "using day care services" and "not using day care services." The statistical significance level was set at $p < 0.05$.

Results

The characteristics of the participants are shown in Table 1. Among the 42 individuals who completed the initial evaluation and agreed with the study protocol, and after excluding those with problems during the evaluation such as hospitalization with state

Table 1. Characteristics of participants

Participant	Gender	Age	Disease	Onset date	Visit starting date	Follow-up period	Visits per week	Visit time (minutes)	Visit time in 3 months (minutes)	Day care services	Note
1	Female	69	Diabetes		4/10/2012		3	40	1,440	No	
2	Male	89	Lumbar compression fracture	5/5/2012	6/21/2012	About 1 month	1	60	720	Yes	
3	Female	79	Hip dislocation		6/19/2012		1	60	720	No	
4	Male	65	Pelvic contusion		7/9/2012		1	60	720	Yes	
5	Female	80	Cerebral infarction aftereffects		9/1/2012		2	40	960	No	
6	Female	81	Left thalamic hemorrhage	4/2003	10/9/2012	About 114 months	1	40	480	No	
7	Male	83	Multiple cerebral infarction		11/6/2012		2	40	1,320	No	60 minutes from 11/30/2012
8	Female	90	Cerebellum infarction aftereffect	8/3/2005	4/11/2013	About 92 months	1	40	660	No	60 minutes from 5/1/2013
9	Male	76	Angina		7/2/2013		1	60	720	No	
10	Female	83	Left hip osteoarthritis		8/6/2013		2	60	1,440	No	
11	Female	71	Cerebral infarction	3/2010	5/1/2012	About 26 months	2	40	960	No	
12	Female	70	Cerebral infarction	12/31/2011	7/2/2012	About 6 months	3	40	1,440	Yes	
13	Female	69	Cerebral infarction	3/16/2012	10/12/2012	About 6 months	2	40	960	Yes	
14	Female	72	Right putamen hemorrhage	6/14/2012	8/25/2012	About 2 months	2	40	960	No	
15	Male	76	Cerebral infarction	2/17/2012	6/22/2012	About 4 months	1	40	480	Yes	
16	Female	93	Lumbar compression fracture	4/1/2012	8/7/2012	About 4 months	2	40	960	No	
17	Female	83	Cerebral infarction	2010	7/16/2012	About 30 months	2	60	1,440	Yes	
18	Female	71	Periaortic fibrosis		9/10/2012		3	40	1,440	Yes	
19	Female	76	Spinal canal stenosis	11/2011	9/6/2012	About 10 months	1	40	480	No	
20	Female	85	Aplastic anemia		10/12/2012		2	60	1,440	No	
21	Female	81	Lumbar compression fracture	10/2012	12/29/2012	About 2 months	2	60	1,440	No	
22	Female	78	Lumbar compression fracture	5/11/2011	9/18/2012	About 16 months	1	40	480	No	
23	Male	77	Cerebral infarction	7/23/2009	8/21/2012	About 37 months	1	40	480	No	
24	Female	77	Left fibula fracture (Guillain-Barre Syndrome)	5/24/2012	7/9/2012	About 1 month	1	60	720	No	
25	Male	76	Cerebral infarction	1990	5/15/2013	About 280 months	2	60	1,440	No	
26	Female	88	Hematoma of knee joint	5/10/2013	10/11/2013	About 5 months	3	40	1,440	No	

deterioration and rejection, we finally analyzed 26 participants with complete three-month evaluation data.

An investigation with evaluation at six months or more would have rendered a very small sample size; thus, we determined that this would have been unreliable and conducted the investigation using the three-month evaluation.

The participants were 7 men and 19 women with an average age of 78.4 ± 7.2 years who were at the following levels of nursing care: 7 participants at Care Level 1; 6 participants at Care Level 2; 3 participants at Care Level 3; and 4 participants at Care Level 4. The participants requiring support on Support Level 2 included 6 people.

The results comparing the initial evaluation with the three-month evaluation are shown in Table 2. ADL performance did not follow a normal distribution, and ADL satisfaction and PGC-MS were found to be normally distributed. The average value of ADL performance and PGC-MS was nearly unchanged, whereas ADL satisfaction tended to improve by three months ($p = 0.065$). Furthermore, participants in the "at least one year since onset or onset unknown" group had significantly improved ADL satisfaction ($p = 0.008$). When classifying participants regarding

Table 2. Changes in each evaluation between initial evaluation and after 3 months.

Evaluation	Initial evaluation (Mean ± SD)	After 3 months (Mean ± SD)	*p*
1. Participants (*n* = 26)			
ADL performance	69 ± 19	69 ± 20	0.98
ADL satisfaction	93 ± 22	101 ± 23	0.065
PGC-MS	9.8 ± 3.6	9.7 ± 4.5	0.76
2a. Participants less than a year from onset (*n* = 10)			
ADL performance	78 ± 12	78 ± 12	0.83
ADL satisfaction	109 ± 15	105 ± 23	0.48
PGC-MS	8.5 ± 4.4	8.9 ± 3.8	0.35
2b. Participants except those less than a year from onset (*n* = 16)			
ADL performance	63 ± 20	63 ± 21	0.86
ADL satisfaction	83 ± 18	98 ± 21	0.008**
PGC-MS	10.6 ± 2.6	10.1 ± 4.6	0.93
3a. Participants using day care services (*n* = 7)			
ADL performance	59 ± 18	61 ± 19	0.27
ADL satisfaction	87 ± 27	85 ± 25	0.61
PGC-MS	10.4 ± 5.5	9.9 ± 4.3	0.40
3b. Participants not using day care services (*n* = 19)			
ADL performance	73 ± 18	72 ± 19	0.50
ADL satisfaction	95 ± 18	106 ± 18	0.022*
PGC-MS	9.6 ± 2.5	9.6 ± 4.4	0.43

PGC-MS, Philadelphia Geriatric Center Morale Scale.
*$p < 0.05$, **$p < 0.01$.

Table 3. Correlations between ADL performance, ADL satisfaction and PGC-MS at initial evaluation.

	ADL performance	ADL satisfaction	PGC-MS
ADL performance		0.71*	0.050
ADL satisfaction			0.15

*$p < 0.05$.

Table 4. Correlations between ADL performance, ADL satisfaction and PGC-MS after 3 months.

	ADL performance	ADL satisfaction	PGC-MS
ADL performance		0.63*	0.10
ADL satisfaction			0.25

*$p < 0.05$.

the use of day care services, ADL satisfaction significantly improved in those not using day care services ($p = 0.022$). There was no significant difference when comparing the initial evaluation and three-month evaluation with other evaluations.

The correlation coefficients between each measure are shown in Table 3 and Table 4. The correlation coefficients between ADL performance status and ADL satisfaction were $r = 0.71$ at the initial evaluation ($p < 0.05$) and r = 0.63 ($p < 0.05$) at the three-month evaluation, which are both strongly correlated. On the other hand, the correlation coefficients between ADL satisfaction and PGC-MS were $r = 0.25$ at the initial evaluation and $r = 0.15$ at the three-month evaluation.

Discussion

1. Changes after three months of home-based rehabilitation

In this paper, we report our multi-institutional study on participants enrolled in a home-based rehabilitation program with two types of QOL evaluations involving ADL performance, and our investigation of the associated changes during the program. We used mFIM as an evaluation of ADL performance. No improvement was seen after comparing the initial and three-month evaluations. Previous reports have indicated an improvement in ADL performance after home-based rehabilitation [4, 5]. However, it is difficult to compare these studies with ours because they vary in terms of the participants' condition and age. Generally, ADL performance is considered to drop suddenly in advanced age [26]. The challenge of future studies is to investigate the effect of age on ADL performance in a larger sample.

Currently, QOL evaluation in home-based rehabilitation has not yet been studied. In our study, we classified QOL into 'emotional aspect' and 'cognitive aspect.' The 'emotional aspect' refers to the individual's emotional and psychological state, such as being happy or sad. For example, the individual may have depressive thoughts such as "I can't live like this." They will objectively judge themselves with thoughts such as "I worry about small things." On the other hand, the 'cognitive aspect' refers to an individual's satisfaction such as with their self-assessed living conditions. It reflects their satisfaction with their living conditions and environment. A specific example is the individual's satisfaction with their current ability to move around in the restroom.

We used the PGC-MS as an indicator of the 'emotional aspect' of QOL, and used ADL satisfaction as an indicator of the 'cognitive aspect' following the previous evaluation method of life satisfaction. The results showed that there was no difference in the PGC-MS after three months of home-based rehabilitation. This evaluation is considered to be a long-term assessment that includes the individual's conventional life [27]; it is considered that the 'emotional aspect' of QOL is resistant to change after only three months of home-based rehabilitation. Nojiri et al. classified the life rebuilding process during home-based rehabilitation into four phases [28]. They state that it starts with a 'set-up phase,' indicating the beginning of life at home, followed by an 'adjustment phase,' indicating the need for readjustment and additional help. The 'maintain phase' involves social support to maintain a continued stable life. The last phase is the 'step-up phase,' where we plan to improve their QOL and expand their sphere of life into participation in community activities. Considering this process, we assumed that because we did not yet change their inner emotions and psychological aspects in the period of three months, we did not improve their 'emotional aspect' of QOL. On the other hand, ADL satisfaction tended to improve during three months of home-based rehabilitation. This evaluation can determine the satisfaction level for each category in daily life, focusing on items that are not satisfied, which can then be changed easily by home-based rehabilitation to allow for a comparison with three months prior to rehabilitation. This may be useful as a short-term evaluation. Kikkawa emphasizes the following three viewpoints on rehabilitation to improve the quality of life for the elderly [29]: (1) activating their mind by maintaining relationships, roles, and responsibilities; (2) addressing social participation and independence; and (3) emphasizing informed consent. Thus, while home-based rehabilitation includes sufficient informed consent depending on the situation, we encourage social participation and independence, thereby creating and maintaining their relationships. As a result, it is considered that ADL satisfaction was improved, which is the 'cognitive aspect' of QOL. This improvement becomes remarkable in the participants who continued living at home for a longer term of one year or more from the onset (Table 2); thus, it is considered that three months of home-based rehabilitation affected the satisfaction of the participants who had been living at home before participating in a rehabilitation program. Further examination should be conducted for repeatability and reliability of this evaluation.

It is believed that the improvement in ADL satisfaction by three months of home-based rehabilitation despite an unchanged ADL performance was because of the assent and acceptance of the present living conditions through explanation and an appeal by the home-based rehabilitation staff, even if ADL performance did not change.

In addition, it is believed that PGC-MS did not change despite an improvement in ADL satisfaction because most of the categories of PGC-MS evaluate the personal character and general feelings and it is challenging to change these with home-based rehabilitation in the short term.

However, it is necessary to consider factors other than the home-based rehabilitation, including whether the participant used day care services, given that ADL satisfaction significantly improved in participants who did not use day care services ($p = 0.022$). The difference was not statistically significant in other evaluations at the time; however, because of the small sample size, future study should have more participants for detailed analysis. In addition, we did not know if participants were previously enrolled in rehabilitation before starting home-based rehabilitation or the period after they began their home life. Therefore, further study is needed to conclude that home-based rehabilitation was the sole cause of the outcomes.

2. Correlation between each evaluation

We estimated the relationship between each evaluation, and a strong correlation was indicated between ADL performance and ADL satisfaction at both the initial evaluation and the three-month evaluation. As a result, we were able to suggest that ADL performance influenced the 'cognitive aspect' of QOL. Granger et al. [9] noted that the FIM score was correlated with satisfaction of personal life when comparing evaluations with the FIM and other QOL evaluations; our study supports this result. On the other hand, a correlation was not seen between ADL performance and PGC-MS at both the initial evaluation and three-month evaluation. This result is similar to a previous report in which Itako et al. studied health care facilities for the elderly [30], and is also similar to that in a previous report in which Hori et al. studied day care users [31]. This evidence supports the notion that it was impossible for ADL performance to influence the 'emotional aspect,' such as PGC-MS, of QOL not only in elderly people in facilities but also in home-based rehabilitation users who lived at home. In this regard, it is revealed that the correlation with ADL performance varies according to the difference in evaluation of the 'cognitive aspect' and evaluation of the 'emotional aspect' of QOL in home-based rehabilitation; thus, it is necessary to examine its contents on the QOL assessment in future studies. In other words, there are many approaches to evaluating QOL, but we can interpret an evaluation result more concretely by clarifying which aspect of QOL the evaluation reflects in detail. Furthermore, it is considered that we can use an evaluation properly depending on the aspect we want to clarify by understanding the specifics of the properties of individual QOL evaluations.

This study has some limitations. First, we were planning to estimate the evaluation at the initiation, and at three months, six months, and one year after starting home-based rehabilitation. However, the analysis of the evaluation after six months became difficult, because some participants were hospitalized due to deterioration in state, and others refused an evaluation; the number of participants was then reduced. Thus, considering future study designs, it is necessary to include a larger number of facilities to increase the number of candidates.

Additionally, participants were enrolled in home-based rehabilitation in this study, and they were at a level where they could be discharged from the medical institution and live at home, and they were limited in that they did not have dementia with more than 21 points on the HDS-R. Therefore, it is considered that they had a higher degree of ADL independence compared to ordinary patients, and so it is necessary to examine how this influences QOL. In addition, certain clinical details could not be examined, as only basic information such as the disease state and the age of the participants was available; other information such as insurance-provided services, family constitution, health condition, care burden of the family, and type of rehabilitation program performed for home-based rehabilitation should be included. Thus, it is necessary to consider such factors in future studies.

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