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An Extended Interpretation and Practice of Rehabilitation

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Abstract

Rehabilitation is gaining more and more recognition because of the rising need resulting from longevity and varieties of disability. Historically, the practice of rehabilitation consists of standard skeletal mobilization trainings as essential provisions. It has become obvious nowadays that skeletal motions are under the control of complex brain activities which need to be involved in the training. Moreover, disabilities could be primarily related to neurological deficits. The concept of rehabilitation, therefore has developed towards a holistic direction: caring for the observable disabilities as well as their deficient central control.

The traditional rehabilitation practices in Asia, as is expressed in Qigong (China) and Yoga (India) emphasize on unique postures related stretching exercises coupled with deep stereotyped breathing. Prolonged practice is expected to lead to a state of meditation.

The Oriental practice of rehabilitation can be explained with the proprioceptive theories. In recent years, the research and explorations on the multiple influences of interstitial fluid circulation as have been discussed in the novel field of Fasciology, further support the plausible claims of Oriental Rehabilitation. The Oriental Practice can be a practical means of achieving a holistic result, gaining harmony between the somatic and autonomic nervous systems.

Since novel therapeutic methods and devices are actively developing in the rehabilitation field, it is proposed that in the planning and organization stage, the Oriental Concept of holistic care in rehabilitation might be included. Self-care and long-term general preventive measures are essential components of the Oriental Practice which would effectively supplement the current clinical practice that emphasizes on immediate results targeted on specific disability problems.

Keywords: Rehabilitation, Yoga, Qigong, Traditional medicine

Introduction

Rehabilitation is an essential part of Medical and Health Care. Rehabilitation helps people of all ages to be independent, particularly after health hazards: which for children and young people are related to congenital anomalies, injuries and acute illnesses; for elderly people, the chronic diseases and aging itself could be the culprit. Due to the ageing population, increasing demands on rehabilitation services are expected. Stroke is a common example of chronic disease requiring heavily on rehabilitation arrangements. It is expected that in ten years' time such demand would increase 25% [1].

To the general public, rehabilitation is known to them as simple physical exercises patients have to practice before recovery. The World Health Organization has given Rehabilitation a much more complex definition as "a set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment" [2]. Such a program might need to include: physical exercises, education on safety, environmental modifications, use of rehabilitation aids, and psychological support. The benefits of the arrangements would be able to minimize the disabling effects, prevent complications, and avoid repetition of the causative event. Although the emphasis of the program is to initiate remedial recovery as soon as the general health allows, the essence of efforts includes the prevention of deterioration and related unfavorable developments which this group of patients are prone to.

Current Hospital Rehabilitation

After the recent few decades of continuous development, Rehabilitation as a unique system of health care, has really matured. The effects of various pathological outcomes have made systematic identifications necessary. These include: identification of expected impairments [3,4], evaluation of the different types of defects [5-7] and their classifications [8]. Prediction of different degrees of recovery has also been worked on [9,10]. Most importantly, comprehensive guidelines have been created and practiced accordingly with great appreciation [11]. Since stroke is the most common cause of disability with varying severity, rehabilitation programs specifically created for stroke could serve as a valuable example to realize the current concepts and provisions of rehabilitation services [12].

A careful scrutiny of the present Rehabilitation Services reveals that, although obviously comprehensive and sometimes specific to disability conditions, they remain conventional and in spite of the obvious need, are lacking the concept of prevention for possible future events.

Thus, with regard to locomotor training of the limbs after trauma and neurological derangements, it might be important to recommend ways to prevent future repetition of disasters and pathological events. For those suffering from the first stroke, it might be necessary to be prepared for another possible attack. Prevention and readiness to respond in order to gain more effective results could be important. Fatigue is a common aftermath of different types of clinical conditions and may serve as an example of neglected concern. The need for a comprehensive insightful rehabilitation arrangement, involving not only simple motor strengthening but also psychological counselling is obvious, although seldom emphasized.

The Concept of the Oriental System of Rehabilitation

The Asian system of Rehabilitation refers to what has been practiced since the ancient cultures of India and China. There is remarkable similarity between the two systems: Yoga for India and Qi Gong/ Tai Chi for China. Both systems are heavily under unique philosophical influences since their early development and maturation: religious guidance in India and mixed philosophical directions in China [13,14] have formed the key instructions of the two systems. The practices rely on persistent self-efforts which are believed to bring about physiological harmony, thus excluding external disturbances that are harmful to bodily functions. The well concerted self-reliant exercises thus constitute a system of Natural Healing. Both Indian and Chinese system of Natural Healing consist of three essential components, viz. Muscle Stretching, Controlled Respiration, and Meditation.

Historically, spiritual dancing could have been the very early practice of Natural Healing. Hence, stretching movements while adopting a variety of special postures have become the most essential components of practice. Early imitation of the postures of different animals have later evolved into chains of movements copying animal activities. Later, different groups of practitioners created their own system of activities and motions with different connotations and hawmarks. Uniformity of these different systems exists: all of them consist of stretching movements. As far as posture is concerned: some advocates natural postures like standing, sitting; modification like “Buddha sitting”, half-kneeling, animal postures, etc.

The practice of Natural Healing invariably includes controlled breathing with which there will be enhancement of the stretching exercises. Qi Gong might have inaccurately been interpreted that it deals with qi (respiration) only. In fact, it is the sustenance and development of the qi, that requires simultaneous stretching, controlled respiration resulting in meditation. It is believed that, with skillful control of breathing, qi is manipulated successfully, so that it not only circulates through the respiratory system, but, together with meditation, it reaches more physiological systems to improve their metabolic state of harmony.

Respiration is controlled so that the normal pattern is not followed. The recommended patterns include extra-long inspiration or extra-long expiration. Abdominal or diaphragmatic breathing is practiced simultaneously. While doing so, the pelvic diaphragm and anal sphincters are also tensed up at will.

So, respiratory control is executed simultaneously with the stretching movements in a smooth synchronized chain of activities under the individual’s free will. It would be up to the individual to develop his/her own policy of training which could be amended from time to time [15,16].

Natural Healing aims at harmonizing physical, humoral and mental activities. Meditation is an indispensable component. The intersectional harmony could be promoted. The skillful practitioner attains a tranquility of the mind while stretching is being performed with controlled breathing. It must be understood that meditation requires the simultaneous support from stretching and breathing and vice versa. The apparently complicated system of movements in Tai Chi should not be hindering meditation. Rather, they provide a good initiating environment where the day to day mental pressure will not be felt. The material background for meditation is resting of the central nervous system. During the training, the intention is to give a good rest to the Central Nervous System: free it from motor and sensory burdens, relieve it from complex memories, protect it from emotions and problem-solving requirements. The assumption is: with

this unchallenged mental state, a reorganization of the interacting neurological messages will take place, initiating a general establishment of harmony and possibly with a re-organized humoral state [17,18].

Rehabilitation Service Given by Traditional Chinese Medicine Practitioners

Basic skeletal exercises in the general sense and some others focusing on special areas of concern are being given, very much similar to standard hospital practices. The common aims include joint mobilizations and muscle strengthening. In addition to the basic offers, traditional practitioners could provide two specific traditional maneuvers for treatment: Acupuncture and Tuina. Acupuncture is certainly a technique originated from ancient China. It is particularly effective in pain control and neurological recovery [19]. With regard to pain treatment, NIH in the United States has approved its use as early as 1998 [20]. Tuina is the translated phrase from a Chinese expression meaning "push and grip", which is a special massage technique, again inherited from ancient times.

The unique practices of acupuncture and Tuina is that not only is the maneuver aiming directly at the symptom presenting regions, but they are intentionally designed to deal with related physiological or pathological problems, directly related to the disability. Traditional practitioners believe that imbalance in internal organs away from the musculoskeletal system could be the culprit of clinical problem. Hence, in the rehabilitation process, treatment needs to extend beyond the focus of concerned. This concept governs not only the treatment procedures but also extends to preventive considerations.

Plausible Physiological Mechanisms Involved in Oriental Rehabilitation

Using modern physiological knowledge to conceptualize the special components of activity of both Yoga and Qigong, one could link those activities to special stimulations related to unique neurophysiologic pathways that are capable of bringing about a harmonious state between the somatic and the autonomic components of the neurological system [21].

What does stretching do? Stretching produces tension within the muscles, tendons, ligaments and the components around the joints. Stretching with selected postures produces tension on special groups of muscles, tendons, ligaments and joints that are normally relaxed and under-used. The Gate Theory in neurophysiology confers that with every stretch and stimulation of the proprioceptive nerve receptors related to the tendons and ligaments, messages are sent up to the spinal cord and brain to block the pain sensation and initiate other chains of events in the central nervous system leading towards a balanced summation of neurological messages from various cortical sources. With every intentional stretch, additional proprioceptive messages are sent up. When muscle groups that are not normally active in day to day activities are activated, they send out massive unusual proprioceptive messages to the mid brain, thus initiating neurological activities useful for pain control: a mechanism that blocks pain perception and harmonizes the two indifferent somatic and autonomic neurological systems [22,23].

What does controlled breathing do? Controlled breathing creates unusual motor activities within the respiratory cycles which are directed to follow a new pattern of activity. The modified rates, intensities and duration of inspiration and expiration, the different groups of muscles mobilized and involved, together compose a totally novel, unusual system of respiratory motor activities. Neurological messages received through these complex unusual motor activities are new to the higher central nervous system. The control of respiratory function is unique in that either the somatic motor system, which allows voluntary activities, or the autonomic (parasympathetic) nervous system, which generates automatic regulatory activities of respiration, could be responsible. Intentional controlled breathing therefore is making use of the somatic motor activity to impose stimulations on the autonomic nervous system, which has wide connections with the internal organs. Intentional controlled breathing therefore opens up new channels of communication between the internal organs which otherwise stay independent of the body's voluntary control. These new channels of communication, could explain how Yoga and Qigong practices help to build up a state of physiological harmony through stretching and controlled breathing, and the subsequent feeling of tranquility [24,25].

What does meditation do? No one is free from the somatic stimulations and cognitive, mental activities culminating into psychological disturbances that constantly bother him/her. One does enjoy a good rest during night-time sleep. Unfortunately, with overloads of worldly events, even night rests are frequently challenged. Achieving extra moments of spiritual tranquility is a blessing for all. Buddhists, monks and priests have means and indulging experiences to acquire the spiritual tranquility. Yoga and Qigong practices aim at the same outcomes. Through the practice of stretching and controlled breathing, a meditative state of mind is expected to automatically arrive. Is this a myth? Should one need to reach the mental state of a fervent religious follower before one acquires such a spiritual state? Presumably the extraordinary neurological inputs from stretching and controlled respiration are the motivating mechanisms pushing the mind towards this

state of tranquility. Firstly, stretching controls any pain through the "Gate theory", eliminates stiffness, relaxes the musculo-skeletal components, thus removes adverse somatic inputs and initiates pleasant humoral exchanges within the brain. Secondly, the controlled breathing mobilizes independent autonomic nervous pathways which help to adjust contradicting and competing physiological activities, possibly involving humoral adjustments. The out-come of the unusual interaction between the two loosely coordinated systems of neurological activities could be a novel state of harmony between the body and mind [23-25].

Discussion

Newly discovered physiological activities important for rehabilitation

1. Circulation of the interstitial fluid

The old concept that the fascial tissues existing between muscles, tendons and fat, wrapping around vessels and nerves are just fibrous spacers without a special functional role: has now been proven defective [24].

Fascial research has given new knowledge and concept with regard to Fascia anatomy, fascia physiology, biomechanics, cytology, innervation and special relations with clinical conditions [24].

The extensive distribution of the fascia all over the body actually forms a vast transmission organ, via direct fibro-fatty tissue linkages as well as through a fluid transmission system. It allows slow but free manipulative gliding of structures within and around it. It serves as force transmissions and information interlinks, mechanically and via a sophisticated network of nerve fibers and specific receptors. More importantly the fascia harbors rich collection of stem cells which are involved in regenerative mechanisms related to aging and tissue damages. The classical plausible terminology given to limb muscles "the second heart pump" could now be justified with the understanding of Fasciology. With these new perspectives, many common clinical conditions like low back pain, neck pain could be better understood; with better and better treatment planning could be undertaken [26].

The Asian way of limb-muscle-joint stretches and controlled respirations, performed with exaggerated postures and sustained slow speed, would undoubtedly promote rhythmic and sustained gliding of fasciae, muscles and tissues involved, to arrive at the desirable physiological results. The mystery of pain control via self-training, massage, manipulation or acupuncture, could also be better explained and understood; with better planning to follow [27].

Fascial innervations also transmit the stretching effects to close connections with the proprioceptive system and involvement of the autonomic nervous system [27].

2. Proprioception – the musculoskeletal control system

The textbook explanation of Proprioception is the neurological mechanisms that keep the body in balance and that it is mainly a cerebella-inner-ear orientated control. Thus, the proprioceptive system dictates all postural changes and maintains the centre of gravity of the individual at the best-balanced position.

This classical understanding is true with regard to the observable, well experienced role of balance which may become problematic when there is inner ear pathology or cerebellar illnesses. However, there is a hidden unfelt role of proprioceptive function devoted to the maintenance of musculoskeletal balance in the effort of keeping the components healthy and resisting the constant, unending wear and tear working against them. Muscles, ligaments and joints are kept balanced and mutually supportive to one another through automatic proprioceptive adjustment without our awareness [28].

It is true that all synovial joints degenerate with aging, presenting as "arthritis" with loss of cartilage, shifting of normal alignment and gradual deformities. These progressive changes are complicated by inborn abnormalities, accidental injuries, chromic stresses and specific pathological conditions. Mild early degenerative changes however, can be compensated through a continuous systematic adjustment of differential muscle pulls around the joints, thus maintaining their stability and preventing unfavorable repetitive pulls leading to structural deteriorations [29].

In the knee joint for instance, the proprioceptive receptors are continuously sensing the detail positions of medial and lateral components of the joint relevant to the stance of the individual. They are responsible to send messages up to the brain which initiates muscular adjustments around the joint to achieve the best-balanced function of the joint. With this effective adjustment of unfelt muscular pulls, the medial and lateral components are allowed to better share the loading stress thus helping to maintain its structural integrity in spite of the common compartmental differences.

Clinical studies have shown that patients with degenerative arthritis of their knees degenerate faster in 2 years among those found to have proprioceptive defects compared with the normal [29].

The proprioceptive neurological system is therefore of crucial importance to maintain the long-term integrity

of the musculoskeletal system. This system starts its balancing initiations via the receptors in the intra-fascial and all locomotor longitudinal structures, messaging up the tiny nerves to the dorsal horns, thence to the spinal cord. Pain of various sources (injuries and inflammations) play an important role because the proprioceptive mechanisms are also responsible to counteract pain through an effective motor stability adjustment. The control of pain is done indirectly through repeated releasing adjustments of the muscular tensions around the joints [30].

Effective proprioceptive training could create a state of auto-adjustment and better balance, thus preventing pain and slowing down deterioration [31].

3. Complex function of respiration

The lungs work without stop throughout life. The respiratory pacemaker system is situated in the brain stem, generating autonomic pre-sympathetic neurons to the spinal cord along the bulbospinal tracts. Neurons of these tracts activate motor neurons of spinal nerves C3 - C5; and thoracic spinal nerves to activate the diaphragm and intercostal muscle contractions. The lung and intestines are connected through the branches of the vagus nerve demonstrating well the influence of respiration on autonomic activities. Respiration in the Wake State is an integration of voluntary and involuntary action, rhythmic and non-rhythmic drives, giving respiratory and non-respiratory inputs.

The process of respiration involves the nasal region, the tongue, pharynx and laryngeal regions. Swallowing activities need close collaborations between somatic and autonomic inputs. Respiration involves neck and shoulder muscles which provides another demonstration of close interconnection between somatic and autonomic orientated components [32,33].

Respiration could be considered an automatic activity, that does not arouse the attention of the individual. When respiration is executed cautiously under control, the subtle connections between the contraction of different groups of muscles, the interplay between somatic and autonomic neurological channels would be enhanced. The apparent peripheral neurological activities are sending feedback information to the higher brain centers all the time to achieve a low level – high command harmony. This is a plausible explanation to the arrival of a meditative state. MRI recordings of relevant functional pictures of brain activities have, to great extents, confirmed the cross relationships [34].

Novel therapies being developed for rehabilitation

In recent years, there has been increasing understanding of the potential of brain function supporting the recovery and adaptation of disabled parts after different types of injury and specific pathological conditions, from skeletal defects or lost components to total loss of function. Biofeedback is one of the techniques used after neurological damage like stroke and after upper limb reconstruction of different natures [35].

For spasticity, standard physical therapy combined with splinting, electrical stimulation and botulinum toxin injection could offer a lot. Joint specific robotic therapy is actively developing. When coupled with virtual reality or interactive video gaming, interesting results are observed with novel functional gains [36].

More experimental attempts include non-invasive brain stimulations for Chronic Stroke patients [37], novel pharmacological interventions [38] and more recently, stem cell therapy has started [39,40].

Non-motor impairments after neurological damages have also invited much research interests on cognitive rehabilitation (enhancement), interventions for sensory, visuospatial and perceptual deficits, fatigue and mood disorders [41,42].

All these research-based attempts focus on specific clinical targets aiming to acquire specific functional gain, either motor or neurologically orientated.

Expanding modern rehabilitation with the inclusion of oriental concepts

Motor recovery after minor injuries could appear natural; training leads to just hastening or improvement of the recovery. With regard to severe pathological causes of motor disability; proper rehabilitation support is required. The chronic functional loss of the affected parts relates not only to the motor components involved, but to different extents, their higher neurological command, that is, the brain control. The essential steps of enhancing joint movements and strengthening muscle power become very complicated and lengthy in these severely affected cases and the central control of the brain becomes crucial for recovery. It is obvious therefore, rehabilitation would give better results of the directly observable parts as well as the brain control are included in the planning.

The rapid advancing needs for non-motor rehabilitation focusing on neurological interventions indicate substantially the partnership of the brain in exercises of recovery and maintenance. In actual fact, when brain damage is already done, as in Stroke, neurological rehabilitation may refer more to mobilization of neighboring functional units in the substitution of disability or for the prevention of further deterioration.

Reflecting once more on the philosophy of the oriental system of rehabilitation, the unique features are not only special techniques like acupuncture and tuina, but the emphasis on prevention. Prevention for the development of falls, unbalanced stance and gait, as well as the control of chronic pain and fatigue. We know now that prevention of such nature is achieved via lengthy repetitive training of proprioceptive stimulation or through stretching exercises. Prevention of the loss of harmony between the complex physiological functions which is a general requirement in complicated rehabilitation programs could be taken care of through simple but well-designed respiratory movements which connect the somatic and autonomic nervous systems through multiple neuromuscular networks. Lastly, the newly discovered interstitial fluid circulation involving the fascial space networks helps to explain the effects of muscular exercises at large. Moreover, the novel phenomena also help to explain how stretching and breathing help with pain control and the general well-being of the individual.

The oriental way of Rehabilitation has been categorized by a distinguished Chinese expert Dr. L.D. Chen into four main streams, viz, Functional restoration; Holistic restoration; Dialectic restoration; and Harmonization [43].

Functional restoration emphasizes on the essential needs of motor function, which must be common to all forms of rehabilitation, from hospital practice to oriental practices. Holistic Restoration has always been emphasized in Traditional Chinese Medicine and refers to practices beyond the visual foci of disability. Instead, the body and mind concept which could be achieved through the practices of Yoga or Qigong is seriously accepted.

Dialectic Restoration refers to the often cyclic need between central and peripheral efforts which can be accomplished through standard motor training, acupuncture and tuina; interchanging with special efforts leading to autonomic responses.

Harmonization is the overall goal of rehabilitation. Not only is immediate short term results expected but there is the primary motive and expectation that physiological harmony could be maintained, not only as the direct result of the present input but laying solid ground against future loss of harmony and repetition of the problem being encountered, which means the building up of an ability for prevention of future disability [44].

As recent advances of rehabilitation techniques are inviting active research programs using biofeedback exercises, electrical stimulations, novel pharmaceuticals, virtual reality technology, and surgical attempts like stem cell therapy, it would be more innovative if the project planning could incorporate the Asian philosophy of rehabilitation. Special attention on the proprioceptive influences and the autonomic involvement will much enrich the experimental programs. In the area of robotics, for instance, mini devices could be implanted to give effective stimulation to proprioceptive receptors in the lower limbs to acquire programed balancing forces to maintain harmonized pressure on the joint surfaces, thus avoiding unbalanced mechanical stresses leading to degenerative arthritis [31].

The Asian way of rehabilitation relies on persistent practices: to acquire harmonious recovery in acute needs and to establish physical and mental abilities to prevent and resist chronic damages when challenged by injuries or disabling pathologies. Rehabilitation programs incorporating the Asian experience could provide optimism in the fight against disability.

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References

1. Truelsen T, Piechowsji-Jozwiak B, Bonita R, Mathers C, Bogousslavsky J, Boysen G. Stroke incidence and prevalence in Europe: a review of available data. Eur J Neurol. 2006;13:581-98.

2. World Health Organization. WHO statement on Rehabilitation 2017.

3. Lawrence E, Coshall C, Dundas R, Stewart J, Rudd AG, Howard R, et al. Estimates of the prevalence of acute stroke impairments and disability in a multiethnic population. Stroke. 2001;32:1279-84.

4. Langhorne P, Bernhardt J, Kwakkel G. Stroke rehabilitation. Lancet. 2011;377:1693-702.

5. Kasner SE. Clinical interpretation and use of stroke scales. Lancet Neurol. 2006;5:603-12.

6. Goldstein LB, Samsa GP. Reliability of the National Institutes of Health Stroke Scale: extension to nonneurologists in the context of a clinical trial. Stroke. 1997;28:307-10.

7. Shinar D, Gross CR, Bronstein KS, Licata-Gehr EE, Eden DT, Cabrera AR, et al. Reliability of the Activities of Daily Living scale and its use in telephone interview. Arch Phys Med Rehabil. 1987;68:723-8.

8. Geyh S, Cieza A, Schouten J, Dickson H, Frommelt

P, Omar Z, et al. ICF Core Sets for stroke. J Rehabil Med. 2004;44 Suppl.:135-41.

9. Coupar F, Pollock A, Rowe P, Weir C, Langhorne P. Predictors of upper limb recovery after stroke: a systematic review and meta-analysis. Clin Rehabil. 2011;26:291-313.

10. Wandel A, Jorgensen HS, Nakayama H, Raaschou HO, Olsen TS. Prediction of walking function in stroke patients with initial lower limb extremity paralysis: the Copenhagen Stroke Study. Arch Phys Med Rehabil. 2000;81:736-8.

11. Weimar C, Ziegler A, Konig IR, Diener HC. Predicting functional and vital outcome after acute ischemic stroke. J Neurol. 2002;249:888-95.

12. National Institute for Health and Clinical Excellence. Stroke Rehabilitation: Clinical Guideline Draft. http://www.nice.org. uk/nicemedia/live/11950/56129/56129.pdf (20 April 2012, date last accessed).

13. Spicuzza L, Gabutti A, Porta C, Montano N, Bernardi L. Yoga and chemoreflex response to hypoxia and hypercapnia. Lancet. 2000;356(9240):1495-1496.

14. Sherman KJ, Cherkin DC, Erro J, Miglioretti DL, Deyo RA. Comparing Yoga, exercise and self-care book for chronic low back pain: a randomized controlled trial. Ann Intern Med. 2005;143(12):849-856.

15. Kato T, Numata T, Shirayama M. Physiological and psychological study of Qigong. Japanese Mind-Body Science. 1992;1(1):29-38.

16. Machi Y. Various measurements of Qigong masters for analyzing Qigong mechanism. Japanese Mind-Body Science. 1994. 3(1):65-87.

17. Won XS. Natural healing review. Tai Chi Review. 2008;11:29-30.

18. Yi XK. Natural healing in Chinese Medicine. World Health Digest 2007;4:269-271.

19. Cao X. Scientific basis of Acupuncture. Consultation meeting on Traditional and Modernization: Harmonizing the two approaches. WHO, Beijing 1999; pp 67-79.

20. NIH, US. Acupuncture NIH Consensus Conference (1998). J Am Med Assoc. 1998;17:1518-1524.

21. Birdee GS, Legedza AT, Saper RB, Bertisch SM, Eisenberg DM, Phillips RS. Characteristics of Yoga users: results of a national survey. J Gen Intern Med. 2008;23(10):1653-1658.

22. Melzack R, Wall PD. Peripheral nerve and spinal mechanisms. In: The Challenge of Pain. London: Penguin Group;1996. p.81-107.

23. Leung PC. Natural Healing in Chinese Medicine: Qigong and Tai Chi. In: Leung PC, editor. Healthy Aging. Singapore: World Scientific Publishing. 2011;221-243.

24. Kato T, Numata T, Shirayama M. Physiological and psychological study of Qigong. Japanese Mind-Body Science. 1992;1(1):29-38.

25. Machi Y. Various measurements of Qigong masters for analyzing Qigong mechanism. Japanese Mind-Body Science. 1994;3(1):65-87.

26. Huijing PA, Hollander P, Findley W, Schleip R. Fascia Research II. Munich: Elsevier;2009.

27. Hromada J. On the nerve supply of connective tissue of some peripheral nervous system components. Acta Anatomica. 1963;55:341-351.

28. Felson DT, Gross D, Hurley M. Effects of impaired joint position sense on the development of pain and structural damage of knee osteoarthritis. Arthritis Rheum. 2009;61(8):1070-1076.

29. Sharma L. The role of Proprioceptive Deficits, ligamentous laxity and malalignment in Development and Progression of knee Osteoarthritis. J Rheumatol Suppl. 2004;87-92.

30. Skinner HB, Barrack RL, Cook SD. Age-related decline in proprioception. Clin Orthop Relat Res. 1984;(184):208-211.

31. Leung Ping-chung. An Overlooked Mechanism Protecting the Knee from Degenerative Arthritis. Ann Orthop Rheumatol. 2020;7(1):1087.

32. Fung PCW, Kong RKC. A Novel Apprehension of the primary lung meridian basing on modern neurophysiology. Chinese Medicine. 2020;11:31-95.

33. Fung PCW, Kong RKC. Bridging Medicine East and West. Traditional Chinese Medicine. 2020; 9(2):145-176.

34. Davis K, Moayedi M. Central mechanisms of pain revealed through functional and structural MRI. J Neuroimmune Pharmacol. 2013 Jun;8(3):518-34.

35. Woodford H, Price C. EMG biofeedback for the recovery of motor function after stroke. Cochrane Database Syst Rev. 2007;2:CD004585.

36. Zijlstra A, Mancini M, Chiari L, Zijlstra W. Biofeedback for training balance and mobility tasks in older populations: a systematic review. J Neuroeng Rehabil. 2010;7:58.

37. Sahin N, Ugurlu H, Albayrak I. The efficacy of electrical stimulation in reducing the post-stroke spasticity: a randomized controlled study. Disabil Rehabil. 2012;34:151-6.

38. Teasell R, Foley N, Pereira S, Sequeira K, Miller T. Evidence to practice: botulinum toxin in the treatment of spasticity post stroke. Top Stroke Rehabil. 2012;19:115-21.

39. Savitz SI, Chopp M, Deans R, Carmichael ST, Phinney D, Wechsler L. Stem Cell Therapy as an Emerging Paradigm for Stroke [STEPS) II. Stroke. 2011;42:825-9.

40. Abe K, Yamashita T, Takizawa S, Kuroda S, Kinouchi H, Kawahara N. Stem cell therapy for cerebral ischemia: from basic science to clinical applications. J Cereb Blood Flow Metab. 2012;32:1317-31.

41. Pollock A, Hazelton C, Henderson CA, Angilley J, Dhillon B, Langhorne P, et al. Interventions for visual field defects in patients with stroke. Cochrane Database Syst Rev. 2011;10:CD008388.

42. Bowen A, Knapp P, Gillespie D, Nicolson DJ, Vail A. Non-pharmacological interventions for perceptual disorders following stroke and other adult-acquired, non-progressive brain injury. Cochrane Database Syst Rev. 2011;4:CD007039.

43. Chen LD. Practice of Rehabilitation in Traditional Chinese Medicine. Instruction and Manual. 3rd Ed. Peoples Medical and Health Press;2018.

44. Chen LD. New Era, New Vision, New Rehabilitation. Rehabilitation Medicine (in Chinese). 2019;29(4):1-3.