

The Influence of Bodily Activity on Retaining the Functionality of the Hand in Aged Persons

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ABSTRACT

Degenerative changes of the hands is one of the leading problems of the elderly because of the inability to perform daily activities. This study aimed to determine whether the application of physical activities and exercises was effective in maintaining and /or improving hand function and the overall quality of life of older people in the institution. The instruments applied were: SF-36, keeping a diary for each subject in certain categories (exercise, creative therapy, communication, cognitive, motor and sensory abilities), Barthel Index, vigorimeter, test of hand function, satisfaction with life scale. Research has shown that the program of physical activities that are conducted throughout the year can maintain and improve hand function in older persons who are placed in an institution which contributes to the quality of their lives in terms of performing daily activities. As a conclusion from the results, it is proposed to introduce a model of physical activity into the institutional form of care for the elderly.

Key words: hand function, physical activity, quality of life, older people in the institution

Introduction

The aging process is marked by many health changes that lead to the gradual restriction of active life. Degenerative changes of the hands is one of the leading problems in the elderly because of the inability to perform daily activities. Recent studies show that hand function is associated with quality of life of older persons¹. The strength of the grip can be a predictor of mortality, a number of health risks and length of hospitalization^{2, 3} as an indicator of malnutrition^{4,5}. Research also shows that older people have less gripping force than the younger, and that optimum hand grip is necessary to perform activities of daily living and functional independence⁶. In a study conducted in 2012 in Canada ⁷ 28 variables were identified that can be used to measure grip strength in older persons.

According to Crimmins and Saito⁸, change in one function is associated with a change in the overall functional capacity, i.e. a worsening of function in a period of two years worsens the performance for another two to five other functions in people older than 70 years. According to Tomek-Roksandic et al.⁹, the health care of older persons requires an active approach towards the elderly in order to reduce morbidity and improve functional ability.

The main objective of this study was to determine whether the application of physical activities and exercises can serve to maintain and / or improve hand function and overall quality of life of older people in the institution. Specific research objectives were: to determine the ability to retain and improve hand function using physical exercise, to determine whether a one year exercise period is sufficient to achieve a better hand function, to determine whether there is a connection between hand function and overall quality of life of older persons, to determine whether there is a correlation between hand function and general health functioning of older adults.

Methods

Participants, measuring instruments and procedure

The study was conducted in the institution, »Trnje« Home for the Aged and Infirm, Zagreb, Croatia, in 2006. Included were 60 clients in the age group 65–95 years, 4 men and 56 women. The selection criteria were functionally disabled elderly and older people who because of health spend from 10–15 hours in the room (multimorbidity).

The measuring instruments were: 1. Qualitative research methods – testing was conducted using questionnaire SF-36 before applying the model of physical activity in preserving the functionality of the hand in the elderly and after the implementation thereof. The questionnaire was used for the evaluation of results of clinical intervention, rehabilitation measures, and review of the general state of functioning of people. Furthermore, qualitative methods of evaluation – keeping a diary for each subject by days, weeks and months through the year were applied; 2. Quantitative research methods – the Barthel index, whereas we estimate the degree of functional independence of older persons, we assessed hand grip with vigorimeter and hand function (modified from: Occupational Therapy Department – Llanelli / Difefwr Unit, Wales, GB). Finally, a self-evaluation was conducted with respondents through the use of scale of life satisfaction.

During institutionalization, quality of life for older people declined sharply during the last few years of life. In order to prevent this process, we applied a model of physical activity that is aimed to preserve the functionality of the hand, and thereby improve the quality of life of older people in the institution. A model of physical activity was implemented through:

1. physical activity – exercise kinesiology (exercise of the head, shoulder girdle, upper extremities, lower extremities, hands-specific exercises);

2. functional activities – skill in carrying out activities of daily living that provide to the respondent maximum independent function and efficiency in self-care activities, activities in bed, wheelchair activities, a variety of activities using the hands, walking and climbing activities;

3. occupational activities – through which the elderly confirm the creation of new values, regardless of their age, actively participating in them with other older people in the institution.

Results

Results obtained in this study show that the preservation of hand function in elderly people is associated with the use of models of physical activity.

Using the questionnaire SF-36 and evaluation of the components, we evaluated the general condition of the functioning of the elderly. The aim was to determine whether there is a correlation of the function of the hand and the general condition of the elderly. Using the results of the questionnaire SF-36 before and after the therapy it can be confirmed that such a connection exists. The results show improvement after the exercise program in the categories: physical functioning, limitations due to physical problems, limitations due to emotional problems, mental health, vitality and energy, and bodily pain.

The correlation between hand function and general health functioning was found with the help of evaluation of the components: interest for the entire program, participation in exercises, creative abilities, communication skills, cognitive skills, motor skills and sensory abilities. Upon an annual evaluation on a quarterly basis the fol-

lowing results were obtained: interest for the entire program has grown with the participants acquainted with the program, interest in the exercise program was always high, creative and communicative skills of the respondents were growing after the first quarter, cognitive abilities (memory, reasoning, concentration) during ongoing tests in subjects from the beginning to the end of therapy were consistent with a number of respondents who had deviated, motor skills were increased with every quarter, and sensory abilities did not change and remain unchanged from the beginning to the end of treatment (except for a few respondents who had deviated from the average group).

We also found that there is a correlation between fist function and general quality of life of older people by assessment of the degree of dependence on others for help – Barthel index. By analyzing the degree of dependence on others for assistance improvement of all activities was obtained (11 sub-tests), while the resulting deterioration in swimming activities and activities of climbing the stairs was found in one patient, which could also explain the deterioration of general health status of respondents. When assessing the performance of personal hygiene after completion of therapy in one year improvement occurred in 12 patients, while in other patients there was worsening. Statistical analysis revealed a significant difference $p < 0.001$, $z = -6613$. When assessing functional ability in performing activities of swimming after completion of therapy in a year an improvement was achieved in 15 patients, and worsened in one patient due to worsening general health. Statistical analysis revealed a significant difference $p < 0.001$, $z = -6350$. When assessing the ability to conduct nutrition activities after completion of therapy in one year improvement occurred in 16 patients, whereas there was no worsening. Statistical analysis revealed a significant difference $p < 0.001$, $z = -6219$. When assessing the functional ability in performing activities of going to the toilet after completion of therapy in a year improvement occurred in 9 patients, whereas there was no worsening. Statistical analysis revealed a significant difference $p < 0.001$, $z = -5304$. When assessing the functional ability in performing activities of climbing the stairs after completion of therapy in a year improvement occurred in 12 patients, and worsened in one patient due to worsening general health. Statistical analysis revealed a significant difference $p < 0.001$, $Z = -4903$. When assessing the functional ability in performing activities of dressing after completion of therapy in a year improvement occurred in 7 patients, whereas there was worsening. Statistical analysis revealed a significant difference $p < 0.001$, $z = -6591$. When assessing the functional ability in performing activities of control of stool after completion of therapy in a year there were changes in all subjects. With regard to scoring, 25 subjects had an improved score, but still remained in the same class of functionality. When assessing the functional ability in performing activities of control of urination after completion of therapy in a year there has been an improvement in 1 subject, while in other patients there was worsening. When assessing the functional ability in performing activities of a chair-bed transfer after

completion of therapy in a year improvement occurred in 15 patients, whereas there was no worsening. Statistical analysis revealed a significant difference $p < 0.001$, $z = -4584$. When assessing the functional ability in activities related to mobility after completion of therapy in a year improvement occurred in 16 patients, whereas there was no worsening. Statistical analysis revealed a significant difference $p < 0.001$, $z = -4463$. When assessing the functional ability in performing activities of wheelchair movement after completion of therapy in a year there were no changes in all subjects. Change had occurred only in points, not in the category of functionality. Statistical analysis estimates that the total Barthel index before and after therapy produced a significant difference $p < 0.001$, $z = -5196$. The total sum of the Barthel index before the implementation of therapy was 68.50, expressed in median. The minimal sum was 33, and the maximum 92, interquartile range 21:50. After the therapy, the average sum expressed in median was 83 minimum 40 maximum 96, interquartile range 975. There is an obvious increase in the Barthel index value that is statistically significant $p < 0.001$, $z = -6684$. The above statistical analysis supports the specific goal of this study to confirm the relationship and functionality of the hand with the overall quality of life of older people in performing activities of daily living.

One of the objectives of the study was to determine whether the one year exercise period was sufficient to achieve a better hand function. For this purpose we used a vigorimeter to measure the hand grip. Measurements were performed on the left and right hand (right hand was mostly dominant), three times – before starting therapy, after 6 months of therapy and at the end of therapy. The median, as the relevant size measurement, for the left hand had increased from 30 to 35 in the first 6 months, and after 6 months until the end of the year it increased to 40. In the right hand increase was achieved after one year of therapy from 40 to 45. Measurements have shown that in a year progress can be made in grip strength – achieving an improvement for the left and the right fist. Improved grip for older respondents was the motivation for further sustained physical activity as reflected in the performance of daily activities in the institution. We can determine that daily hand exercises (as previously mentioned) in older people significantly improve hand function during periods of testing.

We evaluated the ability to retain and improve hand function using physical exercise – the test of hand function. Each function of the hand was examined through two activities. Improvements relate to those subjects who before therapy could not do a particular activity, and after the therapy it is done with assistance or independently. In evaluation of the test hand functional improvements were obtained for the following activities:

1. Light Pinch

a) *lifting pencil* – statistical analysis: the difference was significant $p = 0.014$, $z = -2449$ whereas a noticeable improvement was achieved in 6 patients, while deterioration had occurred in other subjects;

b) *write your name* – statistical analysis: the difference was significant $p = 0.005$, $z = -2828$, whereas a noticeable improvement was achieved in 8 patients, while deterioration had occurred in other subjects.

In the analysis of Light Pinch functions before and after therapy, a significant difference $p = 0.004$, $z = -2.889$ was obtained.

2. Heavy Pinch

a) *strongly crossed pairs* – statistical analysis: the difference was $p < 0.001$, $z = -3.9$, whereas a noticeable improvement was achieved in 18 patients, while deterioration occurred in 1 patient;

b) *drawing of zipper* – statistical analysis: the difference was $p < 0.001$, $z = -6091$, whereas it is evident that improvement was achieved in 40 patients, while deterioration occurred in 1 patient.

In the analysis of Heavy Pinch functions before and after treatment the difference was $p < 0.001$, $z = -568$.

3. Three-finger Pinch

a) *open safety pins* – statistical analysis: the difference was $p < 0.001$, $z = -5396$ whereas a noticeable improvement was achieved in 32 patients, while deterioration occurred in 1 patient;

b) *opening the lid on the jar* – statistical analysis: the difference was $p < 0.001$, $z = -4914$ whereas a noticeable improvement was achieved in 27 patients, while deterioration occurred in 1 patient.

The analysis of functions three-finger Pinch before and after treatment identified the difference $p < 0.001$, $z = -5402$.

4. Cylindrical grip

a) *holding a glass* – statistical analysis: the difference was significant $p = 0.014$, $z = -2449$ whereas a noticeable improvement was achieved in 6 patients, while deterioration had occurred in other subjects;

b) *raising the full teapot* – statistical analysis: the difference was significant $p = 0.005$, $z = -2828$ whereas a noticeable improvement was achieved in 8 patients, while deterioration had occurred in other subjects.

Analysis of cylindrical grip function before and after therapy revealed a significant difference $p = 0.001$, $z = -3276$.

5. Spherical grip

a) *holding the tennis ball* – statistical analysis: the difference was significant $p = 0.0157$, $z = -1414$ whereas a noticeable improvement was achieved in 2 patients, and there was no worsening in other subjects;

b) *opening the door handle with ball* – statistical analysis: the difference was significant $p < 0.001$, $z = -6557$ whereas a noticeable improvement was achieved in 43 patients, while deterioration had occurred in other subjects.

The analysis of spherical grip functions before and after therapy revealed a significant difference $p < 0.001$, $z = -6423$.

6. Lateral grip

a) *the provision of paper* – statistical analysis: the difference was significant $p=0.083$, $z = -1732$ whereas a noticeable improvement was achieved in 3 patients, while deterioration had occurred in other subjects;

b) *provision of a fork with food* – statistical analysis: the difference was significant $p=0.002$, $z = -3162$ whereas a noticeable improvement was achieved in 10 patients, while deterioration had occurred in other subjects.

Analysis of lateral grip function before and after therapy revealed a significant difference $p 0.002$, $z = -3127$.

7. Opposition

The opposition was estimated using the activity of cutting paper with scissors. Statistical analysis: the difference was significant $p<0.001$, $z = -6403$ whereas noticeable improvement was achieved in 41 patients, while deterioration had occurred in other subjects.

8. Pronatio and Supinatio

a) *twisting towel* – statistical analysis: the difference was significant $p<0.001$, $z = -7000$ whereas noticeable improvement was achieved in 49 patients, while deterioration had occurred in other subjects;

b) *closing jars* – statistical analysis: the difference was significant $p<0.001$, $z = -6928$ whereas noticeable improvement was achieved in 48 patients, while deterioration had occurred in other subjects.

The analysis of the pronatio / supinatio function before and after therapy revealed a significant difference $p<0.001$, $z = -6831$.

9. Grip release

Statistical analysis: the difference was significant $p=0.014$, $z = -2449$ whereas a noticeable improvement was achieved in 6 patients, while deterioration had occurred in other subjects.

10. Use of mobility aids

Statistical analysis: the difference was significant $p=0.083$, $z = -1732$ whereas a noticeable improvement was achieved in 3 patients, while deterioration had occurred in other subjects.

Subjects were given an assessment of physical activity and assessment of their quality of life through the activities of daily life at the end of the program. Most respondents expressed satisfaction with the program with a maximum rating (95% of respondents). Improving hand function in of the elderly in the institution provided a better quality of life that is reflected in improving their health and psychosocial status, and this was reflected in respondents' satisfaction assessment program.

Discussion

Functional abilities of elderly persons in an institution due to health conditions and inactivity are declining. It is necessary to carry out everyday professional pro-

grams that retain functional ability at the level of older people entering the institution.

Activities of daily living enable people to communicate, work and take on a number of social roles. Difficulties in performing activities of daily living are an important indicator of disability or incapacity. A large number of studies have been conducted to investigate the loss of functional ability. However, of equal importance, and much less well known, the possibility of recovery of ability exists. According to Ljubić¹⁰ activities are programmed and organized by the institution in order to maintain mental and physical abilities, and in an effort to develop in older people as much personality and ability to function socially.

Rogers et al.¹¹ examine the dynamics of functional ability and its association with sociodemographic factors that are supposed to be able to act to change the state capacity and state failure. Older age, female gender, poor social support, living alone, lower education and lower income factors are assumed to be associated with poorer functional ability, and with less likelihood of recovery capabilities.

Crimmins and Saito⁸ examined how changes in one function are associated with a change in the general functional ability. They found that a deterioration in one function, over a two year follow up of people older than 70 years were correlated to the deteriorating performance of another two to five other functions. Recovering a function improved performance for another two to four functions. They also found that older age is a consistent predictor of decline in functional abilities. Generally, recovery is more likely when the general functional state of a person is better, when the loss occurred recently, and when it is not too serious. The decline is likely to be evident as general functional ability and general health condition worsen, and when the person is older.

Strawbridge et al.¹² analyzed the six-year data collected by monitoring groups of 356 persons older than 65 years to determine predictors of sex-specific changes in functional abilities. Thus, income, education and marital status are predictors of functional change for men, a sense of personal control of health for women. Health behavior and social contacts have proved to be significant predictors of functional change for women and men. Men and women who do not smoke, exercise regularly and maintain social contacts have a better result in the measurement of functional ability. Interesting differences between the sexes in the form of physical activity have been observed – men are more concerned with exercise, and women in family activities or outings with their peers. The authors amusingly conclude that it is all the same whether the older person is to run the race track or run after the grandchildren – in each case there will be a better functional state.

Kaplan et al.¹³ followed a group of 356 people older than 65 years in the period of six years. They were interested in factors that are associated with changes in functional abilities: demographic, medical, psychological, social. The demographic factors that were significant predictors were change in age and low income. Significant predic-

tors of health were self-assessment of health, healthy behavior, one or more chronic diseases, previous stroke or previous heart attack. Significant psychological predictors were depression and a sense of personal control of health and social predictors of marital status and social support. It can be assumed that there are interactions between the various factors associated with functional capacity – for example, sick old people are less likely to move, depressed ones less than healthy ones, and sick old people will likely exhibit decreased functional ability more than the healthy ones.

The level of ability in activities of daily living is an indicator of general health status of older persons, it is certain that it reflects physical, and mental functioning. Functional ability was associated with quality of life of older people, but also mortality. Haga et al.¹⁴ in a longitudinal study in Japan examined the predictors of ability in activities of daily living. They followed 238 respondents aged 69–71 years who were living in their own homes over a period of 10 years. For both sexes, the most important predictor of functional abilities was social activity. The results show that the maintenance and promotion of social activities can help older people to maintain capacity in activities of daily living and improve quality of life.

Longitudinal studies have shown that the functioning of the elderly in daily activities exhibit a dynamic, changing situation. Changes in functional abilities vary systematically by sex, education and income, and health. For instance, Kasi¹⁵ examined the longitudinal predictability of self-assessment of health for future functional ability of older people with respect to their age, sex and direction of change skills (decline or recovery). The authors discuss the mediating processes that take place between the self-assessment of health, functional ability and life expectancy, and they believe that the change of functional capacity in this process represents an important interphase. If self-rated health affects, or at least only indicates a possible change of functional state (which reflects the general state of health) that is reversible, as opposed to death, then the clinical significance of this finding is extremely important. The nature of the process should be more explored. It is possible that self-rated health affects the health status as »self-fulfilling prophecy« – the person that thinks his health is poor makes a fatalistic refusal to make an effort to rehabilitate, to recuperate after, for example, a stroke, or as people whose families are repeatedly beset by cardiac illness neglect diet and exercise because they think they have no control over their health. Rakowski and Hickey^{16,17} have found connections between attribution of functional decline of aging with an increased risk of mortality. Other factors associated with mortality were age greater than 80 years, male gender, poor self-rated health, cancer or diabetes, body weight too small, weak social activity.^{20,21}

Functional capacity is a critical indicator of the quality of life and health among older people, sometimes more important than the presence of a disease^{18,19}. It involves an individual's ability to perform all daily activities to ensure adequate quality of life which is confirmed by this study.

Conclusion

The aging process is marked by numerous changes that lead to the gradual restriction of active life. Particularly vulnerable groups of older people are those who are placed in institutions (retirement homes) due to a permanent reduction in their physical activity, increased immobility and dependency on others.

Our research has shown that the use of models of physical activity can maintain and improve hand function in older people and thus retain the quality of life of older people in the institution in carrying out daily activities.

We also found that there is a connection between hand function and general health functioning of older adults. The results show improvement after the exercise program in the following categories: physical functioning, limitations due to physical problems, limitations due to emotional problems, mental health, vitality and energy, and bodily pain.

In the course of the research we have found connections between hand function and general health functioning through the evaluation program. Annual evaluation by quarter showed that interest in the entire program had grown with the participants acquainted with the program, interest in the exercise program was always high, creative and communicative skills of the respondents were growing after the first quarter, cognitive abilities (memory, reasoning, concentration) in the ongoing study in patients from the beginning to the end of therapy were consistent with the number of respondents who had deviated, motor skills were increased with every quarter, and sensory abilities remain unchanged from the beginning to the end of treatment (except for a few patients who have deviated from the average groups). Subjects were given an opportunity to evaluate the success of the program of physical activities and their own quality of life through the activities of daily life at the end of the program.

The study confirmed that there is a correlation of hand function and the general quality of life of older persons. Continuous program of daily physical activity with the subjects has improved the quality of life due to the improvement of hand function. Improving hand function in older people enabled the elderly easier to perform daily activities in terms of independence in self-care (grooming, oral hygiene, bathing, showering, toilet hygiene, care of personal aids, dressing, feeding and medication, health maintenance, functional communication, functional mobility, mobility within the community.)

We found that the test one year exercise period is sufficient to achieve a better hand function. Measurements have shown that in a year progress can be made in grip strength – achieving an improvement for the left and the right hand in the group. Improved grip in the elderly was a further motivation for continuous physical activity as reflected in the performance of daily activities in the institution. Daily exercises of the fist through a model of physical activity (mentioned above) significantly improved an older person's hand function during the study period.

We found the ability to retain and improve hand function using physical exercises. By assessment of hand function in older persons in the research institution, we obtained results of improved function, i.e. improvement of one function in the subjects showed an improvement in several other functions (eg, raising the pen, writing, holding a pen in hand, closure of zipper, opening the lid on cans, etc.).

Most participants viewed the program as a high grade form of improving hand function in an institution for the

elderly to provide better living in terms of functional abilities (activities of self-care, personal care, feeding, hygiene, dressing, going to the toilet, moving from bed to chair, walking) and the possibility of performing the desired activity.

According to the research results we conclusively propose the introduction of physical activity in the form of institutional care for the elderly.

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UTJECAJ TJELESNIH AKTIVNOSTI NA OČUVANJE FUNKCIJE ŠAKE KOD STARIJIH OSOBA

SAŽETAK

Degenerativne promjene šake jedan su od vodećih problema kod starijih osoba zbog nemogućnosti izvođenja svakodnevnih aktivnosti. Cilj ovog istraživanja bio je utvrditi može li se primjenom tjelesnih aktivnosti i vježbi održati i/ili poboljšati funkcija šake i opća kvaliteta života starijih osoba u instituciji. Primijenjeni su instrument: upitnik SF-36, vođenje dnevnika za svakog ispitanika u određenim kategorijama (vježbanje, kreativna terapija, komunikacija, kognitivne, motoričke i senzoričke sposobnosti), Barthelov indeks, vigorimetar, test funkcije šake, skala zadovoljstva životom. Istraživanje je pokazalo da se programom tjelesnih aktivnosti koje su provodene kroz godinu dana može održati i poboljšati funkcija šake kod starijih osoba koje su smještene u instituciji, što doprinosi kvaliteti njihova života s aspekta obavljanja svakodnevnih aktivnosti. Slijedom rezultata zaključno je predloženo uvođenje modela tjelesne aktivnosti u institucionalni oblik skrbi o starijim osobama.