

Effects of Group Exercise Program on the Health Condition and Quality of Life in Adults with Cerebral Palsy

This study examined the effects of group exercise program on health conditions and quality of life in cerebral palsy. Adults with cerebral palsy in their 20's who participated in the evaluation of measurement tools prior to and following the experiment. The control group was engaged in manual exercise for the range of joint movement and extension exercise for arms, legs and trunk, and experimental group performed group exercise program including boccia exercise. The health condition and quality of life of the experimental group were significantly increased after intervention (.05<). There was a slight increase in the control group, however it was not statistically significant. As a result of comparing the health condition and quality of life of the two groups, the value of the experimental group was significantly higher than that of the control group. The results of this study suggest that exercise programs for patients with cerebral palsy in the twenties are considered as beneficial interventions to improve health conditions and quality of life.

Key words: *Cerebral palsy, Group exercise, Health condition, Quality of life*

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INTRODUCTION

Main problems that occur in cerebral palsy adolescents and adults include pain and fatigue due to damages to nerve system and increase in age, and degeneration of travel skills arising from lack of physical activities¹⁾. There is a trend of increase in anticipated lifespan and gradual increase in the prevalence rate of cerebral palsy in adults since special medical and health services in accordance with growth and development of patients due to the advancement of modern medicine²⁾. In the case of cerebral palsy, although the brain damage itself is non-progressive and permanent, clinical symptoms change diversely in accordance with the passage of time³⁾, and gross motor function is degraded once the patient reaches the stages of adolescents and youth, that is, after the child stage at which the motor development has been completed⁴⁾. In addition, characteristics for each of the types of disability in cerebral palsy reduce the physical functions and impart

direct influence on the daily life movements. Therefore, social functions and the quality of lives of the patients are more degraded with greater severity of disabilities. However, realistically, high quality systemic medical rehabilitation approach method provided to cerebral palsy children are rarely offered to adults with cerebral palsy, and there also are insufficient researches on their health state and treatment intervention at home and abroad^{2, 5)}.

The World Health Organization (WHO)(2012)⁶⁾ defined the quality of life as 'the position that an individual perceives of oneself in one's life in relation to the purpose, anticipation, standards and areas of interest, etc. within the context of the cultural sphere and value system one lives in, and is influenced by a complicated format by physical health, psychological state, extent of independence and social relationship of individuals as well as their relative relationship under a diverse range of environments'. Cerebral palsy in adults induces disability in executing activities essential in daily life including social roles expected of

the gender and age of individuals, that is, self-management, economic activities and social relationship, etc.⁷⁾. Since they have to rely on others for basic daily life activities among these that everyone performs commonly, their quality of life is degraded due to loss of confidence and manifestation of depression that result from such reliance. That is, cerebral palsy needs to be managed throughout the life of the patient from their childhood to adulthood through adolescence. Therefore, it is essential to maximally enhance their motor skills and independence in their daily lives, and improve their level of satisfaction on life by executing continuous therapeutic exercises⁸⁾.

Hutzler and Bar-Eli⁹⁾ asserted that exercise is necessary in order to improve the emotional and mental health of disabled persons. In addition, researches conducted on ordinary and physically disabled persons reported that subjects who regularly participated in physical activity programs displayed not only physical changes such as improvement of physique and changes in external appearance, etc. but also improvement of sociability, cognitive ability and psychological sense of satisfaction, etc.^{10, 11)}. Boccia is a fun sport for children and adults with cerebral palsy. This sport requires coordination of the extremities, thought, teamwork, and emotional control, and therefore provides both leisure and competition functions¹²⁾. Many of children with cerebral palsy like to participate in this game, interact with people, and make new friends, thereby enhancing their quality of life¹³⁾. Therefore, if group exercise program such boccia that can enhance sociability by adding functional factors for interaction between the participants in order to improve the health conditions and independence in life when executing therapeutic exercise to adults with cerebral palsy who lacks activities due to physical movement disability can be designed, it is thought that affirmative effects can be achieved not

only from the perspective of physical function but also emotional perspective.

Accordingly, application of group exercise program, which is a part of physical education subjected to adults with cerebral palsy, can not only increase the muscle strength and mobility but also improve the quality of their lives¹⁴⁾. In addition, it can be deemed to be a highly beneficial therapeutic program since it can provide motivation for life from social perspective through promotion of exchange of information and social interaction amongst the disabled persons¹⁵⁾. Therefore, this study examined the effects of the application of group exercise program that includes boccia exercise, which is a sport for disabled persons using ball, on adults with cerebral palsy in their 20's on their health conditions and quality of life. In addition, it was executed to provide basic clinical data, which would be effective in improving happiness and level of satisfaction of life in their daily lives through physical and emotional interactions of adults with cerebral palsy in the future.

SUBJECTS AND METHODS

Subjects

This study was conducted on adults in the range of 20~30 years old with cerebral palsy diagnosed with Level I~II brain lesion by specialist in rehabilitation medicine/neurosurgeon as the subjects. Detailed selection criteria for the subjects included, first, those capable of sitting in wheelchair with aids, second, those capable of performing boccia game, which is a group exercise program, and, third, those capable of expressing one's opinions with score of higher than 18 points in the simplified Korean type mental state examination. All the subjects were provided with

Table 1. Characteristics of the subjects

(N=24)

Variables	Group exercise(N=12)	Control group(N=12)
Gender(male/female) ^a	7/5	6/6
Age(years) ^b	24.62(4.56)	25.27(4.89)
Height(cm) ^b	164.38(6.48)	163.79(6.19)
Weight(kg) ^b	60.03(7.28)	62.41(7.52)
Gestational age(weeks) ^b	38.09(4.19)	37.34(5.20)
Birth weight(g) ^b	2,341.08(784.81)	2,425.08(618.48)
Incubator care(weeks) ^b	4.23 (3.84)	5.15(3.46)

^a Number(%), ^b Mean(SD)

detailed explanation on the purpose, procedures, measurement tools, inconveniences and risks of this study, and consented to their participation in the study voluntarily. General characteristics of the subjects are given in the Table 1.

Study design and Procedures

In this study, quasi-field experiment research design was applied to examine the effects of group exercise program on the health state and quality of life of adults with cerebral palsy in their 20's. Adults with cerebral palsy in their 20's who participated in the evaluation of measurement tools prior to and following the experiment are put into the control group while those participating in the group exercise program carried out for 8 weeks are categorized into the experimental group. The control group was engaged in manual exercise for the range of joint movement and extension exercise for arms, legs and trunk while experimental group was subjected to group exercise program including boccia exercise for interest and assertive participation of adults with cerebral palsy 2 times a week for 40 minutes per session over a period of 8 weeks for a total of 16 sessions.

Boccia exercise, which is a sport for disabled person with cerebral palsy by using a ball, can improve mobility of body and coordination, and support emotion of the disabled person through interaction between individuals. In this study, boccia game regulation book (9th edition: 2005-2008) for group game for 3~4 persons published through CP-ISR(Cerebral Palsy -International Sports and Recreation Association)¹⁶⁾ was applied in order for several subjects to enjoy the game together by competing with each other in the sports. Detailed program of group exercise applied to this study was composed of the following procedures specified in Table 2.

At the time of execution of group exercise program

including boccia exercise by using balls, warm-up and cool-down exercises were executed in the presence of physiotherapist with more than 5 years of experiences in neurodevelopment treatment and research assistant trained in the detailed exercise procedures in advance. In addition, in order to harmoniously carry out the main exercise executed only on the subjects in the experimental group, that is, boccia game by using balls, 1 judge registered with the Judging Committee of Korea Disabled Persons Boccia Federation and research assistant who familiarized with the boccia game rules in advance provided supervision and assistance in the group game.

Measure tools and Method

The health conditions of adults with cerebral palsy were measured by using MOS SF-36(Medical Outcome Study Short Form-36; MOS SF-36) developed by McHorney, etc.¹⁷⁾. This tool is capable of measuring the health level of the subject including physical and mental concepts through self-evaluation method with its reliability and validity acknowledged in various preceding researches. MOS SF-36 is composed of 36 questions that can be categorized into subordinate domains including physical function (PF), role limitation induced by physical problems (role physical; RP), bodily pain (BP), overall perception on health (general health; GH), vitality (VI), social function (SF), emotional role (RE), mental health (MH) and physical health. Each of these subordinate domains is given scores with the total score summed in the range of 0~100 points. Lower score indicates poorer health conditions while higher score indicates better health conditions¹⁸⁾.

The quality of life of adults with cerebral palsy was measured by using K-WHOQOL, which is a Korean version of the simplified version of the World Health Organization Quality of Life assessment instrument

Table 2. Group exercise program including boccia

(N=24)

Items	Time	Group exercise procedures
Warm-up exercise	10 minutes	<ul style="list-style-type: none"> ▪ Achieve emotional stability and establish rapport ▪ Exercise for the range of motion and stretching of arms, legs and trunk
Main exercise	20 minutes	<ul style="list-style-type: none"> ▪ Enhance coordination and mobility of body, improvement of muscle strength and endurance, and increase activities and participation. ▪ Boccia exercise (3~4 person group game)
cool-down exercise	10 minutes	<ul style="list-style-type: none"> ▪ Deep breathing training and body massage

(WHOQOL) published by the World Health Organization. This measurement tool is a self-reporting type test for subjective evaluation of the quality of life that the subject experienced over the last 2 weeks and is said to be a reliable evaluation tool for which the reliability and validity of examination - re-examination acknowledged through numerous standardization processes¹⁹⁾. This tool is composed of a total of 26 questions including 24 questions in a total of 4 subordinate domains, namely, physical health domain, psychological health domain, social relationship domain and environmental domain, and 2 questions on the overall quality of life (QOL). Subordinate Score for each domain was computed by multiplying the average score of all items included in each of the domains by 4. Therefore, the score for each subordinate domain is in the range of 4~20 with the total score computed by summing the scores of all 4 subordinate domains.

Data analysis

Data collected in this study is analyzed by using

SPSS 25.0 for Windows (IBM Corp, USA) program with the level of significance, α , for statistical significance was set at 0.05. General characteristics of adults with cerebral palsy in their 20's were computed through descriptive statistics and parametric test was executed after having conformed regular distribution of the measurement variables through Kolmogorov-Smirnov test. Match sample t-test was executed to examine the changes in the health conditions and quality of life prior to and after the experiment for the experimental group and control group, and independent sample t-test was executed to analyze the difference between the two groups.

RESULTS

Health conditions

Results of analysis of the differences in the changes prior to and following exercise between the experimental group and the control group, as well as the changes in the average health conditions scores within

Table 3. Comparison of health conditions(SF-36) within and between groups

(N=24)

Variables	Group	Pre-exercise	Post-exercise	Change values	t	p
Physical functioning	Experimental	58.83(12.22)	62.33(12.19)*	3.50(2.24)	2.408	.025 [†]
	Control	59.75(10.64)	61.00(9.64)	1.25(2.34)		
Role-physical	Experimental	63.67(7.79)	66.58(7.33)*	2.92(1.62)	2.666	.014 [†]
	Control	64.50(7.70)	65.33(6.58)	.83(2.17)		
Bodily pain	Experimental	63.58(6.23)	66.00(6.42)*	2.42(1.24)	2.283	.032 [†]
	Control	64.25(6.11)	64.92(5.63)	.67(2.35)		
General health	Experimental	61.92(2.54)	65.00(2.80)*	3.08(1.88)	2.293	.032 [†]
	Control	63.42(3.70)	64.33(4.91)	.92(2.68)		
Vitality	Experimental	62.33(1.23)	65.42(1.68)*	3.08(1.24)	2.661	.014 [†]
	Control	62.16(2.92)	63.17(3.21)	1.00(2.41)		
Social Functioning	Experimental	56.67(6.95)	59.67(6.51)*	3.00(1.81)	2.110	.046 [†]
	Control	57.92(5.07)	59.08(4.89)	1.17(2.41)		
Role-emotional	Experimental	71.92(6.11)	74.25(5.94)*	2.33(1.23)	2.719	.013 [†]
	Control	70.42(5.50)	70.83(4.93)	.42(2.11)		
Mental Health	Experimental	63.75(4.92)	66.17(4.73)*	2.42(1.16)	2.495	.021 [†]
	Control	64.67(4.42)	65.17(3.46)	.50(2.39)		
SF36	Experimental	62.84(3.70)	65.68(3.40)*	2.85(0.64)	5.794	.000 [†]
	Control	63.39(3.50)	64.23(3.16)*	.85(1.01)		

Values are mean(SD). *p<.05 compared within groups. [†]p<.05 compared between groups

the group are presented in the Table 3. There was significant difference in the average health conditions scores following exercise in comparison to those prior to the exercise in both experimental group and control group with significant difference in the changes in health conditions prior to and following the exercise between the two groups ($p < .05$). The average health conditions score of experimental group was improved more than that of the control group.

Quality of life

Results of analysis of the differences in the changes prior to and following exercise between the experimental group and the control group, as well as the changes in the average quality of life scores within the groups are presented in the Table 4. Although there was no significant difference in the control group, there was significant difference in the average quality of life score after the exercise in comparison to that prior to exercise in the experimental group. Moreover, there was significant difference in the changes the quality of life between the two groups prior to and following the exercise ($p < .05$). The average quality of life score was improved more for the experimental group in comparison to the control group.

DISCUSSION

Reduction in the mobility and exercise ability of adults with cerebral palsy induces secondary problems such as chronic pain in muscles and joints, and deformation of musculoskeletal system²⁰⁾. In addition, since loss of such capabilities further reduces the ability to move bodily parts and their interaction in accordance with the environmental changes for efficient execution of exercise, such loss limits the daily life activities of adults with cerebral palsy including self-help activities, transferring and moving, communication and social recognition, etc.²¹⁾. Although therapeutic intervention is needed for a diverse range of musculoskeletal damages and functional disability in the case of adults with cerebral palsy²²⁾, it is difficult to sustain physical training through access to health services following the stage of adolescence after graduation from school in reality. Therefore, efforts must be put by physiotherapist to optimize independence from all aspects throughout their lives by enhancing their ability to perform exercises by focusing on therapeutic exercises since cerebral palsy needs to be cared throughout the life of the patients²³⁾.

In this study, health conditions and quality of life were measured after having applied group exercise program for 8 weeks aimed at improving happiness and level of satisfaction of life in daily life through physical and emotional interactions to adults with

Table 4. Comparison of quality of life within and between groups (N=24)

Variables	Group	Pre-exercise	Post-exercise	Change values	t	p
Physical health	Experimental	11.92(.79)	13.17(.72)*	1.25(.45)	2.789	.011 [†]
	Control	12.25(.97)	12.42(1.08)	.17(1.27)		
Psychological health	Experimental	12.25(.87)	13.42(.90)*	1.17(.39)	2.881	.009 [†]
	Control	11.92(1.38)	12.17(1.03)	.25(1.66)		
Social relationships	Experimental	11.83(1.03)	13.00(.74)*	1.17(.94)	2.402	.025 [†]
	Control	11.83(1.27)	12.08(1.08)	.25(1.81)		
Environmental	Experimental	12.33(1.07)	13.42(.67)*	1.08(.67)	2.124	.045 [†]
	Control	12.50(1.00)	12.67(1.23)	.17(1.34)		
Overall QOL	Experimental	11.58(1.08)	12.67(1.07)*	1.08(.79)	2.746	.012 [†]
	Control	11.67(1.37)	11.75(.97)	.08(1.24)		
Total QOL	Experimental	59.92(4.19)	65.67(2.84)*	5.67(2.23)	4.615	.000 [†]
	Control	60.50(2.75)	60.75(2.53)*	.25(3.84)		

Values are mean(SD). * $p < .05$ compared within groups, [†] $p < .05$ compared between groups

cerebral palsy in their 20's. Since there is extremely few preceding research that applied group exercise program to adults with cerebral palsy at home and abroad, there would be limitations in accurate comparison with this study. However, analysis was made by making comparison with the results of researches in which group exercise was implemented to children or to adult stroke patients.

Group exercise therapy is aimed at promoting interaction amongst the constituent members of the group in order to resolve the problem of difficulties of the individual participants to make adjustment²³⁾. Chung et al.²⁴⁾ asserted that it was possible to confirm the enhancement of motor functions of the lower limbs in the case of stroke patients with significant increase in the evaluation of exercising of lower limb of Fugl-Meyer Motor Assessment ($p=.01$) and impairment domain of Chedoke-McMaster Stroke Assessment ($p=.00$), as the results of application of task-oriented group exercise program to stroke patients. In addition, Leroux²⁵⁾ reported that the exercise score among the stroke impairment assessment set items as the results of 8 weeks of group therapy on chronic stroke patients who was discharged after hospital treatment. Moreover, the research by Dean et al.²⁶⁾ that executed task-oriented circulation exercise on subacute stroke patients reported that it was possible to observe improvement of motor functions. These results are deemed to be possible because group activity can maximize the improvement of motor functions and ability to execute daily life movements by minimizing after effects through provision of motivation and promotion of active participation of patients with chronic diseases such as stroke. Although the subjects of the research differ, in this study in which group exercise program was implemented on adults with cerebral palsy, which is a disease arising from brain lesion, both the experimental group and the control group displayed improvement of health conditions after exercise in comparison to those prior to exercise with significant improvement in the changes in health conditions including physical and mental functions after the exercise in comparison to the exercise in the experimental group than those in the control group. These are results that are in concordance with the results of the researches that found group therapeutic program executed by having the subjects to interact with each other is more effective than the program executed individually²⁸⁾ and research that found activities of interaction with other patients are composed of competition and cooperation, which are helpful in inducing motivation for learning²⁹⁾.

Jeong³⁰⁾ asserted that it is necessary to approach the disabled persons with cerebral palsy through diversified methods since mental health has very important significance in physical activities function in such disabled persons. Case study that applied group exercise program capable of increasing physical and emotional interaction of children with cerebral palsy once a week over a period of 12 weeks reported that gross motor function, self-respect and sociability of the subjects were improved affirmatively³¹⁾. It was also possible to confirm in this study that the average scores not only of the health conditions (domains of physical function, social function, emotional role and mental health) but also of the quality of life (domains of physical health, psychology, social relationship and environment) in adults with cerebral palsy of the experimental group increased more significantly than the control group. In addition, the results of application of group therapy program for execution-basic implementation functions to preschool children with cerebral palsy for 12 weeks, the experimental group displayed significant improvement in basic-execution implementation functions in comparison to those of control group³²⁾. This is deemed to be the result of improvement of social skills including recognition of the game rules and procedures as well as provision of sense of belonging and emotional support as members of the group by means of mutual cooperation for the same goal through team games such as boccia exercise, which is a sport for adult disabled persons with cerebral palsy by using balls as well as the results of having implemented competitive activities in group exercise format, that is, building house with large blocks, searching hidden treasures, cooking and arts assignment in the case of children in both the preceding researches and this study.

Oh and Kim³³⁾ reported that ability of the experimental group, for which group therapy was executed, to support body weight and execute daily life activities was improved more in comparison to the control group for which only traditional therapy was implemented with chronic stroke patients as the subjects. Moreover, Lim³⁴⁾ also reported that there were significant differences in the motor activities of upper limbs, cognition functions and ability to execute daily life activities when group occupational therapeutic program was executed concurrently with individual occupational therapy in comparison to implementation of individual occupational therapy alone on stroke patients. However, the study results of having executed task-oriented training on stroke patients by dividing the subjects into groups and individually for 3 weeks, reported that there was significant improvement of

the upper limb functions and ability to execute daily life activities of the individually trained group with average age of 60.4 ± 16.4 years and 61.5% hemiplegia on the right side in comparison to those of the group training group with average age of 54 ± 11.8 years and 28.5% hemiplegia on the right side³⁵. That is, it is asserted that individual training is a better method than group training when task-oriented training is executed even when the effects of changes in the body due to aging and using the right side more at the time of execution of daily life activities are considered³⁶. It is deemed that such difference is due to the fact that although the two preceding researches executed only traditional therapy for the control group while group therapy program was executed additionally for the experimental group, research by Park et al.³⁵ applied the task-oriented training itself by dividing the subjects into individually trained group and group trained group, thereby unable to exclude such effects. That is, in the case of individual exercise therapy, there is no need to consider the diversity in the individuals that is not controlled in the group exercise therapy. Therefore, it has the advantage of being able to personally teach skills necessary for each individual³⁷.

Concurrent execution of group occupational therapy program that includes therapeutic activity program on stroke patients resulted in significant increase in depression, anxiety and ability to execute daily life activities in comparison to the patients who received only individual occupational therapy³⁸. In addition, since group occupational therapy program executed on patients with mild cognition disorder can impart positive effects on reducing the overall depression of the patients³⁹, it can be deemed that execution of occupational therapy program in a group setting is more effective in managing the depression of mild dementia patients in the local society⁴⁰. In this study, it was also found that the adults with cerebral palsy who participated in group exercise program including boccia exercise for which emotional support through interaction between individuals is possible displayed significant increase in the average scores of the health condition including the domains of vitality, social function, emotional role and mental health, and the quality of life scales including the psychological health domain and the social relationship domain in comparison to those of the control group. This is deemed to be the results of the subjects having psychological stability and self-accomplishment in their daily life since they can practice the ability to solve problems of appropriately coping with the environmental changes through sports in which the partici-

pants are competing with each other with pride and self-respect as several subjects voluntarily participate in the group exercise simultaneously. In addition, although there are research results that execution of group exercise therapy program on ordinary aged persons⁴¹ and program subjected to elderly dementia patients⁴² are effective in changing the cognition functions, daily life activities and balancing, these are results obtained without control group. Moreover, these results cannot be deemed as the outcome of the application of psychological factors such as inducing of motivation that can be obtained in group therapy in these researches⁴³.

This study was conducted to develop group exercise program capable of enhancing the health conditions and quality of life of adults with cerebral palsy in their 20's suffering from difficulties in daily life activities due to physical restraints. However, there are following limitations in interpreting the results of this study. First, there is difficulty in generalizing the research results since this study applied group exercise program to subjects who are from a very limited region. Second, this study measured the quality of life only in relation to the physical characteristics without considerations for psychological characteristics of adults with cerebral palsy in their 20's who experiences the time of physical and emotional changes during the transition period from adolescence to adulthood. Third, it did not exercise control on aspects of the daily lives of adults with cerebral palsy other than the group exercise program, and did not conduct follow-up examination to check the long-term effects of this program. Cerebral palsy patients display widely differing clinical symptoms and cognitive capabilities in accordance with their neurokinetic characteristics, and, particularly in the case of adults, there are widely differing preferences on the exercise method. Therefore, it is deemed necessary to verify the effectiveness of group exercise program on the health conditions, daily life activities and quality of life through multi-faceted researches that supplemented aforementioned limitations in the future.

CONCLUSION

This study was carried out to examine the effects of application of group exercise program that includes boccia exercise, which is a sport for disabled persons by using balls, on the health conditions and quality of lives of adults with cerebral palsy. Manual exercise on the range of movement of joints and extension of arms,

legs and trunk was implemented for the control group while the experimental group was subjected to group exercise program including boccia exercise for interest and assertive participation of adults with cerebral palsy 2 times a week for 40 minutes per session over a period of 8 weeks for a total of 16 sessions with adults with cerebral palsy in their 20's as the subjects. As the results of this study, the average scores of health conditions and quality of life of adults with cerebral palsy in their 20's increased more for the group for which group exercise program was implemented in comparison to the control group. Therefore, group exercise program designed to enable the adults with cerebral palsy in their 20's to participate in the game through physical and emotional interaction as well as by competing with each other can be considered as an efficient intervention method in improving their health conditions and quality of life.

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