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Pilot Study

Effects of taijiquan and qigong practice over behavioural disorders in school-age children: A pilot study

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ABSTRACT

Child development and wellness are strictly dependent on several factors among them physical activity, a proper nutrition and, of critical importance, a healthy mind. Psychopathologies like attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and conduct disorder (CD) have a direct negative impact on social, academic or occupational functioning of the affected children. If left untreated, these pathologies may progress to adulthood, thus requiring research strategies on conventional and nonconventional modalities of treatment. In this pilot study, conducted during the academic year 2015/2016, a combination of exercises of *TaijiQuan* (TJQ) and *Qi Gong* (QG) were taught to four selected children, three males and one female, aged between 6 and 10, suffering from the above mentioned behavioural disorders. The main goal was to understand if it is possible to achieve any kind of improvement in their condition, by evaluating the scores of the Achenbach Teacher's Report Form (TRF) in the beginning and ending of the experimental period. Results showed very interesting improvements in symptoms of CD, ODD and ADHD-HI (hyperactive-impulsive), while ADHD-PI (predominantly inattentive) showed only minor improvements. The overall symptom improvement was 43% across pathologies, which demonstrates that TJQ and QG may be a promising treatment of symptoms for children with behavioural disorders. More research is needed with controlled experimental designs and statistically representative samples in order to fully comprehend the versatility of these modalities.

1. Introduction

Attention Deficit hyperactivity disorder (ADHD) is a persistent pattern of inattention (ADHD-PI) and/or hyperactivity-impulsivity (ADHD-HI) that interferes with functioning or development of a child. Also, a conduct disorder (CD) is characterized by a behaviour that violates either the rights of others or major societal norms and it is usually related to aggressiveness, destruction of propriety, deceitfulness and theft. On the other hand, an oppositional defiant disorder (ODD), is a pattern of angry/irritable mood, argumentative/defiant behaviour or vindictiveness (American Psychiatric Association, 2013).

Externalizing disorder is another denomination that incorporates ADHD, CD and ODD and, as such, Marinheiro and Leal (1999) define it as a disorder that includes behaviours of no collaboration with adult requests or demands, aggression, destructivity, attention problems, impulsivity, hyperactivity, opposition, fury outbursts and other temper tantrums, stubbornness, defiance and taunts.

Whether considering them as separate (ADHD, CD, ODD) or as one (externalizing disorders), these psychopathologies have a direct negative impact on the social, academic or occupational functioning of the affected children (Garq and Arun, 2013) and, clinically speaking, have long-term significance (Cicchetti and Toth, 1991) among other risks like future felony conviction (Savolainen et al., 2015).

According to McMahon (1994), externalizing behaviours are more resistant to treatment and represent a psychological, social and economic problem. Since these disorders are visible and have impact on others, they are often easily identified by parents and

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teachers and commonly studied on infant and children psychopathology.

TaijiQuan (TJQ) and *Qi Gong* (QG), two therapeutic modalities used in Traditional Chinese Medicine (TCM) have already demonstrated several physiological and psychological benefits (Jahnke et al., 2010). These millenary practices were developed and perfected in China as a combination of exercises to enhance physical and mental health and proactively prevent illness (The Chinese Health Qigong Association, 2012). According to Windridge (1994), QG is a system of meditative exercises intended to cultivate physical and mental perfection with the purpose of conditioning the body so that it is able to resist disease, adapt to the environment and restore the correct internal functioning. It combines static, slow and soft movements with breath control and a specific mental state of "awareness" and imagination (Matos et al., 2012) On the other hand, originally a martial art, TJQ is a system of slow-moving and gentle exercises that, nowadays, are intended to promote mental and emotional awareness as well as physical health by correcting imbalances of energy within the body. The traditional viewpoint of health regulation trough physiological changes induced by QG and TJQ is that "*qi*" flows and homeostasis (balance between *yin* and *yang*) is promoted. From a Western perspective these exercises could be understood as traditional vegetative feedback exercises able to trigger vegetative functional changes (Matos et al., 2012).

The correlation between these body & mind techniques and the improvement of cognitive performance of their practitioners is of public interest. In this line of thought, recent studies have shown several benefits of QG practice, for example, Oliveira (2014) showed that QG is an important tool to fight anxiety amongst school teachers and that it exerts evident and positive effects on the autonomic nervous system, regulating and stabilizing vegetative functions. As well, as shown by Matos et al. (2015), QG is able to minimize anxiety-induced cold hands and lower anxiety-induced heart rate in trained young auditing flutists. These authors showed that the positive changes once induced and "conditioned" vegetatively were stable after weeks of training being available in critical stressful situations as part of the individual reactive repertoire. Another example is the study of Lopes (2015) that demonstrated the positive acute effect of QG in the focus and divided auditory attention mechanisms, verified by the augmented speed of reaction time.

Nevertheless, even with the increasing tendency of scientific production on this subject noticed over the last decades, more research is needed in order to fully comprehend the versatility of these modalities. With this pilot study we aim to shed some light on the topic by using the Achenbach Teacher's Report Form (TRF), a well-known behaviour rating scale, to understanding how and in which extension the practice of TJQ and QG during a school-year can affect the symptoms of ADHD, CD and ODD in school-age children.

2. Methods

This study was performed in the primary school *(EB) dos Cedros*, located in Vila Nova de Gaia - Portugal, with the approval of the directress of the group of schools *Soares dos Reis*.

2.1. Participants

The four subjects reported in this study, three males and one female, were aged between 6 and 10 years old, referenced for difficult behaviour in class and presented ADHD diagnosis assessed by a qualified clinical psychologist. A written consent from parents and tutors was required to proceed with the initial data collection. Achenbach Teacher's Report Form (TRF – ages 6–18) was used in order to obtain the scores for ADHD (ADHD-PI and ADHD-HI), CD and ODD. The test contains 113 items describing behaviour, each of which is to be rated on a 3-point scale for applicability to the child: 0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true. These ratings are combined to form eight narrow band scales or syndromes, two broad band scales, and a total problem score (Roussos et al., 1999). Reference mean scores for problem scales as a function of age, gender and referred or nonreferred condition can be found in the literature (Achenbach and Rescorla, 2001). These scores were retrieved before and after intervention, allowing us to obtain raw values that were compared between each other and with clinical and non-clinical average values, for each pathology.

The clinical and non-clinical averages used in this paper were in conformity with the validated form to the Portuguese population (Achenback et al., 2014).

2.2. Study design

The intervention was carried out during the academic year 2015/2016. A total of 30 sessions were conducted. Each one lasted for 20 min and occurred every Thursday, starting at 3pm, in a school room prepared for that purpose. School-breaks along the year resulted in a total of 5 weeks without guided group sessions. However, children were instructed to perform TJQ and QG exercises at home and whenever they felt appropriate.

TJQ *Yang* Style 8-movement form and QG *Ba Duan Jin* form were taught by a qualified QG and TJQ instructor/therapist. TJQ focused on regulation of breathing, mind focus and soft control of movements. On the other hand, QG focused in clearance of mind, slow control of movements with muscle contraction-relaxation patterns synced with breathing.

Final data collection (TRF and a structured interview to the children) was carried out by the responsible teachers after the intervention. The structured interview incorporated 4 simple and direct questions aiming to qualitatively support the quantitative data: a) How do you feel when you are practising TJQ and QG? (General feeling); b) Do you think it helps you? How? (Perception of the benefits); c) Do you like it? Why? (Pleasure of practice); d) Would you like to continue practicing next year? (Desire for continuance).

3. Results

Among the four subjects who took part of this study, all reported

Table 1
Pre and post intervention TRF scores and improvement percentage for ADHD-PI, ADHD-HI, ODD and CD for each case.

	ADHD-PI			ADHD-HI			ODD			CD		
	Pre	Post	Impr.%	Pre	Post	Impr.%	Pre	Post	Impr.%	Pre	Post	Impr.%
Case I	5	4	20.0	9	3	66.7	2	0	100.0	12	2	83.3
Case II	15	13	13.3	7	2	71.4	0	0	–	4	1	75.0
Case III	14	12	14.3	14	12	14.3	8	4	50.0	20	14	30.0
Case IV	20	19	5.0	18	12	33.3	5	4	20.0	20	12	40.0

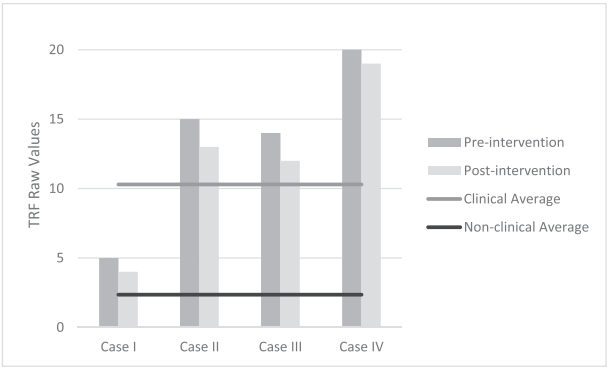

Fig. 1. ADHD-PI pre-intervention and post-intervention TRF raw values for each case and clinical and non-clinical average values.

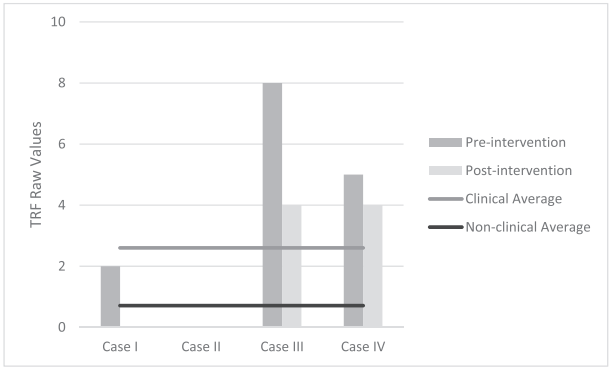

Fig. 3. ODD pre-intervention and post-intervention TRF raw values for each case and clinical and non-clinical average values.

improvements in the symptoms of the considered disorders. Of these, ADHD-PI was the one that showed less response to treatment (see Table 1) with an average improvement of 13.2%.

As can be seen in Fig. 1, minor improvements were achieved with values still above clinical average to cases II, III and IV. Case I post-treatment value came closer to the non-clinical average, however this improvement was still small as the case was already mild before treatment.

Regarding ADHD-HI, we observed an average improvement of 46.4%. Cases I and II presented the highest improvements, 66.7% and 71.4%, respectively. As shown in Fig. 2, both cases had drops on TRF values after treatment lowering values from a clinical average range to a non-clinical range. Oppositely, cases III and IV showed lower improvements, with TRF values remaining above clinical average.

Concerning ODD, we observed the second best overall average improvement across disorders (56.7%). Since no symptoms were noticed after the intervention, the TRF score of case I dropped from 2 to 0 (see Fig. 3), resulting in an improvement of 100%. Case III presented an improvement of 50% and case IV only 20% but, even so, both remained above clinical average. Case II was not considered due to absence of TRF scores before and after treatment.

While comparing all disorders the best overall improvement was achieved by CD (57.1%). The pre-intervention TRF scores of case I and II were above clinical average, falling right under non-clinical average range after the intervention (see Fig. 4), with improvements of 83.3% and 75%, respectively. Cases II and IV, even with good improvements (30.0% and 40.0%), both remained above clinical average value.

Overall, the teacher reported marked improvements in behaviour, performance and grades. In the interviews, the children reported feeling relaxed and calm during and after the practices, recognizing that TJQ and QG helped them gain control over themselves, arousing a feeling of “happiness”, and “joy” while performing the involved “kind of movements”. All of them wished to continue practicing in the next academic year.

4. Discussion

According to the Heidelberg model of TCM, known as a traditional model of vegetative system biology, these behavioural disorders may have its background development in a structural impairment or, in other words, a renal *yin deficiency*. As Greten, (2014a) says, the brain is allocated to the *renal orb* and when the renal function is weak, behaviour, mind's will and continuity, and planned/controlled behaviour are impaired. Besides that, some studies (Rietveld et al., 2004; Thapar et al., 2000; Jacobson et al., 2002; Rose et al., 2004) showed that both genetic and environmental influences are important in the development of these behavioural disorders and so, the *Jing* type of *Yin deficiency* can be related as it is described by Greten (2008) as a functional deficit, like an impaired function of the cell nucleus or a genetic deficit.

On our perspective, and following the same idea that the *renal yin deficiency* is the root of these disorders, ADHD-PI may result from a *cardio-renal imbalance* causing a lack of mental concentration and focus, known in traditional terms as *disturbance of Shen*. On the other hand, ADHD-HI may result from a *pericardio-renal imbalance* causing an elevated drive with frenetic activity and

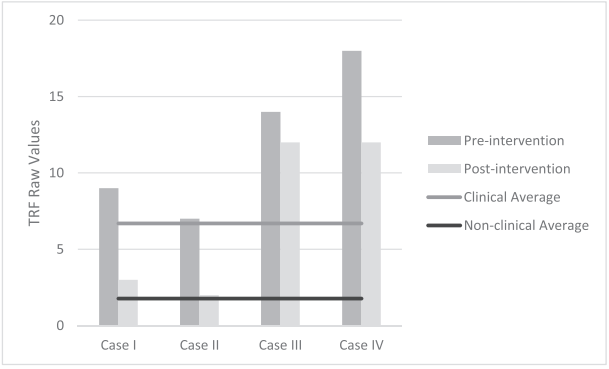

Fig. 2. ADHD-HI pre-intervention and post-intervention TRF raw values for each case and clinical and non-clinical average values.

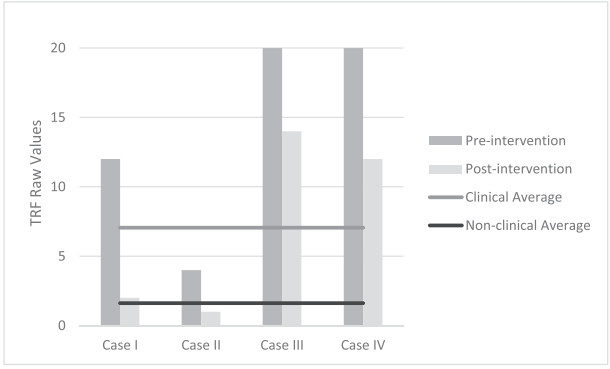

Fig. 4. CD pre-intervention and post-intervention TRF raw values for each case and clinical and non-clinical average values.

pathological over-motivation.

Since there is a big comorbidity between ADHD, CD and ODD (Harvey et al., 2016) and the possibility that the developmental pathway stands on a common psychopathological spectrum (Gosh and Sinha, 2012), in the presence of *renal yin deficiency* there is a great chance that, not only the *cardiac* and *pericardiac* but, the *hepatic* function is also affected. After all, the *renal orb* acts as a provision for the behaviour of the *hepatic orb* (Greten, 2014b) and, the last one, as mediator of general vegetative and mental excitability/irritability, which is often expressed in outputs of cholera and aggressiveness when decompensated (Greten, 2008). These signs are typical of children with CD and ODD, and are also frequent in ADHD. Also, Korngold and Beinfield (2006) state that the faculties and functions associated with the *hepatic* and the *cardiac* networks are considered to have a major influence over the tone, tempo, and clarity of behaviour and consciousness.

The 4 cases presented in this study show this comorbidity of symptoms, most evident between ADHD and CD.

According to TCM, QG/TJQ movements, breathing exercises and imagination aid the circulation of "energy" in the body, which is associated with the flow of the so called "*qi*" and "*xue*", both vegetative capacities that act together in the maintenance of orthopathy. To some authors, these exercises are the forerunner of TCM and considered to be superior to acupuncture (Windridge, 1994).

The breathing in QG and TJQ has a great importance in these cases, and both western and oriental explanations are in conformity to the thoughts being presented here. Conventional medicine understands that controlled, slow and deep breathing acts on the nervous system and induces a sense of relaxation. These relaxation techniques are shown to help address physiological manifestations of prolonged stress (Scotland-Coogan and Davis, 2016), calming the mind and stabilizing emotions. TCM considers that during breathing, the body absorbs a specific type of "energy" known as "*qi magnum*", supporting the renal function and consequently balancing the affected *hepatic*, *cardiac* and *pericardiac* functions, restoring focus, drive and relaxation, at least of course, to some extent.

The practice of QG and TJQ balances the vegetative functions and develop an intuitive awareness of subconscious self-regulation that is then programmed and learned, becoming part of the inner self-concept (Greten, 2014c).

Several studies have been developed in order to show the benefits of this kind of self-management relaxation techniques. For instance, when analysing the brain activity using a functional magnetic resonance imaging (fMRI), it was observed a suppression of brain activity and an induction of a focused mental state (Kobayashi and Koitabashi, 2016). In a pilot study using several mind-body techniques, it was observed an improvement in psychological symptoms associated with distress in medical students (Kraemer and Catton, 2016). These authors suggest the implementation of such techniques in medical schools in order to improve psychological well-being of their students.

Concerning the present study we may report that TJQ and QG showed promising results in the treatment of behavioural disorders, with an average improvement across pathologies of approximately 43%. Specifically, regarding CD, the three cases with initial values above clinical average resulted in major improvements after intervention (average improvement of approximately 57%). However, we noticed that the more severe the case is, the less improvement the intervention produces. Higher frequency and/or duration of sessions may counter this situation.

Considering ADHD, TJQ and QG had good results on ADHD-HI in all cases with an average improvement of approximately 46%. Correia (2015) came across the same conclusions in a case study where all adolescents with ADHD showed a decrease of excess motor activity and improvement of the regulation level of the autonomic nervous system. Nonetheless, none of our cases showed major improvements on ADHD-PI symptoms, with a small average improvement of approximately 13%. Again, it may be worth to state that higher frequency and/or duration of sessions should provide better results. Our results are in accordance with Duarte (2013) that showed a positive influence of QG in the levels of attention of adolescents.

Good results were found on ODD with an average improvement of approximately 57%. However, we observed better effective results in case III where this psychopathology score was greater. This may indicate that TJQ and QG are potential treatments in severe cases of ODD.

Qualitative results showed marked improvements in behaviour, school commitment and grades. All children showed positive response to practice, pleasure and perception of the benefits of TJQ and QG.

Witt et al. (2005) reported similar results after six months of QG lessons with schoolchildren showing improved social behaviour, decreased inappropriate behaviour and stable grades. Another study with adolescents suffering from ADHD showed significant improvements in anxiety, conduct, daydreaming behaviours, emotions and hyperactivity with a 2-week persistence follow-up after the 5-week intervention of TJQ classes (Hernandez-Reif et al., 2001). Both studies support and are in agreement with our findings.

We understand the limitations of this work and suggest a more in depth, extensive and controlled study with higher frequency and/or duration of intervention. We also suggest the use of other questionnaires that can be applied, for instance to parents, in order to broaden the understanding and improve the quality of results. As well, the use of different TJQ and/or QG techniques and systems or even the use of specific exercises only, such as the "white ball" exercise, which has been shown to have positive effects over anxiety and stress disorders, could be of usefulness, allowing these techniques to be compared.

5. Conclusions

The results of this study showed that TJQ and QG may be a promising treatment for symptoms of children with behavioural disorders. Actually, children often have an enthusiastic involvement with these practices showing curiosity and quick learning, leading them to the development of specific vegetative skills with obvious effects on behaviour, anxiety and emotional balance. Since that these practices may condition positive vegetative behavioural patterns we believe that TJQ and QG classes could be valuable while implemented in schools.

Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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