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**INTERNATIONAL JOURNAL OF  
 ADVANCED RESEARCH (IJAR)**

Article DOI: 10.21474/IJAR01/4192  
 DOI URL: <http://dx.doi.org/10.21474/IJAR01/4192>



### RESEARCH ARTICLE

#### TRADITIONAL CHINESE QIGONG FOR ENHANCING SPINAL MOBILITY, FUNCTIONAL INDEPENDENCE, CAPABILITY, AND QUALITY OF LIFE IN A PATIENT WITH ANKYLOSING SPONDYLITIS: A CASE STUDY.

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#### Manuscript Info

##### Manuscript History

Received: 14 March 2017  
 Final Accepted: 18 April 2017  
 Published: May 2017

##### Key words:-

Ankylosing Spondylitis, Qigong,  
 Spinal Mobility, Quality of Life

#### Abstract

The purpose of this present study was to examine whether Traditional Chinese Qigong exercise (TCQG) (MaWangDuidaoyinshu) on improving spinal mobility, functional independence capability, and quality of life in a patient with ankylosing spondylitis (AS). A 44-year-old married man (height = 1.71 meters, weight = 73kg) had been diagnosed with AS since 1999. As reported, AS patient experienced pain on bilateral sacroiliac, frequent fatigue, headaches, low back pain, knee pain, and acute anterior uveitis. Before and after 12-week intervention period, outcomes were measured with using Finger-to-Floor Distance test, Functional Independence Measure, and SF-36. In addition, AS patients used a reflection paper illustrating the influence of TCQG on AS-related outcome measures. Improvement was reported in all outcome measures, particularly for experiencing the greatest improvement in spinal mobility (an initial value of 39cm to zero) as a main clinical manifestation of AS. The findings of the present case study are encouraging, which indicates that TCQG is potentially suitable to be considered as a rehabilitation program to help this special population for enhanced spinal mobility, functional independence capability, and quality of life. To validate the effectiveness of TCQG in this special population, a randomized controlled study should be conducted with a relatively large sample size.

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#### Introduction: -

Ankylosing spondylitis (AS) is considered one of the most commonly occurring rheumatic inflammatory diseases, with an estimated 4.98 million cases in Asia [1]. The prevalence of AS often presents in the second or third decade of life [2], but the symptoms of AS may last a lifetime. Patients with AS do not only experience progressive inflammation to the axial skeleton and peripheral joints, but also experience limitations in spinal mobility from pain, stiffness, and bone ankyloses [2]. Such complications adversely affect the quality of life of people living with AS and contribute to a loss in productivity [3-6]. There is no evidence-based cure for AS due to its unclear etiology [7-9]. The current symptomatic management of AS patients focuses on pharmacological treatment (e.g. non-steroidal anti-inflammatory drugs, tumor necrosis factor inhibitors, and infliximab) [9-12]. Complementary

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and alternative methods (e.g., physiotherapy, physical therapy, and balneotherapy) are also effective in assisting pharmacological treatment [13-15].

In recent years, exercise has been recommended as a non-pharmacological lifestyle therapy in the symptomatic management of AS because of its anti-inflammatory properties that prevent the progression of chronic disease [17-19]. A great number of studies were involved utilizing a variety of moderate exercise training programs (e.g., Pilates, McKenzie, Heckscher, and Global Posture Reeducation) as interventions for improving health-related outcomes in AS patients [14; 20]. Components of these exercise programs are comprised of breathing exercises, chest expansion, muscular strength, mobility and flexibility, and cardiovascular exercise [21]. AS patients in these supervised or home-based individual exercise programs have been shown to gain improvements in AS-related symptoms (e.g., disease activity, and spinal mobility) and quality of life following a two to four intervention sessions weekly for six to twelve weeks [22].

Traditional Chinese Qigong exercises (TCQG) worldwide originate from China and have a history of more than four thousand years. TCQG exercises (e.g. Taichi, Baduanjin, and Daoyishu), characterized by gracefulness, softness, mindfulness, and gentleness [23-26], have been shown to have the positive effect on alleviating symptoms individuals with different rheumatic inflammatory diseases such as Tai Chi Qigong for knee Osteoarthritis [27, 28] and fibromyalgia [29 - 31]. Particularly, researchers recently used a single-blind, randomized controlled study to compare the effect of a 52-week TCQG (Tai Chi) intervention versus physical therapy for 204 individuals with knee osteoarthritis. The findings of this study are very encouraging because TCQG has been shown to be as effective as physical therapy in the treatment of knee osteoarthritis [32].

Although TCQG exercise is shown to have positive effects on health-related outcomes in individuals with rheumatic diseases, previous literature was limited regarding TCQG exercises for Ankylosing Spondylitis as the most common of the rheumatic diseases that specifically affect the spine. Therefore, in the present study, we explored the effect of TCQG on spinal mobility, functional independence capability, and quality of life in an AS patient.

## **Methods:-**

### **Participant:-**

A 44-year old married man (height = 1.71 meters, weight = 73kg), had been diagnosed with AS since 1999, was referred to a TCQG training program in 2016 by a rheumatologist from a hospital of East Coast of China. As reported, an onset of AS-related pain on bilateral sacroiliac took place on June 15, 1998, subsequently leading to frequent fatigue, headaches, low back pain, knee pain. He had been experiencing acute anterior uveitis at some times during the course of the disease since 2014. Three biochemical indices were measured prior to the beginning of the present study, including normal Erythrocyte Sedimentation Rate, 15mg/L for C - reactive protein, a positive expression of human leukocyte antigen B-27.

He started smoking since he was 26-year old, with an average number of 10 cigarettes a day. He considered himself as a middle class with a sedentary lifestyle because he has been working in the information technology industry. To date, AS-related medical charges had reached roughly 50,000 dollars, which mainly involved three different types of drugs purchase. (e.g., Sulphasalazine, Methotrexate, and Celebrex). More specifically, he had been involved with the pharmacological treatments for seven years and dosage as follows: six pieces daily with Sulphasalazine, four pieces weekly with Methotrexate, and one piece daily with Celebrex. However, of the three types of drugs, only Celebrex was reported to have a positive effective on alleviating AS-related symptoms such as pain and stiffness. Before being referred to this TCQG training program. He ironically described "I am a sophisticated AS patients with roughly thirty years of disease duration. With the passage of time, I have gradually experienced deformation of the spinal column, which completely makes me lost confidence and determination of continuing with treatment."

### **Outcome Measures:-**

Spinal mobility was measured using Finger to Floor Distance (FFD) test. According to Perret, Poiradeau, Fermanian, Colau, Benhamou, and Revel [33], the FFD has excellent criteriarelated validity ( $r = .96$ ) and inter-observer reliability ( $ICC = .99$ ). For the FFD test, AS patient was asked to bend forward and attempt to reach the floor with his fingertips. A student physician who was blinded to the purpose of the present study measured the distance between the AS patient's middle finger and the floor using a ruler. An average score was obtained by

dividing the total score of two trials by two. A higher score indicates more severe spinal mobility, which may be attributed to the fact that the forward bending is one of the more painful and limited movements [34].

The level of a patient's ability to carry out activities of daily living was measured using Functional Independence Measure (FIM), with an excellent international consistency (Cronbach's alpha for total = .91; for FIM motor = .91; for FIM cognitive = .90) and interrater reliability ( $r = .95$ ) [35; 36]. FIM mainly involved both motor and cognitive function consisting of 18 items (motor tasks = 13 and cognitive tasks = 5): eating, grooming, bathing, upper body dressing, lower body dressing, toileting, bladder management, bowel management, bed to chair transfer, toilet transfer, shower transfer, locomotion (ambulatory or wheelchair level), stairs, cognitive comprehension, expression, social interaction, problem-solving, and memory. Each task was rated according to a 7-point ordinal scale (1 = complete dependence to 7 = complete independence). A total score for cognitive (ranging from five to 35) and motor function (ranging from 13 to 91) can be computed, so a total of FIM can be obtained ranging from 18 to 126. Higher scores indicate better functional independence capability to carry out activities of daily living.

The 36-item Short-Form Health Survey (SF-36), an internationally recognized, multidimensional, easily administered instrument, is widely used by health professionals worldwide to evaluate quality of life (QOL) because of high validity (Cronbach's alpha for each dimension ranging from .72 to .94) and reliability (split reliability = .778) [37-39]. SF-36 contained eight dimensions: physical functioning; role limitations due to physical health; role limitations due to emotional problems; energy/fatigue; emotional well-being; social functioning; pain; general health [4; 40; 41]. The total scores were computed, ranging from zero to 100, with higher scores indicating greater better health status [42]. *Intervention*

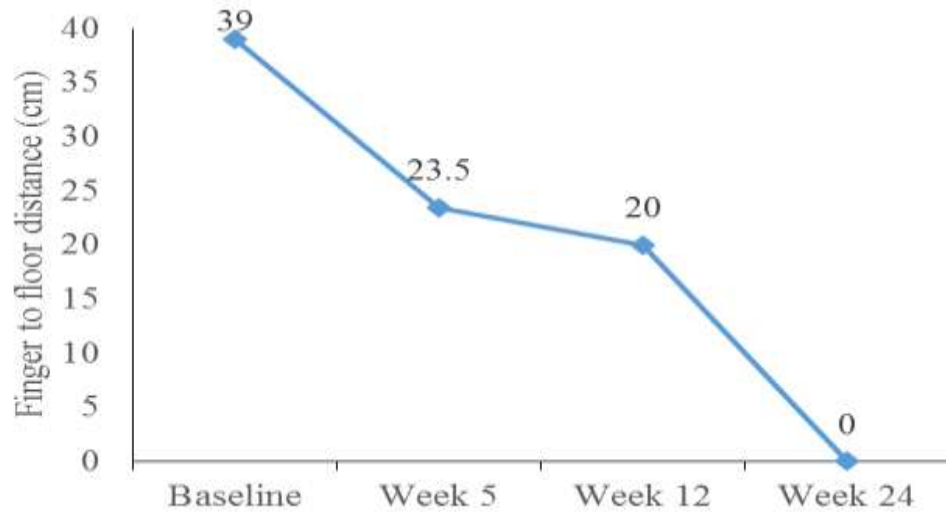
As patient experienced 75-minute TCQG session once per week for 12 weeks, taught by an experienced Tai chi master (8-minute warm up and 7-minute cool-down exercises, respectively, and 60 minutes for TCQG practice). The Tai chi instructor explained the form and technique of each movement along with appropriate demonstrations. The TCQG contained 13 basic movements associated with deep breathing, chest expansion, trunk rotation and bending, hip extension and flexion, flying bird movements, opening and closing the hands, and waving hands in the clouds. Also, AS patient was given a TCQG DVD so that he was able to perform a 20-minute home-based practice daily (please see attachment about home-based daily practice, including practice duration, heart rate before and after practice).

#### **Procedure:-**

Prior to the beginning of this study, AS patient was given a consent form explaining the purpose of this study. A physician assistant who was blinded to the purpose of this study performed the FFD test at baseline and week 12, but the FFD test at week 24 was performed by AS patient's wife at home due to his scheduling conflict. Given that the purpose of this study aimed at exploring whether 12-week TCQG training was effective in health-related outcomes in this AS patient, both SF-36 and FIM tests were only performed at two-time frames: baseline and week 12.

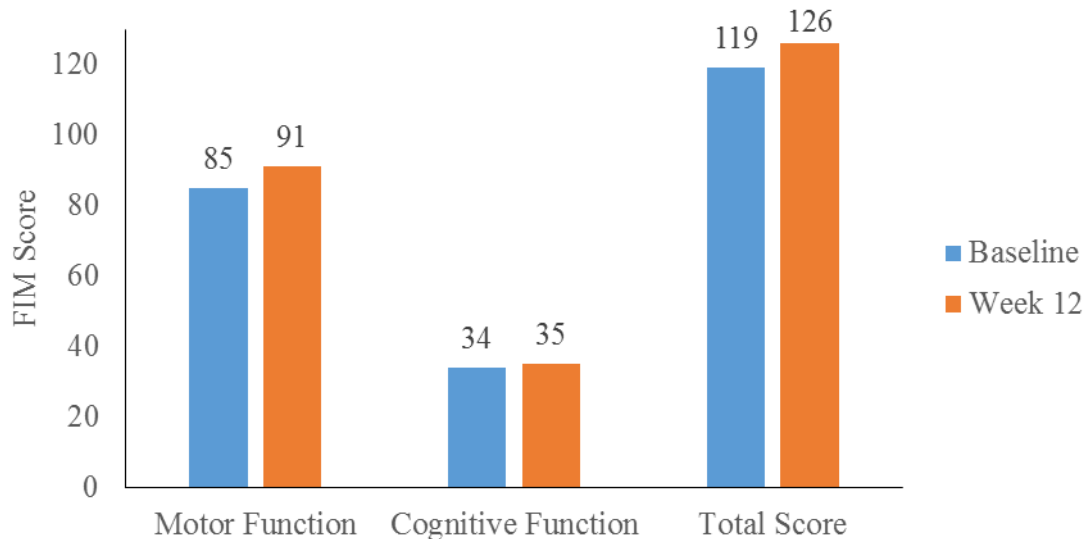
#### **Results:-**

Spinal mobility: After 12-week TCQG training period AS patient experienced a great improvement in spinal mobility from an initial value of 39 cm to 20cm. More interestingly, AS patient experienced a continual improvement from a value of 20cm to zero after additional 12week home-based practice as a follow-up (Figure 1).



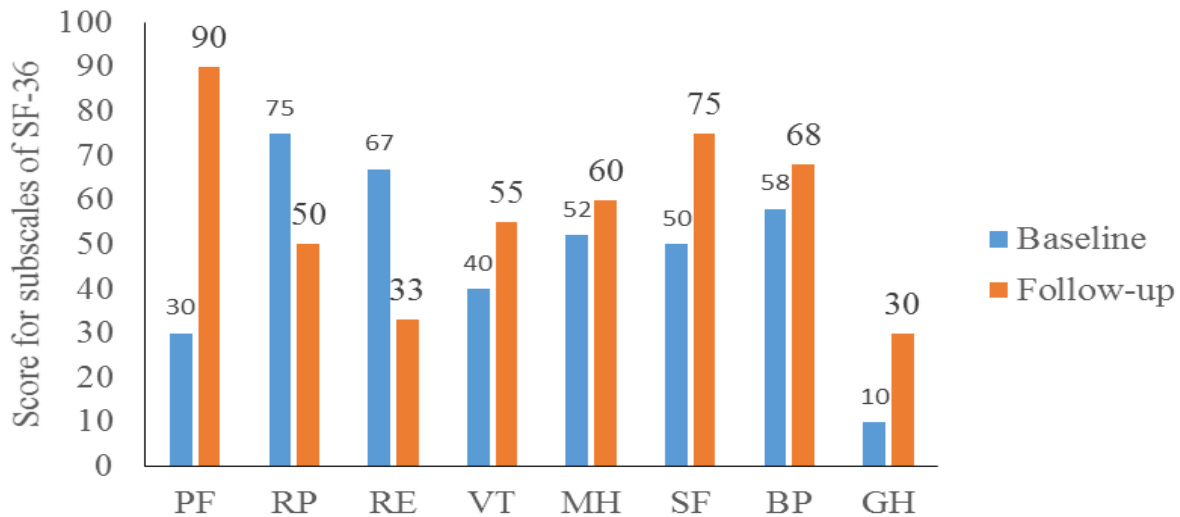
**Figure 1:-** Finger to Floor Test

Functional independence capability: AS patient experienced an improvement from an initial total score of 119 to a final total score of 126. More specifically, AS patient experienced a greater improvement in the motor function from an initial score of 85 to a final score of 91, whereas only an improvement of one point on the cognitive function was observed (Figure 2).



**Figure 2:-** Functional Independence Measure

The quality of life: AS patient experienced the overall improvement in his quality of life from an initial average value of 47.75 to a final average value of 57.625. More specifically, after 12-week TCQG training period, these improvements are mainly presented on six domains of SF-36: 1) physical functioning from an initial raw score of 30 to a final value of 90; 2) vitality from an initial raw score of 40 to a final score of 55; 3) mental health from an initial raw score of 52 to a final score of 60; 4) social functioning from an initial raw score of 50 to a final score of 75; 5) bodily pain from an initial raw score of 58 to a final score of 68; 6) and global health from an initial raw score of 10 to a final score of 30 (Figure 3).



**Figure 3:-** SF-36 Version 1.0

Note: PF = physical functioning, RP = role limitation due to physical health, RE = role limitation to emotional problems, VT = vitality, MH = mental health, SF = social functioning, BP = bodily pain, and GH = general health

### Discussion:-

TCQG had a positive effect on spinal mobility, functional independence capability, and most of the aspects of QOL in a patient with ankylosing spondylitis, suggesting that TCQG could be utilized as an alternative therapy for AS-related symptomatically management, specifically for AS patients with mild to moderate symptoms. Thus, AS patients could have enhanced the QOL through practicing TCQG.

The result of the present study demonstrating increased spinal mobility/flexibility was consistent with a previous study examining the effect of Tai Chi on FFD performance in AS patients [43]. The increased spinal mobility may be mainly attributed to its characteristics of TCQG involving bending, stretching, and rotation on four limbs and trunk (e.g., neck, thoracic, lumbar regions) while incorporating breathing techniques [44]. More specifically, rotating, bending, and stretching trunk and tendons is a way for gradually pulling the connective tissues of relevant parts of the human body, which may potentially prevent loss of joint mobility or even the force applied to the periarticular tissue contributing to the success in the joint recovery of AS patient [45]. Surprisingly, AS patient was able to touch the floor without feeling bodily pain at week 24 as a follow-up.

The improved functional independence capability, as measured by the FIM, contributed AS patient to regain the ability to carry out activities of daily living. For example, before participating in TCQG training program, he was reported to have some difficulty when he got up from his bed, particularly in the morning or assistance is needed while performing a transition from a supine to standing position. After the 12-week TCQG intervention period, he was able to stand very easily without using the chair arms. In addition, given that his profession (IT) involving considerable sitting, it may exacerbate his symptoms, ultimately leading to less workability. Therefore, improving functional independence capability through practicing TCQG does not only help him readapt daily living, but also preserve the workability he needs in order to succeed in his competitive workplace.

For the QOL, multiple dimensions were reported to have improvements after the 12-week TCQG interview period, including physical functioning, vitality, mental health, social function, bodily pain, and global health. It is reasonable to observe noticeable improvement associated with physical function and vitality due to his adherence to TCQG. The improvement on the subscale of mental health may be attributed to the fact that TCQG is widely recognized as a mindfulness-based exercise. In comparison to conventional training regimes stressing musculoskeletal toughness (e.g., resistance training, strength training, and stretching techniques), TCQG as a mind-body exercise does not only pay attention to physical development but also provides the opportunity with practitioners to cultivate internal energy that potentially improves mental health [46]. According to Gyurcsik, Bodnár, Szekanecz, and Szántó [47], moderate exercise can alleviate pain relief. Likely, TCQG as a moderate

exercise could play a similar role in relieving bodily pain. With regard to the social function, AS patient experienced a relatively great improvement. It may be attributed to the fact that this TCQG training program provided him with the opportunity to socialize with Tai Chi master, physician assistants, and rheumatologists [48]. He wrote: "I am very lucky because I found a warm and congenial family. Rheumatism and Tai Chi master dedicated their time to this exercise rehabilitation program or even sacrifice their spare time (e.g., weekend) for us to have enhanced QOL." Gyurcsiket al. [46] reported that exercise is very effective in counteracting the deterioration of AS-related symptoms. In his reflection paper, he emotionally wrote: "I feel like a TCQG characterized by slow, gentle, smooth movements on trunk and limbs is a specifically suitable for AS patients and should be incorporating into AS rehabilitation program. After adhering to TCQG for a prolonged period, I experienced a greatly increased range of motion in my neck and lumbar joint. For example, my body was so tired when I usually got home from my work. Followed by a short time of resting, then I practiced a 20-minute TCQG routine, the tiredness naturally went away and my body was more relaxed and comfortable."

The majority of conventional intervention for mild to moderate AS patients is pharmacological based, which are time and labor intensive and with side effects. In addition, in comparison to Tai Chi requiring supervision of experienced Qigong master, Mawandui Qigong only containing 13 simple moves can be independently practiced at home by watching DVD. For the practical perspective, AS typically takes place at their productive years such as 20 and 30 years old. This special population has to work in daytime, they may not be able to regularly attend supervisor-based exercise rehabilitation program due to the scheduling conflict, but homebased one would be the best fit for them for enhanced quality of life.

### Conclusion:-

The present case study has provided encouraging findings on the beneficial effects TCQG on improving spinal mobility, functional independence capability, and QOL in this AS patients.

It suggest that TCGQ could be taking into account as a rehabilitation program for AS pateints.

The current findings should be waranted with larger sample size in randomized controlled trials.

### Acknowledgements:-

The authors would like to thank the librarians from Springfield College (USA), with use of interlibrary loan.

### Competing Interests:-

The authors declare that they have no competing interests.

### Funding:-

No financial support was received for the conduct of this study or preparation of this manuscript.

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