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Effects of a Sun-style Tai Chi Exercise on Arthritic Symptoms, Motivation and the Performance of Health Behaviors in Women with Osteoarthritis

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Purpose. Tai Chi exercise, an ancient Chinese martial art, has drawn more and more attention for its health benefits. The purpose of the study was to identify the effects of a Sun-style Tai Chi exercise on arthritic symptoms (joint pain and stiffness), motivation for performing health behaviors, and the performance of health behaviors among older women with osteoarthritis.

Methods. Total of 72 women with the mean age of 63 years old were recruited from outpatients clinic or public health centers according to the inclusion criteria and assigned randomly to either the Tai Chi exercise group or the control. A Sun-style Tai Chi exercise has been provided three times a week for the first two weeks, and then once a week for another 10 weeks. In 12 weeks of study period, 22 subjects in the Tai Chi exercise group and 21 subjects in the control group completed the posttest measure with the dropout rate of 41%. Outcome variables included arthritic symptoms measured by K-WOMAC, motivation for health behavior, and health behaviors.

Results. At the completion of the 12 week Tai Chi exercise, the Tai Chi group perceived significantly less joint pain ($t = -2.19$, $p = 0.03$) and stiffness ($t = -2.24$, $p = 0.03$), perceived more health benefits ($t = 2.67$, $p = 0.01$), and performed better health behaviors ($t = 2.35$, $p = 0.02$), specifically for diet behavior ($t = 2.06$, $p = 0.04$) and stress management ($t = 2.97$, $p = 0.005$).

Conclusion. A Sun-style Tai Chi exercise was found as beneficial for women with osteoarthritis to reduce their perceived arthritic symptoms, improve their perception of health benefits to perform better health behaviors.

Key Words : Tai Chi exercise, Osteoarthritis, Health behavior, Motivation

INTRODUCTION

Osteoarthritis patients are characterized by older population, chronic disease, and mostly women. Since they are in chronic condition, long-term management strategies would be more beneficial than short-term intervention. Lifestyle modification by adopting health behaviors is required for this population to manage symptoms and signs more effectively and economically. Healthy People

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2010 advocated the adherence of regular exercise as an effective self-management technique for individuals with arthritis (Center for Disease Control and Prevention USA, 2005). However, only 10-30% of aging population engages regular exercise (Resnick & Nigg, 2003), and those with chronic disease such as arthritis would be expected to exercise even less.

Adoption of health behavior can be successful when the intervention is implemented based on motivation theories. Research has indicated that motivational factors are the best psychological determinant of health behaviors and exercise adherence (Jensen & Lorish, 1994; Song, 2006). Motivation is defined by an integrated cognitive and emotional process, anchored by personal goals that direct, energize, and regulate goal-directed behaviors (Ford, 1992). In previous literature, intervention strategies to motivate older adults to perform health behaviors have focused on enhancing cognitive process through health education classes (Heidrich, 1998). A clinical study revealed that the perceived self-efficacy, benefits, barriers, interpersonal influences were the significant determinants of physical activity and healthy eating among rural women aged 50 to 69 (Walker, Pullen, Hertzog, Boeckner, & Hageman, 2006). On the other hand, the emotional component of the motivation process has also received attention. A study on older adults showed that the adherence of health-promotion programs for older adults could be enhanced by associating exercise with pleasant sensations; pleasant or unpleasant feelings of fun, boredom or fear were reported as main reasons of quitting exercise among older adults (Resnick & Spellbring, 2000). An intervention study supported this premise, showing that enhancing emotion (emotional salience) and cognitive components (self efficacy, perceived benefits, and perceived barriers) of motivation improved the performance of health behaviors among older adults of exercise program (Song, June, Kim, & Jeon, 2004).

Since motivational factors are the common determinants of adopting health behaviors, it can be assumed that an adoption of single health behavior through enhancing motivation would influence to perform more of other health-related behaviors (Song, 1997). A study of health promotion in the work-place by Pender and colleagues (1990) reported the employees with a longer period of participation in fitness activities also performed better in other dimensions of a healthy lifestyle. An intervention study for elderly in residential homes also supported this assumption, showing that those who participated in exercise class were more motivated to perform health behaviors, consequently performed more health behaviors than their counterparts (Song, June, Kim, & Jeon, 2004). Therefore, it may be possible to encourage an individual to perform the physical exercise which he or she prefers to initiate and maintain it, and then the enhanced motivation will lead to the better performance of other related health behaviors.

Recently, Tai Chi exercise, an ancient Chinese martial art, has drawn more and more attention for its health benefits. Tai Chi exercise consists of slow but continuous movements of body parts combined with deep diaphragmatic breathing and relaxation, while maintaining body posture upright (Lam, 1998). Among major types of Tai Chi forms, the 12 forms of a Sun-style Tai Chi exercise has been applied to arthritis patients, supporting its benefits of enhancing muscle strengths, flexibility, and physical fitness (Song, Lee, Lam, & Bae, 2003). Tai Chi exercise was also related to pain management, better balance, risk reduction for falls, and improving quality of life (Klein & Adams, 2004). A study on inactive older adults with random assignment reported that the participants of Tai Chi intervention for 6 months significantly improved self-efficacy and perceived physical function (Li, Harmer, McAuley, & Fisher, 2002). Only a few studies has been found to link Tai Chi exercise and cognitive factors of motivation, yet various health benefits of Tai Chi exercise could lead to potential benefits in health promotion (Lan, Lai, & Chen, 2002). Considering the characteristics of Tai Chi exercise and the potential interaction of exercise participation with other health behaviors, implementation of Tai Chi exercise could be an initiating factor to motivate this population to perform more various health behaviors.

The purpose of the study was to identify effects of a Sun-style Tai Chi exercise on arthritic symptoms (joint pain and stiffness), motivation for health behaviors, and the performance of health behaviors in women with osteoarthritis.

METHODS

Research Design and Subjects

An experimental design with randomized assignment with pretest and posttest was utilized for the purpose of the study. The women older than 55 years of age who has been diagnosed with osteoarthritis were recruited

from outpatient clinics of university hospitals and public health centers. The list of potential subjects has been reviewed by the primary physician to confirm the inclusion criteria and those who agreed to participate in the study were included in the study. The inclusion criteria for the patients were: (1) clinical and radiographic evidence of osteoarthritis, (2) no chronic disease or disability that would hinder from performing Tai Chi exercise such as ischemic heart disease or cerebrovascular attack, and (3) no participation in any regular exercise program during the previous year.

Total of 72 women with osteoarthritis were recruited and randomly assigned by Excel program to the Tai Chi exercise group for 38 subjects and to the control group for 34 subjects. At the end of the study, 22 subjects of the Tai Chi group and 21 of the control group remained for the posttest measure with 43% and 39% of dropout rates, respectively. The reasons for the dropout were having surgery for knee replacement, being tied up for taking care of grandchildren or postpartum care for their daughters, moving out to other part of the city, or too far to come to the exercise site. Those in the control group were able to attend the Tai Chi exercise program after the study had been completed.

Data collection procedure

A face to face interview was performed for each individual to fill out the questionnaire which took approximately 15–20 minutes for each interview. Total of three research assistants were trained prior to the study to make consistency of interview style. The same research assistant conducted an interview with an individual at the pretest and the posttest in 12 weeks. The interview for each group was scheduled before and after the intervention program separately.

The preparation phase of the study was to train exercise leaders for the Tai Chi program for arthritis patients. The exercise leaders were nurses who participated in a certificate workshop for Tai Chi program prior to the study, and practiced together until performing the 12 forms confidently. A registered standardized videotape (ISBN 1-885538-84-7) was provided to exercise leaders to guide them in performing each form of Tai Chi correctly. During the Tai Chi exercise program, one exercise leader taught a form of Tai Chi movement step by step, and the other two assisted the session to make sure the safety and correct posture of exercise for the participants.

Intervention Procedure

The Tai Chi exercise program for arthritic patients developed by Lam and his colleagues consists of warm-up exercise, 12 main movements, and cool-down exercise, and described in detail elsewhere (Song, Lee, Lam, & Bae, 2003). Tai Chi exercise sessions were held in the classroom of the university with non-slippery floor and ample space convenient to perform the exercise. The subjects of the Tai Chi exercise group performed one-hour exercise session three times a week for the first two weeks until they learned the 12 forms of Tai Chi movement step-by-step enough to perform them correctly by themselves at home.

From the third week to the last week, the exercise group came to the supervised exercise session once a week, but they were expected to perform Tai Chi movement 3-4 times a week at home for another 10 weeks. The contract method and weekly follow-up calls from exercise leaders were used to motivate the participants to perform Tai Chi exercise regularly. The frequency and duration of Tai Chi performance at home were recorded on their exercise log, which was assessed during every weekly session.

Measurements

Motivation

The motivation to perform health behaviors was measured by the Motivation Scale for Health Behavior developed in a previous study with myocardial infarction patients (Song & Lee, 2001). The 28 items of the scale were assessed to assure its applicability to the older people who participated in the present study by modifying expressions easier to understand for them. The Motivation Scale for Health Behaviors comprises the variables of perceived self-efficacy (6 items), perceived benefits (7 items), perceived barriers (10 items), and emotional salience (5 items), representing the cognitive and emotional appraisal constructs of motivation. Since each subscale represents specific component of motivation, motivation was assessed based on four motivational variables rather than the total scores.

Perceived self-efficacy was measured by a 4-point forced-choice Likert scale, with each item ranked from 1 (not confident at all) to 4 (very confident). Perceived benefits/barriers and emotional salience were measured with a 4-point Likert format, ranging from strongly disagree (1) to strongly agree (4). The negatively worded items were reversely scored so that the higher scores in

the total motivation scale represented a more motivated state. Song and Lee (2001) reported the validity of the motivational scale, and showed that the reliability coefficients for each sub-dimension were 0.73-0.86. The Cronbach's alpha for the 28-item motivation scale was 0.81, in previous study with older population (Song et al., 2004).

Health Behaviors

The performance of health behaviors was measured by a Health Behavior Scale that was also developed by Song and Lee (2001) developed in cardiac patients. The scale consisted of 5 specific behaviors such as health responsibility (5 items), diet behavior (8 items), exercise (4 items: mostly related to physical activities such as using staircase or walking short distance), stress management (5 items), and smoking habits (3 items). Although it has been developed with cardiac population, the scale was used for the study, because it has been previously applied to older adults and focused 5 specific health behaviors which were consistent to the focus of the present study. The 25-item scale was self-reported on a 4-point response format to determine the frequency of each behavior from 1 (never) to 4 (routinely). Higher scores refer to the more-frequent performance of health behaviors. The psychometrics of the Health Behavior Scale has been reported previously (Song & Lee, 2001). The Cronbach's alpha coefficient for the health behavior scale was 0.82 in the previous study with older population (Song et al., 2004).

Arthritic Symptoms

The K-WOMAC (Bae et al., 2001) was used to assess arthritic symptoms of joint pain and stiffness of the subjects. The subscales of pain (5 items), stiffness (2 items) uses a 5-point Likert scale ranging from none (0) to extreme (4). Scores are generated by summing the coded responses to provide a score within the range of 0-20 for pain and 0?8 for stiffness. The reliability, validity, and responsiveness of the K-WOMAC have been reported in a previous study (Bae et al., 2001), and the Cronbach alphas for the subscales of pain and stiffness were 0.81-0.96 respectively in patients with osteoarthritis.

Data Analysis

At the completion of data entry, SPSSWIN V 11.0 was used to analyze the data with an alpha level set at .05. Independent t-tests and Chi-square analyses were used to test the homogeneity between the Tai Chi exercise group and the control group. Fisher's exact test was used when more than 20% of the cells had expected count less than five. Independent t-tests were used with the difference scores in mean change between pretest and posttest to compare the effects of Tai Chi exercise.

RESULTS

1. Homogeneity tests on demographic characteristics and the outcome variables at the pretest

There were no significant differences between the groups in any of the demographic characteristics (Table 1). The subjects had an average age of 63 years with the range of 55 to 74 years, and the average time since diagnosis was 9.8 years with the range of 1 to 27 years. The subjects from both groups received about 9 years of education. The comparisons on categorical variables between the groups were made by Fisher's exact test due to the small expected count, reporting no significant group differences. Most of the subjects were married, and perceived their economic status as middle or low. Only 3 individuals (14%) of each group did not have any religion. About 28% of the subjects had never performed any type of habitual exercise after their diagnosis, while 2 (9.1%) and 6 (28.6%) subjects of the experimental and the control groups, respectively, maintained their exercise habits for longer than 3 months. More than half of both groups perceived their present health as poor or very poor, while no one perceived their health status as excellent. The results on group comparisons on outcome variables also showed no significant differences between the groups (Table 2).

2. Effects of Tai Chi exercise on arthritic symptoms, motivation, and the performance of health behaviors

At the completion of 12 weeks of Tai Chi exercise, the Tai Chi exercise group reported significantly less pain ($t = -2.19$, $p = 0.03$) and stiffness ($t = -2.24$, $p = 0.03$) in their joints, while the control group had either more pain (K-WOMAC score increased from 8.90 to 9.52) and stiffness (from 3.57 to 3.81).

Four subscales of motivation were compared between the groups, and the Tai Chi exercise group showed significant more perceived benefits than the control group ($t = 2.67$, $p = 0.01$). The group differences in mean changes of other motivational variables were not significant

(Table 3).

The group comparisons were conducted on the performance of health behaviors and specific health behaviors of health responsibility, exercise, diet behavior, stress management, and smoking habits. The Tai Chi group performed significantly more health behaviors than the control group, and specific health behaviors of diet behavior and stress management showed significant differences (t = 2.06, p = 0.04, t = 2.97, p = 0.005 respectively). Other dimensions of health behaviors were not sig-

Table 1. Homogeneity Tests on Demographic Characteristics of the Subjects

Variables	Tai Chi (n=22)	Control (n=21)	t	p
	Mean (SD)	Mean (SD)		
Age (years)	64.8 (6.0)	62.5 (5.6)	1.20	0.23
Education (years)	9.0 (3.8)	8.8 (4.1)	0.11	0.90
Diagnosis period (years)	10.4 (7.1)	9.2 (7.2)	0.53	0.59
	Frequency (%)	Frequency (%)	Fisher†	p
Marital status				
Single/others	2 (9.0)	1 (4.8)	0.55	
Married	15 (68.2)	14 (66.7)		
Widowed	7 (31.8)	7 (33.3)		
Perceived economic status				
High	1 (4.5)	1 (4.8)	0.32	
Middle	13 (59.1)	13 (61.9)		
Low	8 (36.4)	7 (33.3)		
Religion				
None	3 (13.6)	3 (14.3)	0.96	0.89
Catholic	3 (13.6)	3 (14.3)		
Protestant	6 (27.3)	8 (38.1)		
Buddhism	10 (45.5)	7 (33.3)		
Current Exercise habits				
Never	6 (27.3)	6 (28.6)	3.54	0.32
Mostly do not exercise	7 (31.8)	6 (28.6)		
Exercise < 3 months	7 (31.8)	3 (14.3)		
Exercise > 3 months	2 (9.1)	6 (28.6)		
Present health				
Very poor	3 (13.6)	3 (14.3)	0.16	
Poor	9 (40.9)	8 (38.1)		
Good	10 (45.5)	10 (47.6)		

† Values are from Fisher's exact test

Table 2. Homogeneity Tests on Major Study Variables at the Pretest

Variables	Tai Chi (n=22)	Control (n=21)	t	p
	Mean (SD)	Mean (SD)		
Arthritic symptoms				
Joint pain	6.91 (4.1)	8.90 (5.1)	-1.40	0.17
Joint stiffness	3.22 (1.6)	3.57 (2.1)	-0.60	0.55
Motivation				
Self-efficacy	17.47 (4.03)	17.27 (2.45)	0.19	0.84
Perceived benefits	24.22 (2.20)	23.95 (2.24)	0.40	0.68
Perceived barriers	25.22 (4.81)	26.90 (2.56)	-1.43	0.16
Emotional salience	14.90 (1.77)	14.76 (1.41)	0.48	0.63
Health behaviors	68.22 (8.17)	67.40 (6.32)	0.36	0.71
Health responsibility	2.47 (0.55)	2.35 (0.36)	0.83	0.41
Exercise	2.26 (0.77)	2.27 (0.67)	-0.05	0.95
Diet behavior	3.23 (0.47)	3.18 (0.41)	0.37	0.71
Stress management	2.30 (0.47)	2.40 (0.41)	-0.80	0.42
Smoking habits	3.13 (0.64)	2.85 (0.55)	1.52	0.13

Table 3. Mean Group Comparisons in Arthritic Symptoms, Motivation for Health Behaviors, and the Performance of Health Behaviors at the Posttest

Variable	Posttest scores		Difference in mean change		t	p
	Tai Chi (n=22)	Control (n=21)	Tai Chi (n=22)	Control (n=21)		
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
Arthritic symptoms						
Joint pain	4.45 (2.61)	9.52 (4.69)	-2.45 (3.96)	0.61 (5.16)	-2.19	0.03
Joint stiffness	2.27 (1.57)	3.81 (1.80)	-0.95 (1.58)	0.23 (1.89)	-2.24	0.03
Motivation						
Self-efficacy	18.12 (3.67)	17.20 (3.18)	0.65 (3.78)	-0.06 (4.08)	0.60	0.55
Perceived benefits	25.86 (2.31)	24.52 (2.18)	2.36 (2.12)	0.57 (2.27)	2.67	0.01
Perceived barriers	24.54 (2.95)	26.42 (4.19)	-1.86 (4.15)	-0.47 (3.90)	-1.12	0.26
Emotional salience	14.77 (1.63)	13.76 (1.13)	-0.28 (2.86)	-1.00 (1.73)	0.97	0.33
Health behaviors	75.22 (10.32)	67.28 (12.57)	7.00 (8.00)	0.70 (9.29)	2.35	0.02
Health responsibility	2.79 (0.67)	2.44 (0.76)	0.31 (0.66)	0.09 (0.66)	1.09	0.28
Exercise	2.56 (0.71)	2.38 (0.84)	0.30 (0.68)	0.10 (0.61)	1.01	0.32
Diet behavior	3.41 (0.37)	3.05 (0.64)	0.17 (0.32)	-0.07 (0.48)	2.06	0.04
Stress management	2.69 (0.49)	2.32 (0.58)	0.39 (0.50)	-0.08 (0.54)	2.97	0.005
Smoking cessation	3.42 (0.61)	3.14 (0.67)	0.28 (0.62)	0.28 (0.80)	0.01	0.99

nificantly different between the groups.

DISCUSSION

As there is currently no cure for osteoarthritis, the role of exercise in reducing arthritic symptoms and slowing progression to serious disease has been receiving increasing attention (Bennell & Hinman, 2007). In the present study, a Sun-style Tai Chi exercise was applied to women with osteoarthritis for 12 weeks, and the findings showed that women who participated in Tai Chi exercise program perceived less pain and stiffness in their joints, and perceived more health benefits, and consequently performed more health behaviors. The recent intervention study with osteoarthritis patients also reported similar results using K-WOMAC that those who participated in Tai Chi exercise for 8 weeks perceived significantly less joint pain (M = 4.22, SD = 2.92) and joint stiffness (M = 2.01, SD = 1.51) compared to those in aquatic exercise or self help management groups (Lee, 2006). Tai Chi exercise is characterized as slow and gentle movements with low intensity, which would make easier for arthritic patients to move their joints with less perceived pain (Lam, 1998). Based on the recent meta-analysis and large randomized controlled trials, clinical guidelines consistently recommended exercise program to reduce pain and improve function with careful planning for individualized and patient centered program taking into account factors such as age, co-morbidity, and overall mobility (Fransen, McConnell, & Bell, 2002).

While the health benefits of exercise for individuals with chronic disease have been well established in previous research, the safety issues should be emphasized especially for the population with arthritis who are subjects to get injured by conducting exercise (Clyman, 2001). The present study used a stepwise progressive teaching method with exercise precaution that has been suggested for Tai Chi for Arthritis program. According to this teaching method, the subjects with arthritis should learn the movements of a Sun-style Tai Chi step by step and gradually increase their intensity and duration of exercise with allowing resting time to prevent from aggravating the arthritic symptoms (Lam, 2006). A Sun-style Tai Chi exercise are characterized by slow and continuous movements with follow up steps and higher stance with bending knees less than other types of Tai Chi (Song, 2006). This characteristics of follow up steps and higher stance were found helpful to make less burden on individual's knee and ankle, and consequently the participants were able to perform exercise slowly with less pain. The research team of the study assured to apply the characteristics of a Sun-style Tai Chi exercise to maximize beneficial effects while preventing any potential injury. The choice of exercise applicable to the arthritis patients should be based on the right form and intensity prescribed to meet the characteristics of the disease (Clyman, 2001). At the completion of 12 week Tai Chi exercise, the subjects of the present study reported significantly less pain and stiffness with no exercise related

injury, which could support for safe application of Tai Chi exercise to this population.

According to evidence-based recommendations for exercise in managing osteoarthritis, however, exercise program should be accompanied with strategies to improve and maintain adherence and motivation to promote a positive lifestyle change (Bennell & Hinman, 2007). The present study was based on an assumption that the adoption of one specific health behavior, a regular participating of Tai Chi exercise, would lead to motivate an individual to aware of and perform other dimensions of healthy lifestyle (Song, 1997). The study results revealed that the participants of the Tai chi exercise program for 12 weeks perceived more health benefits and performed better health behaviors than those in the control group. Similarly, older adults who performed regular exercise for 10 weeks reported better performance of health behaviors including more active physical activities (Song et al., 2004). The intervention study of urinary incontinence supported the relationship between motivation and the interaction of health behaviors, reporting that the patients who had practiced better health promoting behaviors were more motivated to follow a home exercise program that led to a successful therapy (Shinopulos & Jacobson, 1999). The relationship between single health behavior and multiple health behaviors through motivation as common determinants could lead to a basis for multiple behavioral modifications, and should be further identified to build health promotion strategies.

However, except for perceived benefits, other dimensions of motivation only slightly enhanced not enough to be significant. Perceived benefits along with self efficacy and perceived barriers are recognized as one of major determinants of physical activities and health behaviors in the literature (Kaewthummanukul & Brown, 2006). A study with older adults living in residential homes also reported that the exercise participants reported significantly more perceived benefits than those who dropped out, and consequently better performance of health behaviors (Song et al., 2004).

The findings that several motivational variables were not significant in the present study can be explained by two aspects. First, the pretest scores of self-efficacy and emotional salience were already relatively high (item means = 3.2 and 3.7 respectively in 4 point scale), so the intervention effects could be limited due to ceiling effect. The other reason may be due to the selection of the instrument that has more general target behavior (health behaviors) in this population. Self-efficacy has been proven to have major influence on behavioral modification, especially when is targeted for a specific behavior such as exercise or diet, rather than health behaviors in general. When the target behavior of self-efficacy is more general such as overall health behaviors as the case of this present study, the influence of self-efficacy on the target behavior tends to be weak (Song et al., 2004). A randomized intervention study for older adults showed that individuals in the exercise program experienced significantly improved in exercise efficacy than the control group, but reported not significant in efficacy to 'adhere to exercise' that was more general target (Hughes et al., 2004). Since the target behavior of self-efficacy in the present study was health behaviors which were more general than each specific health behavior, it may be less effective to improve self-efficacy by the exercise intervention.

The limitation of the study findings can be considered as the following points. Although the group assignments were made randomly by computer assigning numbers of excel program, the number of subjects for each group were relatively small and individual variance (within group variance) could reduce the study power. The difference scores between pretest and posttest were used for the final analysis to consider individual variance at the pretest, but the small sample size and high dropout rates (48%) should be considered in interpreting the results. In addition, the study period of 12 weeks was considered long enough to lead significant changes in perceived benefits and behavioral modification, but not enough to result in significant improvement of other motivational variables. Further study would be required to determine the motivational variables that lead to lifestyle modification in long term.

CONCLUSION

The study findings reveal the potential effect of Tai Chi exercise program to apply to the patients with osteoarthritis in a long-term basis. According to the findings, a Sun-style Tai Chi exercise could be applied to those with osteoarthritis in outpatient clinics or public health centers if they are not in acute inflammatory stage to lead successful behavioral modification by reducing arthritic symptoms. There is a need to develop the long term management strategies for the population with chronic illness, because they are required to engage in

health behavior including exercise longer than 3-6 months to have beneficial effects. Therefore, the program needs to provide comprehensive services to assess individual physiological and psychological needs, to teach the benefits and barriers via health education and counseling, and it should use an exercise program that is enjoyable and safely applicable to this population such as Tai Chi exercise. Motivation strategies are required to improve exercise adherence to become habitual exercise, in turn will lead to healthier lifestyle and improved quality of life for those with chronic illness.

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