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INTERNATIONAL DOCTORAL SCHOOL
Health Sciences PhD Program

The effectiveness of physical rehabilitation in the
enhancement of proprioceptive and cognitive aspects on
Alzheimer disease patients

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Dr. D. José Luis Martínez Gil
Dr. Dña. María Gómez Gallego

Murcia, April 11, 2019



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AUTHORIZATION OF THE DIRECTORS OF THE THESIS FOR SUBMISSION

Prof. Dr. José Luis Martínez Gil and Prof. Dr. María Gómez Gallego as Directors of the Doctoral Thesis “The effectiveness of physical rehabilitation in the enhancement of proprioceptive and cognitive aspects on Alzheimer disease patients” by Jasemin Todri in the Ph.D. Program in Health Sciences, **authorizes for submission** since it has the conditions necessary for his defense.

Sign to comply with the Royal Decrees 99/2011, 1393/2007, 56/2005 and 778/98, in Murcia, January 23, 2018.

Fdo.: Dr. D. José Luis Martínez Gil

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AUTORIZACIÓN DE LOS DIRECTORES DE LA TESIS PARA SU PRESENTACIÓN

El Dr. D. José Luis Martínez Gil y la Dra. Dña. María Gómez Gallego como Directores de la Tesis Doctoral titulada “The effectiveness of physical rehabilitation in the enhancement of proprioceptive and cognitive aspects on Alzheimer disease patients” realizada por Dña. Jasemin Todri en el Departamento de Ciencias de la Salud, autoriza su presentación a trámite dado que reúne las condiciones necesarias para su defensa.

Lo que firmo, para dar cumplimiento al Real Decreto 99/2011, 1393/2007, 56/2005 y 778/98, en Murcia a 23 de Enero de 2019.

Fdo.: Dr. D. José Luis Martínez Gil

Fdo.: Dr. Dra. María Gómez Gallego

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**THE EFFECTIVENESS OF PHYSICAL REHABILITATION IN THE
ENHANCEMENT OF PROPRIOCEPTIVE AND COGNITIVE ASPECTS ON
ALZHEIMER DISEASE PATIENTS**

ABSTRACT

INTRODUCTION: Based on the Alzheimer Disease (AD) prevention and slowing down, this study has shown interest in evaluating the effects of Global Postural Re-education (GPR) on the cognitiveness of individuals with AD.

OBJECTIVE: It is important to verify that by modifying and improving postural attitudes, a better concentration of cognitions in older people is achieved, increases self-awareness and proprioception.

MATERIALS AND METHODS: This research study is based on an experimental design where participated 135 subjects with AD. It lasted 6 months, with pre-post tests executed before and after the period of treatment.

RESULTS: The therapy had a significant effect on the Mini Mental State Examination (MMSE), Geriatric Depression Scale (GDS), Quality of life in AD (QoL-AD), Barthel Index (BI), Neuropsychiatric Inventory (NPI) and Tinetti Scale scores (TS) compared to the ones of group factor. In the findings of post-hoc analysis it was observed: the improvement of treatment variables, MMSE scores, GDS, QoL - AD and BI (p corrected by Bonferroni <0.005 in all cases). Nonetheless, the

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improvement was also observed from the first month of therapy in TS scores and NPI (p corrected by Bonferroni <0.005 in all cases).

CONCLUSIONS: This study confirms the validity of the GPR proposal on the cognitiveness of individuals with AD.

KEYWORDS:

“Postural therapy”, “Aging”, “Dementia”, “Alzheimer”, “Cognitivity”.

**LA EFECTIVIDAD DE LA REHABILITACIÓN FÍSICA EN LA MEJORA DE LOS
ASPECTOS PROPIOCEPTIVOS Y COGNITIVOS EN PACIENTES CON
ENFERMEDAD DE ALZHEIMER**

RESUMEN

INTRODUCCIÓN: Basado en la prevención y la desaceleración de la enfermedad de Alzheimer (EA), este estudio ha mostrado interés en evaluar los efectos de la reeducación postural global (GPR) en la cognitividad de las personas con EA.

OBJETIVO: Es importante verificar que al modificar y mejorar las actitudes posturales, se logra una mejor concentración de las cogniciones en las personas mayores, aumenta la autoconciencia y la propiocepción.

MATERIALES Y MÉTODOS: este estudio de investigación se basa en un diseño experimental en el que participaron 135 sujetos con EA, con una duración de 6 meses, con pruebas ejecutadas antes y después del período de tratamiento.

RESULTADOS: La terapia tuvo un efecto significativo en el Mini Examen de Estado Mental (MMSE), la Escala de Depresión Geriátrica (GDS), la Calidad de vida en EA (QoL-AD), el Índice de Barthel (BI), el Inventario Neuropsiquiátrico (NPI) y la Escala de Tinetti (TS) comparadas con las de factor de grupo. En los hallazgos del análisis post hoc se observó: la mejora de las variables de tratamiento, las puntuaciones MMSE, GDS, QoL -AD y BI (p corregida por Bonferroni <0,005 en todos los casos). No obstante, la mejora también se observó a partir del primer mes de terapia en las puntuaciones de TS y NPI (p corregida por Bonferroni <0,005 en todos los casos).

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CONCLUSIONES: este estudio confirma la validez de la propuesta de GPR sobre la cognitividad de las personas con EA.

Palabras clave:

“Terapia postural”, “Envejecimiento”, “Demencia”, “Alzheimer”, “Cognitividad”.

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"If you can't do great things, do little things in a great way".
Napoleon Hill (1883-1970).

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ACRONYMS AND ABBREVIATIONS

AD	Alzheimer Disease
BI	Barthel Index
GDS	Geriatric Depression Scale
GPR	Global Postural Reeducation
H	Hypothesis
IWG	International Work Group
MCI	Mild Cognitive Impairment
MMSE	Mini Mental State Examination
NIA-AA	National Institute on Aging – Alzheimer’s Association
NINCDS-ADRDA Criteria	National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's disease and Related Disorders Association
NPI	Neuropsychiatric Inventory
QoLAD/C	Quality of Life in Alzheimer's disease/Caregivers
QoLAD/P	Quality of Life in Alzheimer's disease/Patients
TS	Tinetti Scale
T0	Pre Test
T1	Post Test
Uiptm	Université Internationale Permanente de Thérapie Manuelle
WHO	World Health Organization

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I – INTRODUCTION

I - INTRODUCTION

1.1 DEFINITION OF DEMENTIA

Dementia means the acquired and chronic progressive disorders pertaining to intellectual functions (1). It is characterized by the disturbance of cognitive functions, mainly the short and long-term memory impairment associated with the impairment of at least one of the primary mental activities such as abstract thinking, consciousness, speech, topographic orientation, critical ability, difficulty in remembering recent conversations, names or events, apathy and depression which are often presented as early clinical symptoms. Meanwhile the later symptoms constitute impaired communication, disorientation, confusion, poor judgment, behavioral changes and ultimately, difficulty in speaking, swallowing and walking (2).

Worldwide statistics demonstrate that dementia is one of the leading causes of death among individuals over the age of 65. In addition worth also mentioning that it is one of the causes of the disability of the third age (3). It prevails concerning the 4-5% of the population over the age of 65 and increases by 1% on behalf of individuals age until 70 and exceeds with 30% over the age of 85 (4).

Generally while dealing with dementia, it paralleling relates to the aging population growth not only in industrialized countries but also in developing countries. According to the statistics, an increase in the number of elderly people is forecasted, exceeding the 1.3 billion compared to the 90's (5).

Although the advancement of science in the identification of the biological base and the manifestations of the most common forms of dementia are evident, an accurate diagnosis is still missing. Dementia is differentiated referring to different subgroups: vascular degenerative (multiple infarcts, Binswanger disease, anoxia and hypoxia, aneurysm); deficiencies (lack of vitamin B12, Kosakoff-Wernicke syndrome, disease of Marchiafava Bignami); metabolic and endocrine (pathology of thyroid, parathyroid, heparin diseases, Willson's disease, dialysis dementia); toxic and pharmaceuticals, infectious (encephalitis, meningitis, autoimmune diseases); tumors and cranial traumas, dementia associated with

prion diseases, normotens hydrocephalus (6). Some of the aforementioned demeanor situations are reversible and can be addressed (7).

From a neuro-pathological point of view, the main forms of degenerative dementia (Alzheimer's, fronto-temporal dementia and Pick's disease, Lewy's disease) represent a quantitative (typology of neuro-pathological lesions) and qualitative heterogeneity (stretching and spreading lesions themselves (8).

In respect to the clinical outlook instead, the way of presentation, natural history, symptoms, the interaction of cognitive and non-cognitive factors as well as the duration of the disease represents the possibilities of individual variations that complicate the prototype clinical framework of the disease (9).

The onset of the disease is characterized at very early stages by unclear symptoms that are almost always recognized as such only retrospectively once the clinical outlook is clearly manifested (10).

1.2 EPIDEMIOLOGY OF ALZHEIMER DISEASE

Because of the aging population, the emergence of Alzheimer's disease (AD) cases is growing rapidly and AD is a concern for public health (11). Up to 2020, the World Health Organization (WHO) predicts that there will be almost 29 million people suffering dementia worldwide, and two-thirds of them are AD cases (12). However, this dramatic perspective can only be modified with new curative treatments or prevention. In recent years, there is growing evidence from epidemiological studies concerning the role of blood vessel risk factors in the etiology of AD, including here hypertension, type II diabetes, and high cholesterol. These potentially modifiable risk factors raise the hope for AD prevention (13).

Considering that on behalf of Alzheimer's Association statistics, in United States during 2017 AD resulted to be one of the top 10 causes of death (14). It also accounts for about 60% of 80% of cases as the most common cause of dementia. Autopsy studies show that 50% of these cases consist of AD only while the other dementia cases contain evidence of additional pathological changes. The prevailing examinations refer that 10% of people around the age of 65 suffer AD. The percentage of people with AD increases with age: 3% in people aged 65-74,

17% in people around the age of 75-84 and 32% of people over the age of 85 and above. 82% of people with AD belong to the age of 75 and above (15). Women are more affected by AD than men. Moreover, almost two-thirds of the Alzheimer's populations are women (16). There are a number of biological and social facts that explain why women are most affected by AD or other dementias (17). The latest epidemiological evidence is related to the fact that women live longer and consequently the main factor of AD is the age (18). Recently, there develop researches that merge the fact that the lack of education in women may be an important factor of AD (19, 20, 21). They prove this by demonstrating that women born in the first half of the 20th century are less educated than men of that period (22).

According to the Alzheimer's Association forecasted estimations is declared that by 2025 the number of people aged 65 and over with AD will reach about 7.1 million. Comparing Alzheimer's data in 2017 to people over the age of 65 who reached 5.3 million, these figures show a rise of about 35% of the population with AD (14). During 2017, in the US, about 2.1 million people with AD belong to the age of 85 and above, accounting for 38% of all people with AD (15).

1.3 DIAGNOSTICS AND AD CRITERIA

Alzheimer's disease was first described in 1906, after Alois Alzheimer's evidence from which it took the name, but there was spent about 70 years before being known as a common case of dementia and one of the deadliest causes (23). For the major part of the twentieth century AD was identified as an unusual cause of adult dementia now considered 'middle age'. The most common diagnosis among individuals aged 65 and over around those years was "Senile Dementia".

Hereinafter, it was Robert Kazman who changed the definitions of dementia in 1976 (24). He scientifically argued that there was no differentiation based only on the age of the patient between Alzheimer's and senile dementia. Furthermore he also presented convincing evidence to show that it was just a disease whose name was Alzheimer's. The scientific contribution of Dr. Kazman indicating that Alzheimer's was a cause of dementia was incorporated in the diagnostic criteria published in 1984, from the National Institute of Neurological

and Communicative Disorders and Stroke and the Alzheimer's disease and Related Disorders Association (currently known as the Alzheimer's Association) Criteria, or NINCDS-ADRDA Criteria (25). The golden period as per AD scientific discoveries was that of Dr. Kazman's time while nowadays with the method of bop markers can be clearly distinguished AD and other forms of dementia. Beyond this, actually the scientific research boosts the progress in diagnosing AD. Under this light, the National Institute on Aging – Alzheimer's Association (NIA-AA) 2011 workgroup (26) and the International Work Group (IWG) (27) have extended the guidelines by proposing the biomarkers as integrative part of the above mentioned diagnosis. The biomarkers (such as brain imaging of amyloid plaques, changes in brain volume, measures of tau and amyloid in spinal fluid) and clinical symptoms used to define preclinical Alzheimer's, Alzheimer's disease and Mild Cognitive Impairment (MCI) due to Alzheimer's (28) are described in the recent guidelines.

The development and validation of biomarkers including those of the blood or cerebrospinal fluid or through neuro-imaging may significantly alter the identification of AD and hence the assessment of individuals with this pathology. These facts are of particular importance as the spread of AD and its incidence is used for calculating additional statistics, which are further used in the function of spreading of AD problem to the world ratio by demonstrating the needs of combating the disease as well as the identification of its distribution.

There are two main categories of AD diagnostic criteria:

1. **The Core Clinical Criteria** which present the criteria of random clinical practice. These criteria can be used in any environment without the need for highly specialized tools or procedures.

2. **The Clinical Research Criteria** which provide the use of biomarkers and are only used in the context of scientific research (29).

In fact, this categorization is necessary when the use of biomarkers is difficult due to the existing restrictions on data standardization because of the limited knowledge on the cut-off of biomarkers useful for diagnosis (26). However, recognizing the importance of these biomarkers, NIA-AA and IWG have suggested that in addition to clinical criteria, biomarkers increase the reliability of a demographic diagnosis that is compatible with AD (27). In addition, NIA-AA specified that individuals with normal cognitive behaviors and

abnormal biomarkers suffer pre-clinical Alzheimer's disease. And if this is validated to individuals who do not exhibit cognitive impairment but have Alzheimer's biomarkers, it can be concluded that they suffer AD (9).

1.4 PHYSICAL AND REHABILITATIVE ACTIVITY ON THE COGNITIVE ABILITIES OF INDIVIDUALS WITH AD

From the above data, it is clearly stated that AD presents a health emergency, from the situation of deteriorating pathology which significantly compromises the quality of life of affected individuals and their families, as well as its economic costs (30). These concrete facts bring about the growth of scientific research on cure, as well as the prevention of this pathology by trying to identify the risk factors and protective factors for the onset of the pathology. Among the most studied risk factors is the decline of cognitive abilities/ individual's cognition. The latter represents the progressive deterioration of intellectual functions. It has been noted that cognitive decline is a physiological process that occurs after the age of 70-80 as a result of brain cell aging (31). This fact can be considered as a risk factor for the dementia if this phenomenon occurs before the above mentioned age, and especially if the other affected element is memory (32). As of today, the most effective strategy to combat dementia result the one of radiation factors modification and cognitive ability decline during aging which is useful in preventing AD in elder people (33).

Based on the disease prevention and slowing down, this study has shown interest in investigating and evaluating the effects of physical and rehabilitative activity on the cognitiveness and perception of individuals with AD. Physical activity is an extremely simple and economical therapy and tool able to produce scientifically proven benefits (34). The practice of physical exercise can positively influence cardiovascular, respiratory, hormonal and neurological levels (35). From the latest advances in neuro-imaging techniques, physical exercise has shown that structural and functional brain changes are noticeable (36). The connection of physical exercise with cognitive capability has been strengthened recently in respect of observational and epidemiological studies prospective. Thus, a large number of lifestyle factors, including intellectual engagement, social

interaction and diet are closely related to the maintenance of cognitive functions and reduction of neurodegenerative disorders risk due to age as AD and vascular dementia (37, 38, 39).

As noted above, despite the progressive loss of cognitive functions, dementia in its clinical setting is a disorder of the motor system. In comparison to healthy elderly, individuals with AD present alterations in the step plan, decrease in walking speed, and an average increase in limb support time (40, 41). The loss of locomotor efficiency increases the risk of falling and the balance hub (42, 43). Usually, in patients with Alzheimer's disease, cracks occur during walking therefore in the course of a dynamic activity. A specific program of physical activity can improve their balance by accelerating the walk-step while increasing the safety for individuals with AD(44).

From the other side a structured physical activity during a 12-week program greatly improves muscle tone, flexibility, alertness, dynamic balance, posture, walking and decreases the risk of fall (46). Meanwhile the elements used to analyze static balance do not apply to dynamic equilibrium; however, it can be assumed that the improvement of static balance helps to optimize walking. In elderly misbalances, physical activity based on balance and muscle strengthening improves the individual's equilibrium with open and closed eyes, as a consequence the numbers of falls decrease (45).

The most important articles concerning the benefits of physical activity over balance, walking, musculature related to the cognitive behavior of individuals with AD are synthetically perceived in the Table.1.

Table 1. Literature review regarding the benefits of physical activity in patients with AD

First Author's Name	Research topic	Year	Journal's Name	References
Maraldi C	Physical exercise, cognitive decline and dementia in older adults.	2006	Giornale di Gerontologia	30
Bishop NA.	Neural mechanisms of aging and cognitive decline	2010	Nature	31
Kawas CH	Visual memory predicts Alzheimer's disease more than a decade before diagnosis	2003	Neurology	32
Middleton LE	Promising strategies for the prevention of dementia	2009	Archives of neurology	33
Yaffe K	Physical activity and cognitive decline in elderly women	2001	Archives of internal medicine	34
Hillman CH	Exercise effects on brain and cognition	2008	Nature reviews neuroscience	35
Booth FW	Physically active subjects should be the control group	2006	Medicine & Science in Sports & Exercise	36
Vaynman S	Lifestyle impacts neuronal and cognitive health through molecular systems	2006	Journal of neuroscience research	37
Karp A	Mental, physical and social components in leisure activities	2006	Dementia and geriatric cognitive disorders	38

Wilson RS	Participation in cognitively stimulating activities and risk of incident Alzheimer disease	2002	Jama	39
Nakamura T	Postural and gait disturbance correlated with decreased frontal cerebral blood flow in Alzheimer disease	1997	Alzheimer disease and associated disorders	40
Goldman WP	Motor dysfunction in mildly demented AD	1999	Neurology	41
Morris JC	Senile dementia of the Alzheimer's type: an important risk factor for serious falls	1987	Journal of gerontology	42
Van Dorn C	Dementia as a risk factor for falls and fall injuries	2003	Journal of the American Geriatrics Society	43
Rolland Y	Feasibility of regular physical exercise for patients with moderate to severe Alzheimer disease	2000	The journal of nutrition, health & aging	44
Santana-Sosa E	Exercise training is beneficial for Alzheimer's patients	2008	International journal of sports medicine	45
Lord SR	Effect of a 12 Month Exercise Trial on Balance, Strength, and Falls	1995	Journal of the American Geriatrics Society	46

1.5 POSTURAL CONTROL AND COGNITIVITY IN THE ELDERLY

The postural control allows the individual to orient and balance the body in space. It is based on the central integration of vestibular, visual, proprioceptive and tactile information (46). The body positioning scheme is constantly modified due to its multi-sensorial response by following the control motor of this position (47, 48). Equilibrium instead is a motor balancing ability which is automatically regulated by sub cortical neural structures and spinal moto-neurons (49). These skills in young people are quick and easy, but in difficult conditions the balance (small support base, only a limb support, difficult field walking) require the cognitive involvement of the individual (50). When postural exercises are difficult and individual equilibrium skills are limited due to normal or pathological aging of the individual, more automotive attention is required, as well as and the perception of the situation where is located (51). It is natural that the individual simultaneously execute many tasks as static, dynamic, and cognitive (52) ones. But the interpretation of executing data with at least 2 tasks is difficult when considering that both sensory-motor and cognitive functions decrease over the years (53, 54, 55, 56).

Unfortunately, the biological aging process modifies rapid execution skills between balance and cognition (57). Frequent falls in the elderly are not only caused by pathological situations but also by the lack of postural control (58, 59, 60). They pose a serious public health problem due to frequency and dramatic consequences (61). It is concluded that post-fall syndrome comes as a result of anxiety, fear of falling and decreased mobility in the absence of physical activity or postural exercises (58). Losses of postural control, and consequently the falls, are caused by the inability to activate the sensory-motor system during the act of walking in the elderly (62, 63). Disruption of the postural balance in the elderly is also caused by the reduction of muscular force to antigravity-extensor muscles, increased muscle activity during the equilibrium situation and the reduction in the capacity of brain centers that control behavior and walking thus losing the choice of useful information for balancing (53, 64, 65). Age-related morphologic and biochemical changes appear at the primary and prefrontal cortex levels known for their proprioceptive and cognitive function (54, 66). From the other hand, for the realization of postural movements, older people require more

cognitive resources than young people, more memory and more attention (67, 68, 69). It is important to note even the vice versa that by modifying and improving postural attitudes, a better concentration of cognitions in older people is achieved, increases self-awareness and proprioceptivity (70).

The role of musculature is essential in postural control. Hence is important to mention the fact that almost all neuromuscular disorders cause degeneration in the postural control system. The most common pathologies with such problems are: chronic ankle sprain, chronic degenerative low back pain, scoliosis, head injury, fractures, falls, etc. Abductors' and adductors have a critical importance during walking (71). From the other side abdominal and spinal muscles also stabilize and compensate postural movements (72). By considering also that the importance of trunk muscles in postural stability is vital (73).

1.6. POSTURAL GYMNASTICS

The postural gymnastics itself does not refer to only a rehabilitation method but involves different techniques with the same basic principles (74). It was born between the end of the nineteenth and the beginning of the twentieth century. The first interested subjects of this therapy were the artists, musicians and philosophers who aspired to develop the potentials of the person considered in its uniqueness and specificity, through the search for a morphological harmony, as well as the expression of body and mind harmony (75). The widespread of these methods is mainly linked to some fundamental differences compared to traditional medical gymnastics. The classical method has always considered the weakness of the paravertebral muscles due to rachis alterations: the only remedy for the pathologies of the spine seemed to be the reinforcement of this musculature (76). The posturalists have instead shown that the spinal muscles are actually numerous and strong, so they should not be further reinforced but it must be given back their elasticity (75). Classical gymnastics has always given great importance to exercises of rachis extension and abduction of the arms during deep inhalation to acquire a greater thoracic capacity (84). According to the advocates of the postural methods these exercises are lordosizing, they go to

the detriment of the body morphology both for their action on the rachis and for the action on the diaphragm continuously stressed in inspiration.

Taking into account that the aspiratory diaphragmatic block causes the shortening of the diaphragm, accentuates the lumbar lordosis and hinders paravertebral muscles lengthening, postural gymnastics aims to propose delordosis exercises and release diaphragmatic motion through a slow and deep exhalation (77). While classical methodologies have a segmental and specific therapeutic approach. The posturalists state that every single body segment must be considered an integral part of the "functional system" of man. Therefore, each treatment must be global and, consequently, must aim not at recovering the single function but above all at the complex relationships it has with the rest of the body and thanks to which it is able to influence and be influenced by the "whole" (77, 78).

According to traditional methods the individual is a simple executor of the proposed exercises. Postural gymnastics does not consider him an a critical performer of exercises but the protagonist of treatment management, able to perceive the various parts of his body and re-educate the incorrect postural habits finding a new morphological balance (75). Therefore, unlike traditional gymnastics, especially those with a competitive orientation, which mainly seeks the development of strength, endurance and extreme dexterity, postural gymnastics trains the subject to concentrate on the sensations that come from his body during a movement or during assumption of a posture (79).

The muscles that are stressed in this type of gymnastics are different from those that regulate the movement, even as regards the neurological mechanisms that govern them, so they will be trained differently through exercises that should affect posture. The postural muscle contraction is used to improve consciousness and the quality of movement. When performing the exercises, one always seeks to control the position of one's body and the principal objective is the quality of movement (79). All this brings considerable benefits from various points of view and for this reason postural gymnastics can be useful as a cure and prevention measure especially of musculoskeletal discomforts, such as scoliosis, lumbago, sciatica, neck pain, scapulohumeral periarthritis, arthrosis and osteoporosis (80).

In addition to this use, it can become an integral part of a normal sports training, in order to prevent certain injuries or diseases from overload. The

postural exercises, in fact, are static exercises that allow a strengthening of the whole musculature of the trunk involving, therefore, abdomen and back.

The body of the athlete must assume and above all be able to maintain, positions of alignment of the various body segments even during the execution of technical gestures. In this way, the exercises are useful to increase the tone of the musculature of the trunk, by also touching the deep muscles of the back, and to prevent back pain (81, 83).

The cornerstones of postural gymnastics can be summarized as follows (80):

- patient approach in a global way, considering that the alterations modify an entire functional system and not a single element;

- Perception as an indispensable tool to allow the individual to participate actively;

- Personalized therapeutic approach adapted to the specific needs of each patient;

- Use of breathing as a tool to change posture;

- Muscle lengthening;

- Recovery of body harmony. All postural methods work by referring to the principles listed above. Thus, the purpose of the treatment is to bring the patient as close as possible to an "ideal harmonic form", modeling the muscles that determine the body's morphology. The form of reference must necessarily be a "perfect form", which does not exist in reality, but to which the patient must be brought as close as possible (82).

1.7 GLOBAL POSTURAL REEDUCATION

The physiotherapy itself must be able to penetrate the pain and enable the slowing down of primary degenerative systemic evolution, but it also needs to act on the results of secondary damage, under non-functional conditions that favor the symptoms, the risk factors of recovery and psychological complications, with the aim to maximize the function and minimize the disability and handicap (84). The essence of rehabilitation is the specific exercise that improves muscular strength, mobility and common stability, the sensory dysfunction that is reflected in the decline of proprioceptivity. It also pays special attention to the patient's

education for anxiety management, the need for the rest of life as well as the importance of relaxation and articulation (85).

An effective therapy for the regeneration of muscular and articular tension, relaxation and anxiety management, psychosomaticity, and globality is the one developed from Philippe Emmanuel Souchard's named Postural Global Reeducation (GPR) (86). This revolutionary therapy was created by Souchard's biomechanical and neuro-physiological research, in the quality of an internationally renowned professor enabling the establishment of the "Université Internationale Permanente de Thérapie Manuelle (Uiptm)", headquartered in Saint Mont, France, functioning as a proliferation center for certain methods delivery worldwide (87). This method has been developed since 1981 and is based on the formation of muscular kinetic glands that may be encountered with their cuts influenced by different individual behaviors, wrong postures, or psychological problems (88). The GPR's aim is prolonged muscle relaxation and contraction of antagonistic muscles by avoiding postural asymmetry (89).

The GPR is indicated for various diseases, such as morphological problems (kypholordia, scoliosis, knee valgus, knee varus, flat feet, hollow feet, etc.), articular problems (neck pain, low back pain, and thoracic back pain), post traumatic problems, respiratory problems, neurological spastic problems and sporting problems. The existence of many studies supports the theoretical basis of this method and its clinical effectiveness (87).

From the literature review, it was noted that this method is effective in treating many pathologies and musculo-skeletal disorders such as back pain, rheumatoid arthritis, ankylosing spondylitis, disc hernias, cystic fibrosis, respiratory obstruction etc. (90, 91, 92, 93, 94, 95). There are also publications that demonstrate the positive effects of this therapy in different pathologies (see Table.2).

The GPR's uniqueness consists in tracing the cause by treating the passage. It enables a global approach involving the patient during treatment (89). According to Souchard therapy, muscles with a higher concentration of muscular tone, are always contracting and therefore are easily subjected to withdrawals and cuts with the reduction of myofascial elasticity and constant static imbalances (96).

The GPR principles are based on:

-Individuality: Individuals are similar to themselves and fit with a variety of proportional postures that are unique to everyone. The technique deployed accordingly cannot be standardized, thus, every treatment is unique. Properly, this element constitutes a distinct feature of the above mentioned therapy.

-Causality: Every musculoskeletal problem has a cause. In each therapeutic treatment it is always intended to treat the cause in function of the effect delivered through kinetic muscular chains.

-Globality: In order to reach the balance, it is important to treat the whole musculoskeletal structure including the upper and lower limbs without forgetting the individual's global influence and the psycho-motivational aspects.

GPR is considered as a "mild" postural gymnastics adapted to different aged groups such as children and the elderly consists in the active posture of muscular kinetic chains practiced in the shoulder, sitting and standing positions (89,79). Over the years, erroneous postural attitudes exacerbate the musculoskeletal system, which begins to manifest various pains.

The GPR technique is intended to act on the musculo-tendinous system by achieving the body harmony by stretching (97). This is accomplished by working on the kinetic muscular chains organized according to a structure (98). The latest are built on body functions basis. Considering that the basic principle of GPR is to treat "sick people and illnesses", GPR intends to regenerate morphology and reveal good biomechanical functions that affect the individuals' personal well-being. It also tries to recapture functionality and body harmony by adapting it to the global context. By this way, it seeks to normalize the organization of the individual in conformity with body deformities and diseases that affect individuals during the entire life cycle in relation to force and gravity (99). According to Souchard, the good body morphology is indispensable for life.

1.7.1 GPR Basic principles

I ° Principle - The first feature of the GPR is to exercise muscle tone with isometric shrinkage in an ever-more eccentric position by combining active and stretching work and recognizing that a rigid muscle is a weak muscle.

Our muscular system is composed by dynamic muscular fascia and static tonic muscle. The first muscles can lose efficiency when they are atrophied or have tonus reduction, while static ones lose effectiveness when contracted, shortened, or hypertensive. Under these circumstances worth mentioned that the latest are essential to human musculature, as they play a difficult role and simultaneously are voluminous, tonic and fibrous.

II ° Principle - should always work in an art decoction due to the therapist's manual action and to correct them simultaneously acting in distortion of micro-lesions and macrodeformations.

When our muscles are hardened and shortened, they create compression that strains all the articularities, especially the vertebral ones. Inter-vertebral discs are as compressed as they support all body weight, but also from resistance to gravity they are shortened. This component of compression can affect all articulations (98). Muscles that guide us are the first to cause pain and postural modifications by creating an articular lesion. This condition allows the body to automatically adapt to antalgic positions by avoiding pain. It is important to treat a painful articulation by facilitating its pressure through decompressing the stretching of all muscles surrounding it, which has for a long time held that untenable tension position (99).

3 ° Principle – The GPR breathing is considered as the global stretching engine. All postural remedies are realized through diaphragm breathing with expiratory applicability. This is an important element not only for the postural function but also for the relaxation of the patient treated during the therapy time-frame. In all kinetic muscular chains we have accessory inspirational muscles, which serve as torso suspensions, so they are tonic, and therefore their tendency is to contract and shorten (100). By stretching these muscles and paying attention to the expiration in order to recover the length and flexibility, their active strength is also re-gained. A torus that is freely emptied by expiration is able to increase

breathing appetite and the volume of gas exchanges by restoring "the vital breath" (96).

Also any alteration in the body or mind is associated with an alteration of breathing and vice versa, breathing affects both the shape and functioning of the body as well as the emotional and mental aspect of the individual. Therefore, it is important to breathe well, without jams or stresses that may adversely affect the rest of the body functions (100).

1.7.2 Kinetic muscular chains

Tonic muscles as mentioned above are organized in groups having as function the insurance of static coordination (96). These muscular groups are classified on behalf of functional purposes. The most suitable term for describing these groups is "kinetic muscular chains". This denomination always pertains to a group of muscles with the same action and quality in the realization of a given action.

The static muscle chains on which to address the treatment are mainly two (96):

1. **The large posterior chain** - is a myofascial chain formed by the spinal muscles, the pelvic-trochanterics, the gluteus maximus, the ischi-crural, the popliteus, the sural triceps and the plantar muscles (refer to Figure.1).
2. **The large anterior chain** - is a myofascial chain formed by the suspension system of the diaphragm and the viscera, the sterno-cleido-mastoid, the long neck muscle, the scalene, the pillars of the diaphragm, the ileo-psoas and the iliac fascia, the pubic adductors and the tibialis anterior (see Figure.2);



Figure 1. The large posterior chain



Figure 2. The large anterior chain

Additionally, in some different relationships, some accessory muscle chains (96) are added:

1. **Inspiratory chain**, where the diaphragm and its suspending systems are called the 'diaphragm tendon', the sternum-cleido-mastoid, scalene, intercostal, spinal and minor chest (100) (as per Figure. 3);
2. **Anterior-internal chain of the shoulder**, consisting on static arm muscles, coracobrachialis, subscapularis and upper fascia of the major chest (in Figure. 4);
3. **Upper shoulder chain**, mainly formed by the upper trapezius to which we must add the central deltoid fascicle and the minor pectoral (see Figure.5);
4. **Anterior chain of the arm**, composed of coracobrachialis, biceps, anterior brachialis, long supinator, all the anterior forearm muscles, as well as those of the eminence hold and hypotenuse (in Figure. 6);
5. **Antero-internal hip chain**, consisting of iliopsoas, capillary and pubic adductors (Figure.7);

6. **Side chain of the hip**, can be described as an additional chain, corresponds to the level of the hip, to the upper shoulder chain and consists of the pyramidal muscle, the gluteus superficial and the lateral fascia, the same thing happens with the front chain for the couple of the muscle fascia tensor and lateral fascia muscle. Its description doesn't represents a theoretical interest (see Figure. 8).

The active work is the prerequisite for the "tonic release" of the shortened muscles to be exploited by using the inverse myotatic reflex and all corrections can be integrated by the automatic mechanisms for controlling posture and the best gestures (99).

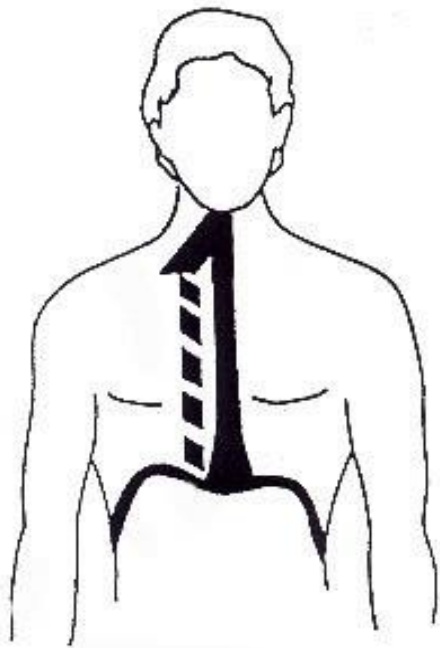


Figure 3. Inspiratory chain

Figure 4. Anterior-interior chain of the shoulder

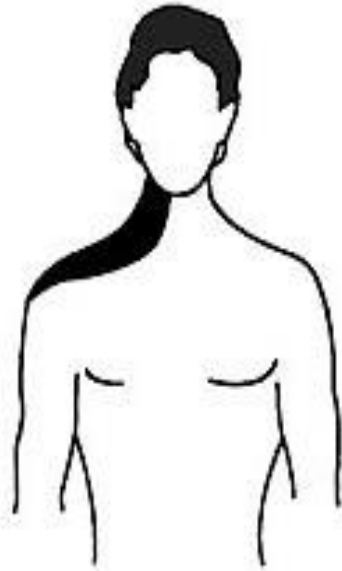


Figure 5. Upper shoulder chain

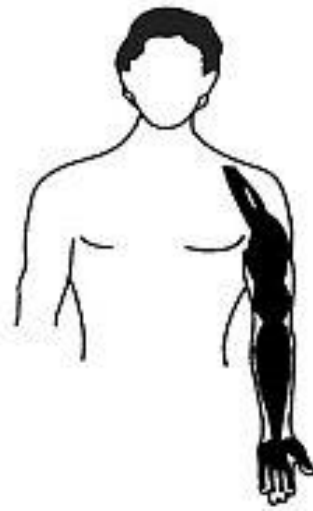


Figure 6. Anterior chain of the arm



Figure 7. Antero-internal hip chain



Figure 8. Side chain of the hip

Meanwhile the search for corrections must take place consciously, without pain or with a minimum pain easily managed by the patient, through manual interventions, to favor the lengthening, in the longitudinal direction, of the contracted or retracted muscles within the shortened muscle chains. For example, the protrusion of the head and the increase of thoracic kyphosis may depend on the shortening of the anterior chain, the protraction of the shoulders and their internal rotation are caused by the shortening of the anterior-internal shoulder chain, the flexion and the internal rotation of the hip is caused by the shortening of its anterior-internal chain (97).

The available postures are different; suitably chosen to deal with patient and disease multiple conditions (refer to Figure.9). Although this technique is widely used by physiotherapists, few researches support its therapeutic efficacy, which seems to be confirmed primarily by the opinion of authors and individual clinical experiences.

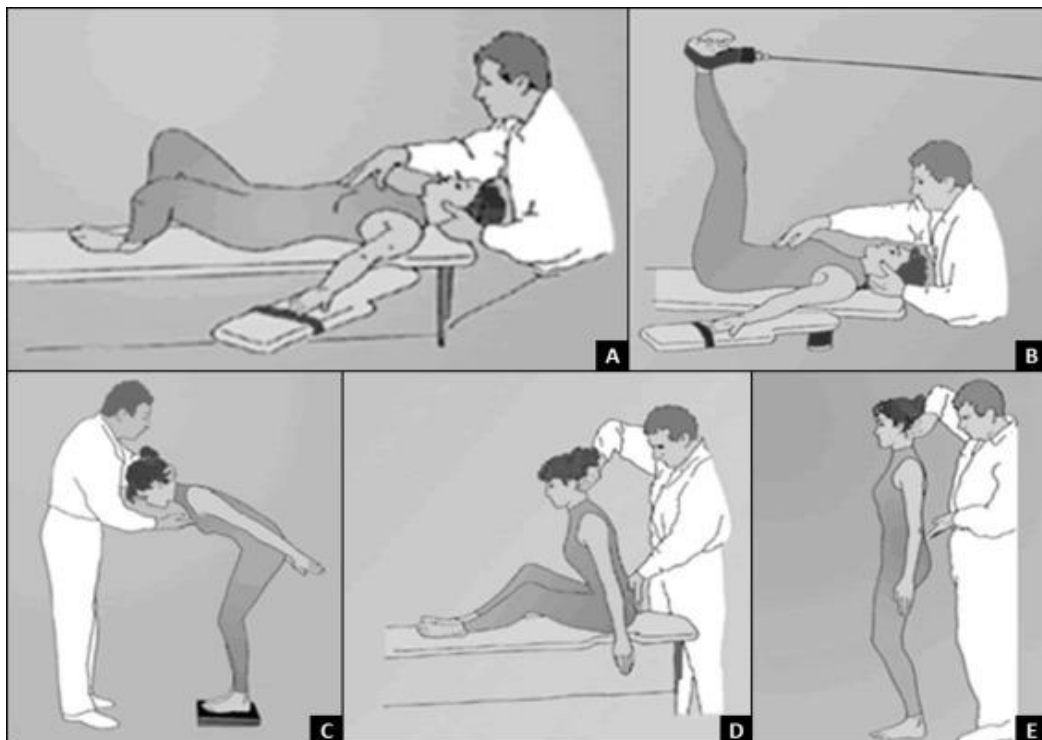


Figure 9- Specific postures modified according to patient needs (89)

1.8 THE GPR EFFECTS ON ADULTS PATHOLOGIES TREATMENT

Musculoskeletal and rheumatoid system disorders such as back pain, ankylosing spondylitis, temporo-mandibular disorders, herniated discs, etc., represent a major social and economic worry for the elderly people (101,102,103).

According to these needs, numerous clinical studies have highlighted the usefulness of physio-chinesitherapy in musculoskeletal and rheumatic diseases, which is effective for pain and joint function in osteoarthritis of the knee and hip, in ankylosing spondylitis, in rheumatoid arthritis, in the reduction of bone mass, in the prevention of vertebral collapse and in the risk of falling into osteoporosis (104, 105, 106). Although in a context that recognizes the usefulness of physiotherapy and physical activity, different rehabilitative strategies can be adopted depending on the pathology, pathological-phase, therapeutic objectives and individual conditions. In all cases, a global rehabilitation project is required. Physiotherapy must be able to intervene on pain and try to slow down the primary degenerative systemic evolution, but must also act in the results of secondary damage, in dysfunctional conditions favoring the symptoms, in risk factors of re-fall and almost in psychological complications, in order to maximize the functions and minimize the disability (107,108,109). Thus, specific exercises to improve muscle strength, mobility and joint stability, the sensory dysfunction that is reflected in the decrease of proprioception, are the core of rehabilitation. Furthermore, it is essential to educate the patient on its anxiety management concerning the need for the rest of life as well as on the importance of articular economy and relaxation (110).

Among the various methods, the RPG is of particular interest in treating these pathologies as it has a low economic cost, considering that's just a physical therapy without the need for taking other medications and for many reasons mentioned above (111,112,113,114). Its effects have been investigated on multiple pathologies, including musculoskeletal and rheumatic disorders (115,116,117,118,119). But aiming to check the effects of GPR at the third age, a literature review was carried out, including randomized controlled trials, pilot studies and study comparisons that are reflected in Table.2.

Table 2. Literature review on GPR effects in the most frequent elderly pathologies

Author	Condition/s	Sample	Treatment Method	Intervention Duration	Total session	Follow-up period	Reference
Cunha et Al.	neck pain	31 patients	GPR	6 weeks	12 (twice a week)	6 weeks and 12 weeks	90
Fernandez-de-las-Peñas et al.	ankylosing spondylitis	40 patients	GPR	15 weeks	15 (once a week)	16 weeks and 1 year	105
Maluf et al.	temporomandibular disorders	28 patients	GPR	8 weeks	8 (once a week)	8 weeks and 16 weeks	92
Pillastrini et al	neck pain	94 patients	GPR	24 weeks	9 (once/twice a week)	1 week, 12 weeks and 24 weeks	93
Appuzzo and Tomaiuolo	lumbar disc hernia	68 patients	GPR	28 weeks	20 (twice a week / 42 days, once a week /30 days, twice a month/30 days, once a month/ 90 days)	1-5 years	118
Lawand et al	low back pain	61 patients	GPR	12 weeks	12 (once a week)	1 week, 12 weeks and 24 weeks	112
Marques et al.	fibromyalgia	20 patients	GPR	6 weeks	6 (once a week)	6 weeks	113

Author	Condition/s	Sample	Treatment Method	Intervention Duration	Total session	Follow-up period	Reference
Marques AP.	scoliosis	1 patient	GPR	16 weeks	16 (once a week)	16 weeks	114
Adorno and Brasil-Neto	chronic back pain	30 patients	GPR	12 weeks	12 (once a week)	12 and 20 weeks	115
Fernández-de-las-Peñas et al.	osteoporosis	40 patients	GPR	12 weeks	15 (once a week)	12 weeks	91
Durmuş et al.	ankylosing spondylitis	51 patients	GPR	12 weeks	60	12 weeks	116
Vincenti L.	discal protrusion	3 patients	GPR	4 weeks	10 (3 times a week /2 weeks and 2 times a week / 2 weeks)	4 weeks	117
Appuzzo et al.	low back pain	68 patients	GPR	20 weeks	18 (twice a week / 6 weeks, once a week / 4 weeks, once a month /2 months)	1 week and 20 weeks	94
Bonetti et al.	low back pain	78 patients	GPR	24 weeks	10 (twice weekly/ 5 weeks)	1 week, 12 weeks and 24 weeks	86
Estol C.	discal protrusion, stenosis	102 patients	GPR	5 months	5 months	22 months	119

1.8.1 The GPR effects in respiratory system

As already mentioned the GPR method is a manual therapy that interferes in the symptoms of mechanical origin. It is defined as a causal therapy, because, in its actions, it tries to interpret and modify the biomechanical alterations responsible for these symptoms and does not use analgesic agents to avoid symptoms persistence (96). The active muscle lengthening of this therapy extends the antigravity muscles (internal rotators and respirators) and is based on the understanding of postural muscle groups. For this reason, GPR considers breathing as fundamental.

As observed any alteration in the body or mind immediately causes an alteration of the breathing; and vice versa, breathing also influences the shape and functioning of the body as well as individuals' emotional and mental aspects. Therefore it is important to breathe well, without blockages or tensions that can negatively affect the rest of individuals' functions (100). Although its benefits have been demonstrated in clinical practice, scientific evidence is crucial for its validation as a therapeutic alternative (95,116, 122).

In general, the alterations in respiratory mechanics derive from an excessive shortening of the respiratory muscles. The main causes of this shortening are the psychological factors (stress), the increase in the volume of the visceral mass, the inappropriate posture, the respiratory disease, muscle weakness and aging (89). All postural exercises involved in the GPR method allow respiratory muscle lengthening. The postural positions of the GPR allow a greater stability of the diaphragm insertions and are ideal for stretching the diaphragm muscles, the sternocleidomastoid muscle, the scalene muscles, the intercostal muscles and muscles of the dorsal part, as well as the major and minor pectoral muscles (99).

While the greater flexibility of the diaphragm is made possible by the fixation of its inserts, together with its eccentric contraction. (120). The stretching of a muscle fiber favors a serial increase in the number of sarcomeres. The increase in muscle strength as a function of stretching could be attributable to a better interaction between actin and myosin filaments, in virtue of the increase in functional muscle length (121).

Even if the respiratory musculature can not be immobilized, its permanent contraction favors a particular posture during the inhalation, limiting the mobility of the thoracic cavity (120). The GPR method has some advantages in relation to other types of stretching due to the fact that the GPR maintains the muscles in extension for a prolonged period. Not only that, but GPR activates the muscle groups in an integrated way, facilitating the adaptations that promote improvements in terms of flexibility and strength (125,126,127). These favorable results are confirmed also in the studies presented in Table.3, which specifies the effect of GPR on respiratory diseases. Exist additional studies that demonstrate the favorable effects of maximal respiratory pressures and measurements of thoraco-abdominal cirtometry in individuals without pulmonary changes, suggesting that GRP can be used even as a rehabilitative physiotherapeutic resource for respiratory pathogens (123,124).

In many clinical studies it is important to place the patient, in the postures of "frog in the floor with closed arms" and "frog in the air". According to the authors, both postures allow a better stability of the diaphragm insertion points, being ideal for working the pectoral muscles of the diaphragm, of the sterno-cleidomastoide, scaleno, intercostal major and minor (122,128). Properly, the studies of these authors have been effective in promoting a significant increase in the analyzed spirometric variables, corroborating the results of this work that not only are the postures "frog on the ground" and "frog in the air" applied in the treatment protocol, but they also showed significant results in relation to the analyzed spirometric variables. These postures have shown a statistically significant improvement in thoracic expansion and maximum respiratory pressure in other studies (129,130).

With respect to other researches and their results, only the change in sitting postures, dorsal decubitus, lateral decubitus or head positioning show a significant effect in respiratory physiology, spirometry, pulmonary volume, etc. (131,132,133).

Table 3. The GPR effects in respiratory pathologies

First Author's Name	Research topic	Year	Journal's Name	References
Moreno et al.	Muscle stretching program using the GPR method on respiratory muscle strength and thoraco-abdominal mobility	2007	Jornal Brasileiro de Pneumologia	95
Durmuş et al.	Exercise interventions on pulmonary functions	2009	Joint Bone Spine	116
Teodori et al.	Stretching of the inspiratory musculature through GPR	2003	Braz J Phys Ther	122
Abreu et al.	Influence of GPR on the posture, flexibility and cardiovascular system	2014	Fisioterapia em Movimento	123
Moreno et al.	Influence of GPR on method on respiratory muscle strength	2005	Anais de Eventos da UFSCar	124
Feroldi et al.	Physiotherapeutic protocol on the respiratory function of children with cerebral palsy	2011	Rev Neurociencia	125
Kakizaki et al.	Respiratory muscle stretch gymnastics in patients with chronic obstructive pulmonary disease	1999	Journal of Cardiopulmonary Rehabilitation and Prevention	126

First Author's Name	Research topic	Year	Journal's Name	References
Moreno et al.	Respiratory system adaptations related to lung function in response to a muscle stretching program using the GPR	2009	Fisioterapia e Pesquisa	128
Lozano at al.	GPR effects in patients with Chronic Obstructive Pulmonary Disease	2010	Revista Eletrônica Novo Enfoque	129

II – JUSTIFICATION

II - JUSTIFICATION

When quoting the equilibrium, we always refer to the global concept of relationship between human beings and the surrounding world. Since the interest in the equilibrium study is high, it has devoted great importance in analyzing its elements such as: psychobiology, psycho-neurology or human anatomy-physiology; as well as its role in the sciences of motion. It is important to note that globalistic equilibrium for every theoretical-practical approach is based on important elements such as: a) phylogeny and ontogenesis of human beings data; b) review of mechanisms by which the central nervous system adequately balances; c) concerns and their impact on cognitive abilities; d) socio-emotional relations of human society. Worth mentioned that the most interesting fact is if one of the elements above is altered, the equilibrium is not the same, it loses the balance.

The postural-human equilibrium is the result of sensory-perceptive-motor integrations. Posture itself represents body position in space and relative relationship with body segments. It serves as a communication tool of the inner world with the surrounding environment. In addition it is a personalized fit of every individual with a physical, psychic and emotional environment.

Most of the postural remedy methods developed by: Françoise Mezières (1947); Marcel Bienfait (1962); Philippe Emmanuel Souchard (1980); Gerda Alexander (1983); Feldenkrais (1985); Matias Alexander (1986), Thérèse Bertherat (1987); Blandine Calais (1991); Antoni Munné (1993); each with its features, confess that the back muscles of the body, and in particular the spinal column, which is associated with the location of the major antigravital muscles, is responsible for all the bad postural habits.

According to Philippe Emmanuel Souchard it is possible to differentiate the behavior from the static and dynamic muscles role. Muscles contributing to static are the so-called "postural". The dynamic muscles instead execute the movement, they are not shortened but weakened. These two muscle groups should develop

special skills to carry out selective functions; while postural muscles should be resistant the dynamics should be strong enough to achieve the ideal balance. Muscle treatment that modifies the posture should provide specific therapeutic programs compared to traditional ones that develop the dynamic structure.

The proprioceptive method of inhibiting Postural Global Reeducation (RPG) is that of E.P. Souchard, which is based on myopathic inversion reflex. He points out that static muscular pathology is produced by hypertension, muscular stiffness and shortening, while dynamic muscular pathology is a consequence of hypotonicity and muscular distension. In addition, the RPG method is perfectly complemented with other therapeutic methods, allowing its use even in the most aggressive stages, as it enables the treatment of "fragile" patients with no difficulty. RPG is a proprioceptive technique that contributes to the improvement of patient self-efficacy and pain management thanks to the diaphragmatic release and articulation of the pain that occur during the postures evolution.

Since individuals with AD in the early stages of the disease are endangered by loss of balance and multiple lesions, this study suggests the practice of postural therapy of RPG which not only improves balance, modifies misplaced postural attitudes, but also through diaphragmatic muscle training aims to increase the perception of the location of these individuals and not only; having a secure posture enhances cognition, cognitive abilities, improves emotional, functional condition and thus improves the quality of life of these individuals.

III – OBJECTIVES AND HYPOTHESIS

III – OBJETIVES AND HYPOTHESIS

3.1 OBJECTIVES

3.1.1. General objectives

The therapeutic activities of the GPR in a first phase are based on the maintenance of motorist autonomy of patient with AD. Correspondently this research study:

- Develop the proprioception and motor skills, through specific techniques of GPR, reacquiring the body control (neuromuscular re-education) and the installation of increasingly complex postural patterns;
- Organizes the concentration and self-limiting capacity during the GPR treatment, for the management of stress, thanks to the physical and respiratory exercise modalities, create fun aspects, self-gratification and relaxation that accompany patients as well as the conscious use of view and neuro-associative conditioning;
- Improve postural attitude, balance and movement, as a natural consequence of everything and increase the psycho-physical well being.

3.1.2. Specific objectives

- The designation of a personalized action plan through the implementation of GPR technique, based on the severity, age and physical capacity of the subject with AD, taking advantage of the residual abilities of the individual while keeping the patient integrated in social and family environment;

- The introduction of relaxation techniques during the GPR therapy for the control of anxiety during periods of crisis of the subject with AD, practice the active global stretching to alleviate muscular pain symptoms and to improve postural attitude, the perception of the patient concerning the surrounding environment;
- Use of postural exercises aimed at multiple effects, so as to be most effective in achieving all the objectives.

3.2 HYPOTHESIS

H1- The application of Global Postural Reeducation to Individuals with Alzheimer's Disease improves equilibrium, postural stance, walking and spacio-temporal orientation.

H2- The Global Postural Reeducation technique improves the cognitive and proprioceptive behavior of patients with Alzheimer's Disease.

H3- The treatment with the Global Postural Reeducation Technique in Patients with Alzheimer's Disease reduces depressive symptoms and anxiety and by consequence improves their emotional state.

H4- The application of Global Postural Reeducation improves the autonomy of people with Alzheimer's Disease.

H5- Global Postural Reeducation Technology improves the quality of life of people with Alzheimer's Disease.

IV - METHODOLOGY

IV – METHODOLOGY

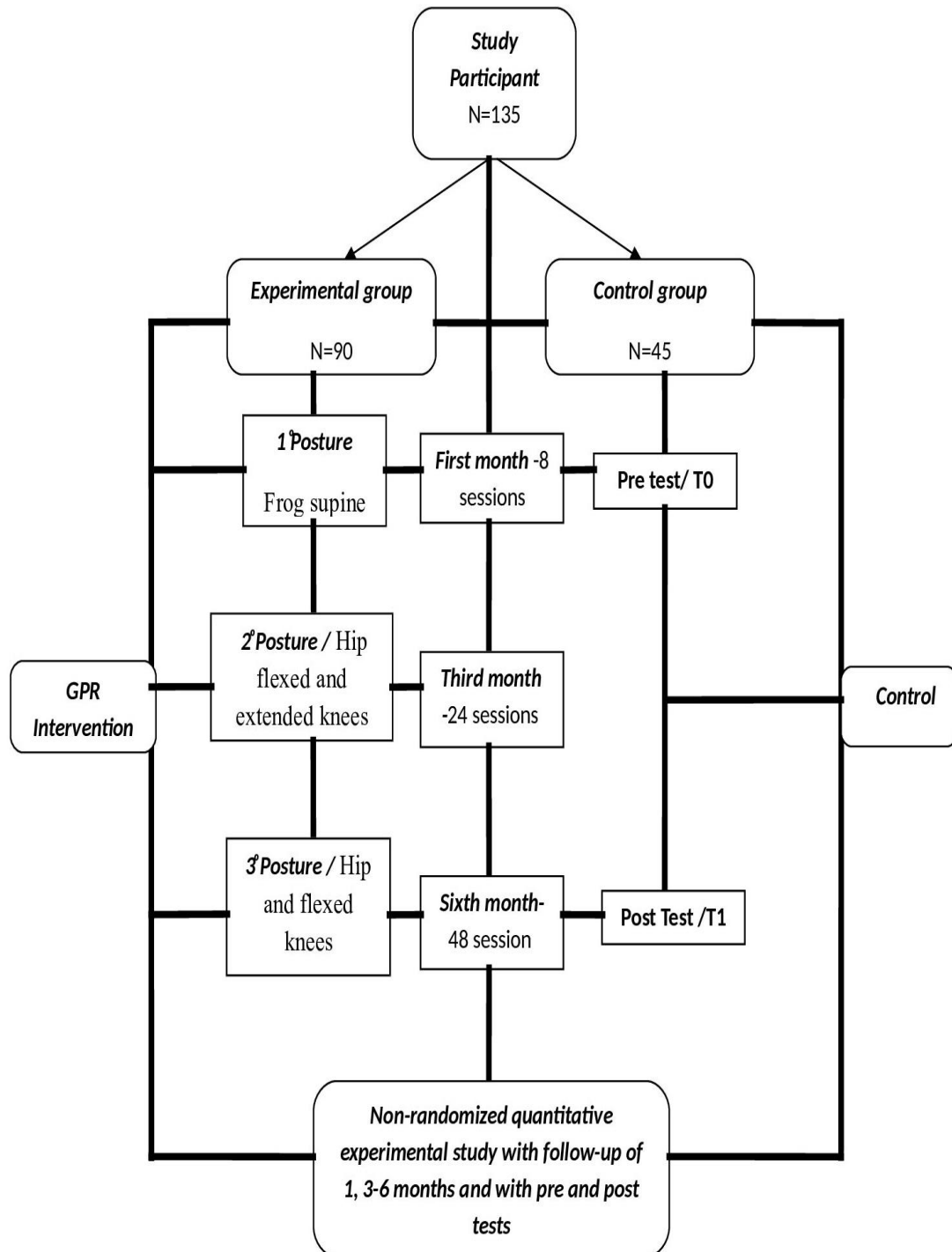
4.1 STUDY DESIGN

This research study is developed based on an experimental design with non-randomized controlled interventions were participated 135 subjects with AD including 45 of the control group. It lasted 6 months with pre-post tests (T0-T1) executed before and after six months of treatment and with a follow-up of one, three and six months concerning the experimental group results. By having in focus the evaluation of GPR therapy effects on cognitive, proprioceptive, depressive, autonomy, gait and life quality of the above mentioned subjects.

The research intervention consisted in the reappointment of three GPR therapeutic postures. The first posture consisted in the patient's supine position with the upper limbs open and frog legs applied for a period of one month with an application frequency of two weekly sessions for approximately 30-40 minutes. The second posture against consisted in the patient's supine position with extended legs, basins bent and upper limbs opened, applied with a frequency of two weekly sessions for a period of two months. The third posture after the third month of treatment consisted of a supine position with upper limbs opened, even and knees flexed by 90 ° for another 3 months, applied with a frequency of 2 weekly sessions for approximately 40 minutes in order to verify if the technique of GPR and posture change interferes positively in the intervention group during a six month period.

The scores retrieved from cognitive, life-long, autonomic, depressive and march tests implemented under GPR postural treatment in experimental group were compared to the scores of the same control group tests that had not undergone any intervention. The data are analyzed in comparison between groups [BETWEEN factor, experimental vs. control group] and among the nominal test scores obtained before and after intervention [WITHIN Pre vs. Post factor]. The research design has been described in Figure 10.

Figure 10. Study design



4.2 PARTICIPANTS

A total of 135 subjects with AD in the mild or moderate phase participated in the study during November 2016 - June 2017 period from which 90 pertain to research group and the rest to the control one. The examined subject were selected in the senior residences of Tirana (Albania), Murcia and Malaga (Spain) according to the NINCDS-ADRDA criteria (134), based on the medical documentation of dementia with differential diagnosis of AD aged between 67 to 92 years. All participants signed the informed consent and their family members were also informed concerning the purpose of the study. Correspondingly the data were provided by the physiotherapists who performed the above mentioned technique. Thereafter the study was validated and approved by the Ethics Committee of Catholic University of Murcia.

Inclusion criteria: older than 40 years of age, both male and female with medical records that affirm the intellectual disability, individuals with dementia, Alzheimer's disease differential diagnosis in mild and moderate phase, cognitive impairment, capable to go to the bathroom by themselves as well as eat and wear in full autonomy.

Exclusion criteria: presence of brain tumors, infection or inflammation in chronic diseases with the involvement of the central nervous system, psychiatric disease, depression symptoms, borderline and neurological patients with peripheral neurological signs, neuromuscular disease, aggression, stroke and fractures.

Inclusion and exclusion criteria were maintained the same during the therapeutic intervention of the study. Patients were not randomized simply because of the lack of sufficient sample subjects as luckily Alzheimer's disease is not present in most of the elderly. Precisely the inclusion /exclusion criteria are summarized in Table 4.

Table 4. Inclusion/Exclusion participants details

Inclusion Criteria	Exclusion Criteria
Older than 40 years old	Under 40 years old
Both male and female	Infection or inflammation in chronic diseases
Intellectual disability	Presence of brain tumors
Individuals with Alzheimer disease in mild or moderate phase	Psychiatric disease, Borderline
Cognitive impairment	Ictus, Neuromuscular disease, Fracture presence

4.3. STUDY VARIABLES

In this study, there defined 3 groups of study variables pertaining to following dimensions:

I) Independent descriptive sample variables, II) independent cognitive valuation variables and III) independent variables of the postural evaluation from which derive the above mentioned research results. Each group belongs to a dimension where it is assigned also a number according to the study importance.

I) **First dimension variables:** These variables are specified by the subject of the search itself or by data obtained through medical team or clinic files. They reflect that kind of data cannot be collected through standardized tests. The first group of independent variables includes: gender, level of education, Alzheimer's phase, daily training (as: aerobic exercise, walking, and arts / animations) (Table.5).

Table 5. I° dimension variables: complementary study variables

Variable	Description	Category	Response
Gender	Important for the study analysis	Dichotomic	Male vs female
Level of education	Important for the cognitive tests	Qualitative	Basic vs medium vs high
Alzheimer phase	Important for the treatment	Qualitative	Mild and moderate phase
Daily training	Social insertion	Dichotomic	Aerobic exercise, walking, arts/animations

II) **Second dimension variables:** These variables represent the standardized study-specific tests related to the subject's cognition. They are examined in 2 stages of the study before and after as reflects the neuropsychological, depressive, social and autonomic signs and symptoms of AD-related to research subjects. And rationally can be considered as the fundamental variables of the study as they express the current neuro-conjunction capacity and advancement in time. Through respective description it can be provided the study situation, the average and the standard deviation of the neuropsychological characteristics of the subjects. Here is the case of: Mini Mental State Examination (MMSE), Quality of Life in Alzheimer's Disease (QoL-AD), Geriatric Depression Scale (GDS), Barthel Index (BI), Neuropsychiatric Inventory (NPI) (Table 6).

Table 6. II° dimension variables: objective variables related to the exploration of subjects' cognitively

Variable	Description	Category	Response
<i>MMSE</i>	Level of dementia	Qualitative	Numeric
<i>QoL-AD</i>	Aspects of life	Qualitative	Numeric
<i>GDS</i>	Depression	Qualitative	Numeric
<i>BI</i>	Independence	Qualitative	Numeric
<i>NPI</i>	Psychiatric symptoms	Qualitative	Numeric

III) **Third dimension variables:** This set of variables pertains to the postural evaluation of the subject. The data obtained derive from the postural behavior of the subjects, the materials used in the study and the specific tests. They are equally important as those of the second dimension as represent the postural situation of subjects in relation to neuropsychological data aiming to verify possible relationships between them (Table 7).

Table 7. III° dimension variables: objective variables related to subject's postural exploration

Variable	Description	Category	Response
TS	Equilibrium	Qualitative	numeric
Therapeutic evaluation	Perpendicular Anatomical planes	Qualitative	3 axial planes
Freeman table	Proprioceptive table	Dichotomic	yes vs no
GPR Postural bed	Postural therapeutic tool	Dichotomic	Position

4.4 COGNITIVE EVALUATION

The cognitive evaluation was performed by using standardized neuro-cognitive tests. Since the latter are a simple and effective tool able to monitor the cognitive abilities of a healthy person, and furthermore able to assess the behavior evolution of a subject affected by dementia of Alzheimer type. As well as being very useful for the purpose of a early diagnosis, which in this pathology is essential for the prognosis of the subject by contemporaneously admitting that the only neurological tests can not be sufficient for diagnostic purposes. Definitely among the advantages offered by this type of test is the possibility of multiple tests repetition allowing therefore to have a monitoring of cognitive functions in short, medium and long term, the extremely low implementation cost, the absolute non-invasiveness of the procedure and the relatively short duration of administration and processing of results. Precisely for these reasons, these tests are widely used and exist to date through an extreme variety of standardized and validated tests each of which aims to assess the overall cognitive skills or to evaluate a specific cognitive domain.

In order to assess the cognitive abilities of the patients a cognitive test was administered which acts through a scale concerning depression and mood evaluation as well as a questionnaire was developed aiming to evaluate the examined subjects' functional abilities. The following measurement tools were administered initially, after the first and third month and finally at the end of the study. All the tests administered are briefly described below and summarized in Table 8.

- **Mini Mental State Examination (MMSE)** (135). The version of 30 elements was used to obtain a global measure of cognitive function. It allows obtaining a global score of the level of cognitive impairment by evaluating different cognitive areas: spatio-temporal orientation, memory, executive functions, language (repetition, comprehension, oral and written denomination) and practice-constructive abilities.

- **Quality of Life in Alzheimer's disease (QoL-AD)** (136-137). It consists in 13 elements referring to the perception that patients have concerning various aspects of their life: mood, health, cognition, environment and functional

capacity. The range of scores is 13-52, where higher scores indicate a better life quality.

- **The Geriatric Depression Scale (GDS)** (138). The version of 15 articles was used, which given its length can be validly and reliably resolved by patients themselves in the quality of a self-report questionnaire aiming to investigate the possible presence of depressive symptoms. This questionnaire is specifically designed for elderly people and is widely used for the evaluation of depressive symptomatology in geriatric age since 1980. It scores from 0 (positive to depressive symptoms) to 15 (negative to depressive symptoms).

- **Barthel Index (BI)** (139). It is used to measure performance in the basic activities of daily life. This index provides an indicative score of the possibility of eating, dressing, managing personal hygiene, bathing, using the toilet, moving from the chair to the bed and back again, walking slowly, up and down the stairs, control defecation and urination. 15, 10, 5, or 0. The maximum score is assigned if the patient performs the task in a completely independent manner. The maximum score used is 100 points and refers to the patient's independence in all basic daily living activities.

- **Neuropsychiatric Inventory (NPI)** (140). This test includes 12 symptoms scored according to the phenomenon severity and frequency. It is an instrument specifically designed for the assessment of psycho-behavioral disorders in individuals with cognitive impairment. For each individual scale, correspond each of the 12 neuropsychiatric syndromes and finally by multiplying the frequency and gravity the total score is achieved (maximum score of 12); since each scale is composed of multiple questions, it must be multiplied the frequency and severity for each question and considering the highest value as the syndrome score. The overall score is obtained by summing the total scores of the symptoms (product of frequency and severity). The score range is 0-144.

Table 8. Cognitive evaluation tests of patients with AD

Test	Evaluation	Description	Authors	References
MMSE	Cognitive domains	Questionnaire 0-30 scores	Folstein et al. 1975	135
QoL-AD	Life quality	Questionnaire for patients and caregivers 13-52 scores	Gómez-Gallego et al. 2012	137
GDS	Depressive symptoms	Questionnaire 0-15 scores	Yesavage 1988	138
BI	Autonomy	Questionnaire 0-100 scores	Mahoney 1965	139
NPI	Neuropsychiatric syndromes	Questionnaire 0-144 scores	Cummings et al. 1994	140

These tests allowed the collection of multiple information and scores from one side concerning the general cognitive skills of the subjects participating in the study and specific cognitive domains such as: the praxis, memory, executive functions, etc from the other one. The scores retrieved allowed "a numerical evaluation" of the cognitive state of the subjects by therefore allowing the achievement of the purpose of this work.

4.5 POSTURAL AND THERAPEUTIC EVALUATION

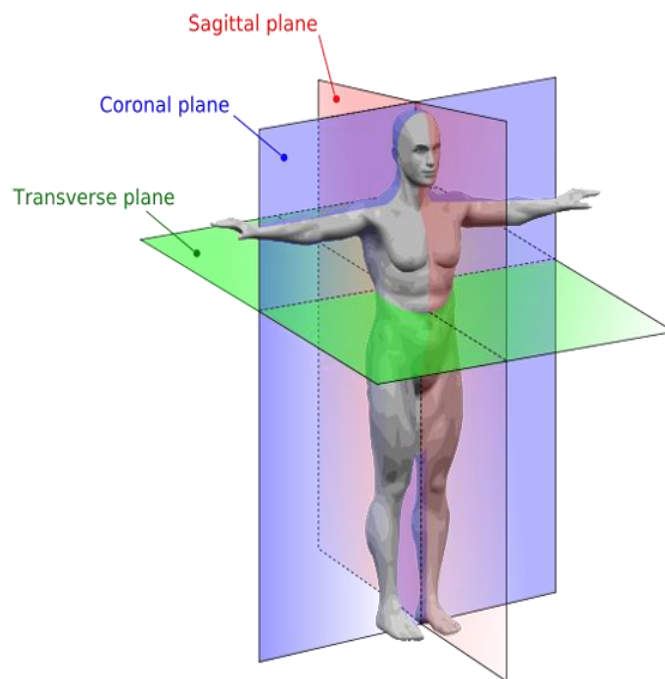
Postural evaluation was performed through a specific test concerning the walking, equilibrium and posture control as well as the physiotherapeutic evaluation in three planes. Through a rectangular equilibrium tablet known to be re-licensed under the name Freeman, it was measured the profitability, balance and equilibrium. And through the postural bed it was assured the patient comfort during the treatment.

- **Tinetti Scale (TS)** (141). The equilibrium subscale has been applied, which consists in 7 elements and has a score between 0 and 13. Highest scores indicate a better balance. It is a valid and important means of rehabilitation, a tool used in

the hospital, nursing homes and private studios with the purpose of assessing the patient's balance and path.

- **Therapeutic evaluation (142)** - It is a therapeutic evaluation that measures postural body lines in 3 axial planes. It simultaneously evaluates the balance, orientation and proprioceptivity as well as is commonly used in skeletal treatments with the GPR method. Evaluation is done by respecting the biomechanical equilibrium. The action is on the 3-story space since the position of any part of the human body can be defined by referring to the 3 planes perpendicular to each other (Figure 11).

Figure 11. Perpendicular anatomical planes



- **Freeman table** - Proprioceptive table of reeducation of neuro-muscular-sense. It is a table with cylindrical or spherical basis which measures balance, equilibrium and the patient proprioceptivity. Contemporaneously it can be used

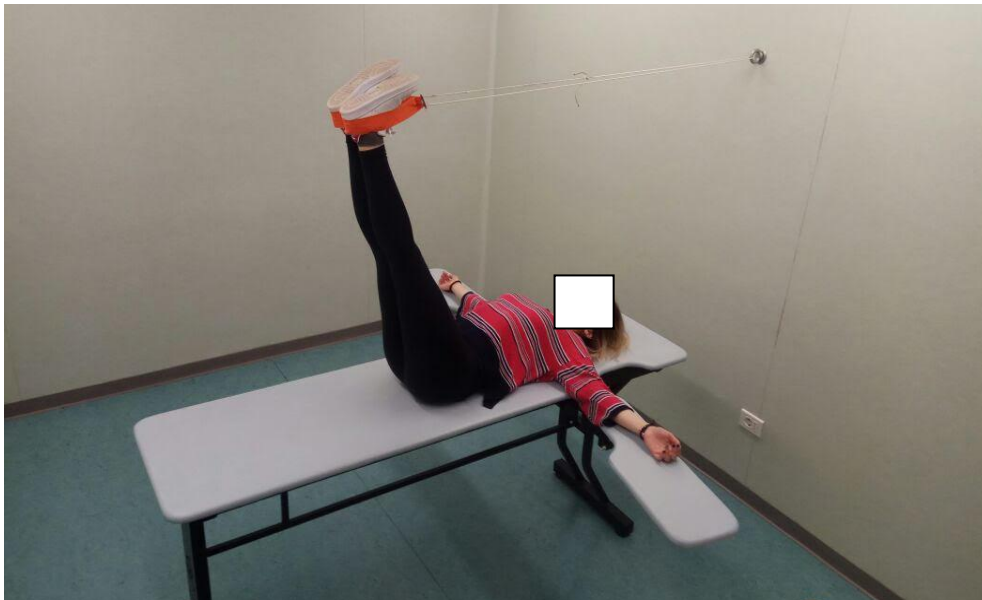
as a test which is implemented with the aid of a mirror in front so the patient can adjust him/her self (Figure 12). The bipedal support in dynamic situation is used to refine the postural management with the use of proprioceptive strategy without the visual feedback that allows working in low frequencies (143).

Figure 12. Freeman proprioceptive tables



- **GPR Postural bed** - The specific proportions are about 180cm-120cm, with a broader base, which can be applied to all types of postural therapies. It helps the therapist for the quality of the therapies and assures patient safety for the postural steps (Figure 13).

Figure 13. Postural bed specific for GPR treatment



4.6 INTERVENTION

The intervention implemented to the patients with AD was the postural therapy which lasted about 30-40 min in repeated sessions of 2 meetings per week pursued as per 1, 3 and 6 months respectively by making 48 sessions in total during a six month period. It consists in a global neck pompage, relaxed lying patient associated with deep diaphragmatic breathing and legs in shape of frog

during the first period. During the second period the position of patients' therapy with AD was modified, it was addressed by changing the position of the legs (tied with a rope in the angle with Pelvis 90°). In the last period of therapy, the position changed again with legs relying on pelvis 90°, the knees in 90° in pillows or chair as auxiliary; always patient lying supine in bed therapy.

Concretely:

I° posture - Frog with supine patient

During the first month of therapy, the patient was placed in a supine position on the therapeutic bed with upper limbs opened of 50° in the frog position (144) (Figure 14.a.). The treatment consisted in 10 sets of neck traction (overall pumping) (145), each of them with a duration of 90 seconds. Each individual treatment includes 30 seconds of progressive traction, 30 seconds of maintaining the neck tension and 30 seconds of progressive relaxation of the traction.

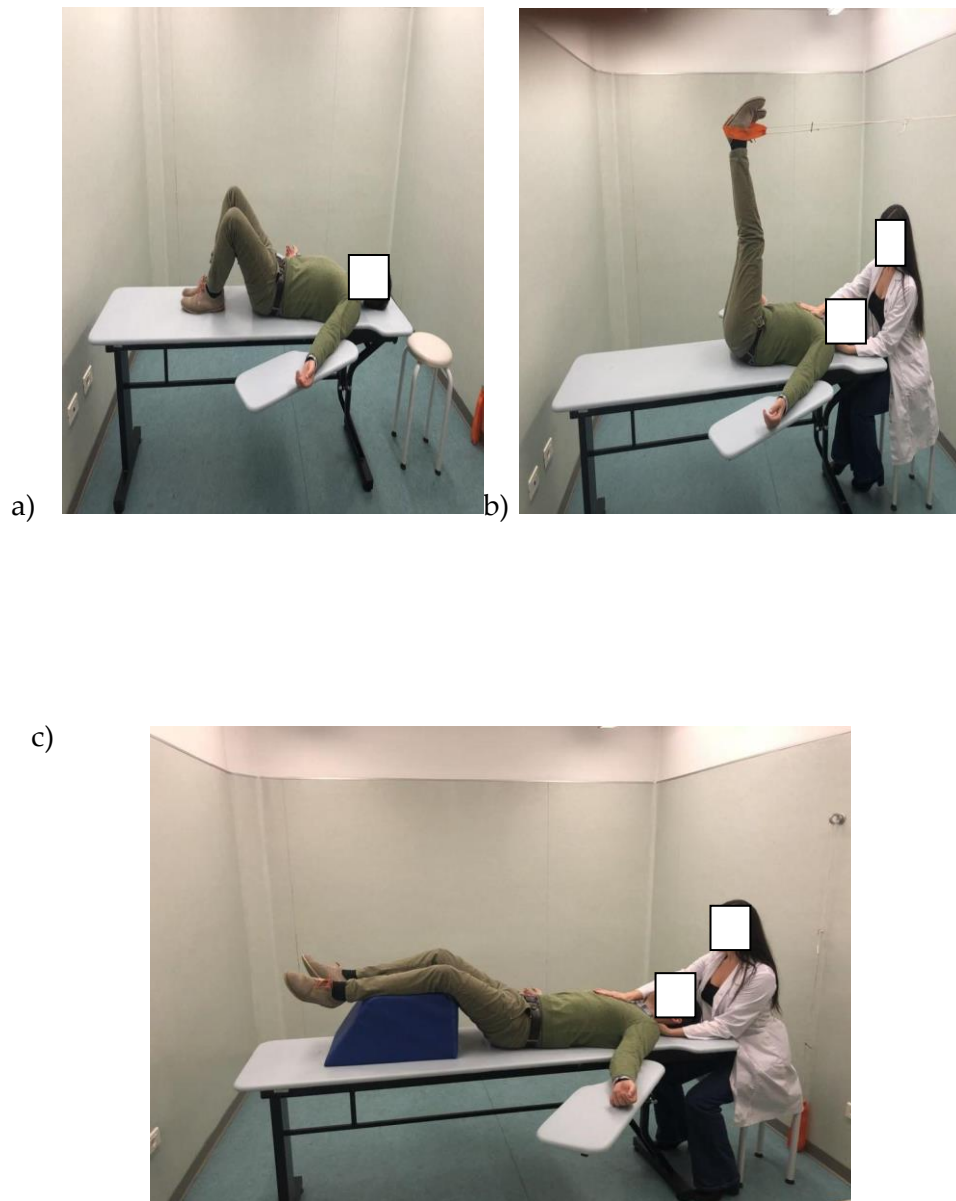
II° posture - Hip flexed and extended knees

During the second and third month of therapy, the patient was placed in a supine position with upper limbs opened of 100° and legs raised (90° of flexion of the hip) and extended (the knees in extension of 180°) as shown in Figure 14.b. The technique of cervical traction is identical to that applied during the first month but, in this case, it was accompanied by prolonged inspiration and expiration, whose frequency was marked by the therapist.

III° posture - Hip and flexed knees

During the last 3 months of the operation the posture has been changed again. The patient remained in a supine position, closing the upper limbs resting on the trunk, hip and knees bent by a maximum 90°. This posture was accompanied by diaphragmatic breathing in harmony with the overall cervical pompage (Fig.134.c) (145,146).

Figure 14. Treatment postures a) Frog with supine patient posture; b) Hip flexed and extended knees; c) Hip and flexed knees.



4.7 STATISTICAL PROCEDURE

A comparative study of an exhibition consisting of 2 groups (experimental and control) was carried out.

The statistical analysis was performed using Statistical Package for the Social Sciences - SPSS 21 for Windows (147). In the first moment there were established the variables treated. Thus a descriptive statistical analysis (frequency, mean, standard deviation) was performed for clinical, neuropsychological, functional and psycho-behavioral variables at baseline and at the end of the study. Quantitative variables were expressed as mean plus standard deviation (SD). Furthermore the variables normality diagnosis has been realized with the Kolmogorov-Smirnov test for $n > 50$. In addition, a variance analysis model (ANOVA) was used to compare the continuous variables while chi-square test was used for dichotomous ones. The significance value was corrected according to the Bonferroni analysis for multiple comparisons of the multivariate General Linear model. Pearson's coefficient instead was used to test the correlations between variables.

And finally a logistic regression model was used to identify which variables were independently associated in 6 months-dementia in patients with AD. The statistical examinations were performed at 95% confidence level.

4.8. CONFLICTS OF INTEREST

The author declares that has no conflict of interest as regards the study.

V - RESULTS

V – RESULTS.

5.1 SAMPLE DESCRIPTIVE ANALYSIS (EXPERIMENTAL AND CONTROL GROUP)

In this study participated 135 elderly people of whom 45 belong to the control group. The sample is composed of 34% male (n = 46) and 66% female (n = 89) gender around the age of 67-92 (M Age = 80.76, SD = 5.32). Specifically, the control group consists of 38% male (n = 17) and 62% female (n = 28) aged 73-92 years (M Age = 81.87, SD = 4.83). To get a clear idea of how the sample is distributed 9 and 10 tables help to reflect all the characteristics of study groups including gender.

It deemed also necessary to analyze the distribution of the sample by age, level of education and AD phase considering that the intellectual abilities of individuals with AD, as mentioned above, are related to the cognitive process. In terms of age (referring to Table 10), the sample represents a uniform distribution (M Control= 81.87, M Experimental = 80.21) for both study groups. There is also an almost linear distribution of patients versus AD phases.

The results of the descriptive analysis were taken into account for the investigation of hypotheses about the cognitive, autonomy, quality of life of patients and the way of completing the tests between the research and control groups. The test variables values used before and after 6 months were also analyzed: QolAd Caregiver-QolAd Patients, GDS, MMSE, NPI, BI and TS. The detailed framework of analyzed variables results is presented in Table 11.

Table 9. Sample descriptive data distribution versus gender

		Groups		Total	
		<i>Experimental</i>	<i>Control</i>		
	Woman	Count	61	28	89
		% Within Group	67.8%	62.2%	58.5%
Gender	Man	Count	29	17	46
		% Within Group	32.2%	37.8%	41.5%
	Total	Count	90	45	135
		% Within Group	100.0%	100.0%	100.0%

Table 10. Sample descriptive variables distribution

	Age				Gender		Level Education			Alzheimer Phase		
	N	Mean	Min	Max	Std.D	Woman	Man	High	Medium	Basic	Mild	Moderate
Control Group	45	81.87	73	92	4.836	28	17	8	27	10	22	23
Experimental Group	90	80.21	67	89	5.495	61	29	7	81	2	36	54

Table 11. Descriptive analysis of study variables

	First Month						Sixth Month							
	QoAD Caregiver	QoAD patients	GDS	MMSE	NPI	BI	TS	QoAD Caregiver	QoAD Patients	GDS	MMSE	NPI	BI	TS
N	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Min	18	21	14	6	8	20	2	20	19	14	6	12	20	2
Max	46	49	1	25	35	100	13	44	45	5	23	40	95	13
Mean	32.71	34.27	84	19.49	17.38	68.67	7.96	30.42	32.13	9.2	17.78	21.51	65.33	7.51
Std.D	7.896	6.308	3.222	3.935	6.326	21.727	3.364	7.057	6.025	2.408	3.490	6.377	20.654	3.321
N	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Min	26	22	10	13	12	70	8	23	20	10	13	8	70	8
Max	41	41	0	26	29	100	13	44	46	1	26	24	100	13
Mean	33.73	33.89	5.3	21.28	18.99	92.33	10.99	35.31	35.52	4.08	21.94	15.62	93.67	11.96
Std.D	4.887	5.211	2.175	2.793	4.531	9.487	1.597	5.371	5.432	2.184	2.814	3.914	8.538	1.491

5.2 THE GPR EFFECTIVENESS ANALYSIS ON THE EXPERIMENTAL GROUP

In order to test the effectiveness of GPR technique, the follow-up research group results in the first, third and sixth months of treatment were analyzed and were further compared with the one of control group for the same period of time through pre and post tests.

Ninety elderly people participated in this composition of the research study sample: 69 women and 21 men aged from 67 to 89 years (age M = 80.21, DS = 5.49) divided into two groups according to the Alzheimer's disease severity and considered through inferential analysis (1st Phase = 36 patients, 2nd Phase = 54 patients). More precisely Table 12 shows the clinical characteristics of patients belonging to these groups. Significant differences were observed with MMSE, GDS, QoL-AD, BI, NPI and TS ($p < 0.005$ in all cases).

Table 12. Comparative analysis between groups for different disease severities

Differential groups severity						
	1° Phase		2° Phase		F	p
	(n = 36)		(n = 54)			
	Mean	DT	Mean	DT		
MMSE	23.4	1.4	19.8	2.4	4.2	0.043
GDS	4.8	2.2	6	1.8	8.2	0.005
QoL-AD	36.1	5.2	32.4	4.6	11	0.001
BI	93.61	8	91.4	10.3	5.2	0.024
NPI	15.78	2.3	21.13	4.3	3.36	0.037
TS	11	1.3	10.9	1.7	56.7	0.000

The results of repeated ANOVA measurements with interaction (inter-subject factor: severity of Alzheimer's disease, factor among subjects: therapy) are summarized in Table 13. The severity of therapy interaction * has significantly anticipated changes in all outcome variables. Moreover it has had a significant effect on MMSE, GDS, QoL-AD, BI, NPI and TS scores. In the post-hocs analysis of these results we observed: improvement from the first month of treatment, MMSE scores (p adjusted by Bonferroni <0.005 in all cases), GDS (p corrected by Bonferroni <0.005 in all cases) QoL-AD (p corrected by Bonferroni <0.005 in all cases) and BI (p corrected by Bonferroni <0.005 in all cases). However, improvement has also been observed since the first month of therapy in the NPI and TS scores (p corrected by Bonferroni <0.005 in all cases).

The improvement of sixth month therapy was calculated in MMSE, BI, TS and QoL-AD outcome measures as the difference between the final score less the initial one. While the one pertaining to GDS and NPI scores was calculated as the difference in the initial score, considering that the highest scores in these variables indicate greater gravity. In addition the results of Pearson correlations between these improvements in the total group indicate that the improvement in MMSE is significantly correlated with the improvement of QoL-AD ($r = 0.394$, $p = 0.000$). Foremost the improvement of BI is significantly correlated to the improvement of MMSE, QoL-AD and Tinetti-S. While concerning the GDS scale have not been observed correlations in improvements. From the other hand the improvement of the NPI neuropsychological symptoms significantly correlates with the one of QoLAD and MMSE measures. The analysis of these correlations is reflected in Table 14.

Table 13. Time effectiveness of postural therapy on outcome variables

	ANOVA repeated measures			p corrected (Bonferroni)		
	F	p	Eta2	0-1 ^o month	1-3 ^o month	3-6 ^o month
MMSE	20.3	0.000	0.1	0.018	0.049	0.000
GDS	8.2	0.005	0.1	0.007	0.003	0.021
NPI	42.8	0.000	0.3	0.000	0.000	0.000
Qol-AD	11	0.001	0.1	0.001	0.002	0.004
BI	5.4	0.002	0.1	0.001	0.002	0.001
TS	26.8	0.000	0.4	0.001	0.000	0.001

Table 14. The relationship between the improvements of different variables during the sixth month of therapy

		Pearson Correlations					
		QoLAD	BI	MMSE	GDS	TS	NPI
QoLAD	Pearson Correlation	1	.583**	.394**	0.046	.419**	-.356**
	Sig. (1-tailed)		0	0	0.668	0	.001
BI	Pearson Correlation	.583**	1	.305**	-0.163	.701**	-.172
	Sig. (1-tailed)	0		0.003	0.125	0	.105
MMSE	Pearson Correlation	.394**	.305**	1	0.182	0.165	-.714**
	Sig. (1-tailed)	0	0.003		0.086	0.119	.000
GDS	Pearson Correlation	0.046	-0.163	0.182	1	-0.102	-.181
	Sig. (1-tailed)	0.668	0.125	0.086		0.337	.088
TS	Pearson Correlation	.419**	.701**	0.165	-0.102	1	-.110
	Sig. (1-tailed)	0	0	0.119	0.337		.301
NPI	Pearson Correlation	-.356**	-.172	-.714**	-.181	-.110	1
	Sig. (1-tailed)	.001	.105	.000	.088	.301	

** . Correlation is significant at the 0.01 level

* . Correlation is significant at the 0.05 level

5.3 STUDY SAMPLE RESEARCH ANALYSIS RESULTS

Referring to the follow-up test results for 1, 3, and 6 months of the intervention group divided into two subgroups according to AD gravity versus the GPR application it was demonstrated that the technique significantly influenced the cognition, life quality, autonomy and depressive symptoms it was deemed reasonable to confront the results of this group with that of the control one in order to verify the significance of these tests throughout the study sample.

As previously mentioned the study sample consisted in 135 individuals divided into 2 groups according to the therapy benefits. The group to which GPR technique was not applied was qualified as the control group ($n = 45$) and the experimental group ($n = 90$) was the one of the intervention. The analysis was based on two different periods considering the prior and after experimental group treatment (in the first and six months) with pre and post test (T0-T1). The sample was not randomized. The clinical characteristics of the examined sample are reflected in Table 15 from which a significant difference was observed between the experimental and control groups over the tests used as MMSE, BI, TS ($p < 0.005$ in all cases). It is important to mention the significance of the depressive and neuropsychological symptoms of the sample, whose tests show a decrease order in their improvement referring to respective results GDS ($F = 54.9$, $p < 0.005$) and NPI ($F = 5.7$, $n = 0.018$).

There were also apart analyzed the QoLAD Caregivers and QoLAD Patients tests with the purpose to confront the results based on the significance that they would present concerning the same assessment test. In both test phases, the therapy effectiveness referred to the significance of QoLAD / C ($F = 79.4$, $p < 0.005$) and QoLAD / P ($F = 71.7$, $p < 0.005$).

Table 15. GPR results on the study sample in T0-T1

	Sample					
	<u>Control Group</u>			<u>Experimental Group</u>		
	(n = 45)			(n = 90)		
	T0	T1	T0	T1	F	P
	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>		
MMSE	19.49 (3.93)	17.78 (3.49)	21.28 (2.79)	21.94(2.81)	18.3	0.003
QoLAD/C	32.71(7.89)	30.42 (7.05)	33.73 (4.88)	35.31(5.37)	79.4	0.000
QoLAD/P	34.27(32.13)	32.13 (6.02)	33.89 (5.21)	35.52(5.43)	71.1	0.000
GDS	8.40 (3.22)	9.20 (2.40)	5.30 (2.17)	4.08(2.18)	54.9	0.000
BI	68.67 (21.7)	65.33 (20.6)	92.33(9.48)	93.67(8.53)	8.67	0.004
NPI	17.38 (6.32)	21.51 (6.37)	18.99 (4.53)	15.62(3.91)	5.7	0.018
TS	7.96(3.36)	7.51 (3.32)	10.99 (1.59)	11.96(1.49)	9.89	0.002

5.4 THE COMPARISON OF EXPERIMENTAL – CONTROL GROUP STUDY ANALYSIS

The results of repeating ANOVA measurements with interaction (inter-subject factor: group, factor among subjects: therapy) at 95% confidence level are summarized in Table 16. The severity of therapy interaction * has significantly changed all outcome variables. The therapy had a significant effect on the MMSE, GDS, QoL-AD, BI, NPI and TS scores compared to the ones of group factor. In the findings of post-hocs analysis it was observed: the improvement of treatment variables, MMSE scores (p corrected by Bonferroni <0.005 in all cases), GDS (p corrected by Bonferroni <0.005 in all cases), QoL -AD (p corrected by Bonferroni <0.005 in all cases) and BI (p corrected by Bonferroni <0.005 in all cases). Nonetheless, the improvement was also observed from the first month of therapy in TS scores (p corrected by Bonferroni <0.005 in all cases) and NPI (p corrected by Bonferroni <0.005 in all cases).

5.4.1 The interaction of sample values through Pearson's correlation

The results of Pearson correlations with the statistical significances $p = 0.001$ and $p = 0.005$ among the improvements in the exhibition indicate an interaction between all variables given. The MMSE cognitive test is significantly correlated with the QoL-AD / C life quality improvement ($r = 0.49$, $p = 0.000$) and QoLAD / P ($r = 0.42$, $p = 0.000$); with the autonomy of BI ($r = 0.50$, $p = 0.000$) with the improvement of GDS depression symptoms ($r = -0.41$, $p = 0.000$), neuropsychological symptoms of NPI ($r = -0.56$, $p = 0.00$) and with equilibrium of TS ($r = 0.47$, $p = 0.000$). In the same way they result to be correlated with all other variables. The correlation analysis results are reflected in Table 17.

Table 16. Comparative therapy effectiveness / study sample results

		ANOVA Repeated measures			p corrected (Bonferroni)		95% Confidence Interval for Difference ^b	
		F	Sig. ^b	Eta ²	Mean Difference	Std.E	Lower Bound	Upper Bound
<i>Control Group</i>	MMSE	55.8	0.000	0.29	1.71*	0.2	1.31	2.1
	QoI-AD/ C	41.7	0.000	0.239	2.28*	0.35	1.58	2.99
	QoL-AD/ P	10.8	0.001	0,07	2.13*	0.365	1.41	2.85
	GDS	12.9	0.000	0.08	0.8*	0.22	0.36	1.24
	IB	36.1	0.000	0.21	3.33*	0.55	2.23	4.43
	NPI	137.7	0.000	0.509	4.13*	0.352	3.43	4.83
	Tinetti-E	10.7	0.001	0.07	0.44*	0.13	0.17	0.71
<i>Experimental Group</i>	MMSE	9.28	0.003	0.06	0.66*	0.14	0.94	0.38
	QoI- AD/C	39.6	0.000	0.23	1.57*	0.25	1.08	2.07
	QoI- AD/P	40.1	0.000	0.232	1.63*	0.258	1.12	2.14
	GDS	60.2	0.000	0.31	1.22*	0.15	0.91	1.53
	IB	11.5	0.001	0.08	1.33*	0.39	0,55	2.1
	NPI	182.8	0.000	0.57	3.36*	0.24	2.87	3.85
	TS	101.6	0.000	0.43	0.96*	0.09	0.77	1.15

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni

VI – DISCUSSION

VI - DISCUSSION

This study 6-month follow-up result showed that GPR technique was effective in individuals with AD while improving cognitive, autonomy, balance, neuropsychological and depressive symptoms. A possible explanation for the significance of all results produced by GPR intervention is that this procedure is based on the globalism of the individual and not only as it takes into account all kinetic chains. Nonetheless, these findings can be discussed in a wider context by also taking into consideration the treatment psycho-social components. Global postural re-education can be a light therapy for painless movements, to increase relaxation through breathing rhythm and to provide a positive experience in modifying your bodily behavior. This therapeutic session approach can modify not only "postural attitude" but also the negative feelings of patients' confidence that are often associated with insecurity up to psycho-somatic pain. Moreover the above mentioned non-invasive procedure could be autonomously applied at patients' home against the therapist's recommendations.

As far as the study sample is concerned, even why a mid-term follow-up therapy was undertaken it focused on 2 weekly sessions and was noted that the experimental group compared to the control one had a notable symptomatic improvement and dominance of the AD symptoms. The characteristic of this study was the non-randomized sample, mentioning here the fact that neurodegenerative diseases do not always provide randomization opportunities and thus, becomes difficult to study a representative sample. And properly this element constitutes a homogenization to the sample characteristics as dictated in the descriptive results.

Furthermore homogeneity may have been a beneficial element in the meaningful research results. Another positive element in the GPR implementation technique which may have positively impacted the study is the proactive patients' co-operation during the treatment as it should be all the time in order to auto-correct the wrong postures during the treatment, combined with postural

harmonious breathing cycles. A good postural control allows the patient's motor control, balance and breakdown of the wrong postural schemes. In this regard, other studies suggest that intensive postural treatment significantly improves functional performance, which is a distinctive sign of life quality and independence associated to mobility (148,149).

Aiming to prevent the methodological deficiencies reported in systematic reviews, special attention was paid to the research design and development of this study. For this purpose standardized tests were used including physical treatment, cognition, proprioceptivity etc and a clear definition of cases including the confirmed dementia diagnosis was given by considering homogeneous samples concerning cognitive abilities (150,151).

It was interesting to reveal that the participants in the AD advanced phase benefited more from the GPR, and with reference to other studies that can be explained that the greatest damage to functionality and cognizance is associated with greater benefits (152).

As in the epidemiological studies concerning the AD incidence among women (16,17,18), in this study participated 135 elderly patients' suffering ADs, the sample consisted of almost 66% females (n = 89). Because as epidemiologically, mentioned also in other studies (18), women live longer and perhaps this fact mostly brings the appearance of AD to them. Against epidemiologically referring to the latter, in the review of statistical data on individuals with AD, it is noted that a possible factor for the decline of cognition is the lack of study (20). In addition another important element is that around the first half of the 20th century, women had inferior education than men referring to the same period (22).

By comparing these interesting data with our study, the samples' average age was about 80 years. It's worth mentioning that this fact leads to cognitive deterioration from the aging process and consequently to the appearance of a multitude of cognitive pathologies. According to World Health Organization projections, in recent years there are more cases of dementia, of which two-thirds are revealed with AD (12). Not disconnected from descriptive analysis, the sample's major part (n = 108) consisted in subjects with an average education, not low. Thus, perhaps these results do not confirm most of the above

data considering that the sample is small ($n = 135$) in confront to the entire population.

Closing referring to this research results in the above mentioned study all variables explored evidenced correlations between. This important fact demonstrates that cognition affects the psychological, depressive, autonomy and quality of life of the individuals with AD. A meaningful interaction of all study variables approves the hypotheses raised correspondingly.

The correlation between the improvement of depression and neurological symptoms was also observed. Furthermore, the correlation between functional and cognitive improvement exists. And the effect on the functional state is likely to precede global cognitive improvement. In fact, it has been reported that the elderly confinement as well as the simultaneous reduction of mobility and independence limits their social relationships and accelerates the progression of cognitive impairments (153).

The magnitude of the effect on these improvements is considerable and thus, it can be said to have a clinical significance, although it would be necessary to develop longer studies in order to validate these results. The postural therapy positively influences the orientation and relaxes the depressive symptoms of the disease. Relaxation is the door to discover oneself, a parenthesis in activity, in agitation, a pause in which the person is freed from this feverish, mechanical and automatic activity (154). Anxiety can be reduced as it can be learned to relax muscles' tension.

Tension and effort are accompanied by a shortening of muscle fibers. Reduced muscle tone reduces the activity of the central nervous system and relaxation is the opposite state of arousal and can be considered an adequate remedy for the prophylaxis of psychosomatic illnesses (155). At the same time, it contributes to the improvement of the patients' postural balance causing a significant improvement in the quality of their life. Postural therapy helps the patient to focus on the feelings that come from his body during a movement or the assumption of a certain posture (156). The main postural objective is the enhancement of movement quality (157). Guarantees to the patient a personalized therapeutic approach by recovering body harmony; globally approaches the patient, considering that the postural, emotional, cognitive and perceptive alterations modify a complete functional system and not a single element (158).

The postural therapy draws attention to each part of the body, educating the patient to rediscover himself and possibly enrich that image (87). By learning to perceive the body as a whole, the patient can be aware of every bodily element, as an integral part of the whole. Only in this way he can also actively participate in the re-education of respective positions, finding a new body harmony (158).

This study shows that GPR is an interesting therapeutic method not only for the treatment of musculoskeletal pathologies referring to the literature review (93,94,105) but also to the invisible intellectual sphere with neurodegenerative pathology like AD. The positive results refer not only to clinical parameters (pain, postures, balance, and articulation mobility) but also to functional indexes. Some 'case reports' argue that in patients with postural changes and pain presence GPR has proven to be effective in postural and symptomatic improvements (114, 159). But beyond the latest these evidences cannot significantly demonstrate the results. Meanwhile it should be highlighted that based on this literature review, GPR therapeutic injections may be applied to conservative treatments of muscular-skeletal, rheumatic or cognitive diseases at the initial or chronic stage.

Unlike other physical therapies with competitive orientation, which mainly seek the development of strength, endurance and extreme dexterity, the GPR trains the subject to focus on the sensations that come from his body during a movement or during the assumption of a certain posture (80). Furthermore the GPR is useful for improving the proprioception and emphasizes the improvement of the quality of movement, unlike other rehabilitative therapies such as: Pilates, Chinese-therapies (166). It also uses the breath as a tool to change not only posture, but also the affective state. All this can contribute to have significant benefits in different areas (motorist, proprioceptive, respiratory, and cognitive-affective) (167). Anyway, this therapy requires a personalized therapeutic approach adapted to the specific needs of each patient in order to promote greater effectiveness.

With regard to the postural treatment attitude, not all postures are easy to fit with the pathology typology or even patients' general condition. By this way, referring 1, 2 and 3 treatment's postures (Figure 13a, b, c), they were selected as the most adequate ones in the treatment of individuals with AD. Accordingly, the supine patient position enabled the patients' total control by the therapist. Worth also added that these postures are deployed when diseases symptomatology is

still evident, therefore postural corrections must be necessarily and adequately calibrated (88). They are also recommended in situations where it is necessary to act on respiratory dysfunction (limiting the torso excursion). Regarding other posts, intentionally not applied in this study (Fig. 9c, d, e) it must be said that they were not selected because result to be complex for the balance control in individuals with AD. Although more complex they are functional too. Active patient participation in posture positioning is a prerequisite for the performance of the above mentioned technique, which cannot be applied to children or non-collaborative elderly people.

From the other side it's not possible to standardize the number and articulation of therapeutic sessions as they depend on the patient's momentum conditions. Although in many researches individuals have been subjected to 1-2 weekly sessions in acute or sub-acute phases (90,105, 113,114) it is not possible to take into consideration this weekly treatment frequency. Perhaps since Souchart's literature (89) does not indicate more than 2 weekly sessions. This is explained by the implication of respiratory and postural techniques which, if frequently applied cause dizziness and headache in patients of all ages. Even not scientifically based, the recommendations concerning GPR's treatment are suggested to be undertaken at no more than 2 weekly treatments.

Some authors have applied at the beginning of treatment a higher weekly frequency by reducing it over time (94,118). Meanwhile the retention of GPR results over time was confirmed in three studies with long follow-ups periods concretely of 1-5 years (105,118,119). No study was conducted to investigate the effect of autonomous posture managed at home after the physiotherapists' training (the so-called "auto-posture"), although therapeutic reasoning would suggest them in long-term treatments, in order to reduce health costs.

In this study through the GPR technique, a special attention was paid to breathing, as was mentioned in the methodology. The use of respiratory pressure has been widely used in physiotherapy to support clinical practice, as it provides information on the strength of the respiratory muscles (160,161). Almost referring to the literature the strength of the respiratory muscles is altered when it is in a shortened state. When a muscle loses its normal flexibility, there is a change in the length-tension relationship of the muscle, disabling it to produce a suitable peak

of tension, by further developing a weakness in retraction (162). In addition, GPR involves active muscle stretching techniques and presents particular concern for respiratory muscles (113). Referring to some other studies, reveal the results of a significant increase in respiratory pressure after the intervention with the GPR method, obtained by Teodori et al. (2003) as well as the increase in the strength of the respiratory muscles, returning to the discussion on the length-tension relationship. Due to these, in this study all the respiratory frequencies and technique were rigorously followed starting from the second month of treatment as in the first month and the patient should be focused and to appropriate the therapeutic treatment. Considering the fact that more the muscle is stretched, the greater is its ability to generate tension up to a certain limit and a better contractile capacity (163) is achieved, the increase in the strength of respiratory muscles may be a consequence of stretching, which involves the inspirational muscle chain in a global position. This muscle training that involves proprioceptive rehabilitation probably allows the maintenance of muscle strength for a long time.

Ultimately the result is the need to investigate how long the result obtained after the end of the treatment is maintained, referring to Teodori et al. (2003). However, the greatest difficulty in this aspect, when working with humans, is to undertake long-term longitudinal follow-up to establish the ideal frequency for intervention and maintenance. The results of Teodori et al. (2003) study, with supine-frog posture of the GPR method were efficient enough to increase maximal respiratory pressures, suggesting its use even as a physiotherapeutic resource for the development of respiratory muscle strength. And although this study presents data related to people with AD, but without respiratory diseases, the results indicate that training can be of therapeutic importance concerning the treatment of respiratory muscle dysfunctions.

It is important to underline that although the respiratory muscles cannot be immobilized, the constant permanence of the contraction favors an aspiratory posture (120) that limits the mobility of the rib cage. Hereinafter even the mobilization of the trunk is important because it allows the maintenance of the mobility of the vertebral column between the sternum and the ribs, allowing a more effective thoracic expandability. Individuals who have postural changes

may present a characteristic respiratory pattern with a tendency to breathe with the chest with limited use of the diaphragm, displacing a small amount of air (164). Disruption of upper limb and head movement provides thoracic sprains and decreases the efficiency of respiratory muscles (165).

According to the above mentioned study, the effectiveness of this therapy could also be due to improvements in ventilation and cerebral oxygenation. These two aspects are interrelated, since the static balance contributes to major respiratory excursions and vice versa (168). When the individual stays in equilibrium and accompanies deep breathing uterus, the absorbed oxygen increases the ventilation of the lungs, thus causing an increase in the oxygenation of the brain; these elements are best associated with a more efficient orientation and a more specific proprioceptivity. Furthermore, the training in diaphragmatic breathing can help in the anxiety reduction (169).

Foremost it is important to note that this study has encountered various difficulties such as:

- The establishment of an initial diagnosis only and lack of updating of cognitive data or patients' psychological tests records, by not allowing a complete cadence of patients' cognitive progression and the partial evaluation during in a six month period;
- The progressive age of AD which is reflected even in the diagnosis as the cognitive deterioration and dementia can be caused by aging; obviously that this situation cannot bring a noticeable improvement to individuals after treatment;
- Difficulty in the determination of the sample because the majority of individuals with AD in mild or moderate phase do not go to residential centers since there are still no apparent signs and clinical symptoms of dementia '(es: young people around the age of 50-65);
- Physical rehabilitation of the elderly consists in maintaining muscle tone and reflexes left unavailable for postural therapy or individual proprioceptive. This fact makes GPR difficult because the patient needs to be taught with an innovative approach that is not always easy;

- The realization of GPR technique and not only in patients with AD is suggested to be implemented in morning due to the privacy of the individual, thus, facilitating the co-operation. On the other hand, this time element so important for the patient, limits the study concerning quick sample results;
- The existing neuropsychological and depressive symptoms make difficult the treatment and co-operation. Occasionally, the therapeutic session has not been able to be properly performed due to the patient's postures discomfort;
- Postural difficulty and respiratory control are strict tasks for the patient by limiting uncontrolled movements or breaks in treatment, occasionally until the session interruption.

The research findings suggest that postural therapy can improve patients' psychological symptoms. Moreover, it seems likely that this therapy individually applied, makes patients more heard and listened to. Simultaneously it was observed that the disease severity was not a moderating factor in the effect of this therapy. The later requires postural changes that could, a priori, suppose a difficulty in very elderly patients (over 80 years). However, in this study the tolerance was very good and matching results are valuable because they provide useful data for developing controlled studies with this therapy. Independently, this is a pioneering study, which suggests that regardless of age, GPR is a useful technique in treating patients with AD.

The current scarcity of the experimental-trial on a large-scale and methodologically rigorous does not allow any other conclusions to be drawn, but the results obtained so far represent a stimulus to further research in this interesting and conservative treatment sector. In particular, it would be interesting to investigate the effectiveness of the GPR in the pathologies covered by this study with the aid of additional randomized controlled trials and to expand the research into other neurological, rheumatic, prophylactic, musculoskeletal or other psychological, painful spine and limb disorders, by comparing the results of this technique with those of other physio-chinotherapy procedures.

VII – CONCLUSIONS

VII CONCLUSIONS

7.1. CONCLUSIVE REMARKS

- Specific GPR techniques increased subject's proprioceptiveness, enabled postural control and installation of more and more complex treatment models;
- The achievement of concentration organization and subject limits was made possible, as well as the management of stress and anxiety due to the physical and respiratory mode that enabled the technique;
- Patients self-esteem and relaxation was also noted during the treatment of technique globality;
- The personification of the postural treatment of GPR was achieved, having in mind the current situation at any moment of the intervention;
- Muscle cramps were reduced by stretching the GPR and stimulated a correct postural stance and the environmental perception;
- During the treatment, relaxation techniques were provided as per the critical moments of the study;
- This research was characterized by practicing as many postural GPR exercises as a function of meeting the objectives set.

This study confirms the validity of a postural technique proposal such as that of controlled and supervised GPR as well as the indication of an active lifestyle for subjects with mild and moderate AD.

Analyzing the overall findings of the study proposed in this thesis, it can be concluded that it is probably not the type of physical activity that affects memory, congruence, but rather the variety, constancy and frequency of the treatment. In fact, worsening of memory is generally the first symptom of cognitive decline.

As far as it can be understood from the results of experimental group, GPR's intervention confirm that intensity is also not an important protection parameter for this type of problem, on behalf of study subject. Therefore it is established that the cognitive stress due to the adaptation to different types of postural GPR technique is more effective for this kind of sample.

The perception of improved physical efficiency allows older subjects to believe in their abilities including here the cognitive ones.

Future studies will verify the effects on the cognitive abilities obtained from the practice of a longer postural treatment in a follow up at one and three years.

Concluding the results reported so far would seem to indicate that the regular practice of individual postural treatments and an active lifestyle can have positive effects on cognitive abilities. It should also be reiterated that unfortunately the mechanisms by which the GPR can affect cognitive abilities is still unclear as of today.

However, the idea of this study is that the GPR, acting broadly on the physical and psychological well-being of the elderly person with AD, can improve many metabolic and physiological aspects of the human body, thus allowing it to have a "better aging" process.

**VIII – LIMITATIONS AND
FUTURE LINES OF
RESEARCH**

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8.1 STUDY LIMITATIONS

In literature there are still contradictory data regarding the benefit of GPR and the duration of this benefit on cognition and t on cognition and proprioception; and for this it was necessary to evaluate the efficacy of 48 therapeutic sessions carried out over six months with follow-up in the first, third and sixth month to patients with mild-to-moderate AD, firstly on cognitive level and then on functional and emotional performance.

In this study, equipments were predicted concerning the assessment of patients' balance, posture- oscillation, and journey. In the absence of a stabilometry, for a complete research framework, the Freeman proprioceptive tablet was used, and the latter records are missing considering that isn't a standardized scientific instrument. Spirometry could also be very useful to measure the breath of air in the inhalation-exhalation process with a maximal effort at the movement speed as this examination could represent an assessment of breathing. In this study, in the absence of this machine, the postural respiratory frequency data were received in harmony with the cervical pumping. Rationally they are not scientifically represented and furthermore aren't evaluated in the study. To obtain an interesting analysis of the study, the measurement of muscular strength could also be useful through the electric digital dynamometer.

The study showed that even it was homogeneous in the descriptive characteristics of the patients, for an ideal research the groups were proportionally organized (remember that the experimental group = 90; control group = 45 participants). In addition must be recognized that in terms of aging, nowadays one hundred and thirty-five people cannot significantly represent the patients with AD.

As already mentioned in the discussion, the current scarcity of the experimental-trial on a large-scale and methodologically rigorous concerning GPR technique does not allow convincing results to be drawn. Thus, it definitively remains a pioneering study for further confirmations concerning GPR effects in the perception and cognition of patients with AD with longer treatment time and with a more representative sample.

8.2 FUTURE LINES OF RESEARCH

The GPR more than a technique is actually a constantly evolving treatment, within its own guidelines and postural methodology, and for this reason it is necessary to continuously attribute innovations and scientific researches together with the indispensable contribution/experiential comparison of the participants to it. Considering that this technique is at the same time an open and synergistic system. This important fact does not contrast the other postural techniques but enriches them by generating mutual benefit. A corrected posture is of fundamental importance for physical and mental well-being. Our physique has evolved to allow us postural adaptations in a natural environment. Particularly the postural therapy should therefore demonstrate scientifically that it respects these "genetic tendencies" by involving as many muscles and joints as possible, but always in a moderate manner. In addition, worth estimated in future researches that it's rewarding even from the mental point of view. By this way, the importance of postural therapy must remain intact at all ages.

In a postural treatment one must always keep in mind that muscle stretching has the same importance as muscular reinforcement, as well as joint mobilization and motorist re-education. Under this context a postural methodology must be complete and personalized; it must take into account the basic principles of posturology as well as the problems due to the patients' current functional state. Except this, nowadays posturology must scientifically demonstrate its beneficiaries in relation to the main factors that strongly influence our equilibrium system, such as: the vestibular and stomatognathic apparatus and the sight.

A good posture promotes also an improvement in breathing which, in turn, will contribute in an important way to psycho-physical wellbeing. There are few studies that prove this fact without forgetting that respiratory rehabilitation must always be an integral part of any postural treatment.

Today exist various posturology institutes' concerning postural techniques development and implementation such as: Françoise Mézierès, Marcel Bienfait, Souchart, Gerda Alexander, Feldenkrais, Antony Munné etc. but in order to verify the benefits of these techniques, studies of a certain scientific importance together with clinical trials, must be published. Logically, whereas there are many GPR associations all over the world but for important scientific bases one can only refer to the controlled studies of: Portugal, Brazil, Argentina and Chile. As through the GPR technique it must be given importance to the prevention of muscles and joints' disability.

From the other hand a positive mental attitude, together with a good mental education, is able to act very positively on the physical level. In case of pain and / or pathology, the first thing to do is to relax as much as possible, because it is only in a state of great relaxation that the body is able to activate its powerful processes of self-healing. Psychic tension, besides hindering these processes, produces muscular stiffening by heightening pain. And properly on this topic nowadays there is not so much scientific basis, thus it is important to be provided the deserved attention concerning the treatment of body and mind.

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X – ANNEXES

ANNEX 1: Ethical Committee Approval



UCAMETHICS COMMITTEE

PROJECT DATA

Title: "The effectiveness of physical rehabilitation in the enhancement of proprioceptive and cognitive aspects on Alzheimer disease patients"		
Principle Researcher	Name	Email
PhD.	José Luis Martínez Gil	jimgil@ucam.edu

COMITTEE REPORT

Date	25/11/2016
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Type of Experimentation

Experimental clinical research involving human subjects.	
Using human tissues from patients, embryonic or fetal tissue.	
Using human tissues, embryonic or fetal tissue from banks or tissue samples.	
Observational research with humans or use of personal data, genetic information, etc.	X
Animal studies.	
Use of biological agents of risk to human health, animal or plant.	
Use of genetically modified organisms (GMOs).	

Comments regarding the type of experimentation
<i>No problem</i>

Comments regarding the methodology of experimentation
<i>No problem</i>



UCAMETHICS COMMITTEE

Suggestions for the researcher

In view of the application of the attached report by the Researcher and the above mentioned recommendations, the opinion of the Committee is to:


Issue a favorable report	<input checked="" type="checkbox"/>
Issue an unfavorable report	<input type="checkbox"/>
Issue a favorable report with subject to correction	<input type="checkbox"/>

MOTIVATION
<i>It can increase knowledge</i>

Approved by the President,

Approved by the Secretary,

J. Cánovas
Sig.: José Alberto Cánovas Sánchez


J. Alarcón
Sig.: José Alarcón Teruel

Universidad Católica San Antonio. Vicerrectorado de Investigación. Salida n.º 6573 25/11/2016 17:40:45

ANNEX 2: Informed Consent

CONSENTIMIENTO INFORMADO

Yo, _____ con DNI: _____

DECLARO:

Haber sido informado/a del estudio y procedimientos de la investigación del Proyecto titulado: **The effectiveness of physical rehabilitation in the enhancement of proprioceptive and cognitive aspects on Alzheimer disease patients**

Los investigadores que van a acceder a mis datos personales y a los resultados de las pruebas son:

Asimismo, he podido hacer preguntas del estudio, comprendiendo que me presto de forma voluntaria al mismo y que en cualquier momento puedo abandonarlo sin que me suponga perjuicio de ningún tipo.

CONSIENTO:

- 1.-) Someterme a las siguientes pruebas exploratorias (en su caso): **Terapia Postural, Ejercicio físico, Ejercicio Propioceptivo, Ejercicio Cognitivo**
- 2.-) El uso de los datos obtenidos según lo indicado en el párrafo siguiente:
En cumplimiento de la Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal, le comunicamos que la información que ha facilitado y la obtenida como consecuencia de las exploraciones a las que se va a someter pasará a formar parte del fichero automatizado INVESALUD, cuyo titular es la FUNDACIÓN

UNIVERSITARIA SAN ANTONIO, con la finalidad de INVESTIGACIÓN Y DOCENCIA EN LAS ÁREAS DE CONOCIMIENTO CIENCIAS EXPERIMENTALES Y CIENCIAS DE LA SALUD. Tiene derecho a acceder a esta información y cancelarla o rectificarla, dirigiéndose al domicilio de la entidad, en Avda. de los Jerónimos de Guadalupe 30107 (Murcia). Esta entidad le garantiza la adopción de las medidas oportunas para asegurar el tratamiento confidencial de dichos datos.

En Guadalupe (Murcia) a 17 de noviembre de 2016

El investigador,

ANNEX 3: Information document for subjects submitted to study

**DOCUMENTO DE INFORMACIÓN PARA SUJETOS SOMETIDOS A
ESTUDIO
(HOJA INFORMATIVA)**

1. EN QUÉ CONSISTE Y PARA QUÉ SIRVE:

El propósito de este estudio consiste en el explorar el deterioro de la terapia postural, los efectos y la calidad de vida percibida por los residentes, los familiares y el personal después de la rehabilitación física y cognitiva, y contribuir a la comprensión global de la calidad de vida de las personas mayores.

2. COMO SE REALIZA:

La terapia que se aplicará su las personas con Alzheimer es la terapia postural que durará aproximadamente 30-40 min en repetidas sesiones de 2 reuniones por semana perseguido como por 1, 3 y 6 meses, respectivamente.

Consiste en un pompage global de musculatura del cuerpo, con paciente acostado y relajado; también asociado con profunda respiración diafragmática.

3. QUÉ EFECTOS LE PRODUCIRÁ:

Con respecto a los efectos de la terapia postural en la mejora de:

1. síntomas depresivos;
2. síntomas cognitivos;
3. síntomas físicos;
4. aumento propioceptivo;

5. respiración;
6. postura;
7. balances;
8. relajarse;
9. calidad de vida en los pacientes con enfermedad de Alzheimer.

4. EN QUÉ LE BENEFICIARÁ:

- Mantener durante el mayor tiempo posible la capacidad intelectual y funcional, oponiéndose al grado de deterioro de la enfermedad
- Proporcionar apoyo psicológico y físico y ayudar a la persona con demencia
- Superar la soledad y el aislamiento emocional que involucra al individuo con la enfermedad de Alzheimer a través de formas de rehabilitación de participación activa;
- Fortalecer la autodeterminación de la persona;
- Adaptar el enfoque terapéutico en conjunción con el nivel mental funcional;
- Mantener el mayor tiempo posible la autonomía en las actividades cotidianas;
- Estimular la orientación espacial y las adaptaciones ambientales;
- Estimular el interés y la motivación a través de actividades reales;
- Promover una formación de rutina y un buen comportamiento social;
- Mantener el nivel más alto de función física y mental

5. QUÉ RIESGOS TIENE: No tiene ningún riesgo

5.1 LOS MÁS FRECUENTES: -

5.2 LOS MÁS GRAVES: -

5. SITUACIONES ESPECIALES QUE DEBEN SER TENIDAS EN CUENTA:

No serán parte de investigación las personas del tercero y cuarto grado de enfermedad de Alzheimer

7. OTRAS INFORMACIONES DE INTERÉS (a considerar por el/la profesional)

Este estudio apoya y promueve las funciones mentales activas y las áreas neuropsicomotrices que no intervienen completamente en los individuos con demencia. Además de estos aspectos, el objetivo real de la rehabilitación postural del paciente con demencia es ralentizar la regresión de la enfermedad más que restaurar las funciones dañadas.

Precisamente, la novedad de este proyecto de investigación es estimular y aumentar las funciones que son relativamente salvadas y que da la oportunidad al rehabilitador que es parte de este proyecto y tiene un fondo cultural específico para ver la progresión del paciente en un contexto multidimensional. La selección de las técnicas a utilizar más se dependen **principalmente de:**

- El conocimiento del fisioterapeuta;
- Evaluación funcional del paciente;
- La capacidad residual del paciente;
- Los resultados que se obtienen

Este proyecto considera contemporáneamente la combinación de intervenciones de estimulación inespecíficas tales como:

- Rehabilitación neuro-psicomotora;
- Terapia ocupacional,
- Terapia musical
- Relajación

8. OTRAS CUESTIONES PARA LAS QUE LE PEDIMOS SU CONSENTIMIENTO


Para utilizar los datos en análisis estadísticas de los resultados de investigación siempre conserva el anonimato.

ANNEX 4 : MMSE Questionnaire

Mini-Mental State Examination (MMSE)

Patient's Name: _____ Date: _____

Instructions: Ask the questions in the order listed. Score one point for each correct response within each question or activity.

Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day of the week? Month?"
5		"Where are we now: State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible. Number of trials: _____
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, ...) Stop after five answers. Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.) 
30		TOTAL

(Adapted from Rovner & Folstein, 1987)

Source: www.medicine.uiowa.edu/igec/tools/cognitive/MMSE.pdf

Provided by NHCQF, 0106-410

ANNEX 5: Geriatric Depression Scale (GDS)

Geriatric Depression Scale (Short Form)
--

Patient's Name: _____ Date: _____

Instructions: Choose the best answer for how you felt over the past week.

No.	Question	Answer	Score
1.	Are you basically satisfied with your life?	YES / NO	
2.	Have you dropped many of your activities and interests?	YES / NO	
3.	Do you feel that your life is empty?	YES / NO	
4.	Do you often get bored?	YES / NO	
5.	Are you in good spirits most of the time?	YES / NO	
6.	Are you afraid that something bad is going to happen to you?	YES / NO	
7.	Do you feel happy most of the time?	YES / NO	
8.	Do you often feel helpless?	YES / NO	
9.	Do you prefer to stay at home, rather than going out and doing new things?	YES / NO	
10.	Do you feel you have more problems with memory than most?	YES / NO	
11.	Do you think it is wonderful to be alive?	YES / NO	
12.	Do you feel pretty worthless the way you are now?	YES / NO	
13.	Do you feel full of energy?	YES / NO	
14.	Do you feel that your situation is hopeless?	YES / NO	
15.	Do you think that most people are better off than you are?	YES / NO	
TOTAL			

Scoring:

Assign one point for each of these answers:

- | | | | | |
|--------|--------|--------|---------|---------|
| 1. NO | 4. YES | 7. NO | 10. YES | 13. NO |
| 2. YES | 5. NO | 8. YES | 11. NO | 14. YES |
| 3. YES | 6. YES | 9. YES | 12. YES | 15. YES |

A score of 0 to 5 is normal. A score above 5 suggests depression.

Original article

Yesavage J.A., Brink T.L., Rose T.L. et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J. Psychiatr. Res.* 1983; 17:37-49.

ANNEX 6: QoLAD Questionnaire (Family Version)

Quality of Life in Alzheimer's Disease cont'd



UWMC/ADPRI/QOL Aging and Dementia: Quality of Life in AD Quality of Life: AD (Family Version)					Score (for clinician's use only)
ID Number □□□□□□	Assessment Number □□	Interview Date □□ □□ □□ Month Day Year			
Instructions: Please rate your relative's current situation, as you see it. Circle your responses.					
1. Physical health	Poor	Fair	Good	Excellent	
2. Energy	Poor	Fair	Good	Excellent	
3. Mood	Poor	Fair	Good	Excellent	
4. Living situation	Poor	Fair	Good	Excellent	
5. Memory	Poor	Fair	Good	Excellent	
6. Family	Poor	Fair	Good	Excellent	
7. Marriage	Poor	Fair	Good	Excellent	
8. Friends	Poor	Fair	Good	Excellent	
9. Self as a whole	Poor	Fair	Good	Excellent	
10. Ability to do chores around the house	Poor	Fair	Good	Excellent	
11. Ability to do things for fun	Poor	Fair	Good	Excellent	
12. Money	Poor	Fair	Good	Excellent	
13. Life as a whole	Poor	Fair	Good	Excellent	
Comments: _____ _____					Total

Source: <http://www.cogsclub.org.uk/professionals/files/QOL-AD.pdf>

ANNEX 7: QoLAD Questionnaire (Participant Version)

Quality of Life in Alzheimer's Disease cont'd

QOL-AD

UWMC/ADPRI/QOL Aging and Dementia: Quality of Life in AD Quality of Life: AD (Participant Version)					Score (for clinician's use only)
ID Number □□□□□□		Assessment Number □□		Interview Date □□ □□ □□ Month Day Year	
Instructions: Interviewer administer according to standard instructions. Circle your responses.					
1. Physical health	Poor	Fair	Good	Excellent	
2. Energy	Poor	Fair	Good	Excellent	
3. Mood	Poor	Fair	Good	Excellent	
4. Living situation	Poor	Fair	Good	Excellent	
5. Memory	Poor	Fair	Good	Excellent	
6. Family	Poor	Fair	Good	Excellent	
7. Marriage	Poor	Fair	Good	Excellent	
8. Friends	Poor	Fair	Good	Excellent	
9. Self as a whole	Poor	Fair	Good	Excellent	
10. Ability to do chores around the house	Poor	Fair	Good	Excellent	
11. Ability to do things for fun	Poor	Fair	Good	Excellent	
12. Money	Poor	Fair	Good	Excellent	
13. Life as a whole	Poor	Fair	Good	Excellent	
Comments: _____ _____					Total

Source: <http://www.cogsclub.org.uk/professionals/files/QOL-AD.pdf>

ANNEX 8: TINETTI Balance Scale (TS)

TINETTI BALANCE ASSESSMENT TOOL

Tinetti ME, Williams TF, Mayewski R, Fall Risk Index for elderly patients based on number of chronic disabilities. Am J Med 1986;80:429-434

PATIENTS NAME _____ D.o.b. _____ Ward _____

BALANCE SECTION

Patient is seated in hard, armless chair;

		Date	
Sitting Balance	Leans or slides in chair	= 0	
	Steady, safe	= 1	
Rises from chair	Unable to without help	= 0	
	Able, uses arms to help	= 1	
	Able without use of arms	= 2	
Attempts to rise	Unable to without help	= 0	
	Able, requires > 1 attempt	= 1	
	Able to rise, 1 attempt	= 2	
Immediate standing Balance (first 5 seconds)	Unsteady (staggers, moves feet, trunk sway)	= 0	
	Steady but uses walker or other support	= 1	
	Steady without walker or other support	= 2	
Standing balance	Unsteady	= 0	
	Steady but wide stance and uses support	= 1	
	Narrow stance without support	= 2	
Nudged	Begins to fall	= 0	
	Staggers, grabs, catches self	= 1	
	Steady	= 2	
Eyes closed	Unsteady	= 0	
	Steady	= 1	
Turning 360 degrees	Discontinuous steps	= 0	
	Continuous	= 1	
	Unsteady (grabs, staggers)	= 0	
	Steady	= 1	
Sitting down	Unsafe (misjudged distance, falls into chair)	= 0	
	Uses arms or not a smooth motion	= 1	
	Safe, smooth motion	= 2	
	Balance score	/16	/16

Source: <http://hdcs.fullerton.edu/csa/Research/documents/TinettiPOMA.pdf>

ANNEX 9: Neuropsychiatric Inventory Scale (NPI)

NPI-Q SUMMARY

	No	Severity	Caregiver Distress
Delusions	0	1 2 3	0 1 2 3 4 5
Hallucinations	0	1 2 3	0 1 2 3 4 5
Agitation/Aggression	0	1 2 3	0 1 2 3 4 5
Dysphoria/Depression	0	1 2 3	0 1 2 3 4 5
Anxiety	0	1 2 3	0 1 2 3 4 5
Euphoria/Elation	0	1 2 3	0 1 2 3 4 5
Apathy/Indifference	0	1 2 3	0 1 2 3 4 5
Disinhibition	0	1 2 3	0 1 2 3 4 5
Irritability/Lability	0	1 2 3	0 1 2 3 4 5
Aberrant Motor	0	1 2 3	0 1 2 3 4 5
Nighttime Behavior	0	1 2 3	0 1 2 3 4 5
Appetite/Eating	0	1 2 3	0 1 2 3 4 5
TOTAL			

