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INSTITUTO DE CIÊNCIAS BIOMÉDICAS ABEL SALAZAR
UNIVERSIDADE DO PORTO

The effect of Qi Gong on Attention- Deficit/ Hyperactivity Disorder (ADHD)

- *A protocol for a prospective, randomized, placebo-controlled clinical trial*

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DISSERTAÇÃO DE MESTRADO APRESENTADA
AO INSTITUTO DE CIÊNCIAS BIOMÉDICAS ABEL SALAZAR
DA UNIVERSAIDADE DO PORTO EM
MEDICINA TRADICIONAL CHINESA

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The effect of Qi Gong on Attention- Deficit/ Hyperactivity Disorder (ADHD)

– *A protocol for a prospective, randomized, placebo-controlled clinical trial*

Master thesis proposal in Traditional Chinese Medicine (TCM) submitted to Instituto de Ciências Biomédicas de Abel Salazar – Universidade do Porto.

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Resumo

Introdução: A Perturbação de Hiperatividade/Défice de Atenção (PHDA) é uma das perturbações crónicas mais comum e de acordo com os mais recentes inquéritos à população, afeta cerca 5% das crianças. Frequentemente diagnosticada durante a infância, pode persistir na adolescência e até mesmo manter-se em 2,5% da população adulta, afetando o desempenho escolar, formação académica e a vida profissional dos pacientes. Além da intervenção comportamental, é recomendada a intervenção combinada com o uso de psicofármacos. No entanto, inúmeras vezes, o sucesso deste tratamento revela-se insuficiente, podendo emergir efeitos colaterais. Consequentemente assiste-se a uma elevada procura por outras opções terapêuticas, incluindo a Medicina Tradicional Chinesa.

Objetivos: O objetivo deste protocolo de estudo é avaliar os efeitos do exercício "White Ball" Qi Gong (WBQG) em adolescentes com PHDA, (1) na atenção seletiva e concentração avaliada pelo d2 - Teste de Atenção; (2) no funcionamento do Sistema Nervoso Autónomo (SNA), através do parâmetro fisiológico variabilidade da frequência cardíaca (VFC); (3) no excesso da atividade motora avaliado pela Escala de Conners para Pais – Versão Revista (Forma Reduzida) (ECPR-R), e (4) aferir a viabilidade da integração desta terapia de biofeedback vegetativo no contexto de vida diária dos adolescentes, através de um registo de auto monitorização e auto avaliação.

Metodologia: Estudo Exploratório de Casos Múltiplo como ação preliminar a um Estudo Prospetivo Randomizado com Controlo Placebo.

Critérios de Inclusão: Adolescentes com idade entre os 11 e os14 anos, com diagnóstico de Perturbação de Hiperatividade/Défice de Atenção (PHDA) por um médico especialista independente (pedopsiquiatra, pediatra ou neuropediatra), com intervenção farmacológica estável há mais de 3 meses, cujos pais assinem o consentimento informado, pressupondo a participação voluntária do adolescente.

Critérios de Exclusão: Adolescentes com perturbação mental, incapacidade intelectual (perturbação do desenvolvimento intelectual) ou outros handicaps relevantes que constituam um obstáculo à realização dos exercícios de Qi Gong.

Intervenção: Os participantes receberam, duas sessões por semana, do exercício WBQG com duração aproximada de 10 minutos, por um período de quatro semanas. Os participantes tiveram ainda como tarefa, realizar diariamente o referido exercício e registar esta ocorrência num registo de auto monitorização.

O impacto da intervenção foi avaliado através dos seguintes parâmetros:
- Parâmetros Principais: d2 - Teste de Atenção e estudo da Variabilidade da Frequência Cardíaca (VFC), em momento de linha de base (T0), 2 semanas após a intervenção (T1), 4 semanas após intervenção (T2) e 1 semana depois do fim da intervenção (follow up).
- Parâmetros Secundários: Escala de Conners para Pais – Versão Revista (Forma Reduzida), em momento de linha de base (T0) e após 4 semanas de intervenção (T1) e registo diário de automonitorização da tarefa.

Resultados: Atendendo aos casos clínicos apresentados e após quatro semanas da prática continuada do exercício WBQG, os resultados sugerem o efeito positivo do Qi Gong em adolescentes com PHDA, traduzido: 1) no aumento da atenção seletiva e da capacidade de concentração; 2) na diminuição do excesso de atividade motora; 3) no aumento da atividade parassimpática do SNA e regulação da função vegetativa; 4) a aceitação e possível integração desta prática de biofeedback vegetativo no dia-a-dia dos adolescentes.

Discussão/Conclusão: Apesar das limitações inerentes à realização de uma investigação assente na metodologia de estudo de caso e num contexto clínico, é possível equacionar a hipótese de o Qi Gong pode constituir-se como medida de intervenção terapêutica na PHDA, no sentido de aumentar os níveis de atenção seletiva e de concentração dos adolescentes com PHDA e regular a atividade parassimpática do SNA, com consequente ação ao nível da atividade motora.

Palavras-chave: Perturbação de Hiperatividade/Défice de Atenção (PHDA); Atenção Seletiva; Concentração; Qi Gong; Medicina Tradicional Chinesa.

Abstract

Background: Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most common chronic disorders and according to the most recent population surveys, affects about 5% of children. Often diagnosed during childhood, can persist in adolescence and even at 2.5% of the adult population, affecting school performance, academic education and professional life of the patients. In addition to the behavioral intervention, intervention is recommended in combination with the use of psychostimulants. However, numerous times, the success of this treatment proves to be insufficient, and may emerge side effects. Consequently, there is a high demand for other therapeutic options, including Traditional Chinese Medicine.

Objectives: The aim of this study protocol was to evaluate the effects of "White Ball" Qi Gong exercise (WBQG) on adolescents with ADHD, (1) on selective attention and concentration as assessed by the d2 – Test of Attention (2) in the functioning of the Autonomic Nervous System (ANS) through the physiological parameter heart rate variability (HRV); (3) on excess motor activity as assessed by the Conner´s Parent Rating Scale – Revised, Version: Short Form (CPRS-R:S); and (4) assess the acceptance of the exercises as shown by a self-assessment system.

Methodology: Exploratory Multiple-Case Study Design as preliminary action to a Prospective Randomized Placebo-Controlled Clinical Trial.

Inclusion criteria: Adolescent from 11 to 14 years, with ADHD diagnosis by an independent medical specialist (Child Psychiatrist, Pediatrician or Neuropediatrician), stable pharmacological treatment for more than 3 months, informed consent signed by the parents and voluntary participation of the adolescent.

Exclusion criteria: Mental disorder, intellectual disability (Intellectual Developmental Disorder) or other relevant handicaps as an obstacle to the performance of Qi Gong exercises.

Intervention: Training on "White Ball" Qi Gong exercise, twice a week, for 10 minutes, by a certified trainer, repeated daily at home, during four weeks and documented in a self-monitoring registration.

The intervention impact was assessed by:
Main Parameters: d2 – Test of Attention and HRV is performed before the exercises (T0), after 2 weeks (T1), after 4 weeks (T2) and 1 week after the end (follow up).
Side Parameters: Conner´s Parent Rating Scale - Revised Version: Short Form (CPRS-R: S) scale is performed before the exercises (T0) and after 4 weeks and self-monitoring is performed continuously through the study on a daily basis.

Results: According to the clinic cases submitted and after four weeks of continuous practice of the WBQG exercise, the results suggest that the positive effect of Qi Gong in adolescents with ADHD, showned: 1) in an increase of selective attention and concentration; 2) on a reduction of excess motor activity; 3) an increased of parasympathetic activity and regulation of ANS vegetative function; 4) acceptance and possible integration of the practice of this vegetative biofeedback therapy in daily life of adolescents.

Discussion/Conclusion: Despite the limitations inherent in conducting an investigation based on the methodology of case study and in a clinical context, it's possible to state the hypothesis that Qi Gong can be consideraded as a therapeutic intervention on ADHD, increasing levels of selective attention and concentration of adolescents with ADHD and regulating the parasympathetic activity of the ANS, with consequent action at the level of motor activity.

Key-words: Attention-Deficit/Hyperactivity Disorder (ADHD); Selective Attention; Concentration; Qi Gong; Traditional Chinese Medicine.

Acknowledgements

In life we're not going too far away alone, so I would like to thank all those who have accompanied me in this inspiring experience.

To the three teenagers and their parents, all the kindness and availability to participate in this study.

To my supervisors, all support and their contribution.

To Ramiro Gonçalves, all the empowerment and everything I learned from him.

To Luis Correia, the availability to share knowledge.

To Bruno Ramos, all the technical support.

To "The Magnificent Seven", particularly to Marta Pereira, all the emotional support.

To Zé Alexandre, the motivation to be focused on the task.

To my family and friends, for all support and strength along this journey.

Abbreviations and Acronyms

ADHD: Attention-Deficit/Hyperactivity Disorder

WBQG:"White Ball" Qi Gong

ANS: Autonomic Nervous System

DSM-5™: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

APA: American Psychiatric Association

HRV: Heart Rate Variability

CPRS-R:S: Conner´s Parent Rating Scale-Revised: Short Form

ICD: International Classification of Diseases

WHO: World Health Organization

FDA: Food and Drug Administration

HM-TCM: Heidelberg Model of Traditional Chinese Medicine

TCM: Traditional Chinese Medicine

TN: Total Number of Items Processed

TH: Total Hits

TN-E: Total Items Minus Errors

CP: Concentration Performance

SDNN: Standard Deviation of RR Intervals

RMSSD: Square Root of the Mean Squared Differences Between Successive RR Intervals

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I. INTRODUCTION

The Attention-Deficit/Hiperactivity Disorder (ADHD) is one of the neurodevelopment disorders with more prevalence and has aroused much interest in the field of scientific research.

The greater competitiveness, social and environmental constraints imposed by, involves increased school performance needs, regardless of individual abilities. This seems to be one of the factors responsible for a greater visibility of ADHD in children genetically and biologically predisposed (Banerjee T.D., Middleton F., Faraone S.V., 2007).

The longer school obligation, the requirement of curriculum content and the need for senior levels to avenge professionally, in a society progressively more demanding, carry with them the awakening of children with less attention span and concentration maintained and in need of more time to perform the tasks, implying the loss of school learning.

The ADHD is one of the most common forms of psychopathology in children and adolescents, leading to individual and social burdens heavy in human and economic terms, could be very disabling disorders precursor in adulthood. The diagnosis of ADHD is clinical, based on the evidence of specific behavioral symptoms of diagnosis and therapeutic approach consists in the administration of psychostimulants such as methylphenidate, and behavioural and educational strategies. It‘s estimated that about 66% of those children keep criteria for ADHD and a potentially significant number have symptoms in adulthood (Faraone S., Biederman J., Mick E., 2006).

The complexity of factors involved in the etiology and the specificity of the diagnosis of ADHD tend to hinder the implementation of effective intervention strategies, conditioning the therapeutic success. That’s why it’s important to check the effectiveness of Qi Gong as a strategy of therapeutic intervention in ADHD.

Duarte (2013) has developed a study involving 66 adolescents (12 to 14 years) belonging to three classes of the eighth grade, in order to evaluate the effect of “White Ball” Qi Gong exercise in their attention levels. Through the application of the d2- Test of Attention, the investigator found increase levels of attention from adolescents, and concludes that the exercise "White Ball" Qi Gong may be recommended for increase attention, presenting itself as a reliable, affordable strategy and without revealing side effects.

So, for what was described above and after the identifying the issue of this study, the question arises of structural investigation of this research project: "What's the effect of the continued practice of Qi Gong exercises in adolescents with Disorder Hyperactivity Disorder and Attention Deficit?"

According to Stake (1999), the design of good research questions is one of the most difficult tasks for the researcher. However, it's revealed as an essential task for proper orientation of thought investigator throughout the investigation process. Also Yin (2005) believes that the study of propositions direct attention to something that should be examined in the study, so the clarity of the questions to which seeks to respond is fundamental to the methodological decisions to be taken.

Based on this research question and complexity of ADHD, the objectives of this study are evaluate the effects of WBQG exercise on adolescents with ADHD, (1) on selective attention and concentration as assessed by the d2 - Test of Attention (2) in the functioning of the Autonomic Nervous System (ANS) through the physiological parameter heart rate variability (HRV); (3) on excess motor activity as assessed by the Conner´s Parent Rating Scale – Revised, Version: Short Form (CPRS-R:S); and (4) assess the possibility of integrating this vegetative biofeedback therapy in the context of everyday life of adolescents.

The consideration of the research question arose four research propositions:

1) the selective attention and concentration increases in adolescents with ADHD, after four weeks of intervention with WBQG exercise;
2) the level of regulation of ANS improves, after four weeks of intervention with WBQG exercise;
3) excessive motor activity decreases in adolescents with ADHD, after four weeks of intervention with WBQG exercise;
4) it´s possible to integrate this vegetative biofeedack therapy in the daily context of life of adolescents with ADHD.

Under the planning of methodological issues, the case study proved to be the most appropriate methodology to respond to the research question of this study, as a preliminar action to a Prospective Randomized Placebo-Controlled Clinical Trial.

The case study as a methodological strategy is approached by many authors as Yin (2005) and Stake (1999), among others, to which the case study may be something well defined or concrete, as an individual, a group or an organization but also as something less defined or defined in a more abstract level as decisions, programs, implementation processes or organizational changes. The case studies seem to inherit characteristics of qualitative research, being the dominant position of authors who address this methodology. Thus, and according to Latorre *et al.* (2003) case study is governed within the logic that guides the successive stages of collection, analysis and interpretation of information of qualitative methods, with the peculiarity that the purpose of the investigation is the intensive study of one or a few cases.

Ruling on the nature of the research , the authors report that in addition to the case study to be seen more emphasis on qualitative methodologies , this doesn´t mean that it cannot contemplate more quantitative perspectives (Latorre , A. Rincon, D. & J. Arnal, 2003). To Stake (1999) the distinction of qualitative and quantitative methods is a matter of emphasis, since in reality it is a mixture of both. Also Yin (2005) addresses this question emphasizing the case study as a comprehensive strategy and may include quantitative evidence and be limited to the evidence.

The development of research projects is a difficult component when performing case studies because, unlike other research strategies, case study projects aren´t yet systematized way (Yin , 2005), also putting the issue of generalization of the results. According to Stake (1999), the purpose of the case studies is to make understandable the case through the special feature. However, there are circumstances in which a case study may be able to generalize to another case, and the findings of a study may be relevant and transferable to other cases where it is assessing the individual and contextual conditions of each situation (Stake, 1999).

With regard to type of case studies and according to the number of cases in study, Yin (1993) classifies them as single or multiple. The first is based only on a single case study, and the latter study in more than one case. As its purpose is referred to the exploratory, descriptive or explanatory. Exploratory studies are aimed at defining the questions or hypothesis for further investigation, with perhaps, according to Yin (1993), the most notorious reputation. While descriptive studies aimed at complete description of a phenomenon inserted in context, the explanatory studies seek information that enables the establishment of cause - effect relationships, looking for the cause that best explains the

phenomenon studied and all its causal relationships. Depending on whether single or multiple case studies can also be exploratory, descriptive or explanatory (Yin, 1993).

Regarding the characteristics of the general design of case studies drawing, and according to Yin (2005), assuming that the cases may be single or multiple, they may also simultaneously be holistic (with an analysis unit) or incorporated (various analysis units).

This thesis " The effect of Qi Gong on Hyperactivity Disorder and Attention Deficit (ADHD)", is organized into five sections differentiated, despite their complementarity: (I) Introduction; (II) State of the Art Section in which it is carried out the theoretical framework of the theme in question, (III) Study Design, where the objectives are described, propositions research, methods and participant data collection; (IV) Results (presentation and discussion) where will be presented as clinic cases individually and the discussion of them held together; and (V) Conclusion, highlighting the main achievements, contributions, the study limitations and suggestions for future research.

II. STATE OF THE ART

To increase the knowledge within the theme under study was done a literature review about ADHD and Qi Gong, drawn up on the basis of a search in the databases Pubmed, Medline, Google Scholar taking into account the available information and the timeliness of the articles, giving particular attention to articles published in the last decade. To this end, we have used the following keywords: ADHD; Hyperactivity; Attention Deficit; Selective Attention; Qi Gong; Tradictional Chinese Medicine. Documentary research was carried out in works of reference.

This literature review is founded on three fundamental vectors: regarding ADHD aspects (history, definition and diagnosis, prevalence, etiology, associated commorbility and differential diagnosis, treatment/intervention, evolution and prognosis, selective attention); Traditional Chinese Medicine and ADHD and Qi Gong.

2.1 Attention-Deficit/Hyperactivity Disorder (ADHD)

2.1.1 Historical evolution of the concept

To increase the understanding, which is complex, of the definition, conceptualization, assessment and intervention of ADHD, it's important to approach the historical evolution of the concept.

The literature mentions probability the first references to what is referred to commonly by hyperactivity, in the second half of the XIX century. Although the first references to ADHD (or for what, at the time, he corresponded) appear to have arisen in this century.The precursor of the study was Heinrich Hoffman, a German psychiatrist, in the year of 1845, through drawings, illustrated a brief conduct of a child with hyperactivity in his storybook Zappel-Philip (Barkley R. , 2006).

However, it was George Frederic Still, responsible for the first scientific descriptions. Em1902 referred to, in a medical publication, children excessively active behavior and rough, with short attention spans, difficulties in learning and behavior problems. A set of three texts published by the *Royal College of Physicians*, describes 43 children who observed in his clinical practice, which were characterized by aggressive behavior, challenger, undisciplined, with moral control problems and of the impulses, "low levels of volitional inhibition", and as problems associated with dishonesty, cruelty, systematic disobedience and school learning problems. This disturbance was then known by the name

of "Still Disease" that points to an organic source of this problem, talking about a biological predisposition to this behavioral framework (Still, 1902; cit. Lopes, 2004).

At the end of World War I (1917-1918), the ADHD was associated with brain damage, due to the encephalitis outbreak in Europe and United States. It is considered that it was from that time that Americans began to demonstrate his interest in disturbance. At that time, many clinicians encountered a large number of children who, despite having survived this brain infection, had significant cognitive and behavioral consequences. It was observed a similar behavior of ADHD in children who survived the epidemic of encephalitis, and Hohman describes them as limited in their attention, in the regulation of the activity and impulsivity (essential symptoms related to what is now referred as ADHD) (Barkley R. , 2006). These children had also cognitive changes in memory and were socially disruptive. This symptomatology was the result of brain damage and has been designated "Post-encephalitic Behavior Disorder" (Dykman, 2005). In the 30s, Eugene Kahn and Louis h. Cohen, suggests that ADHD comes from an organic origin and develops due to a brainstem dysfunction, arising the concept of " Organic Impulsivity syndrome" (Dykman, 2005)

An equally important milestone in the evolution of ADHD' concept was the set of works published between 1936 and 1941, by Goldstein and Bradley (Lopes, 2004) about the treatment of children with different types of psychopathology. Tell us Lopes (2004),that the finding of a "paradoxical" effect of amphetamines and antidepressants in the appeasement of the signs of hyperactivity and improvement in school performance, had a strong impact. Arise then, "speculations about the neurological mechanisms underlying behavioral disorders of childhood" and with them the concept of "Minimal Brain Injury Syndrome " (Barkley R. , 2006).

Thus, in the 50s the notion of brain injury, referred to so far to describe the ADHD, gave way to the notion of "Behavioral Hyperkinetic Disturbance", that would be caused by injury or dysfunction of the diencephalon, once that was not proven evidence of brain damage in children (Dykman, 2005). The disorder would be then described as a hyperkinetic impulse disorder, characterized by restlessness, hyperactivity, decrease the attention, concentration, distraction and irritability, predicting the notion of "Minimal Brain Dysfunction" drawn by Clements and Peters, in 1962 (Barkley R. , 2006).

The period of 1960 to 1969 is pointed by Barkley (2006), as the "golden age" of hyperactivity. In fact, it was at that time that appears the "Hyperactive Syndrome of

Childhood". By this time, start, too, the differences between the North-American and European position with regard to the disorder' characterization. According to Barkley (2006) in the United States, hyperactivity tends to be seen as a relatively frequent behavioral syndrome, fundamentally characterized by higher-than-normal activity levels, not necessarily associated with a brain pathology and an extreme degree in the normal variation of infant temperament and in Europe (with the exception of the Netherlands which followed the North-American position), hyperactivity was seen as an extreme state of excess activity, very common and often associated with other signs of brain damage. Thus, diagnostic criteria, estimates of prevalence and treatment prescriptions showed considerable differences (Brakley,2006) that were expressed in DSM-III (APA, 1980), and DSM-III – R (APA, 1987), as "Attention Deficit and Hyperactive Disorder" and in ICD-9 and ICD-10, where appears the name "Hyperkinetic Disorder of Childhood" (Barkley R. , 2006).

During the 70s, arise at this time numerous studies on ADHD and, at the end of the Decade, were thousands of articles, books and published scientific texts. It's also in the 70s that hyperactivity ceases to be the essential factor of disturbance, giving greater emphasis to the attention deficit and impulsivity (Lopes, 2004). Douglas (1972, cit. in Dykman, 2005) points to the need to consider the inattention and impulsivity as persistent problems of disturbance reaffirming the importance of attention problems. As a result of those investigations, the DSM-III (1980) reconceptualizes the "Hyperkinetic Reaction of Childhood" that gives way to "Attention Deficit Disorder" name that adopts the attention problems as key symptom and not the motor activity as had been previously proposed (Dykman, 2005).

If, as stated in the 70s had emerged up a plenty of works on ADHD, the 80s stressed noticeably this trend, becoming this disorder the most studied of childhood and adolescence. Search models become technically more complex and some authors claim that couldn't always find attention problems in children with this disorder and it turns out that the instructional and motivational factors are extremely important in determining, the presence and degree of symptoms, which leads some researchers to put on a motivational model explanatory hypothesis of deficits in children with this disorder (Lopes, 2004). Yet in the 80s, further investigation pointed out the socio-ecological impact of symptoms of ADHD in children, parents, teachers, relatives and peers and in DSM-III-R (1987) was review the criteria defining the "Attention Deficit Disorder" and it happens to be referred to as "Attention Deficit Hyperactive Disorder" and included in the category of behavior disorders (Barkley R. , 2006).

The first years of the 90s were formed not only as a time of reflection on the scientific work performed in the previous decades, as well as a time of active research, especially in order to validate the models and hypotheses previously developed. Barkley, in 1990, draws attention to the fact that self-regulation is essential to characterize the ADHD (Lopes, 2004)and presents a global theory of ADHD, which applies to problems brought out the behavior a "developmental theory of self-control" (Barkley R. , 2006). According to Barkley (2006), ADHD is characterized by a lack of "behavioral inhibition", which leads to the disruption of four executive functions, related to auto-regulation, the behaviour and cognitions to impulsiveness, hyperactivity, social inconvenience and difficulty of maintenance tasks.

The trend of active investigation of the 90s, with the arrival of the year two thousand, however, with special attention to research on heredity, molecular genetics and neuroimaging. The hereditary basis of ADHD and it is estimated to have discovered "candidate genes", related to the disorder. Were also recognized new chromosomal regions that may be related to ADHD, although this area needed also further research to the proper confirmation. Doesn't had emerged, new theories about ADHD, however existing theories, abreast of advances, boosted even more research on the disturbance based on Neuropsychology (Dykman, 2005) (Barkley R. , 2006).

Ther would be more to describe the historical evolution of the concept of ADHD, concluding that the same is constituted of various perspectives, being the main purpose of all of them, finding a setting free of controversy and as consensual as possible. The first theories stifled the definition to its causes and symptoms, associating this disruption to brain damage. With the development of research, new theories emerge and began to realize that ADHD was not only its symptoms and causes and that had consequences in various fields. The investigation pointed out the impact eco-partner of the symptoms of ADHD, with special emphasis on the family and school. Later, it was found the persistence of these behaviors during adulthood, determining the importance of treatment

2.2 Diagnosis and Clinical Presentation

2.2.1 Diagnostic Criteria

Regarding to the nonspecific symptoms of ADHD, the diagnosis may become problematic. On the other hand, there is no objective examination findings or diagnostic allowing additional tests confirm or rule out the diagnosis. Therefore, it is a clinical diagnosis, based on behavioral criteria that are subject to the subjectivity of the evaluation. Despite the structural and functional abnormalities, image studies doesn't serve as diagnostic method, and doesn´t indicated no additional examination, laboratory or imaging (American Academy of Pediatrics, 2000).

The ADHD is described in two manuals of disease classification, Diagnostic and Statistical Manual of Mental Disorders (DSM), of the American Psychiatric Association (APA) and the International Classification of Diseases (ICD) of the World Health Organization (WHO). Although presenting different designations (Attention- Deficit/Hyperactivity Disorder, on the DSM-V ™ and Hyperkinetic Disorder on the ICD-10), the current perspective is that the two manuals tend to approach with regard to diagnostic criteria for this disturbance. However, this approach doesn't yet a consensus, since, according to Taylor *et al*. (2004), at the time of submission of the *European Clinical Guidelines for Hyperkinetic Disorder*, refer to these designations must coexist, since present different diagnosis schemes. (Taylor E. et al., 2004). This difference lies in how the symptoms are organized by categories or areas in two manuals. In the case of ADHD is considered that to make the diagnosis, must be present problems in one of the defined areas (hyperactivity, attention and impulsivity), while as regards the Hyperkinetic Disorder should register problems in all areas.

However, and in accordance with the latest recommendations, will be considered for diagnosis behavioral criteria thus defined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5$^{TM),}$ of American Psychiatric Association (APA).

According to this diagnostic manual, ADHD is characterized by a persistent pattern of inattention and/or hyperactivity-impulsivity, interfering with the functioning or development of the child, with significant impact on its performance in various contexts of life (APA, 2013).

The symptoms must occur with a maladaptive intensity and inconsistent with the subject's level of development, persist for at least six months, arise before 12 years of age and

interfere with or reduce the quality of social, academic or occupational functioning (APA, 2013).

DSM-5™ Diagnostic Criteria
Attention-Deficit/Hyperactivity Disorder

A. A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, as characterized by (1) and/or (2):

1. Inattention: Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:

Note: The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions. For older adolescentes and adults (age 17 and older), at least five symptoms are required.

a. Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks or misses details, work is inaccurate).

b. Often has difficulty sustaining attention in tasks or play activities (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading).

c. Often does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction).

d. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., starts tasks but quickly loses focus and is easily sidetracked).

e. Often has difficulty organizing tasks and activities (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines).

f. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g., schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers).

g. Often loses things necessary for tasks or activities (e.g., school materials, pencils, books, tools, wallets, keys, papenwork, eyeglasses, mobile telephones).

h. Is often easily distracted by extraneous stimuli (for older adolescents and adults, may include unrelated thoughts).

i. Is often forgetful in daily activities (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments).

2. Hyperactivity and impulsivity: Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:

Note: The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or a failure to understand tasks or instructions. For older adolescentes and adults (age 17 and older), at least five symptoms are required.

a. Often fidgets with or taps hands or feet or squirms in seat.

b. Often leaves seat in situations when remaining seated is expected (e.g., leaves his or her place in the classroom, in the office or other workplace, or in other situations that require remaining in place).

c. Often runs about or climbs in situations where it is inappropriate. (Note: In adolescentes or adults, may be limited to feeling restless.)

d. Often unable to play or engage in leisure activities quietly.

e. Is often “on the go,” acting as if “driven by a motor” (e.g., is unable to be or uncomfortable being still for extended time, as in restaurants, meetings; may be experienced by others as being restless or difficult to keep up with).

f. Often talks excessively.

g. Often blurts out an answer before a question has been completed (e.g., completes people’s sentences; cannot wait for turn in conversation).

h. Often has difficulty waiting his or her turn (e.g., while waiting in line).

i. Often interrupts or intrudes on others (e.g., butts into conversations, games, or activities; may start using other people’s things without asking or receiving permission; for adolescents and adults, may intrude into or take over what others are doing).

B. Several inattentive or hyperactive-impulsive symptoms were present prior to age 12 years.
C. Several inattentive or hyperactive-impulsive symptoms are present in two or more settings (e.g., at home, school, or work; with friends or relatives; in other activities).
D. There is clear evidence that the symptoms interfere with, or reduce the quality of, social, academic, or occupational functioning.
E. The symptoms do not occur exclusively during the course of schizophrenia or another psychotic disorder and are not better explained by another mental disorder (e.g., mood disorder, anxiety disorder dissociative disorder, personality disorder, substance intoxication or withdrawal).

Table1. *DSM-5™ Diagnostic Criteria of ADHD. Adapted from American Psychiatric Association (2013, p. 69-70).*

2.2.2 Specifiers

According to the DSM-5™ diagnostic manual (APA, 2013) and given the predominant symptom pattern, it's possible to identify one of three performances (former subtypes of the DSM-IV-TR): Combined Presentation, Predominantly Inattentive Presentation and Predominantly Hyperactive/Impulsive Presentation.

In this way, it is considered Combined Presentation, if are fulfilled the Criterion A1 (inattention) and Criterion A2 (hyperactivity-impulsivity); Predominantly Inattentive Presentation, in the event that criterion A1 (inattention) is filled in but not the criterion A2 (hyperactivity-impulsivity) and Predominantly Hyperactive/Impulsive Presentation if it's filled the criterion A2 (hyperactivity-impulsivity) but not the criterion A1 (inattention), during the last 6 months. (APA, 2013).

2.2.3 Diagnostic features

Individuals with ADHD feature a clinical symptomatology picture turning around three major deficit areas of behavior: inattention, impulsiveness and excessive motor activity (Rodrigues A. N., 2004), these characteristics that Barkley (1997) means of the "Holy Trinity" of ADHD.

Being as the ADHD' essential dimensions, demonstrate a degree that becomes excessive and inappropriate for the age and level of development, covering a variety of situations that put to the test the ability to be attentive, to retract movements, to inhibit impulses and regulate behavior, respect the rules, the time and the future.

According to Barkley (2006), these problematic in terms of behavior, results from a primary deficit in inhibiting behavior and according to the author's perspective, is that best symbolizes ADHD aspect (Barkley R. , 2006) and by definition, children have more difficulties to demonstrate ADHD attention than children without ADHD, of the same gender and age.

Nevertheless not so visible as hyperactivity, attention deficit is the symptom that major constraints cause at school. Children with ADHD, being evident in oversight by schoolwork, difficulty in following instructions, in losing often material, daily activities often forgotten and difficulty organizing tasks and activities. According to the APA (2013), on ADHD, inattention is behaviorally by the digression on tasks, lack of persistence, revealing difficulty on maintaining concentration and organization, without which it is challenging behavior or lack of understanding. Of all the issues related to attention, it seems that the biggest battle for children with ADHD, is to keep the attention on something, for long periods of time. The studies by Barkley (2006), indicate that children with ADHD spend less time to be attentive to what they request.

Referring to impulsiveness or behavioral disinhibition, Barkley (2002), tell us that this is a failure of personal control in response to the demands of a particular situation. According to the author (Barkley R. , 2006) children with ADHD are acting quickly without measure the consequences of their behavior; make unwarranted comments and interrupt the speech of others; give answers impulsively, without emotional control, being the target of criticism for this reason and their behavior is seen as aggressive and insensitive, giving rise to them to lose friends easily without realize why. In social terms these children are seen as "immature", "irresponsible", "rude" and "lazy", have difficulty in following instructions and do not wait for their turn when they are in game situation or when waiting in a queue. At school, easily come into conflict with their peers. Reveal great difficulty in resisting the frustration, so prefer the less labor-intensive tasks and they are offset immediately. Spend less effort and time to perform activities considered unpleasant and boring. These children are still subject to a greater risk of suffering accidents since they have a tendency to get involved in dangerous activities, without measure its consequences (Barkley R. , 2006), (West, J.; Houghton, S.; Douglas, G.; & Whiting, K., 2002).

Hyperactivity is the third central feature of ADHD and concerns the presence of excessive levels of activity. Several empirical studies have demonstrated the difference in activity between children with ADHD and children without ADHD, by monitoring their activities and daily movements (Fonseca, Ferreira, Simões, & Rebelo, 1996). Among the discrepancies

noted, Barkley (2006) highlights the school situations related to record the biggest differences between pairs (Porrino et al, 1983; cit in Barkley R., 2006). However, not all children with ADHD are hyperactive. Those that are called the attention for its motor agitation, more creased and in many more situations, if compared to the standard of other children. This symptom manifests itself in the form of restlessness, impatience, and unnecessary movements and rhythm of conversation. This children are always moving around, seems interested in everything and nothing at the same time, they're never satisfied and need constant supervision. Move permanently the hands and legs, revealing a lot of difficulty in being quiet or in being able to rest (Lopes, 2004).

Barkley (2006), considers that hyperactivity is part of the same problem that the impulsivity, as both symptoms are associated with a difficulty in inhibiting behavior. The inattetion may, according to the same author, be relate to this lack of inhibition. The explanation would be that of children with ADHD take more time to resume the task, since they manifest difficulty inhibiting their desire to do other things. Hence the problem with attention in children with ADHD, can also be a result of their problem in tackling responses inhibit around. So, these children move their attention more than their peers without ADHD, and are unable to resist the temptation to get distracted with other things, while carrying out an activity for a longer period of time, because they can't inhibit their tendency to demand for other stimuli. Thus, the central issue of ADHD would be correlated with a problem of behavior inhibition, with a delay in the development in the control of impulses (Barkley R. , 2006).

2.2.4 Differential diagnosis and associated Commorbility

One of the peculiar features of ADHD is high associated commorbility with other neurological or psychiatric disorders, present in much of the individual with ADHD, conditioning often the diagnosis and the definition of a therapeutic plan (American Academy of Pediatrics, 2000).

In situations where there is the completion of diagnostic criteria for multiple disorders, ADHD can arise in associated commorbility with many of the following disorders present. However, it’s likely that symptoms that can be interpreted as belonging to a diagnosis to integrate and are best explained by another, being critical and necessary to establish the differential diagnosis.

DIFFERENTIAL DIAGNOSIS	Oppositional Defiant Disorder Intermittent Explosive Disorder Other Neurodevelopmental Disorders Specific Learning Disorder Intellectual Disability (Intellectual Developmental Disorder) Autism Spectrum Disorder Reactive Attachment Disorder Anxiety Disorders Depressive Disorders Bipolar Disorder Disruptive Mood Dysregulation Disorder Substance Use Disorders Personality Disorders Psychotic Disorders Medication-induced symptoms of ADHD Neurocognitive Disorders

Table 2. *DSM-5™ differential diagnosis of Hyperactivity Disorder/Attention Deficit. Adapted from American Psychiatric Association (2013, p. 74-76).*

According to the *American Psychiatric Association* (2013), in the general population, Oppositional Defiant Disorder competes with ADHD in approximately half of children with Combined Presentation and about a quarter with Predominantly Inattentive Presentation. Conduct Disorder co-occurs in about a quarter of the children and adolescents with Combined Presentation, depending on age and context. Most children and adolescents with Disruptive Mood Dysregulation Disorder have symptoms which also meet the criteria for ADHD and a smaller percentage of children with ADHD has symptoms that meet criteria for Disruptive Mood Dysregulation Disorder (APA, 2013).

The Specific Learning Disorder commonly co-ocurrs with ADHD. Anxiety Disorders and Major Depressive Disorder occur in a minority of adults with ADHD, but at rates above those of the general population. Although the Substance Use Disorders are relatively more frequent in adults with ADHD than in the general population, the troubles are only present in a minority of adults with ADHD. Other disorders which can co-ocurrs with ADHD include Obsessive-Compulsive Disorder, Tic Disorders and Autism Spectrum Disorder (APA, 2013).

2.3 Epidemiology

2.3.1 Prevalence

It‘s estimated that the prevalence rate of ADHD varies according to the nature of the sample, with the method of evaluation, with the type of information source and as a function of gender, age, socioeconomic status, ethnicity and the origin of individuals. (Rodrigues A. N., 2004).

In accordance with the diagnostic manual DSM-5^{TM}, population surveys suggest the occurrence of ADHD in most cultures, a percentage of 5% for the children and of 2.5% for adults. (APA, 2013).

According to Staller (2006), the boys are three times more diagnosed with ADHD than girls, the studies, the proportion of boys compared to girls who demonstrate disruption varies between 9:1 and 3:1, depending on the sample (a sample of the community or referenced clinically). In relation to gender diferences and according to the APA (2013), in the general population, there is a higher prevalence in males than in females, with a ratio of approximately 2:1 in children and 1.6:1 in adults.

According to the American Academy of Child and Adolescent Psychiatry (Pliszka, S., Bernet, W., Bukstein, O., Walter, H., Arnold, V., Beitchman, J., et al., 2007) there´s 60 to 85% of children with ADHD that diagnosis persists during adolescence. When the diagnosis is made in childhood, the monitoring and treatment must be continued as needed. It should also be mentioned that some adolescents are without ever having been diagnosed, and the symptoms of the disorder may remain subtle in this age group. Finally, some studies suggest the existence of a variable percentage of children and adolescents who have symptoms of ADHD insufficient to establish the diagnosis, but who continue to disrupt the normal evolution of learning and educational success (Taylor E. et al., 2004)

2.3.2 Development and Course

The ADHD is most commonly diagnosed in school age, on the basis of the largest social and academic requirements. However, can also manifest itself in earlier ages, particularly in preschool age.

The first sign of excessive activity, is reported by many parents when the child is beginning to walk. However, the symptoms are difficult to distinguish before the 4 years, since it's part of the normal progression of development of any child the acquisition of certain skills such as regulating the activities, control of impulses and the increase of concentration and attention. In pre-school children, the main manifestation is hyperactivity and inattention becoming most prominent during primary school what justifies the fact that ADHD be more often identified at this time and in school context, when the inattention becomes more evident and damaging (APA, 2013).

In the early years of adolescence, the disorder is relatively stable, although some individuals suffer from a worsening course disorder due to the development of antisocial behaviour. In longitudinal follow-up studies, it was found that in 60 to 85% of cases, the diagnosis persists during adolescence (Polanczyk, G., Lima, M., Horta, B., Biederman, J., & Rohde, L., 2007). In relation to the symptoms of hyperactivity, these become less obvious in adolescence and adulthood, despite the difficulties at the level of restlessness, inattention, poor planning and impulsivity continue (APA, 2013).

According to diagnostic manual DSM-5^{TM} (APA, 2013), a substantial proportion of children highlights the persistence of symptoms until adulthood, and together the inattention and restlessness, impulsivity may remain problematic even when the symptoms of hyperactivity have already disappeared.

2.4 Etiology, Risk and Prognosis Factors

Although it's a given that ADHD is one of the most common forms of psychopathology in childhood, the various studies carried out, point to a great variability in the identification of a predominant etiology. So, depending on the country and the theoretical current, it seems that the scientific community is still divided on understanding the nature of this disorder.

The various available studies indicate that the main cause is genetic (Faraone, & Khan 2006; Pliszka, 2007) with a hereditabilidade of around 65 to 90% (monozygotic twins) (Taylor E et al., 2004; Kutcher et al., 2004). It is known that there is a predisposition or family aggregation: the risk in siblings of children with ADHD is three to five times that of the general population and parents will have two to eight times more likely to perform the diagnostic criteria (Kutcher et al., 2004). Molecular genetic studies have revealed defects in genes of 2, 4 and 5 of the dopamine, dopamine transporter and dopamine-hydroxylase, serotonin transporter gene, the serotonin 1B receptor and sinaptossomal gene-associated

protein 25 (SNAP-25) (Taylor et al., 2004; Faraone & Khan, 2006; Thapar et al, 2005, 2007).

The decrease of neurotransmitters such as dopamine, noradrenaline and serotonin, conditioned by genetic factors, cause a central catecholaminergic deregulation, which may also contribute to the pathophysiology of the disorder (Taylor et al., 2004; Faraone & Doyle, 2001). This hypothesis is supported by the therapeutic efficacy of the substances with dopaminergic and serotonergic activity.

According to the results of Neuropsychological studies, children with ADHD, have deficits in executive functions, i.e. neurocognitive processes which allow us the ability to solve problems, to achieve a particular goal (Pliszka, 2007). Several cognitive functions in excess might reveal changes, such as the processes of motivation, the deficit between the processing of the information received and the response produced, or an inability to inhibit the response properly, until it's processed all information; can also be affected, the ability to wake and task planning, as well as working memory (Pliszka, 2007; Taylor E et al., 2004).

Gene-environment interaction and not only genetic factors are likely to be decisive for the phenotype. Although, not always results with statistical significance, several studies indicate that prenatal exposure to alcohol and drugs, as well as pre-and peri-natal complications can contribute to future behavioral problems (Banerjee T.D., Middleton F., Faraone S.V., 2007).

Among other factors can also refer to food factors (sugars, dyes and preservatives, although the results of the studies are controversial), the institutionalization, or early and severe affective deprivation and exposure to toxic levels of lead (Banerjee T.D., Middleton F., Faraone S.V., 2007). Although studies have not proved the existence of a direct link between family life and ADHD, should consider various risk factors (see Chart 3) (Kutcher et al., 2004).

Genetic Factors	Heredity of around 65-90% with familiar aggregation.
Pre – and perinatal Factors	Exposure to alcohol and drugs (nicotine and benzodiazepines) during pregnancy. Low weight at birth. Prematurity. Traumatic brain injury. Anoxia.
Neurological Damage	Epilepsy.

Familiar Factors	Large family. Breakdown or parental conflict. Low socio economic level. Parental criminality. Parental psychiatric pathology (maternal depression, anti-social behaviour, substance abuse, cognitive deficits). Relational aspects (family of understanding disability, and child behavior organization, affective deprivation, early institutionalization).
Other Factors	Diet (sugars, dyes and preservatives) Exposure to toxic levels of lead (neurotoxins)

***Table 3**: Risk factors for ADHD. (Drawn from Kutcher et al., 2004 and Banerjee et al., 2007)*

The prognosis of ADHD varies according to the intensity of the symptoms and the attitudes of the environment. It should be noted that parents an educators should worry less about the cause, and more with measures that reduce the impact of this disorder in children's lives, since the quality of relations with the family and the school can mitigate or aggravate the disorder (Taylor E., Döpfner M., Sergeant J., Asherson P., Banaschewski T., Buitelaar J. et al., 2004)

The moment of diagnosis and early intervention are one of the most important factors that may condition a more adverse prognosis. In addition, the presence of co-morbidities, particularly behavioral characteristics of aggression and conduct disorder and opposition are unfavourable in the evolution of the disorder.

Also the cognitive deficit, school failure, family psychopathology (including ADHD family history), and the low socio-economic and cultural level, are factors that worsen the prognosis. It's estimated that between 30 to 60% of affected individuals can retain significant symptoms, in adulthood (Harpin, 2005). The prevalence in this age group will be 4.4%, varying this value in the literature available based on the instruments and diagnostic criteria used (Pliszka, 2007; Kessler et al., 2006).

Adults not treated will have higher rates of disturbance of conduct, labour difficulties, depression, anti-social and criminal behaviour, accidents, marital problems and abuse of alcohol or drugs. Timely intervention, aimed at improving school performance, the acquisition of skills, social and emotional compensatory mechanisms can influence the prognosis in a positive way (Pliszka, 2007; Kessler et al., 2006; American Academy of Child and Adolescent Psychiatry, 2003).

2.5 Evaluation and Intervention

2.5.1 Evaluation

According to Taylor *et al.* (2004) the child with ADHD diagnostic suspicion requires careful consideration, rather by a multi-disciplinary team, given that these children may submit query various reasons such as hyperactive or disruptive behavior in the classroom, learning disabilities, inattention, low self-esteem and relationship with parents, teachers or peers.

The assessment procedure must include a medical approach (clinical history and examination purpose) and behavioral, addressed to the three components of ADHD, attention, activity and impulses. A questionnaire should be careful to parents about the behaviors included in the DSM-V™ diagnostic criteria and if present, determine for each its duration, frequency and seriousness. It is necessary to question about the age of onset of symptoms, the context in which they occur and their impact, particularly in terms of learning (American Academy of Pediatrics, 2000).

Can also be considered a cognitive and academic assessment, although not essential to establish the diagnosis. This assessment allows you to establish a psychometric profile (psychologist) and academic performance (by professor). Thus, child can be characterised about learning skills, attention and intelligence, allowing to individualize the intervention plan (Taylor et al., 2004). According to Taylor e*t al.* (2004), it's determining the presence not only of diagnostic criteria, but also of signs or symptoms of other disorders associated with, once these disruptions are a risk factor for a less favourable evolution. In this sense, must wonder if the clinical history about low self-esteem, depressive mood, aggression and oppositional behaviors.

The direct observation may not be enlightening about the normal behaviour of children, outside the clinical consultation environment. As auxiliary diagnostic instrument, standardized behaviors scales can be used which allows the analysis and quantification of characteristics, establishing normative values, taking into account the gender and age of the child (American Academy of Pediatrics, 2000). Conners' scales completed by parents and teachers, which tell about the children' behavior, particularly in terms of attention, hyperactivity, social skills and behaviors of opposition, which shall always be interpreted in the context of an overall assessment of the child. The discrepancy in the results obtained in the questionnaires of the parents and teachers, in both directions, doesn't exclude the diagnosis, and obtain additional information (previous teachers, coaches or monitors in extracurricular activities, catechists, or other). This disparity may be due to different

expectations, levels of structure, behavioral strategies and environmental conditions (American Academy of Pediatrics, 2000).

2.5.2 Therapeutic Intervention

Taking into account the multiplicity of difficulties presented by children with ADHD in various areas of its development, it should be noted, the importance of the intervention.

Early and timely intervention is desirable, considering the consequences of ADHD. The therapeutic plan should always take into account the need to recognize ADHD as chronic condition and with potential to persist into adulthood; in most cases include drug therapy, associated or not to behavioral therapy. In this sense, the most studied forms of assistance within the framework of this disorder started the medication, behavioral intervention and cognitive-behavioral intervention. The medication has been shown to produce clearer and more long-lasting effects; the behavioral intervention is an effective aid of medication; and cognitive-behavioral intervention has proved very effective in the treatment of ADHD (Lopes, 2004).

According to Rodrigues (2005), research has demonstrated the effectiveness of pharmacological intervention in the short term and behavioral therapies. However, there is still doubt as to its use, individually or combined, due to extended impact ADHD symptoms in the life of each individual.

Accept and understand the disorder is needed, creating a therapeutic alliance between the child, the parents, the doctor and the teacher; this attitude aims, above all, the enlightenment and appropriate advice to all stakeholders, that makes it possible to implement changes in attitudes and adapt to different situations, as well as reinforce positively appropriate behaviors (Pliszka, 2007; Jensen, 2005).

The goal of treatment is to control symptoms of inattention, hyperactivity and impulsivity, improving academic performance and social skills, allowing in this way to increase the self-esteem of the child. Can be considered therapeutic behavioral and educational strategies, individualized educational support or special educational support, family therapy and extra-academic activities participation in parent groups or community support (Barkley,2002; Pliszka, 2007; Taylor, 2004). A therapeutic test with a psychostimulant, should be included as long as they are not contraindicated in association with other interventions.

2.5.2.1 Pharmacological Intervention

In the intervention of individuals with ADHD, psychostimulants are the most widely used and referred to by being presented as more effective. Given this assumption, literature and studies already carried out to prove the superior efficacy of treatments that included psychiatric drugs, regarding the use of isolated behavioral therapy (American Academy of Pediatrics, 2000; Pliska, 2007). Used since the 30s, the psychostimulants are drugs of first line in pharmacological therapy of ADHD, correcting biochemical changes, influencing the attention and impulse control. The target of numerous investigations about its safety and effectiveness, response rates of 70 to 80% (Pliska, 2007). In Portugal, the psychostimulant methylphenidate is the only available, being generally used only in children aged less than 6 years. According to studies, this drug has proved to be safe and well tolerated. Although not frequent and transient, it´s possible to verify the occurrence of the following side effects: anorexia, epigastralgias, ponders loss, nausea, constipation, insomnia, anxiety, tremors, depression or emotional lability, tics and mannerisms, headache and dizziness. Rarely justify the interruption of treatment and slight changes in the diet and/or medication schedule can mitigate them (Pliszka, 2007; Taylor et. al, 2004).

Therapeutic effects on growth, have aroused concern, and the results of the available literature are controversial. The most recent studies suggest a reduction in the expected rate of growth in the early years of treatment. This deceleration, however, does not translate into statures below average for his age, as there does not appear to be clinically significant differences in relation to controls, in adulthood (Spencer, 2006; Wilens, 2003). Also recently, another study, in which all the children interrupted treatment during school holidays (which could have influenced the result), showed no significant effect on growth rate (Pliszka, 2007).

According to the Working Group of the American Academy of Child and Adolescent Psychiatry (Pliszka, S., Bernet, W., Bukstein, O., Walter, H., Arnold, V., Beitchman, J., et al., 2007) the recommended starting dose of methylphenidate is generally 0.3 mg/kg/day, up to a maximum daily dose of 1 mg/kg/day or 60 mg (72 mg in the case of Concerta ®). In most cases where the ADHD affects essentially the academic achievement, is consensual implementation of discontinuous treatment, with disruption on weekends, holidays and vacation (days in which no increased requirement of the school). However, in more serious situations, with some very disturbing behaviors at home, it is advisable to resort to

continuous scheme. Are available several formulations, similar efficacy and time variable action, and choice will depend on the activities of each child (Pliszka S., 2007).

	Short-Acting	Mid-Acting	Long-Acting
Comercial Name	Rubifen®	Ritalina LA®	Concerta®
Dosage	10 mg	20,30, 40 mg	18,36 mg
Initial Dose	5-10 mg	20 mg	18 mg
Maximum Dose	60 mg	60 mg	72mg
Onset of action	20-60 min	30min – 2h	30 min- 2h
Time action	3 a 6 horas	6 a 8 horas	10 a 12 horas

Table 4. *Therapeutic formulations of methylphenidate (only the available in Portugal). Adaptado de Pliszka, 2007.*

The drug chosen must have a time action that may cover a whole term. The short-acting are administered in time corresponding to certain activities of children and require two or three times daily. Are the preferred choice in children weighing less than 16 kg (in which the other formulations do not allow doses low enough), or in older children, until an effective dose. The mid and long-acting formulations avoid medication time during school hours and are preferred at least in older children. Require only one taking and control the symptoms for a time interval, which can improve adherence to treatment (Pliszka S., 2007).

Advocates-whether starting treatment with lower doses and keeping adjustments, every one to three weeks, until it reached the maximum dose, there is remission of symptoms, or side effects arise (Taylor E et al, 2004; Pliszka S., 2007). The vast majority of individuals with ADHD, without co-morbidities, responds to the stimulant medication. After a sufficiently long period of treatment, in appropriate doses, there is no answer, should reconsider the diagnosis. Is particularly important to consider associated pathologies, which can be the primary cause of attention deficit or impulse control (Pliszka S., 2007).

Although they are rare situations, should take into consideration the contraindications to treatment with Methylphenidate: schizophrenia, hyperthyroidism, heart arrithymias, angina pectoris, glaucoma, hipersensibility before the medically, monoaminooxidase inhibitors, depression, arterial hypertension, ticks, pervarsivo development disorder, severe mental retardation, uncontrolled epilepsy. It's recommended monitoring of treatment a month after its inception, to evaluate the effectiveness, side effects and, eventually, a dose adjustment (Pliszka S., 2007).

According to Taylor (2004), once established effective treatment, monitoring should take place at least every six months. In all queries must verify adherence to treatment, the presence of side effects (ticks, depression, irritability, among others) and look up symptoms and behaviors that may suggest comorbilities. An annual reassessment is needed to maintain the treatment, according to the information of parents and teachers at the beginning of each school year, after an initial period without medication (Taylor E. et al., 2004).

In the case of therapeutic failure, co-morbidities or serious side effects, is recommending the use of alternative second-line drugs that are not approved by the *Food and Drug Administration* (FDA), for the treatment of ADHD. In the case of tricyclic antidepressants, risperidone, clonidine, guafancina and bupropion. The use of atomoxetine, in the treatment of ADHD, was approved by the FDA in 2002. Recently available in the national market, can be used as an alternative to methylphenidate, when coexist anxiety or ticks and has a duration of action of about 24h (Pliszka S., 2007).

2.5.2.2 Non-Pharmacological Intervention

Non-pharmacological intervention covers a wide range of situations, ranging from advice to parents when it comes to minor child behavior disorders, to the residential relocation, in cases of serious conduct problems. They may also encompass what Rodrigues (2008) designated by intermediate forms, which are those that guide for the reduction of symptoms, for modification of behaviors in the classroom, or for the modification of behavior in preschool (parents training) or in adolescence (social skills training).

Presently the forms of intervention with scientific support regarding their efficacy are: parental and teachers education; parental training (school age) and intervention in relationship parents-children (adolescents); family therapy; behavior modification in the classroom: special education; regular physical exercise; parent support groups and family support services (residential and intensive interventions), (Barkley, 2007; *cit. in* Rodrigues, 2008).

The intervention of the multimodal or combined type (Rodrigues, 2008), is the one that has shown effective results. This approach is based on the combination of drugs with other types of non-pharmacological intervention (Rodrigues, 2008) and seems to offer some advantages, particularly in reducing the complexity of the intervention with regard to the

behavioral component, once the medication acts on that level (Atkins et al, 1989; cit in Pelham & Cagney, 1999; *cit. in* Rodrigues, 2008) and reducing medication in 50%, since the intervention also produces behavioral effects (Carlson et al, 1992; cit in Pelham & Cagney, 1999; *cit. in* Rodrigues, 2008).

One of the best known and highly regarded studies - Multimodal Treatment Study of Children with ADHD – MTA - carried out by the Institute for Mental Health of USA (NINH), em 1992. In this study, were analyzed 579 children aged between 7 and 9 years, for 14 months and the main objective was to compare different intervention programs. The results showed decrease symptoms for all programs, after the intervention (Smith, Barkley & Shapiro, 2006, cit in Rodrigues 2008). However, the combined intervention proved to be the most effective, according to the data recorded in the three mom*ents of folow-up* (24, 36, 48 months) that involved the study. It was possible to verify the disappearance of statistically significant differences between the group submitted exclusively to medication and treatment combined, and a general decline of the positive effects of early intervention (Rodrigues A. , 2008).

As an essential aspect of any type of intervention, should consider the changes taking place at home, at school and in any other location or context in which the child spend some time out of their day. The critical step is to get the understanding and acceptance of the problem, bearing in mind that this isn't a disciplinary problem, or dependent of the children's will. It's favorable the adaptation of expectations and demands, as well as the modification of attitudes of parents and teachers/educators, avoiding the frequent criticism and situations leading predictably to failure (Barkley R. A., 2002).

2.6 Selective Attention and ADHD

The ability to direct attention to the enormous amount of stimuli with which we are confronted is part of a central aspect in the life of human being. The attention is a crucial process for learning, being also underlies other cognitive process, including memory, language and executive functions

The literature refers to several types or areas of attention. Among the most consistently referred to by various authors, selective attention (ability to focus attention on a particular

stimulus, ignoring other stimuli present), the divided attention (ability to give attention to two stimuli simultaneously) and sustained attention (ability to maintain attention and performance over a long period of time in a certain task, continuous and repetitive) (Baron, 2004; Strauss *et al.,* 2006; Ward, 2004).

The diagnosis of ADHD, based on diagnostic criteria of DSM-V™ (APA, 2013) (see Table 1), signals the existence of deficits in a number of areas of attention, namely: *sustained attention* ("often have difficulty maintaining attention on the performance of tasks or activities"); *selective attention* ("is often easily distracted by extraneous stimuli") and *executive attention* ("often has difficulty organizing tasks and activities") (Tsal *et al.*, 2005).

However, there has been some controversy regarding the existence or not of a level of attention deficit, when evaluated based on cognitive tests (Taylor E et al, 2004). More specifically, referring to sustained attention, Taylor (2004) considers that, in order to assert, in formal evaluation, children with ADHD manifest difficulty maintaining attention, the errors should focus essentially on the final. However, what is happening is that children with ADHD make more errors than controls, since the beginning of the test. In turn, Barkley (1997) considers that ADHD is not a deficit in terms of attention, being this symptom secondary to a primary deficit at the level of inhibitory control.

In this context, and compared to executive functions, attention deficits have been somewhat relativized. On the other hand, other studies come show what are the symptoms of inattention, and hyperactivity/impulsivity, not the best predictors of surveillance capacity deficit and even inhibition (Chhabildas *et al*., 2001). Sustained attention deficits are most pronounced and characterize most children with ADHD. Some authors considered that children with ADHD were evaluated in several cognitive measures (attention, memory, motor skills, language and executive functions), one of the main cognitive deficits in ADHD, along with inhibiting and deficits in working memory (Pineda *et al*., 2007).

In addition to sustained attention deficits, several studies show that children with ADHD also have significant deficits in selective attention (Assef, E.; Capovilla, A.; & Capovilla, F., 2007) divided attention (West *et al*., 2002) on executive attention (inhibiting responses to irrelevant stimuli) (Tsal *et al*., 2005) and the guidance of (directing attention to a particular location and redirect to a new location (Tsal *et al*., 2005). These studies show that children with ADHD have a variety of attention deficits and alert to the possibility of a deficit in executive functions constitute only one of the deficits (and not only) that characterizes ADHD as proposed by Barkley (Pineda *et al*., 2007; Tsal *et al.*, 2005).

2.7 Traditional Chinese Medicine and ADHD

According to Ni *et al.* (2014), in ancient TCM literatures there was no specialized term for ADHD as a diagnostic syndrome. However, ADHD and comorbid symptoms were described with many terms such as forgetfulness, dysphoria, injudicious, and so forth. ADHD-like symptom description and management methods can be found in many ancient Chinese medical documents (Ni et al., 2014). A Western medicine practitioner first reviewed ADHD, known as minimal brain dysfunction syndrome at the time, in a Chinese journal in 1975 (Li Xr., 1975, cit. Ni et al., 2014). In 1986, China Association of Chinese Medicine proposed ADHD diagnostic criteria and recommended Chinese herbal medicine to treat ADHD. Since then, TCM theoretic and clinical systems for treating ADHD have been developed (Ni et al., 2014).

According to the same authors, in TCM theories, ADHD is a condition affecting the mind, thought, and emotion and TCM's diagnosis and treatment of this disorder are based on the holistic and unique syndrome differentiation in TCM theories. TCM syndromes refer to the generalization of pathologic causes, organs, and the nature and the evolution of the symptoms and signs. Syndrome differentiation in TCM mainly relies on the comprehensive analysis of clinical information (symptoms, signs, pulse conditions, and tongue pictures) gathered by the 4 main diagnostic procedures: observation, auscultation and olfaction, questioning, and pulse analysis. Syndrome differentiation analysis is then used to establish therapies, such as the choice of herbs and formulae. Overall TCM symptoms are often divided into main and secondary symptoms according to their contribution to the diagnosis. The main symptoms reflect the basic attributes of the syndrome and determine the disease essence (see Table 5).

		Sympthoms
Orb Location	Cardial orb	Inattention, emotional lability, dreaminess and dysphoria.
	Hepatic Orb	Impulsiveness, hyperkinesia, irritability and lack of in self-control.
	Lienal Orb	Inattentiveness and poor memory
	Renal orb	Poor academic achievement and memory, enuresis, soreness and weakness of the waist and knees.
Repletion/Depletion	Repletion	Excess syndromes are always found in the early stage of ADHD, dominated by calor in the Cardial orb and Hepatic orb.
	Depletion	Deficiency syndromes are always found in the late stage of

		ADHD, dominated by hepatic and renal yin deficinecy.
Yin/Yang	Yin	If there is a yin deficiency, the symptoms include inattention, poor self-control, emotional lability and absent mindeness.
	Yang	If there is a yang excesso, the symptoms include hyperactivity, talkativeness, impulsiveness, willfulnes and irritability.

Table 5. Differentiation according TCM. *Elaborated and adaptaded from Greten (2007).*

The focus of TCM treatment is on the individual patient rather than the disease. According to Ni *et al*. (2014), although the pathophysiologic mechanism underlying ADHD is still not clear, it's well recognized that gene and environment interactions play a significant role in ADHD. Such interactions are well recognized in the TCM theories and treatments consider five interconnected dimensions (time-space-social-psychological-biological) which are more complex than the modern Western medical model of biological-psychological-social (Xue, C. *et al.*, 2003, cit in Ni *et al*., 2014). TCM practice is patient-oriented with an emphasis onthe overall improvement in all dimensions and TCM clinicians prescribe individually designed therapies for each patient, composed mainly of Chinese herbal medicine, with adjuvante acupuncture, tui na, Qi Gong, and diet. It has been recognized in Asian culture that chronic diseases with an unclear cause, multi-pathogenic factors, and complex pathophysiology have always been the preponderant illnesses for TCM therapy. ADHD was officially recognized as one of the preponderant illnesses in pediatric TCM in 2011 in China (Ni, X.; Zhang-James Y.; Han, X.; Lei, S.; Sun, J.; Zhou, R., 2014).

2.8 Qi Gong

Greten (2007) defines the Qi Gong as a traditional biofeedback therapy, where the patient can control voluntarily and knowingly the processes of the body, interacting with the natural energies, by integrating postural exercises, breathing, movement and meditation with vegetative stabilization properties, self-regulation of biological systems targeting body treatments with the advantage of not needing medicines and not known any side effect or dependency risk (Greten, 2007).

Qi Gong can be described as a set of exercises and body movements that aim to prevent or combat diseases, from the perspective of prolonging life and maintain good health (Dong, 2007, cit. Oliveira 2014).

Qi Gong work "the three treasures of TCM", *qi, shen* and *jing,* referring to fundamental energies necessary for human life. According to the Heidelberg Model, Greten (2007) define

qi as "vegetative capacity of functioning of a tissue or organ which can cause a feeling of pressure, tear or stream"and shen as" functional capacity to put in order the associativity of mind and emotions, thus creating a mental presence ". To the same author, the functional state of shen is evaluated by consistency of speech, by the brightness of the eyes and through the fluency of fine motor skills. Regarding the term, Greten (2007) defines it as a structuring potential ("essence"), that means the possibility of creating a structure of populations of cells and have the ability to regenerate the structure of the body. The structuring potential also refers to the potential of the structure to perform the function (Greten, 2007).

According to the model of Heidelberg, the Qi Gong exercises allow the acquisition of strength and security, enabling renal ORB and, therefore, make individuals free of anxiety. On the other hand, enabling some points of the hands can achieve a great balance and a purifier effect body and mind. With certain views you want to get a cleansing effect, which acting on the nervous system allows for pain relief and improve the image and the patient's physical and emotional representation. (Greten, 2010).

Ni *et al.* (2014) describes Qi Gong as slow movements of both dynamic and static forms. By exercising breathing and body movements, Qi Gong activates and harmonizes qi-blood. Every form and motion of Qi Gong is guided by thought and combined with slowly regulated breathing to synchronize both the inner and outer universe and to improve mental concentration. An integration of diaphragmatic breathing (deep, full, and shallow) and body movements (slow, gentle, graceful) can quell inner restlessness, quiet the mind, and slowly transfer the underlying distracting thoughts into the Qi Gong postures that concentrate attention. Long-term practicing of Qi Gong improves attention, reduces hot temper, anxiety, and irritability and thereby alleviates ADHD symptoms (Ni et al., 2014).

Attention,described in terms of TCM, is generated by directing the senses and mind to a target by some functional power called *Shen*. This term refers to a special *Qi* generated by the cardiac orb as by reducing over-associativity and distracting emotional imbalances and ambivalances (Greten, 2013, *cit. in* Duarte 2013). From the cognitive point of view, focused attention lies in the activity of the cerebral cortex and is related with higher brain functions which in terms of TCM are connected to by what in TCM is called *Shen.* According to Greten (2007), *Shen* is the functional ability to establish, put order to emotional movements and their balance as well as to the associative process, thus creating “mental presence” and is the guiding and organizing instance in a context of the body-mind concept of TCM (Greten,

2007). *Shen* is a special kind of functional capacity or energy that originates from the cardiac orb, and expresses the need of limitation of the emotions and associations (Greten, 2012). The *Shen* is derived from the cardiac orb and is a part of a complex network of interacting emotional and behavioral movements of the so-called phases. There, it acts as the inner "principal" within an inner dialogue and balance with the "counterweight" of the mindwill *Zhi* derived from genetic and substantial matter (renal orb).

The delicate balance of the *Hun* (animus, an unquiet "Wandering soul"), it´s also reigning a mental aspect of the hepatic orb creating an controlling mental and behavioral impulsivity. The counterplayer of this *Hun* is considered to be *Po* the "embodied soul" which analogous to the odem of life in Christianity brings *Qi* and life into the body substance *Yin* by the action of the pulmonary orb by the breath. In so far, the body brought to life by breathing, receives functional, awakening impulse by the *Hun* as a mental process to be controlled as to avoid inappropriate impulsivity and irritability. The *Yi* (the "one-ness") of the phases earth finally provides coherence and balance, the ability to assimilate and develop logical thoughts by the lineal orb, interacting with the sensory apparatus (,*Shen*) (Greten, 2013, *cit. in* Duarte 2013).

In the literature there are lack of studies on the effect of Qi Gong in ADHD, and would be mentioned some of them that most closely matches the subject under study.

According to Ni *et al.*, there have been few clinical trials using tai chi chuan (practices similar to Qigong) for the treatment of ADHD. Where randomized ADHD children into a tai chi chuan group (16 cases) and a control group (14 cases). In a 12-week training program, tai chi chuan was practiced 3 times per week for 45 minutes. The tai chi chuan group was superior to the control group in reducing hyperactivity and aggressiveness and improving vestibular function, proprioception, and learning abilities. Hernandez-Reif *et al.* (2001, cit, in Ni *et al*., 2014) observed 13 adolescents with ADHD practicing tai chi chuan twice a week for 5 weeks. The adolescents displayed improvement in anxiety, daydreaming, inappropriate emotions, hyperactivity, and conduct disorder, which persisted at the 2-week posttreatment follow-up (Ni, X.; Zhang-James Y.; Han, X.; Lei, S.; Sun, J.; Zhou, R., 2014).

Duarte (2013) has mentioned before, developed a study involving 66 adolescents (12 to 14 years) belonging to three classes of the eighth grade, in order to evaluate the effect of "White Ball" Qi Gong exercise in their attention levels. Through the application of the d2-Test of Attention, the investigator found increase levels of attention from adolescents, and concludes that the exercise "White Ball" Qi Gong may be recommended for increase

attention, presenting itself as a reliable, affordable strategy and without revealing side effects (Duarte, 2013)

Silva (2005) applied a medical Qigong protocol to a group of eight autistic children under the age of six. The children received medical Qigong massage twice weekly from the physician and daily Qigong massage from the parents for a five-week period, followed by daily parente massage for an additional four weeks. Standardized tests showed a decrease in autistic behaviors and increase in language development in all the children, as well as improvement in motor skills, sensory function and general health (Silva & Cignolini, 2005)

Witt et al. (2005) evaluated the effects of qigong lessons on schoolchildren in terms of their achievements at school, social behavior, and general health. A controlled intervention pilot study was conducted with children in two second-grade classes at an elementary school and in two eighth-grade classes at a high school. One class from each school received qigong lessons for 20 minutes at least twice weekly over a period of 6 months, while the control class from the same school received no intervention. Two additional classes at two elementar schools participated in the qualitative analysis only. The authors conclued the feasibility of integrating Qigong in school lessons was shown. Six months after starting qigong lessons, schoolchildren improved in social behavior and showed stable grades, while inappropriate behavior decreased, compared to the control (Witt, C.; Becker, M.; Bandelin, K.; Soellner, R.; Willich, S.N., 2005).

III. STUDY DESIGN

3.1 Issue, Objectives and Research Propositions

Research question:

- What's the effect of the continued practice of Qi Gong exercises in adolescents with Hyperactivity Disorder and Attention Deficit?

Objectives of the study:

- Evaluate the effect of Qi Gong in adolescents with ADHD.
- Evaluate the effectiveness of WBQG exercise in increasing selective attention and concentration.
- Evaluate the potential effect of WBQG exercise in the functioning of the Autonomic Nervous System through physiological parameters (heart rate variability).
- Assess the impact of WBQG exercise in excessive motor activity.
- Assess the possibility of incorporating this growing biofeedback therapy in the context of everyday life of adolescents.

Research proposals:

- Selective attention and concentration increases in adolescents with ADHD, after four weeks of intervention with WBQG exercise;
- The ANS regulation level improves in adolescents with ADHD, after four weeks of intervention with WBQG exercise.
- Excessive motor activity decreases in adolescents with ADHD, after four weeks of intervention with WBQG exercise.
- The integration of this vegetative biofeedack therapy in daily life context of adolescents with ADHD is possible.

3.2 Method

This research is part of a generically called methodological approach of qualitative research, specifically the case study.

The choice of the case study as comprehensive methodological strategy, as described by Yin (1993, 2005), appeared to be the most appropriate approach to the research question

that animates this research project, as a preliminar action to a Prospective Randomized Placebo-Controlled Clinical Trial.

Regardless of the methodological study strategy case falls within the scope of qualitative research, some authors refers the importance of using, in some research methods, both qualitative and quantitative data. The use of qualitative and quantitative data on the same research mean look at these methods in a perspective of complementarity rather than opposition (Yin, 2005) (Flick, 2004).This way of thinking the case study, is an asset to this investigation, since it allows you to use, so additional qualitative and quantitative data.

Given the categorization of Yin (2005) about the case study methodology, described in the introduction, it is possible to frame the present study in a multiple case study design (study of three clinic cases), but only to an analysis unit (the effect of Qi Gong on ADHD).

About the fact that studying three cases, in the opinion of Yin (2005), whenever possible it's preferable to study more than one case because the chances of making a good study are higher than using just a single case design. Evidence arising from multiple cases is considered more compelling and, the global study is seen as more robust and the benefits of the analytical findings could be substantial. Thus, if the conclusions are identical from the two cases, they increase the possibility of generalization. For these reasons, it should be a target to have at least two cases in the study (Yin, 2005).

3.3 Subject Study / Participants

The recruitment of participants was conducted in Medical Private Clinics.
Within the participants' selection process were applied inclusion and exclusion criteria.
As inclusion criteria, they were considered valid to participate in the study, adolescents aged between 11 and 14 years, diagnosed with ADHD attested by a medical specialist (Child Psychiatrist , Pediatrician or Neuropediatrician) independent, with stable pharmacological intervention for over 3 months whose parents signed informed consent, assuming the child's voluntary participation .

Exclusion criteria invalidated the participation of children with mental, psychiatric or neurological disorder, intellectual disability (disruption of intellectual development) or other relevant handicaps that could hinder the achievement of Qi Gong exercises.

After the identification of potential participants and in accordance with the anterior criteria, three participants were admitted to the study.

3.4 Intervention

This research was developed in the participants' house, because it seems more convenient for children and the respective parents.

Prior to the beginning of the intervention, proceeded to the explanation of the objectives of the present study and practical procedures, clarifying mutual expectations and obtaining permission of parents and children through informed consent (see Annex 1). Furthermore, it was also defined according to the duration of the study and the availability of the participants, the intervention schedule.

Later, through semi-structured interview to parents of participants, the Anamnesis Sheet was filled. In addition to the collection of information, it was asked to parents, completing the Conners' Parent Rating Scale Revised – Short Form (CPRS-R:S) (see Annex 2), before ([T0.CPRS-R:S]) and after ([T1.CPRS-R:S]) the intervention.The CPRS-R:S allows to get the parents' answers through a questionnaire that assesses the frequency of observed behavior in the last month, and due to the fact that the CPRS-R:S optimal range of administration is from 3 to 6 weeks (Rodrigues A. N., 2004), it was considered appropriate to use this data collection instrument before and after 4 weeks of intervention. The remaining measurements were performed in four stages: baseline, mid-term evaluation, post-intervention and follow-up (see Table 6).

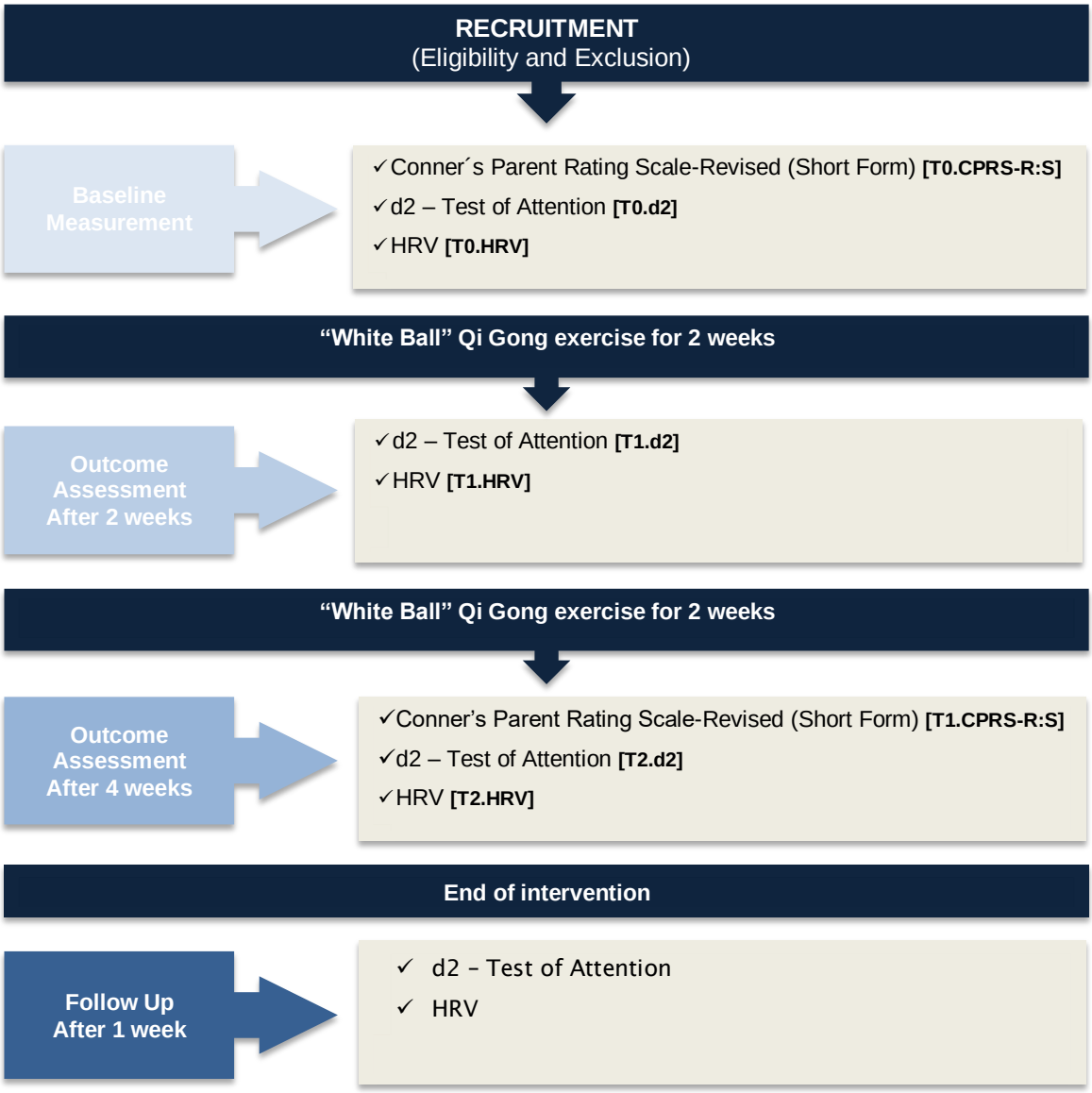

Table 6. *Intervention Flowchart.*

The participants received two sessions per week, the WBQG exercise lasting about 10 minutes, for a four-week period. Participants also had the task of daily conduct that exercise and record this occurrence in a self-monitoring register and evaluate the experience during the intervention period (see Annex 3).

According to the thinking of Western science, *Qi Gong* allows the practitioner, through their active practices and naturally, physiological and psychological mechanisms that promote self-regulation and the recovery of health, resulting in a better quality of life (Lee, Pittler & Ernst, 2009, cit. Oliveira, 2014).

To perform the exercise WBQG it was necessary that participants perform the five steps of the following script features (Greten, 2007), as shown in Table 7.

"WHITE BALL" QI GONG SCRIPT

I. THE MAN BETWEEN HEAVEN AND EARTH

Establish the internal axis for finding our subconscious through the intuitive intelligence.

For this you must follow the following directions:

1. Feel the inner body axis passes through the point R1 (*Fons Scatens),* located in the plant of the foot (Figure 1):
Put your back in the upright position.
Adjust your knees so as to fit our internal axis.
Adjust body position oscillating slightly forward and backward.

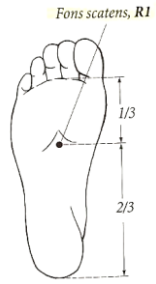

Figure 1 – Point R1 *Fons Scatens*. Adapted from Porket&Hempen (1995)

2. Connect with the ground (Earth):
Connect the point Rg20 *(Conventus Omnium Yang)* located at the top of the head (Figure 2) with internal axis.
Feel the inner axis extension toward the center of the Earth.

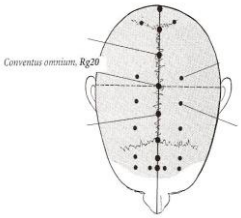

Figure 2 – Point Rg20 *Conventus Omnium Yang*. Adapted from Porket&Hempen (1995)

3. Connect to the Sky and to Olympus
Adjust again the whole body posture.
Check the connection between the points Rg20 and R1.
Check the connection to the Earth (R1) before the extension shaft upward toward the sky (Rg20).

II. THE "WHITE BALL" TO RELAX AND CLEANSE THE FLOW OF QI

Close your eyes.
Keep your arms bent in front of the *Dantian.*
Adjust the distance between the hands in order to feel the flow *o*f qi.
Expire seven times (for boys) or eight times (for girls), trying to feel the improvement of stream.

III. **FEED THE KIDNEY REGION TO STRENGTHEN THE MATERIAL/SUBSTANCE**

Close your eyes.
Relax your shoulders to improve the flow.
Receive the heat by opening the stream.
Expire to improve the flow of qi.

IV. CLOSING THE CIRCLE (CLOSE THE SURFACE TO PROTECT)

Move your hands gently.
Connect the points PC8 *Medium Palmae* (Figure 3), placing one hand over the other, with the right hand over the left for men and the left hand on the right hand for women.
Connect the PC8 points on both hands with t*he Dant*ian;

Figure 3 – Point PC8 *Medium Palmae*. Adapted from Porket&Hempen (1995)

Relax your eyes, looking into infinity.
V. THANKS FOR FINDING THE PROPER RELATIONSHIP WITH THE UNIVERSE
Bend the wrists perpendicular. Rotate the handles down. Track the movement of the hands with the whole body.

Table 7. "*White Ball" Qi Gong Script. Adapted from Greten (2007)*

3.5 Data Collection Instruments

Inherent in the data collection process, the following instruments were used: Anamnesis Sheet; Conners ' Parent Rating Scale Revised – Short Form (CPRS-R:S); d2 – Test of Attention and physiological data record in order to study the HRV.

Anamnesis Sheet

The Anamnesis Sheet is a document developed in order to collect information about medical history and development of the child or adolescent. The collection of information is made use of semi-structured interview to parents, registering data about psychomotor and emotional development of children and adolescents, risk factors during pregnancy, health issues of the child or adolescent and other family members, whether or no advance warning behavioral difficulties by the school, among other development aspects considered relevant.

Conners ' Parent Rating Scale - Revised (Short Form)

The Conners ' Parent Rating Scale - Revised (Short Form) Keith Conners, PhD (1997) , adaptation of Ana Nascimento Rodrigues (2000) – Departamento de Educação Especial da Faculdade de Motricidade Humana, Universidade Técnica de Lisboa, evaluates the behavior of children and adolescents problems getting responses from parents through a questionnaire. Coated as extremely important in the process of referral and assessment of ADHD, it's referred to in the literature as one of the oldest and most used (Fonseca, Ferreira Simões, & Rebelo, 1996) in the clinical evaluation of children and adolescents with high consistency internal and able to effectively diagnose children with behavioral problems.

With regard to its applicability in contexts of intervention, the CPRS-R:S is perfectly usable, allowing the quantification and measurement of a considerable body of behavioral problems. The scores of the scales have proven as an essential aid in treatment with medication situations, identifying the relevance, the purpose and the end of treatment. Further to this aspect, the range is also sensitive to other non-pharmacological forms of treatment (Rodrigues, 2004).

The CPRS-R:S (Conners, 1997) was developed to contain the clinically most significant derivation factors from the study complete, and all the factors and items selected to form reduced have excellent psychometric properties (Rodrigues, 2005). According to Rodrigues (2004), the reduced forms include the most relevant items and the administration of reduced forms is done in cases of limited application time and proved to be particularly useful in situations of successive applications (monitoring).

The reduced form of the Conners' Parent Rating Scale - Revised, consists of 27 items and includes four subscales of the complete form, including: A) Oppositional, B) Cognitive Problems/Inattention, C) Hyperactivity and D) ADHD Index. Each item is associated with one of the four previously mentioned subscales, although there are some common items 2 subscales. The items are made up of affirmations, and who fills have to mention the frequency of the observed behavior by the child in the last month (Conners, 1997).

The completion of the scales should be done according to a Likert 4-point scale, where values (0), (1), (2) and (3) correspond respectively to the terms "never", "a little", " often "or" very often ". The more often parents signal a value (3) "very often", the higher the value obtained in each subscale. The value of the sum of answers indicated by parents is the gross profit. To transform the gross profit in normative result (Score T and respective percentile) is required to analyze the profile of the grill (male or female) for the sex of each child. This way and given the value obtained is possible to identify the most significant problems of the child: oppositional behavior, cognitive / inattention, excessive motor activity or ADHD index.

Finally, and with respect to the psychometric properties of the CPRS-R:S, the internal consistency coefficients lie between 0.75 and 0.90 and test-retest values (every 6 to 8 weeks) 0.60 to 0.90 (Rodrigues, 2004).

d2 – Test of Attention

Developed in Germany in 1962 (date of the first version), the test d2 – Test of Attention, Rolf Brickenkamp (1962) , Portuguese adaptation of Carla Ferreira and António Menezes Rocha (2007) , CEGOC -TEA , Lisboa (see Annex 4) It is a measuring instrument that evaluates selective attention and sustained attention.

Since its first version, the d2 test has undergone several revisions (currently with eight editions in Germany) and adaptations, including the version adapted to the Portuguese population and whose validity patterns are very similar to the German original version. With regard to psychometric characteristics of d2- Test of Attention, the internal consistency coefficients are located between 0.75 and 0.9. Its applicability is vast, extending the clinical, neuropsychological and pharmacological the school and organizational areas (Brickenkamp, 2007).

According to Zillmer and Spiers (1998), (*cit. in* Brickenkamp , 2007) , selective attention refers to the ability to direct attention to a particular area of the visual field , ignoring other stimuli as sustained attention relates to ability to maintain attention focus during a given period of time. Thus and given the test manual d2, the construct of attention and concentration, it's presented against the background performing a task oriented continuously and focused way in selecting stimuli. In this process, is fundamental the ability of the subject meet, selectively, the significant aspects of a task at the expense of irrelevant aspects, by performing the task quickly and accurately (Brickenkamp, 2007).

The d2 test is a time limit and is considered a cancellation test or dam because the type of task that the subject is required (point a specific stimulus). In addition to the selective attention and the ability to concentrate, the d2 test also measures the information processing speed, precision in this process and qualitative aspects related to the performance.

The d2 test has only about one form, may be administered individually or collectively from the subject of eight and with an exposure time up to 10 minutes.

In the front of the Answer Sheet is possible to find the space for data identification, specific instructions, sample item and training item. The reverse comprises 14 lines each of 47 characters, a total of 658 characters, and each corresponding character of a letter "d" or "p" which can carry one, two, three or four lines above and / or below.

The subject's task is to look for in each row, from left to right , the letters " d " with two dashes in top, bottom or a dash above and another below , and mark them with a dash (/), having 20 seconds per line to do so.

Given the procedures for correction and calculation of d2 scores (Brickenkamp, 2007) by d2 quotation, it´s possible to check the following results:
- Total Number of Items Processed (TN) , designed to measure two dimensions of attention (selective and sustained) , as well as information processing speed (speed of execution) , the amount of work (productivity) and motivation.
- Total Hits (TH), which assesses the accuracy / effectiveness of the subject in carrying out the task;
- Total Items Minus Errors (TN - E), which corresponds to an overall performance measurement and allows to evaluate the attention and control of the inhibition of inappropriate behavior, as well as the relationship between the speed and thoroughness performance;
- Concentration Performance (CP), which allows the evaluation of concentration and the combination of speed and accuracy in performance;
- Fluctuation Rate (FR), which assesses the stability and consistency of performance of the subject during the task;
- Error Percent (% E) which allows assessing qualitative aspects of performance, such as accuracy and neatness.

All evaluation instruments included in this study have standards for the Portuguese population and, specifically, for those ages.

Registration of physiological data

In order to complement the results obtained in the previously mentioned instruments, were also assessed the physiological effects taking into account the heart rate variability (HRV). The HRV was monitored on a tablet PC, having resorted to the use of a heart monitor (with wireless receiver) and a data storage software. The data collected have been exported to an HRV analysis software, the program Kubios HRV 2.2 (Department of Applied Physics University of Eastern Finland, Kuopio, Finland, 2014).

The heart monitor (device that captures the electrical impulses of the heart through a strap with electrodes, placed on the chest of the evaluated, transmitting them to the monitor through an electromagnetic field) was the chosen device to measure HRV, given that it’s

easy to handle and transport. One of the existing heart monitor is the Polar S810 and model, citing Oliveira (2014), "according to Kingsley, Lewis and Marson (2005) presents a good accuracy in the records in low-intensity exercises when compared to the ambulatory ECG, opinion also supported by Gamelin, Berthoin and Bosquet (2006), to compare the data obtained by the ECG and the Polar S810 in exercise situations want to sleep " (Oliveira, 2014).

In the present study, the HRV measurements took place in three stages: baseline (T0), even before the study start; test-intermediate (T1) which corresponded to a period of 2 weeks after the start of the study, post-intervention after four weeks (T2) and after a week of the end of the intervention (Follow-up). During the measurements the participants adopted lying position, silent, breathing normally and with the least amount of movement possible. The collection of physiological parameters had a duration of 10 minutes, and within the possible, carried out at the same time. In order to avoid any kind of feedback during the measurements, the participants didn't have access to the register of reads performed by the device.
At the end of measurements and after obtained the analysis through specific software, proceeded to the interpretation of the parameters measured by HRV, using indicators: standard deviation (SDNN) and square root of the sum of the successive differences between normal RR intervals adjacent to the square (RMSS).

The SDNN is a concise indicator to measure HRV. The rise or fall of SDNN depends on two main nerves of the ANS: the sympathetic and parasympathetic. An increase in SDNN indicates an increase in parasympathetic activity regulation; on the other hand, a drop in SDNN indicates an increase in the regulation of sympathetic activity (Günzel Medical Consulting & Development UG., n.d, cit. Oliveira, 2014). RMSSD parameter reflects the activity of the parasympathetic part of vegetative nervous system, and an increase in parasympathetic activity RMSSD indicates high vegetative regulation; on the other hand, a drop in low activity on the indicates SDNN parasympathetic vegetative regulation. (Günzel Medical Consulting & Development UG., n.d, cit. Oliveira, 2014).

3.6 Ethical Considerations

The completion of any investigation required by the investigator compliance with ethical and legal principles, which require it to inform, to respect and ensure the rights of those who voluntarily participate in their work in relation to the methodologies used and the relationship with the subject in study.

Given this assumption, the present study was conducted with the permission of the parents of the respective participants, through the Informed Consent document explaining the objectives and procedures for the implementation of the research project. It was also clarified the possibility, at any time, the participant could leave the investigation.

With regard to the personal information of individuals, these were kept confidential, thus respecting the principle of privacy and confidentiality of the data collected, which were used only by the researcher of the study. According to the usual procedure of clinical research, all data will be destroyed later on, after the regulatory period from the date of completion of the study.

IV. RESULTS

4.1 Results Presentation

CLINIC CASE 1

Adolescent male of fourteen, attending the 9th grade of the 3rd cycle of basic education, diagnosed with ADHD, Predominantly Inattentive Presentation and stable pharmacological intervention for more than three months. The clinical condition was diagnosed by an independent specialist doctor (neuropediatrician) independence in December 2013, for whom the adolescent continues to be monitored. Currently taking 36mg Concerta® (methylphenidate), only during the school period. It should be noted that during the intervention period in the context of this study, which coincided with school holidays, the taking of the medication did not happen.

The family has a medium-high socioeconomic level, exercising his father occupation entrepreneur and mother, occupation of engineer. With regard to qualifications, the father has the 12th grade and the mother degree in Agricultural Engineering. The family values school and reveals implementation capacity of educational and intervention strategies that appear to be most appropriate.

Only son of the couple, the pregnancy was unplanned, though desired and guarded, with eutocic birth without complications.
In the family history there are no records or other psychiatric illness, including ADHD (at least declared and / or diagnosed).

The chronology of the development acquisitions occurred as expected, with independent walking at 13 months, appointment of the first words at 9 months of age and sentences construction to 15/16 months.
No alterations in eating and sleeping patterns, being described in the first year of life as a quiet child who responded to the mother's smile and social interaction.

The adolescent was at home with his maternal grandmother to the three and a half years of age by the entrance to the nursery. Adaptation to pre-school education took place without difficulties. He joined the first cycle of basic education in a regular educational establishment situated in an urban area, checking out a good adaptation to it.

Throughout the school years showed good use, despite the complaints of inattention and easy distraction during class. During the frequency of the 7th grade the inattention problems intensified, when the parents sought the neuropediatrician consultation. Will start the frequency of the 10th year in a Science Course Humanistic Secondary School, namely Social and Economic Sciences.

Ate the level of social interaction, easily relates to peers and preferably with young people of their age, though also please you living with younger children, revealing patient and considerate of them. Practicing handball, football and enjoys playing computer games and Playstation® and "play" to wrestling with his father.

With regard to the intervention at the level of ADHD, the adolescent only takes the medication on time classes and regularly, never having been targeted for intervention of another kind that non-pharmacological. Parents report that the adolescent, most of the time is very inattentive, easily distracted, pays attention only when it's something of his interest and reveals a hard time concentrating in class and the symptoms improve when he uses these medication. Nevertheless, parents recognize the need for pharmacological intervention, showing some concern for the long-term effects of taking the medication, demonstrating openness to new attention control strategies.

After the implementation of the intervention strategy, as described in the previous section, we proceeded to the analysis and interpretation of the results, which then presents itself.

Regarding the use of the CPRS-R: S, first, it’s necessary to emphasize their implementation in the present study, as a characterization tool of behavior in the home environment and not as a diagnostic criterion, since one of the inclusion of participant’s criteria in the study was the existence of a previous diagnosis of ADHD by an independent medical specialist. On that basis, the implementation of the CPRS-R: S possible to quantify the presence of symptoms observed by parents before and after the intervention.

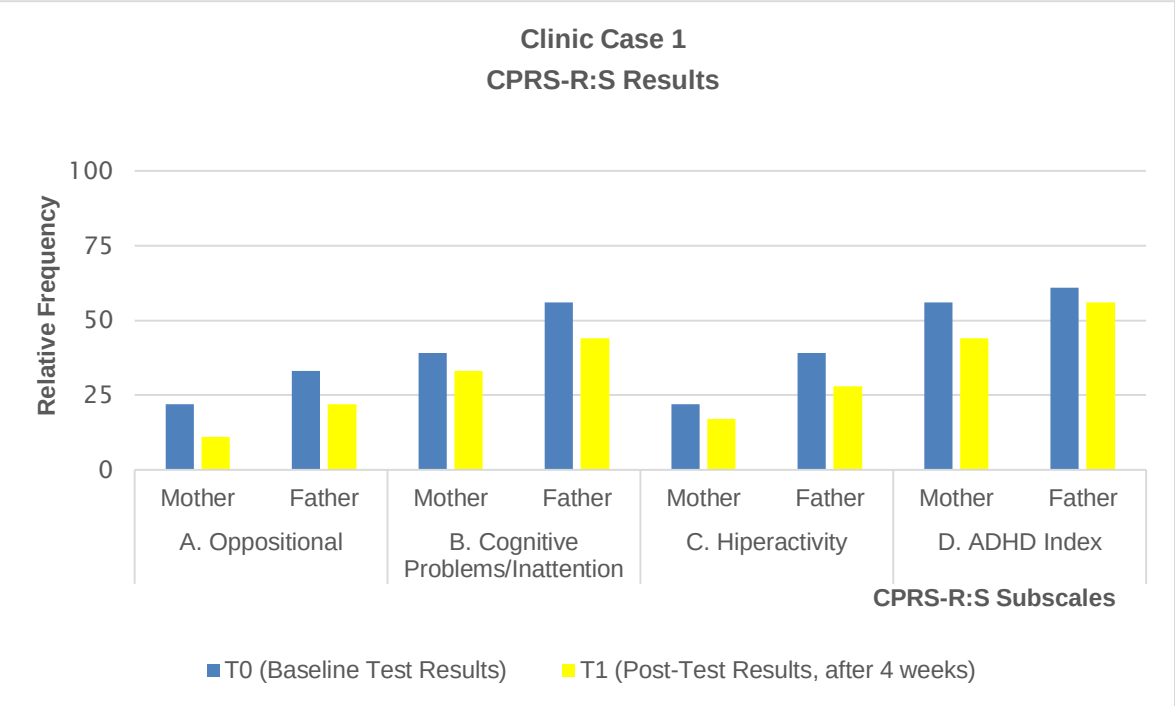

Chart 1: *Results evolution in the different subscales of the CPRS-R:S, evaluated by both parents, in moments of baseline and post-intervention.*

In view of the Chart 1 and results in the baseline moment, the father assigns a higher score on all subscales compared to the score by the mother.

Subscales B. Cognitive Problems / Inattention and D. ADHD Index were the most scored by both parents, suggesting that according to the parents, the symptoms of these two subscales, are the most frequent.

In general, post-intervention time, it is possible to observe a decrease results in all the subscales CPRS-R: S, indicating a decrease in the frequency of problem behaviors that feature.

As regards the results obtained in D2 Test of Attention, and Chart 2 considering the data obtained in the baseline time, in general terms, they suggest that the adolescent presents a capacity concentration / attention higher than the average. The overall performance (TN-E), as well as its concentration capability (CP) are superior to the subject of his age group as the results are the 75 percentile and 60, respectively. The subject was able to perform effectively the task (TH), a good showing an information processing capability (TN).

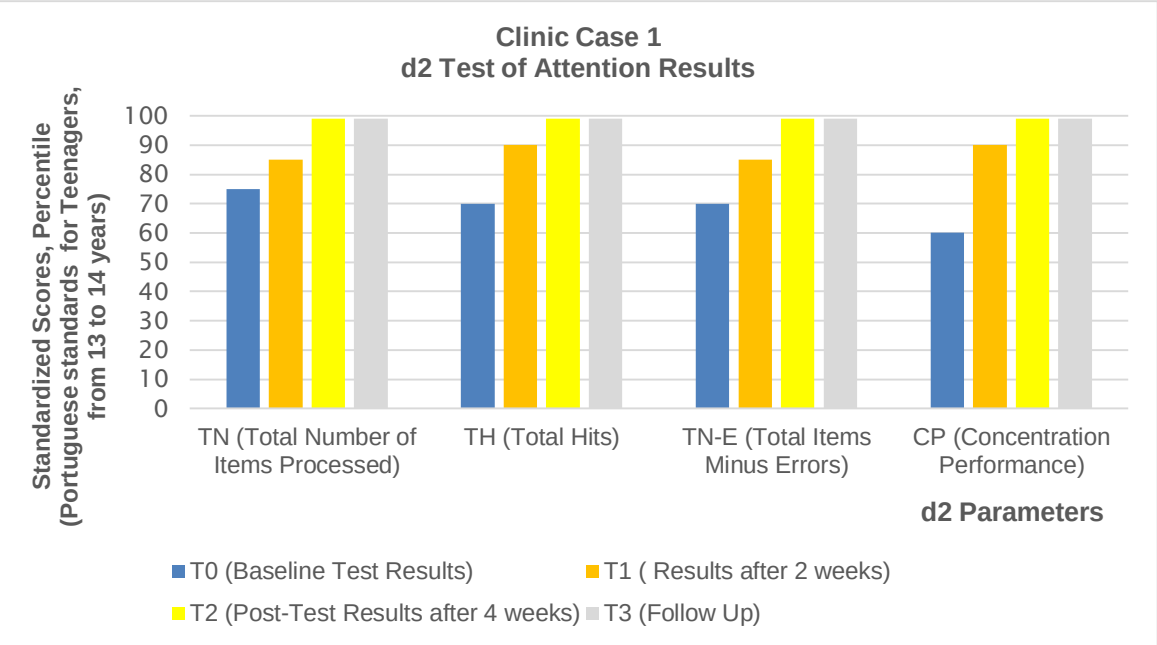

Chart 2: *Results evolution in the different parameters of the d2-Test of Attention, in moments of baseline, mid-term evaluation, post-intervention and follow-up.*

Given the results obtained in the different stages of evaluation, it's possible to observe an increase in results in all parameters evaluated by the d2 test. From baseline to post-intervention time, there is a significant improvement in terms of information processing and the amount of work done (TN), precision and efficiency in performing the task (TH), the overall performance (TN-E), with special emphasis on attention span (CP). Also in relation to the results shown for this last item (CP), also stands out the fact that increasing your score be related not only with the total number of characters marked correctly, but also by reducing the total of dialing errors of extraneous characters (E2).
Comparing the results obtained in T2 (post-intervention) with the results of follow up, there were no significant differences.

As regards the study of the HRV, will be considered for the analysis the values of SDNN and RMSSD parameters.

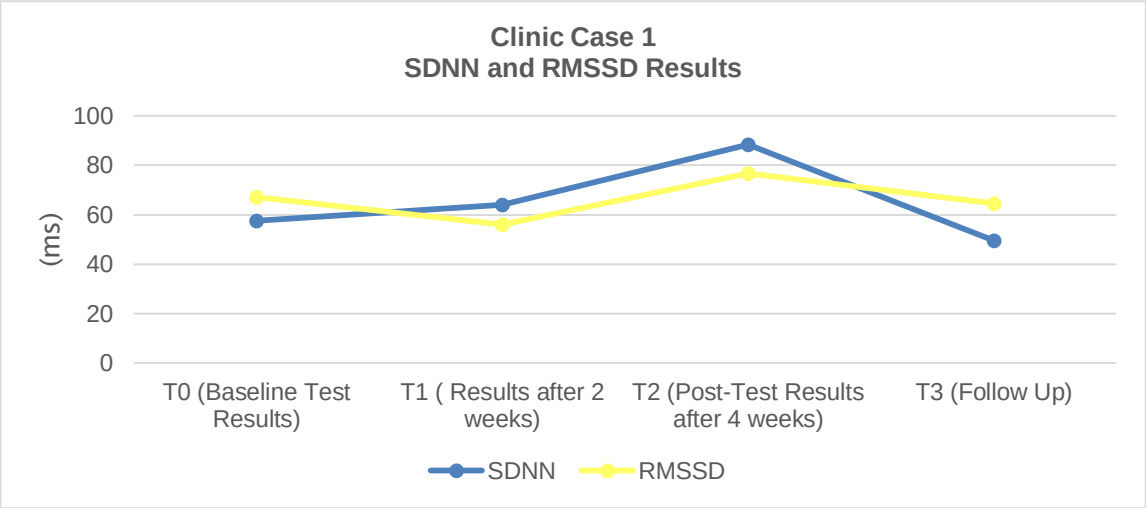

Chart 3: *Evolution of the SDNN and RMSSD parameters at baseline, mid-term evaluation, post-intervention and follow-up.*

For SDNN and RMSSD parameters we can observe a significant increase in the baseline time for the post-intervention time. Comparing the obtained results in T2 (post-intervention) with the results of follow up, there is a decrease in the value of both parameters, approaching the T0 values (baseline).

According to the registration of self monitored daily WBQG completion of the exercise, it appears that the adolescent performed every day proposed task.

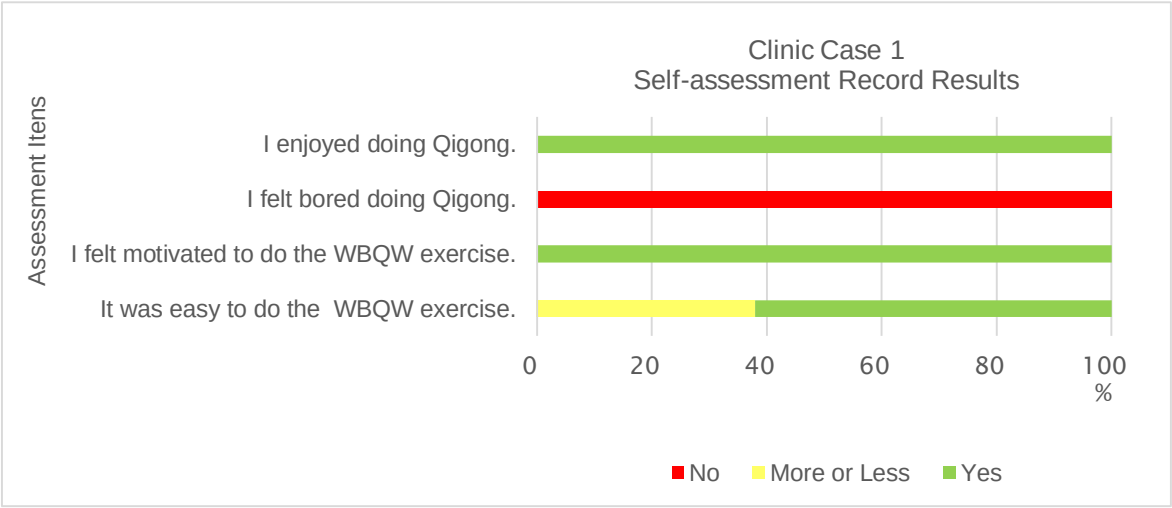

Chart 4: *Self-Assessment Registration.*

Attending Chart 4 we can realize that 100% of the time the adolescent enjoyed doing Qi Gong and felt motivated to do it, so in any of the time he felt annoyed at having to do the exercise and in more than 50 % of the time held it on easily.

CLINIC CASE 2

Adolescent male of thirteen, attending the 7th grade of the 3rd cycle of basic education, with a diagnosis of ADHD, Predominantly Inattentive Presentation and with pharmacological intervention stable for more than three months. The clinical picture was diagnosed by a specialist doctor (pediatrician of development) in mid-2009, for whom the adolescent continues to be accompanied. Currently take Concerta ® (methylphenidate) 36mg and Rubifen ® (methylphenidate), only in S.O.S. Medication' take is discontinuous, i.e. is reserved for the school year and on the eve of the evalutaion tests. It should be noted that during the intervention period in the context of this study, which coincided with school holidays, the taking of the medication did not happen.

The family presents a middle-high socio-economic level, the mother has a degree and holds the professional activity of a teacher. The family values the school and shows ability to implement educational strategies and intervention that are most appropriate.

Second child of the couple, the pregnancy was planned, desired and watched being born premature at 33 weeks of pregnancy and caesarean. With a weight of 720g, remained 12 weeks in an incubator, not checking for complications.

In family history there's no psychiatric pathology or including ADHD (at least declared and/or diagnosed). Highlights only the existence of sensory disease by the father (hearing loss).

The chronology of the acquisitions of development occurred within expectations, with independent walking at 15 months and autonomous language acquisition at 12 months. No changes in sleeping and feeding patterns. Mother only reports that the adolescent always had great difficulty in gaining weight.

The adolescent was at home with his paternal grandmother until the age of three years, at which point he entered kindergarten. The adaptation to pre-school occurred without difficulties. He joined the first cycle of basic education in a regular education establishment

set in a urban area, with a good adaptation to the same, showing even a good school performance.

The parents were divorced at the age of seven and the child went to live with his mother, holding a little regular contact with the father, reserved only the holidays until the beginning of this year, when father emigrated. With the paternal grandparents was keeping a daily contact.

In the second year of 1st cycle of basic education (which coincided with the divorce of his parents), the adolescent revealed some emotional and behavioral adjustment difficulties. The teacher complained their constant lack of attention and this aspect were also report at home by his mother. It was at this point that the adolescent was consulted in the specialty of Pediatrics, diagnostic development with ADHD and medication, initially with Rubifen ®.

Over the school years showed good recovery, adapt easily to changes in school which has occurred. It should be noted, that at the end of the sixth year of schooling was victim of bullying, which experienced quiet due to threats. However the mother discovered and resolved the situation effectively. The change of school in the 7th grade overed for help in overcoming this episode. Currently, it keeps the same school and will attend the 8th grade level. At the level of study habits, the adolescent still studies with her mother, with the paternal grandparents or in ATL (study center). The mother reports that the adolescent does not make any refuse, but it takes sometimes a lot of time to carry out the tasks proposed, needing constant supervision.

At the level of social interaction, relate easily with peers and preferably with young people their age, though also like living with younger children, is being very careful with the same. According to the mother, the relationship with the sister is unstable. The two adolescents both share common interests, relating well, as conflict easily. Practice swimming, enjoy playing football, computer games and Playstation ®.

With regard to the intervention in the field of ADHD, the adolescent takes medication on time and on a regular basis, never having any kinf of intervention of another type that's not pharmacological intervention. Although in the third period of the school year before, he had psychological support at school, due to the fact that the father had emigrated (in February 2015) and the maternal grandmother passed away (in December 2014).

After the implementation of the intervention strategy, as described in the previous section, we proceeded to the analysis and interpretation of the results, which then presents itself.

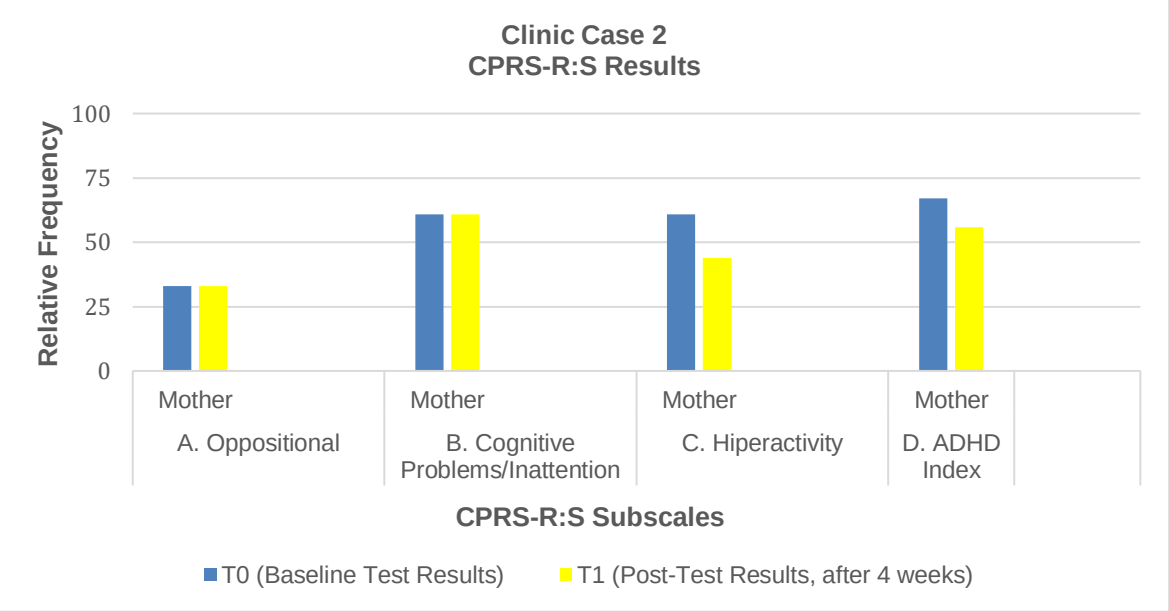

Chart 5: Ev*olution of the results in the different subscales of the CPRS-R:S, evaluated by the mother, in moments of baseline and post-intervention.*

Attend the Chart 5, the subscale A.Oppositional was the least scored suggesting, that according to the mother, the symptoms of these subscale, are less frequent. At the moment, with the exception of post-intervention subscale A.Oppositional, it's possible to observe a decrease of results on all subscales of the CPRS-R:S, indicating a decreased frequency of problematic behaviors that feature.

As regards the results obtained in d2 Test of Attention, considering the data obtained in the baseline time, in general terms, they suggest that the adolescent presents a capacity concentration / attention higher than the average. The overall performance (TN-E), as well as its concentration capability (CP) are superior to the subject of his age group as the results are the 80 percentile. The subject was able to perform effectively the task (TH), a good showing an information processing capability (TN).

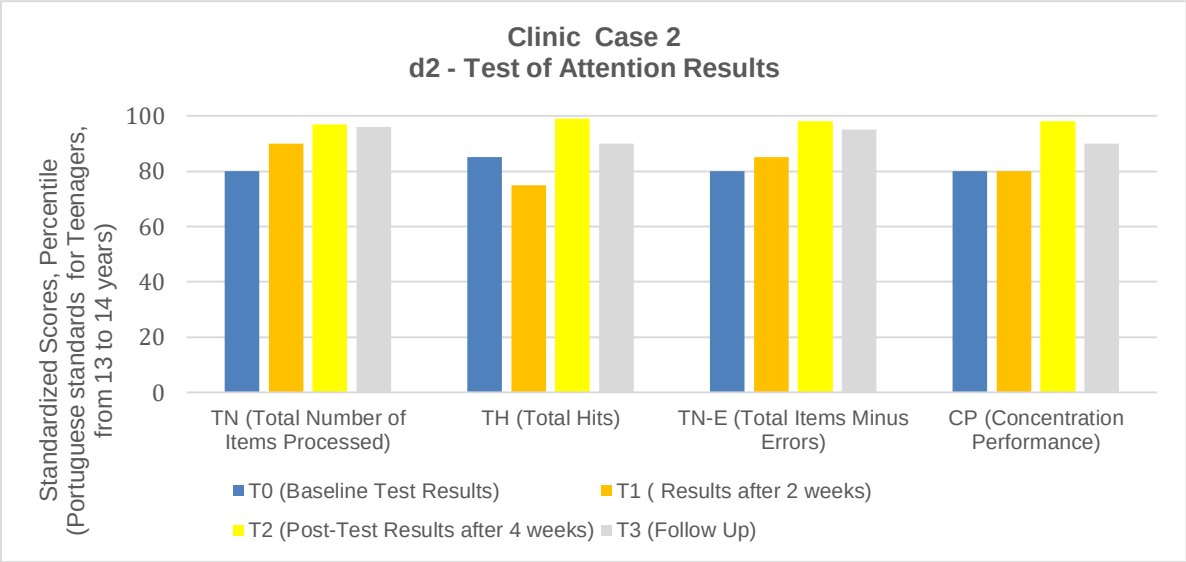

Chart 6: *Evolution of the results in the different parameters of the d2-Test of Attention, in moments of baseline, mid-term evaluation, post-intervention and follow-up.*

Given the results obtained in the different stages of evaluation, it´'s possible to observe an increase in results in all parameters evaluated by the d2 test. From baseline to post-intervention time, there is a significant improvement in terms of information processing and the amount of work done (TN), precision and efficiency in performing the task (TH), the overall performance (TN- E), with special emphasis on attention span (CP). Also in relation to the results shown for this last item (CP), also stands out the fact that increasing your score be related not only with the total number of characters marked correctly, but also by reducing the total of dialing errors of extraneous characters (E2).
Comparing the results obtained in T2 (post-intervention) with the results of follow up, there were no significant differences.

As regards the study of the HRV, will be considered for the analysis the values of SDNN and RMSSD parameters.

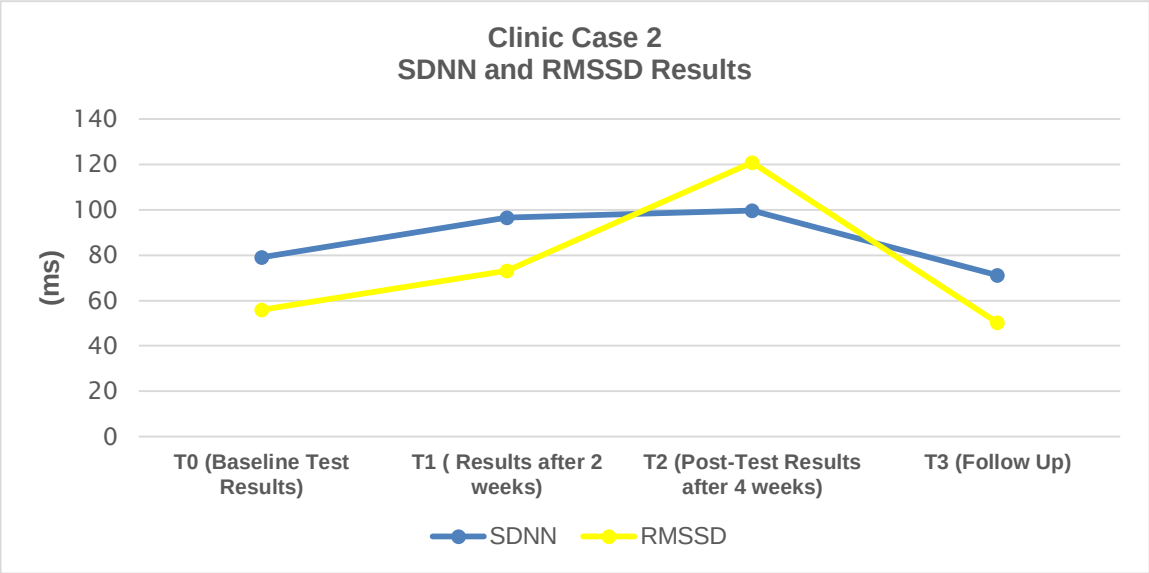

Chart 7: *Evolution of the SDNN and RMSSD parameters in moments of baseline, mid-term evaluation, post-intervention and follow-up.*

For SDNN and RMSSD parameters we can observe a significant increase in the baseline time for the post-intervention time. Comparing the obtained results in T2 (post-intervention) with the results of follow up, there is a decrease in the value of both parameters, approaching the T0 values (baseline).

Analyzing the registration of self monitored daily WBQG completion of the exercise, it appears that the adolescent performed every day proposed task.

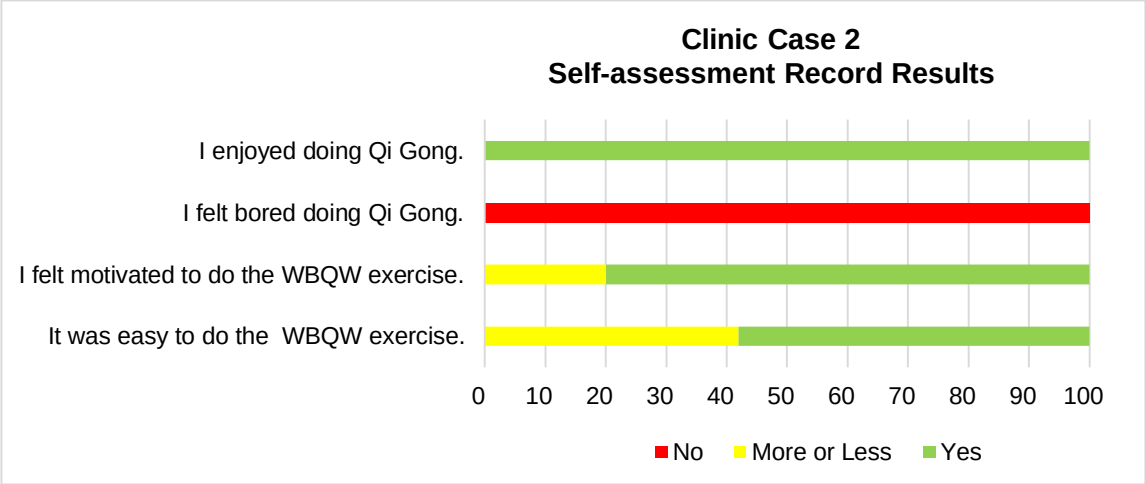

Chart 8: *Self-assessment registration.*

In view of Chart 8 we can realize that 100% of the time the adolescent enjoyed doing Qi Gong, in 80% of the time felt motivated to do it, so in any of the time he felt annoyed at having to do the exercise and in more than 50 % of the time held it on easily.

CLINIC CASE 3

Adolescent male of eleven, attending the 5th grade of the 2nd cycle of basic education, with a diagnosis of ADHD, Combined Presentation and stable pharmacological intervention for more than three months. The clinical condition was diagnosed by a specialist doctor (Child Psychiatry) in mid 2011. Currently taking Concerta ® 27mg, with discontinuous treatment (only during the school period). It should be noted that during the intervention period in the context of this study, which coincided with school holidays, the taking of the medication did not happen.

The family presents a socio-economic level, medium-low, exercising professional activity parents of rural workers. As regards education, the parent has the 6th grade and the mother the 12th grade. The family values the school and shows interest and limited capacity to implement educational strategies and intervention that are most appropriate.

Second child of the couple, the pregnancy was not planned, however wanted, and then watched in a private medical clinic. At 30 weeks gestation, the offset of the placenta occured, and the mother rest until the time of delivery. Due to fetal pelvic presentation, the delivery was by caesarean section at 42 weeks.

In family history there is a paternal cousin of the adolescent with ADHD.

The chronology of the acquisitions of development occurred within expectations, with autonomous walking and language acquisition at 12 months. No changes in sleeping and feeding patterns. Currently, the mother states that the adolescent has trouble gaining weight (especially in periods in which takes the psychostimulant medication).

In terms of clinical history, there's a record of asthmatic bronchitis at the age of 4 months, and allergic reaction (mites). Currently the situation is under control with follow up in Pulmonology consultation.

The adolescent was at home with his mother until the age of 12 months, at which point he entered to the nursery. The adaptation to pre-school occurred without difficulties. He joined the first cycle of basic education in a regular educational institution situated in a rural area, and start showing learning difficult and behavioral difficulties at school: the schoolteacher complained that he moved too much, was very inattentive and refused to learn. By the second period of the first year, was evaluated for specialty consultation of psychology (in private medical clinic), having been referred for specialty consultation of child psychiatry (also in a private medical clinic). He was diagnosed with ADHD-Combined Presentation. Initially treated with Ritalin®, shortly after became enhanced with Rubifen®. Failed the 2nd grade level and had the support of Special Education. In the third year of schooling, was accompanied in the child psychiatry consultation of the Hospital Center of his residence area, starting a dose of Concerta ® 27mg and psychological monitoring.

Over the school years always demonstrated many school difficulties, in particular on Portuguese language and mathematics disciplines. The entry in the 2nd cycle of basic education brought the change of school and great difficulties of adaptation. In the previous school year (fifth year), the adolescent was victim of bullying, continued with physical and verbal aggression (older student broke his rib).

Currently remains in the same school and will attend the 6th grade of schooling. At the level of study habits, the adolescent has support for study and sometimes his mother and sister help him. Mother said the the adolescent offers some resistance to the realization of homework, taking a long time to carry out the tasks proposed, needing constant supervision.

At the level of social interaction, relate easily with peers and preferably with young people their age, though also like living with younger children. The adolescente likes very much working on the agricultural fields with his father. According to the mother, the relationship with the sister is unstable. The two adolescents both share common interests, relating well, as conflict easily. Like playing football, help the elderly people (namely, maternal grandparents), playing with the animals (dogs) and computer games.

With regard to the intervention of ADHD, the adolescent takes medication on time and on a regular basis and is accompanied on a monthly basis in psychology consultation Center Hospital in his residence area.

After the implementation of the intervention strategy, as described in the previous section, we proceeded to the analysis and interpretation of the results, which then presents itself.

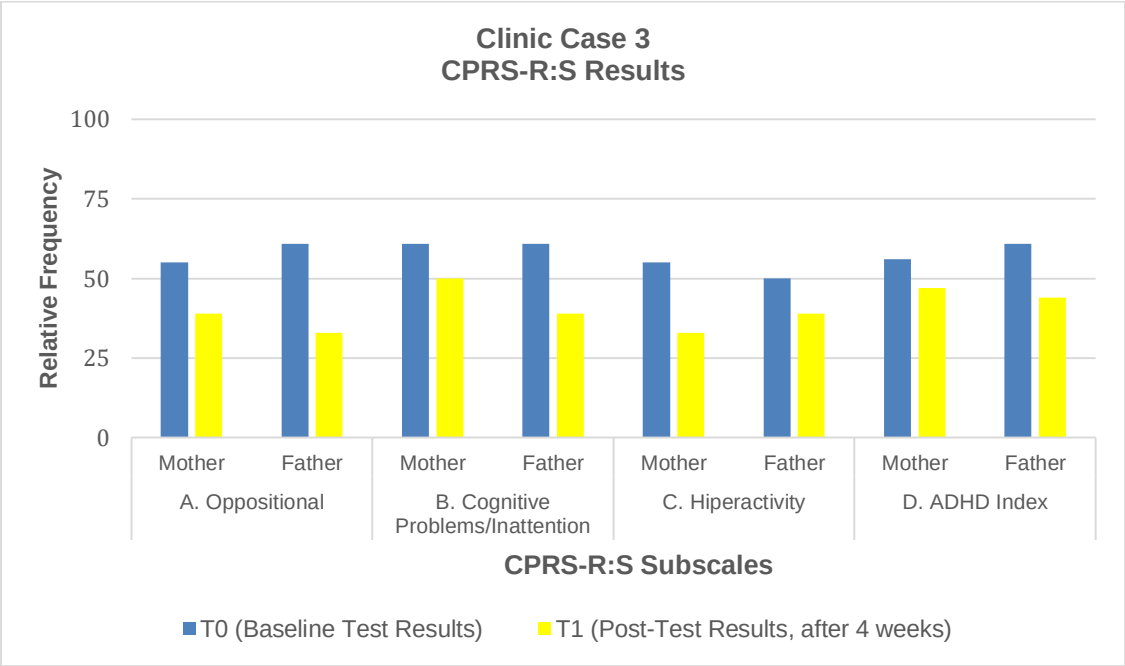

Chart 9: *Results evolution in the different subscales of the CPRS-R:S, evaluated by the parents, in moments of baseline and post-intervention.*

In view of the Chart 9 and results in the baseline moment, there's no significant difference in the score that father assigns to all subscales, when compared to the score assigned by the mother.

The subscale C. Hyperactivity was the least subscale scored by both parents, suggesting that according to the parents, the symptoms of these two subscales, are the most frequent.

In general, post-intervention time, it's possible to observe a decrease results in all the subscales CPRS-R: S, indicating a decrease in the frequency of problem behaviors that feature.

As regards the results obtained in d2 Test of Attention, considering the data obtained in the baseline time, in general terms, they suggest that the adolescent presents a capacity concentration / attention lower than the average. The overall performance (TN-E), as well as its concentration capability (CP) are inferior to the subject of his age group as the results are the 40 percentile and 30, respectively. The adolescent managed to accomplish the task so little effective (TH), demonstrating to have a limited capacity for processing information (TN).

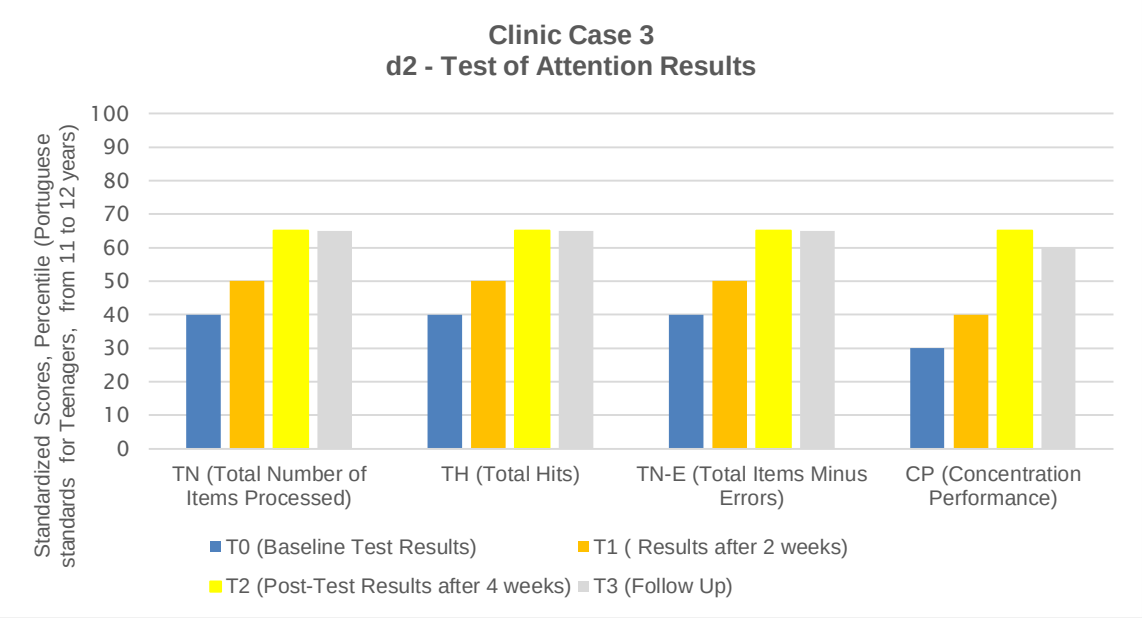

Chart 10: *Evolution of the results in the different parameters of the d2-Test of Attention, in moments of baseline, mid-term evaluation, post-intervention and follow-up.*

Attending the results obtained in the different stages of evaluation, it's possible to observe an increase in results in all parameters evaluated by the d2 test. From baseline to post-intervention time, there is a significant improvement in terms of information processing and the amount of work done (TN), precision and efficiency in performing the task (TH), the overall performance (TN- E), with special emphasis on attention span (CP). Also in relation to the results shown for this last item (CP), also stands out the fact that increasing your score be related not only with the total number of characters marked correctly, but also by reducing the total of dialing errors of extraneous characters (E2).
Comparing the results obtained in T2 (post-intervention) with the results of follow up, there were no significant differences.

As regards the study of the HRV, will be considered for the analysis the values of SDNN and RMSSD parameters.

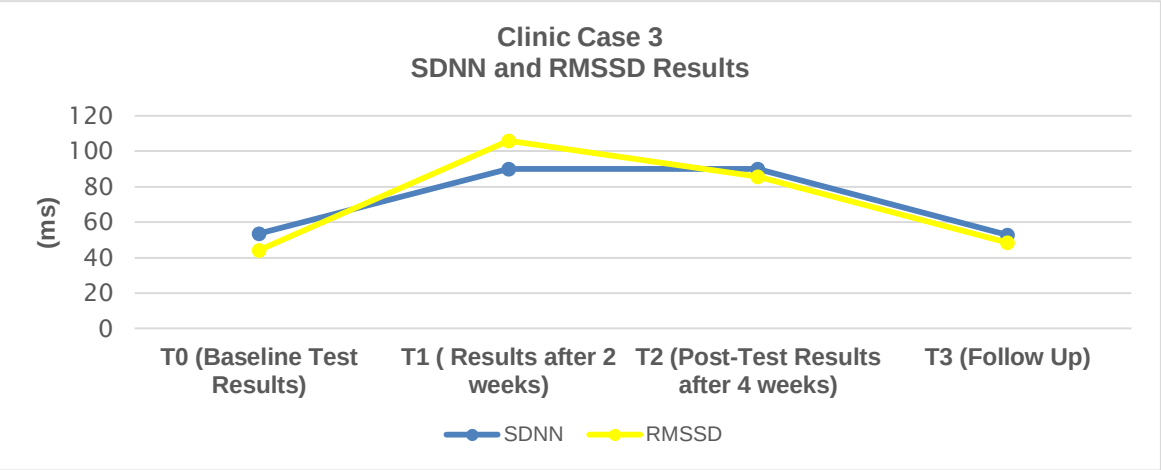

Chart 11: *Evolution of the SDNN and RMSSD parameters in moments of baseline, mid-term evaluation, post-intervention and follow-up.*

For SDNN and RMSSD parameters we can observe a significant increase in the baseline time for the post-intervention time. Comparing the obtained results in T2 (post-intervention) with the results of follow up, there is a decrease in the value of both parameters, approaching the T0 values (baseline).

Attending to the registration of self monitored daily WBQG completion of the exercise, it appears that the adolescent performed every day proposed task.

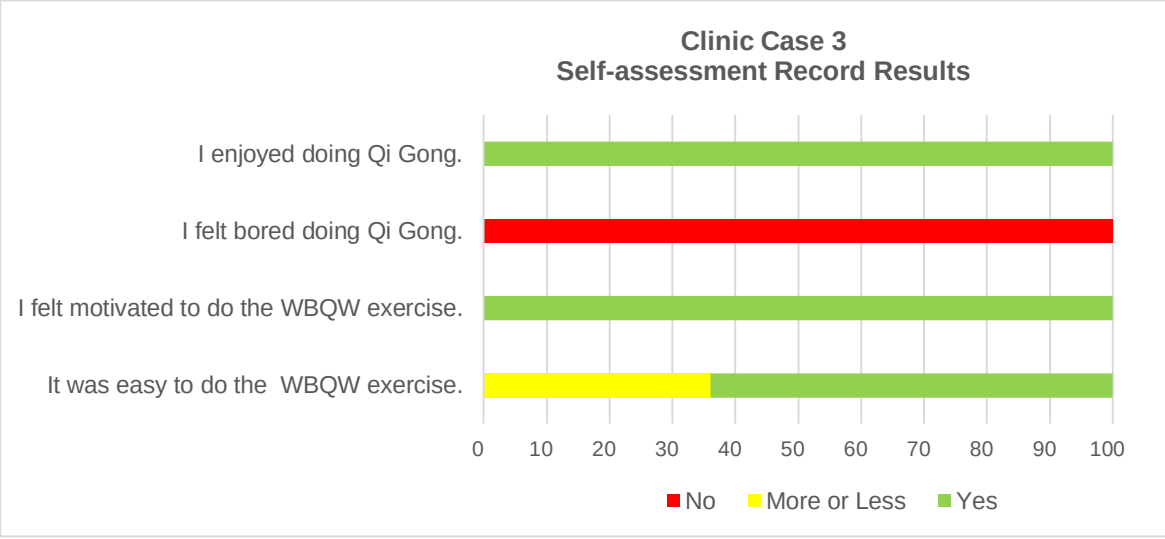

Chart 12: *Self- assessment registration.*

In view of Chart 12 we can realize that 100% of the time the adolescent enjoyed doing Qi Gong and felt motivated to do it, so in any of the time he felt annoyed at having to do the exercise and in more than 50 % of the time held it on easily.

4.2 Discussion of Results

With the development of this study it was intended to, in general, check the therapeutic potential of Traditional Chinese Medicine and in particular the effect of Qi Gong in ADHD. Increasingly are studies that corroborate the therapeutic efficacy of Qi Gong in several areas, however, there are no studies in quantity and quality relevant to relate the effect of Qi Gong in ADHD.

In the context of clinical research in TCM, Greten (2008), argues that the quality is dependent on the implementation of appropriate evaluation criteria, the placebo groups, the inclusion of adjusted work methods, giving preference, wherever possible, to control blind or double-blind. Given this assumption, the present study based on the case study methodology, constituting itself as a preliminary action to carry out a prospective randomized placebo control clinical study.

To achieve this end, were formulated four propositions that had guided the development of this study.

Proposition 1: Selective attention and concentration increases in adolescents with ADHD, after four weeks of intervention with the WBQG exercise.

The ability to direct attention to the enormous amount of stimuli with which we are confronted is part of a central aspect in the life of human being. The attention is a crucial process for learning, being also underlies other cognitive process, including memory, language and executive functions. Selective attention refers to the ability to focus attention on a particular stimulus, ignoring other stimuli present.

Duarte (2013) has developed a study involving 66 adolescents (12 to 14 years) belonging to three classes of the eighth grade, in order to evaluate the effect of exercise of “White Ball” Qi Gong in their levels of attention. Through the application of the d2 test the investigator found to increase levels of attention from adolescents, and concludes that the “White Ball” Qi Gong exercise may be recommended for increased attention, presenting itself as a reliable, affordable and without revealing side effects.

After 4 weeks of continuous practice of the WBQG exercise, the results obtained in the present study seem to point in the direction of the findings of the previous study: in all cases,

at post-intervention occured significant improvement at the level of information processing and amount of work done (TN), precision and efficiency in carrying out the task (TH), the overall performance (TN), with special emphasis on the ability to concentrate (CP).

Proposition 2: Excess motor activity decreases, in adolescents with ADHD, after four weeks of intervention with the WBQG exercise.

One of the main features of ADHD is hyperactivity. This symptom manifests itself in the form of restlessness, impatience, and unnecessary movements and rhythm of conversation in excess. In this way, are children who are always moving, always moving around, it seems interested in everything and nothing at the same time, they're never satisfied and need constant supervision. Move permanently the hands and legs, revealing a lot of difficulty in being quiet or in being able to rest (Lopes, 2004; Barkley R., 2006).

In all cases, the results obtained through the application of the CPRS-R:S, showed decrease of the scores of the subscales C. Hiperactivity and D. ADHD Index, suggest the decrease of symptoms that characterized these subscales.

Proposition 3: The level of regulation of SNA improves, in adolescents with ADHD, after four weeks of intervention with the WBQG exercise.

According to Oliveira (2014), the practice of Qi Gong encourages the practitioner to stop, to focus attention fully on you, look inside yourself and have the lack of what's going on inside. It's believed that with practice this process of physical, psychological and physiological harmonization there will be a positive influence increasing on the regulation of the SNA, enabling thus increasing parasympathetic activities and at the same time decrease the influence of sympathetic activity.

Analyzing the results obtained in the study of HRV, through the SDNN and RMSSD parameters, after 4 weeks of continuous practice of exercise WBQG, it's possible to observe the increase of these parameters at the time of baseline (T0) to the moment of post-intervention (T2), in three clinic cases, suggesting a better regulation of the SNA, through increased parasympathetic activity (RMSSD) and its consequent regulation (SDNN).

As previously stated, the SDNN is a concise indicator to measure HRV. The rise or fall of SDNN depends on two main nerves of the SNA: the sympathetic and the parasympathetic.

An increase in SDNN indicates an increase in parasympathetic activity regulation; on the other hand, a drop in SDNN indicates an increase in the regulation of sympathetic activity (Günzel Medical Consulting & Development UG., n.d, cit. Oliveira, 2014). RMSSD parameter reflects the activity of the parasympathetic part of vegetative nervous system, with an increase in parasympathetic activity RMSSD indicates high vegetative regulation; on the other hand, a drop in low activity on the indicates SDNN parasympathetic vegetative regulation (Günzel Medical Consulting & Development UG., n.d, cit. Oliveira, 2014).

Proposition 4: It's feasible to integrate this vegetative biofeedack therapy in the context of daily life of adolescents with ADHD.

The pace of life dictated by an increasingly demanding society, appealing and excessive in terms of stimuli, brings with it the need to develop new strategies for conciliation of family life, school and professional. The opening to new routines and new habits is a real challenge for young people and for parents.

When analyzed the records of self-monitoring and self-assessment results the task (exercise WBQG): in all cases it was possible to verify that all of the time the adolescents like to do the WBQG exercise, in the most of the time they felt motivated to do the WBQG exercise and more than half the of time performed the tasks easly, being possible to infer the feasibility of integration of the practice in daily life of adolescents.

V. CONCLUSION

5.1 Reflection and Final General Conclusions

The present study had as purpose, through the analysis of three clinic cases, find valid inferences and extrapolations that may serve as the basis of informative and guidance for the subsequent implementation of a Prospective Randomized Placebo Controllled Clinical Trial.

Based on the specificity and complexity of ADHD, in the small number of studies carried out within the framework of the Qi Gong and the research question "What's the effect of the continuing practice of Qi Gong exercises in adolescents with Hyperactivity Disorder and attention Deficit?" this study had as its objectives: 1) evaluate the effect of Qi Gong in adolescents with ADHD; 2) evaluate the effectiveness of the WBQG exercise in selective attention and concentration increase; 3) evaluate the impact of the WBQG exercise in excess motor activity; 4) to assess the potential effect of exercise WBQG on the functioning of the autonomic nervous system through physiological parameters (heart rate variability); 5) assess the feasibility of integrating this biofeedback therapy of vegetation in the context of daily life of adolescents.

Attending to the clinic cases submitted and after four weeks of continuous practice of the WBQG exercise, the results suggest that the positive effect of Qi Gong in adolescents with ADHD, showed: 1) in an increase of selective attention and concentration; 2) on a reduction of excess motor activity; 3) an increased of parasympathetic activity and regulation of ANS vegetative function; 4) acceptance and possible integration of the practice of this vegetative biofeedback therapy in daily life of adolescents.

Despite the limitations inherent in conducting an investigation based on the methodology of case study and in a clinical context, it's possible to state the hypothesis that Qi Gong can be consideraded as a therapeutic intervention on ADHD, increasing levels of selective attention and concentration of adolescents with ADHD and regulating the parasympathetic activity of the ANS, with consequent action at the level of motor activity.

It´s expected that the data of this research could contribute to a better understanding of the effect of Qi Gong in the regulation of the vegetative functions and their impact on selective attention and concentration on a neurodevelopmental disorder so complex as ADHD, as

well as the integration of this vegetative biofeedback therapy in the context of daily life of adolescents. It´s also expected that this information awaken the interest and curiosity of researchers and set up as a prelude to new investigations.

5.2 Limitations and Suggestions for Further Research

And finally, it seeks to reflect on limitations to the present study.

The main limitations stands out: 1) the complexity of the diagnosis of ADHD and the specificity of its features; 2) lack of robust scientific studies that address the application of Qi Gong as therapeutic measure in the field of ADHD; 3) the difficulty in establish homogeneous groups of participants, taking into account the ADHD specifiers (Predominantly Inattentive Presentation; Combined Presentation and Predominantly Hyperactive/Impulsive Presentation); 4) the period in which the investigation took place (school holidays) made it impossible the involvement of teachers, while privileged agents at the level of the registration of the frequency of the symptoms of ADHD; 5) the validity and reliability of the system used for the study of HRV.

Stands still, the greatest limitation of all the problems of generalization, intrinsic to the case study methodology, by putting only the possibility of transfer of knowledge from one case to another later. It would be important to replicate this study, considering a significant sample and given the assumptions of the experimental method.

Thus, it's suggested the development of a prospective randomized placebo-controlled study, with three groups formed randomly: verum *Group* (GV), control group (placebo Qi Gong) (GCP) and the waiting list group (GLE). The verum group would make the "White Ball" Qi Gong (WBQG) while the control group would hold a Qi Gong placebo exercise, that would remain in an Qi Gong orthostatic basal traditional during the viewing of a cartoon program. The exercises would be repeated daily at home, for four weeks. The two groups (GV and GQP) would receive two sessions of 10 minutes per week, for a specialist certificate, and will be advised to practice the exercises at home daily.

The intervention impact would be assessed by:
Main Parameters: d2 - Test of Attention and HRV, performed before the exercises (T0), after 2 weeks (T1), after 4 weeks (T2) and 1 week after the end (follow up).

Side Parameters: Conner´s Parent Rating Scale - Revised Version: Short Form (CPRS-R:S) scale, performed before the exercises (T0) and after 4 weeks and self-monitoring performed continuously through the study on a daily basis.

It would be designed for adolescents from 11 to 14 years, with ADHD diagnosis by an independent medical specialist, stable pharmacological treatment for more than 3 months, or those who obtained a higher score in all subscales of CPRS-R: S, indicating a possible diagnostic of ADHD, informed consent signed by the parents and voluntary participation of the adolescent. Wouldn't be allowed the participation of adolescents with mental, psychiatric or neurological disorder, intellectual disability (Intellectual Developmental Disorder) or other relevant handicaps as an obstacle to the performance of Qi Gong exercises.

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ANNEXS

Annex 1: *Informed Consent*

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM PROJETOS DE DOCÊNCIA E/OU INVESTIGAÇÃO

de acordo com a Declaração de Helsínquia[1] e a Convenção de Oviedo[2]

Por favor, leia com atenção a seguinte informação. Se achar que algo está incorreto ou que não está claro, não hesite em solicitar mais informações. Se concorda com a proposta que lhe foi feita, queira assinar este documento.

Título do estudo: *"O efeito do Qigong na Perturbação de Hiperatividade e Défice de Atenção (PHDA)"*

Enquadramento: O estudo será realizado nas instalações do ICBAS, inserindo-se no Mestrado em Medicina Tradicional Chinesa, do Instituto de Ciências Biomédicas Abel Salazar, da Universidade do Porto (ICBAS-UP), orientado pelo Professor Doutor Henry Johannes Greten e co-orientado pelo Professor Doutor Jorge Machado e pelo Mestre Mário Gonçalves.

Explicação do estudo: Com este estudo pretende-se verificar o efeito do Qigong na atenção de crianças com Perturbação de Hiperatividade e Défice de Atenção (PHDA). Serão realizadas 2 sessões semanais, com a duração de 10 minutos, durante 4 semanas. Serão realizadas avaliações antes, após duas semanas e após 4 semanas, através da mensuração de parâmetros psicométricos (D2-Teste de Atenção, Escala de Conners para Pais e Escala de Conners para Professores) e fisiológicos (Variabilidade da Frequência Cardíaca).

Condições e financiamento: O presente estudo será realizado sem qualquer custo para os participantes. Todos os custos serão suportados pelo Instituto de Ciências Biomédicas Abel Salazar da Universidade do Porto (ICBAS-UP).

Sendo a participação do(a) seu (sua) filho(a)/(educando(a) voluntária terá o que tempo que necessitar para ponderar sobre a autorização na participação do referido estudo. É livre de consultar a opinião dos seus familiares ou amigos. Caso decida autorizar, poderá posteriormente a qualquer momento recusar a continuidade do(a) seu (sua) filho(a)/(educando(a) no estudo, sem quaisquer tipos de prejuízos assistenciais ou outros.

A responsabilidade de eventuais danos ocorridos durante o estudo, será da inteira responsabilidade da Heidelberg School of Chinese medicine, sito na Karlsruher Str. 12, 69126 Heidelberg, Germany,, e cujo contacto telefónico é +49 (0) 6221 37 45 46.

Confidencialidade e anonimato: Todos os dados recolhidos para o presente estudo asseguram uma total confidencialidade e anonimato dos participantes e os seus nomes nunca serão tornados públicos. Todos os resultados obtidos serão devidamente codificados e os dados serão apenas do conhecimento da investigadora principal e dos orientadores do estudo.

Agradecimentos e identificação do/a investigador/a: Eu, Marta Raquel Custódio Correia, mestranda do curso do Mestrado em Medicina Tradicional Chinesa do Instituto de Ciências Biomédicas Abel Salazar da Universidade do Porto (ICBAS-UP), agradeço toda a colaboração de quem possibilitará a realização deste projeto.

Para qualquer esclarecimento poderá entrar em contacto com a Mestranda Marta Correia, através do telemóvel número 965621795.

Assinatura:

_____

Eu, abaixo-assinado

_____ BI/CC:_____

[1] http://portal.arsnorte.min-saude.pt/portal/page/portal/ARSNorte/Comiss%C3%A3o%20de%20%C3%89tica/Ficheiros/Declaracao_Helsinquia_2008.pdf

[2] http://dre.pt/pdf1sdip/2001/01/002A00/00140036.pdf

Representante legal de:

_____ BI/CC:_____

Declaro ter lido e compreendido este documento, bem como as informações verbais que me foram fornecidas pela pessoa que acima assina e que considero suficientes. Foi-me garantida a possibilidade de, em qualquer altura, retirar o(a) meu/minha filho(a)/educando(a) deste estudo sem qualquer tipo de consequências. Desta forma, aceito que o(a) meu/minha filho(a)/educando(a) participe neste estudo e permito a utilização dos dados que de forma voluntária serão fornecidos, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pela investigadora.

_____, _____ *de* _____*de 2015*

Assinatura do(a) representante legal:

_____

Assinatura do(a) participante menor:

_____

Assinatura da investigadora:

_____

ESTE DOCUMENTO, COMPOSTO DE 2 PÁGINA/S E É FEITO EM DUPLICADO:
UMA VIA PARA A INVESTIGADORA, OUTRA PARA O REPRESENTANTE LEGAL DO MENOR QUE CONSENTE.

Annex 2: *Conners' Parent Rating Scale Revised – Short Form*

ESCALA DE CONNERS PARA PAIS – VERSÃO REVISTA (FORMA REDUZIDA)

(Keith Conners, PhD.,1997)

Tradução e Adaptação para Investigação de Ana Nascimento Rodrigues - Departamento de Educação Especial e Reabilitação da Faculdade de Motricidade Humana – parte integrante da dissertação de doutoramento.

Nome da Criança										Género		F	M
Data de Nascimento:					Idade:			Ano Escolaridade:					
Nome do familiar:						Data de preenchimento:							
Observações:						Código:							

Abaixo estão descriminados os problemas mais comuns que afectam as crianças no seu percurso de desenvolvimento. Muitas destas características são normais e passageiras desde que não se manifestem com elevados valores ao nível da intensidade, frequência e duração. Por favor responda avaliando o comportamento da criança durante o último mês. Por cada item, pergunte-se: "Com que frequência isto aconteceu no último mês?", e marque a melhor resposta para cada um. Nenhuma, nunca, raramente ou com pouca frequência, pode marcar **0**. Verdadeiramente, ou se ocorre muitas vezes e frequentemente, marque **3** . Pode marcar **1 ou 2** para classificações entre um e outro. Por favor responda a todos os itens.

NUNCA	UM POUCO	FREQUENTEMENTE	MUITO FREQUENTE
0	1	2	3

1. Desatento, distrai-se facilmente (38)	0	1	2	3
2. Furioso (zanga-se com facilidade) e ressentido (1)	0	1	2	3
3. Dificuldade em fazer ou acabar os trabalhos de casa (2)	0	1	2	3
4. Está sempre a movimentar-se ou age como "tendo as pilhas carregadas" ou como se "estivesse ligado a um motor".(3)	0	1	2	3
5. Atento por curtos períodos de tempo (56)	0	1	2	3
6 Discute/argumenta com os adultos (11)	0	1	2	3
7. Mexe muito os pés e as mãos e mexe-se ainda que sentado no lugar.(55)	0	1	2	3
8. Não consegue completar o que começa (12)	0	1	2	3
9. Difícil de controlar em centros comerciais ou sítios públicos(13)	0	1	2	3
10. Desarrumado ou desorganizado em casa ou na escola (63)	0	1	2	3
11. Perde o controlo (21)	0	1	2	3
12. Precisa de acompanhamento para executar as suas tarefas (22)	0	1	2	3
13. Só presta atenção quando é uma coisa que lhe interessa (69)	0	1	2	3
14. Corre e trepa em situações inapropriadas (23)	0	1	2	3
15. Distraído e com tempo de atenção curto (45)	0	1	2	3
16. Irritável (31)	0	1	2	3
17. Evita, tem relutância ou tem dificuldade em empreender tarefas que exigem um esforço continuado (tal como trabalhos na escola ou de casa) (9)	0	1	2	3
18. Irrequieto, "tem bicho carpinteiro" (32)	0	1	2	3
19. Distrai-se quando lhe estão a dar instruções para fazer uma coisa (48)	0	1	2	3

20. Provocador ou recusa em satisfazer os pedidos de um adulto (40)	0	1	2	3
21. Tem problemas em concentrar-se nas aulas (19)	0	1	2	3
22. Tem dificuldade em manter-se numa fila ou esperar a sua vez num jogo ou trabalho de grupo (42)	0	1	2	3
23. Levanta-se na sala ou em lugares onde deveria ficar sentado (76)	0	1	2	3
24. Deliberadamente faz coisas para irritar os outros(67)	0	1	2	3
25. Não segue instruções e não acaba os trabalhos no lugar (Não é dificuldade em entender as instruções ou recusa) (29)	0	1	2	3
26. Tem dificuldade em brincar ou trabalhar calmamente (59)	0	1	2	3
27. Fica frustrado quando não consegue fazer qualquer coisa (78)	0	1	2	3

Muito obrigado pela sua colaboração

Annex 3: *Example of Daily Self-Monitoring and Self-Assesement registration*

Registo de Auto Monitorização

Realização Exercício Qigong "White Ball"(QWB)

No final de cada sessão Qigong, preenche por favor, com um X, o registo de auto monitorização que se segue, de forma a comprovar que realizaste o exercício.

Agosto 2015 I

SEG.3	TER. 4	QUA. 5	QUI.6	SEX.7	SÁB. 8	DOM.9
SEG.10	TER. 11	QUA. 12	QUI.13	SEX.14	SAB. 15	DOM.16
SEG.17	TER. 18	QUA. 19	QUI.20	SEX.21	SÁB. 22	DOM.23
SEG.24	TER. 25	QUA. 26	QUI.27	SEX.28	SÁB. 29	DOM.30
SEG.31						

* Neste dia, o exercício QWB será realizado em conjunto com a investigadora.

Observações

Auto Avaliação

No final de cada sessão Qigong, preenche por favor, com um X, o registo de auto avaliação que se segue, de acordo com a seguinte legenda:

 Não  Mais ou Menos  Sim

Semana I

Data I	Hora I		
Sessão 1			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

Data I	Hora I		
Sessão 2			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

Data I	Hora I		
Sessão 3			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

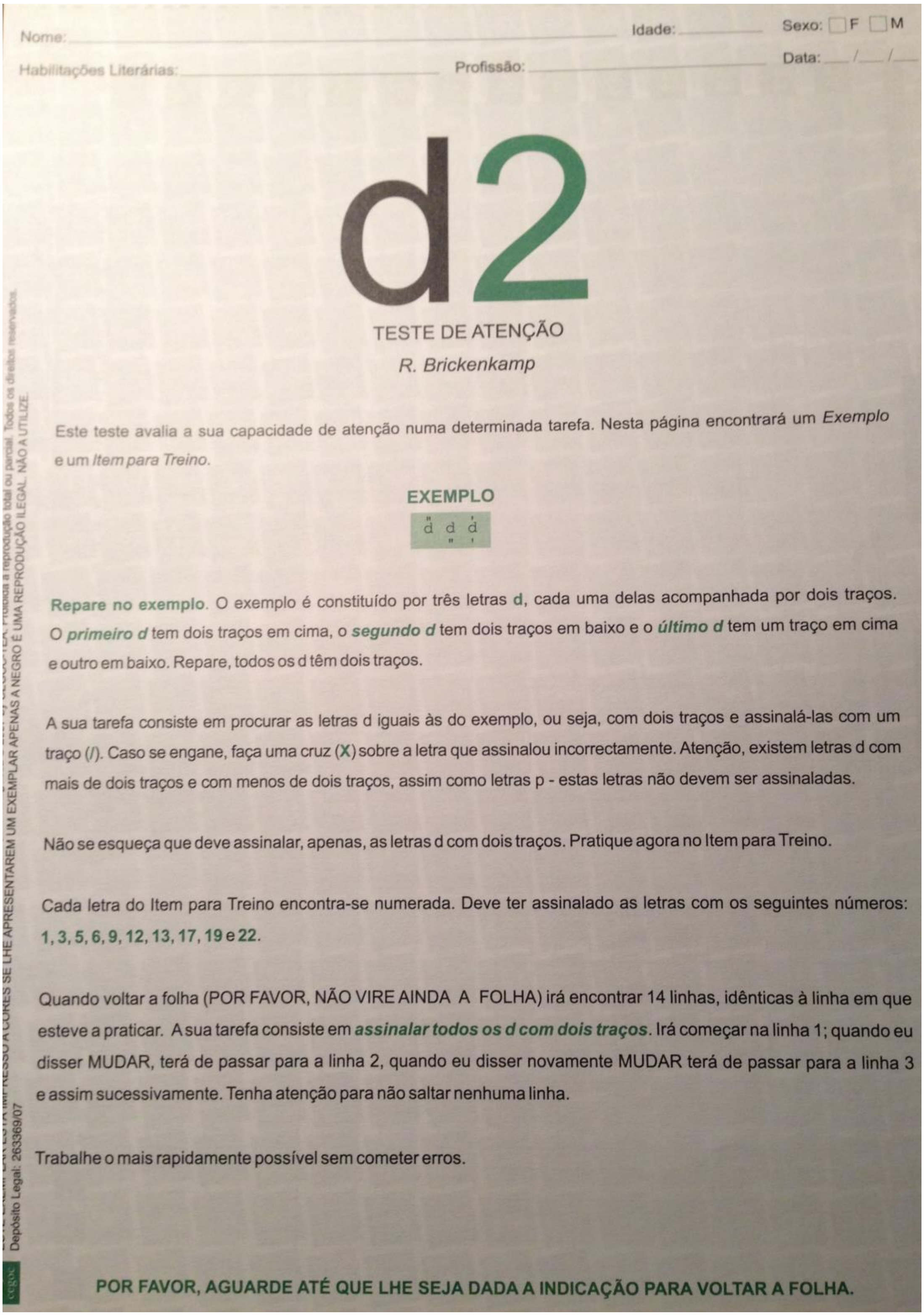
Data I	Hora I		
Sessão 4			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

Data I	Hora I		
Sessão 5			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

Data I	Hora I		
Sessão 6			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

Data I	Hora I		
Sessão 7			
Realizei o exercício QWB com facilidade.			
Fiz o exercício QWB com vontade.			
Senti-me aborrecido por ter de fazer Qigong.			
Gostei de fazer Qigong.			
Este espaço em branco serve para escreveres o que sentiste, o que não correu como o previsto, entre outros.			

Annex 4: *d2 – Test of Attention*



Nome: ______ Idade: ______ Sexo: ☐ F ☐ M

Habilitações Literárias: ______ Profissão: ______ Data: __/__/__

d2

TESTE DE ATENÇÃO

R. Brickenkamp

Este teste avalia a sua capacidade de atenção numa determinada tarefa. Nesta página encontrará um *Exemplo* e um *Item para Treino.*

EXEMPLO

Repare no exemplo. O exemplo é constituído por três letras **d**, cada uma delas acompanhada por dois traços. O ***primeiro d*** tem dois traços em cima, o ***segundo d*** tem dois traços em baixo e o ***último d*** tem um traço em cima e outro em baixo. Repare, todos os d têm dois traços.

A sua tarefa consiste em procurar as letras d iguais às do exemplo, ou seja, com dois traços e assinalá-las com um traço (/). Caso se engane, faça uma cruz (**X**) sobre a letra que assinalou incorrectamente. Atenção, existem letras d com mais de dois traços e com menos de dois traços, assim como letras p - estas letras não devem ser assinaladas.

Não se esqueça que deve assinalar, apenas, as letras d com dois traços. Pratique agora no Item para Treino.

Cada letra do Item para Treino encontra-se numerada. Deve ter assinalado as letras com os seguintes números: **1, 3, 5, 6, 9, 12, 13, 17, 19** e **22**.

Quando voltar a folha (POR FAVOR, NÃO VIRE AINDA A FOLHA) irá encontrar 14 linhas, idênticas à linha em que esteve a praticar. A sua tarefa consiste em ***assinalar todos os d com dois traços***. Irá começar na linha 1; quando eu disser MUDAR, terá de passar para a linha 2, quando eu disser novamente MUDAR terá de passar para a linha 3 e assim sucessivamente. Tenha atenção para não saltar nenhuma linha.

Trabalhe o mais rapidamente possível sem cometer erros.

POR FAVOR, AGUARDE ATÉ QUE LHE SEJA DADA A INDICAÇÃO PARA VOLTAR A FOLHA.

IMPORTANTE

POR FAVOR, NÃO ESCREVA NADA NESTA COLUNA VERDE. SE O FIZER PODERÁ INVALIDAR O TESTE.